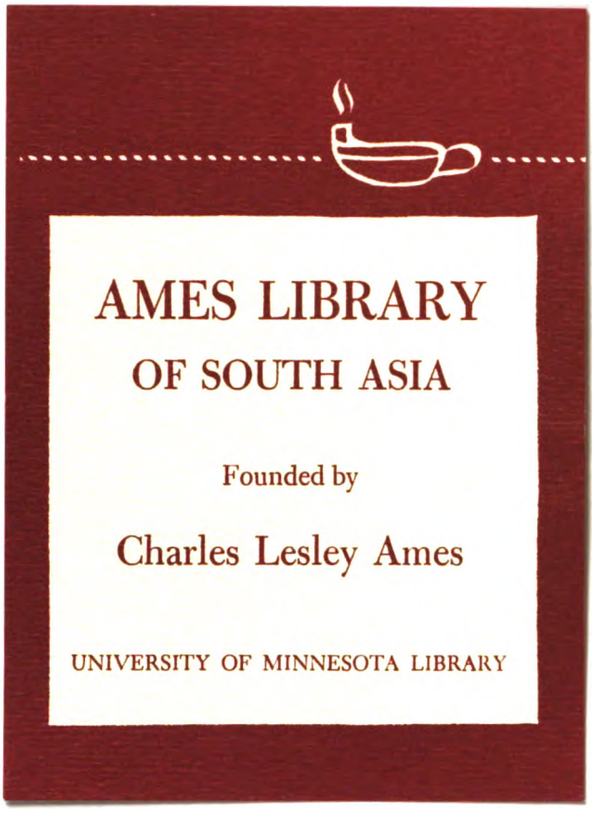
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# AN ACCOUNT

OF THE

# MEASUREMENT OF TWO SECTIONS

OF

# THE MERIDIONAL ARC OF INDIA,

&c. &c.

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# AN ACCOUNT

OF THE

# MEASUREMENT OF TWO SECTIONS

OF

# THE MERIDIONAL ARC OF INDIA,

BOUNDED BY THE

PARALLELS OF 18° 3′ 15″; 24° 7′ 11″; & 29° 30′ 48″.

CONDUCTED

**Under the Orders of the Honourable East-India Company,**

BY

LIEUT.-COLONEL EVEREST, F.R.S. &c.

LATE SURVEYOR-GENERAL OF INDIA,

AND HIS ASSISTANTS.

LONDON:

PRINTED BY ORDER OF THE COURT OF DIRECTORS
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1847.

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# PREFACE.

THE work now given to the Public has been extracted from the 7th Volume of my Manuscript General Report of Operations of the Great Trigonometrical Survey of India, the completion of which, together with the 8th and 9th Volumes, formed the concluding act of my official career, as also from my own private memoranda and journals, and contains an account of all meridional measurements executed under my superintendence, with a view to determine the Figure and Dimensions of the Earth.

These Operations extend from the parallel of 18° 3′ to the northern extremity of the British Possessions in India, and stand quite independent of all others, excepting only that the height and longitude of the southern limit are derived from the labours of my predecessor Colonel Lambton, which have at divers times been published in the Transactions of the Asiatic Society of Calcutta and the Royal Society of London. To these therefore the reader is referred who desires to make himself acquainted with particulars relative to the southern portion of the Meridional Arc of India lying between the parallel of 18° 3′ and the Station of Punnæ near Cape Comorin in latitude 8° 9′; but it is not necessary that I should do more than incidentally allude to them in this place, for the two meridional sections which form the subject of the present volume are just as entire, whether in regard to their bases, their units of measure, the instruments employed, their latitudes, and all other matters, as if no such prior operations had taken place.

It may not be uninteresting, however, to those who give their attention to such subjects to know that there is every reason to hope that the topography of the Indian Atlas will eventually depend on elements derived from trigonometrical operations executed on principles and system, and by observers and instruments, claiming to bear



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no disadvantageous comparison with those of Europe, for since the series of the Great Arc was carried by me in 1824-5 across the mountain-range which separates the southern from the northern portion of the peninsula, those operations have been proceeding slowly but surely in the manner which I will here describe.

In the first place, a longitudinal series emanating from my principal stations near the Seronj Base was carried across the peninsula in an easterly direction as far as Calcutta, where a base of verification was measured in 1831-2.

In the second place, a certain number of principal stations of this series, separated from each other by an average distance of sixty miles, were made the origins of so many meridional series, which were carried northward, as far as circumstances admitted.

In the third place, the northern limits on which these meridional series abutted are in process of being united by a series of principal triangles running as nearly in an easterly direction as the case allows.

By these means an ellipsoidal quadrilateral space will be formed bounded on the west by the Great Arc Series, and on the east by the Calcutta Meridional Series, which will be intersected by series running up intermediate meridians at every 60 miles asunder, the spaces between which can obviously be filled up, conformably to the method of ray-tracing which I have described in the Introduction, page xix, either by minor triangulation or by some other analogous process less rigorous perhaps but still sufficiently accurate to suit the circumstances of the case and to prevent the intrusion of errors of any magnitude.

Similarly the longitudinal series running westward from the neighbourhood of Beder, which, as mentioned in my former book, was commenced by me in 1822-3, has been completed, and has been made the basis of two other spheroidal quadrilaterals, one in the tract to its north and one in the tract to its south, all which will in due course of time be intersected in like manner by so many meridional series, separated from each other by an average distance of 60 miles.

These operations which have all been undertaken since my return to India in 1830 are referable to the same unit with those which are the subject of the present volume: they were still in progress when I quitted India in December, 1843, and were entrusted to my able successor Captain A. S. Waugh of the Bengal Engineers, formerly my Astronomical Assistant, but as the British possessions in India are very extensive, and

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to the attainment of accuracy time and caution are indispensable, it may be expected that many years will elapse before they are completed.

This will serve to explain the principles laid down for obtaining correct data for the Atlas of the British Possessions in India. It will naturally be concluded that each portion of the territory will be taken up in the order of its importance as regards the revenue which it yields to the state, whereby, generally speaking, worthless hilly, stony, and barren tracts will be reserved for the last; but that the whole of India will be eventually covered with triangles may be looked for as a result almost as certain as any future event can be, for it was only after long deliberation that the Court of Directors of the East-India Company came to the resolution of making their Atlas depend on trigonometrical operations, and the unity of design and firmness of purpose of that body are too well known to need that I should dilate on them.

Whether the Meridional Series of the Great Arc of India will ever be carried to the northward of its present limit is a question which will depend on so many circumstances that any opinion hazarded regarding it would be vain and useless. I have always been of opinion that an approximate series should be attempted and the practicability of a final measurement thereby ascertained, because even though extreme accuracy should not be arrived at, yet the trace contemplated would extend our geographical knowledge over a part of the globe highly interesting and but little known; and though in truth there is a belt to be passed through of several hundred miles in extent, over which the Chinese government have a control nominal or real, yet as that belt is bounded by the territory of Russia on the north and the British possessions on the south, the jealousy to be apprehended from that source would no doubt be mainly counteracted by the influence of two such potent neighbours, could they ever be persuaded to act combinedly.

An arc of the meridian extending from Cape Comorin in 8° 9′ to the northern extremity of the Russian dominions near Nova Zembla! It is a vast project certainly! Utilitarians will scoff at the bare idea and say *cui bono?* Let these gentlemen prove to me the use of any earthly thing, and then I will take in hand to demonstrate the point at issue; till then I shall confine myself to stating that it would increase our knowledge of the Globe we inhabit, which at all events is the most important planet we are acquainted or in any wise connected with.

Perhaps it is legitimate to hope that, in addition to meridional measurements of

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the nature detailed in the present volume, we may eventually, through the agency of the Electric Telegraph, succeed in the measurement of Arcs of Longitude, for certainly the main cause of uncertainty in operations of that nature would thereby be to a great extent surmounted.

That the operations now given to the public may be reducible to a common standard with those carried on in other parts of the world, I have subjoined, in Appendix No. 2 to the Introduction, the Comparisons made *inter se* of the Standards used by myself as well as those made at Southampton at the office of the Ordnance Survey of Great Britain.

Here closes my long and laborious undertaking in which though from first to last I have necessarily gone through much hardship and privation, yet these have not been without many alternations of gratification and amusement. To those who have served under my orders let me now tender my sincere acknowledgments for their cheerful and willing obedience, and let me beg my respected masters to accept my heartfelt and grateful thanks for the confidence they have for so many years reposed in me.

GEORGE EVEREST, LIEUT.-COLONEL,

*Late Surveyor General and Superintendent of the Great Trigonometrical Survey of India.*

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# INTRODUCTION.

On the 20th of January 1823 Lieutenant-Colonel Lambton the celebrated Superintendent of the Great Trigonometrical Survey of India, who had commenced that vast work and was zealously bent on prosecuting it, died at Hingan Ghat on his way to Nagpur, whither he was proceeding with the object of extending the Great Arc series to the northward; in consequence of which event I who had been his chief assistant since 1818 was appointed to succeed him. At the time when the intelligence reached me I was engaged in carrying on a Longitudinal series to connect the presidency of Bombay with the Great Arc of India, but it was manifest that my presence would be more urgently required to carry into effect the object on which the late Superintendent had been engaged, as the most important portion of the operations of the Great Trigonometrical Survey of India, and accordingly I resolved, as soon as the season was favourable, to take up the series of the Great Arc exactly at the points where it had been left off in 1822, and continue it to the northward.

Colonel Lambton had measured a base line in the valley of Berar in 1822, near a place called Takalkhera, which he intended should be the limit of the next section north of Beder, but this base had not been connected with the base measured at Beder, nor had the triangulation of the series been extended beyond the line Pilkher to Ikjhera. Accordingly, at this line the operations were resumed by me in November 1823; a series of celestial observations was also taken at Takalkhera, to determine the latitude of that place, which, in conformity with the arrangements of my predecessor, I likewise proposed to retain as a limiting station; and when these were finished, the triangulation was carried on through the mountainous tract to the north of the valley of Berar as far as the plains of Seronj with as much expedition as circumstances admitted.

In November 1824 a base line of verification was measured by me in the valley of Seronj with the same chain which had been used throughout all the measurements of the Great Trigonometrical Survey on former occasions. In January 1825 I took a series of celestial observations at a station called Kalianpur in the vicinity of Seronj, which I had selected as the northern limit of the section bounded on the south by Takalkhera, and these being effected, the portions of the triangulation, which still remained to be observed in order to complete the connection of the section, were filled up. At Bhaorasa the last principal station of the series, my health, which had for many months



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been seriously deranged, obliged me to apply for leave to proceed to England, and as this section was now in all respects an entire work (though certainly by no means free from objections), an account of it was given to the world in a work printed in 1830 by order of the Directors of the East-India Company.

It will appear on referring to that work that there is a very exact agreement, on closing in, between the base measured by me in the plains of Seronj in 1824 and that measured by my predecessor in the valley of Berar in 1822; but that between this latter and the base measured by Colonel Lambton at Beder in 1813 there is no such satisfactory agreement; at the time however of which I speak there was no possibility either of rectifying this disagreement or pronouncing decidedly how it had originated, and it necessarily stood as a blemish on the work; it will be seen eventually how this difficulty has been satisfactorily cleared up.

I returned to India from England in October 1830, having been intermediately appointed Surveyor-General of India by the Honourable Court of Directors, and as soon as circumstances permitted me to leave Calcutta I proceeded to the upper provinces to resume the Great Arc series at the points near Seronj at which I had been obliged to abandon it in 1825.

As my department was now liberally supplied with instruments by the first artists of the day, both for terrestrial and celestial purposes, the embarrassments which had been formerly felt from a want of efficiency in the apparatus were not now to be expected, so that if I had had a personal establishment able to use and appreciate this excellent material, there would have been comparatively little trouble in bringing the whole of the Great Arc to a conclusion; but it was quite the reverse, for unfortunately there was not at my disposal a single individual on whom I could rely for rendering me efficient aid in conducting any part of the operations in a style accordant with the ideas of accuracy and attention to minutiæ which for the last 20 years have become the order of the day in Europe. In fact I had excellent instruments, but nobody who could aid me at all in getting the most out of them that they were capable of, or even in doing any thing with them that could be relied on. All these I had to form and train, and where to meet with persons suitable to the purpose — that is, persons capable of being taught and willing to learn, who were prepared to devote themselves zealously to so arduous a task — was a difficulty which seemed at one time quite appalling.

It is easy to conceive how greatly this difficulty was enhanced by the circumstance of my now holding two situations, of which the one, that of Surveyor-General of India, called for my constant presence in office to conduct all the business and correspondence relating to the Geographical Department of that country, whilst the other, that of Superintendent of the Great Trigonometrical Survey, required me to be perpetually in the field to instruct my subordinates and to take an active part in observing.

But it would take a great deal of trouble and verbiage to describe the mental anxiety I had to endure until I had those about me in whose judgment, and ability to take part in the operations I could place implicit reliance; wherefore I must leave that

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to the imagination of my readers and confine myself to remarking that this object was at last accomplished to the full extent of my most sanguine expectations, and that, at the period of my quitting India on the 15th December 1843, which involved the relinquishment of my official situation, I left an establishment in a high state of training and efficiency at the disposal of the gentleman appointed by the Honourable Court of Directors to succeed me.

That gentleman was Captain A. S. Waugh of the Bengal Engineers, to whom and to Captain T. Renny I am indebted more than I can express for their zealous co-operation. They joined my department in 1832, and I consider it one of the most fortunate occurrences of my life that at that period when my prospects of success seemed so bleak desolate and dismal I met with two persons of their character whose views and principles so thoroughly coincided with my own. It is to their example that I chiefly attribute the admirable state of subordination and high principle which pervaded all the subordinate members of my department—it is to the ready attention which they paid to my instructions and directions that I owe that I was ultimately enabled to depute the most important portions of my operations to their management with as much confidence as if I were personally present to execute them. They made easy to me at last the burden which had at the outset been so grievous; and it was a gratification to me of no slight order that on the occasion of my retirement the Honourable Court of Directors paid me the high compliment of nominating, at my recommendation, the former of these gentlemen to succeed to my post. But to return to my subject:—It is necessary to mention that at the period of my leaving India in 1825 to return to England it was resolved by the local government that the situation of Superintendent of the Great Trigonometrical Survey of India should be kept open for three years in order to afford me an opportunity of resuming the duties thereof in the event of my health being sufficiently reinstated; and as during that time the operations of the Great Arc series were to be suspended, it was necessary to select some other field on which the establishment at that period in existence should be employed.

After due deliberation it was resolved that a Longitudinal series emanating from the Seronj base, and continuing eastward to unite Calcutta with the Great Arc series, should be carried on under the direction of Mr. Joseph Olliver my principal sub-assistant, for whom I accordingly drew up the necessary instructions previous to my departure.

This work does not form part of the present volumes, nor is it I believe the intention of the Honourable East-India Company to publish the detail, as it was intended for purposes purely topographical; it will suffice to say that on my return to India in October 1830 I found the triangulation had arrived within 100 miles of Calcutta, and as the line travelled over was nearly 700 miles long without any intermediate base, I urged upon the notice of the Government of India the necessity of measuring a base of verification at the eastern limit. It was conceded at my recommendation that such a base should be measured, and as there is a broad road leading from the Government

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House in Calcutta to the Government Palace at Barrackpore, which immediately on emerging from the suburbs is sufficiently straight for about 6½ miles, this was given up to my express use for the purpose.

Calcutta and its vicinity and in fact all places in lower Bengal are so encumbered with lofty trees and dwelling-houses, that the view is restricted to a very short distance, and as these cannot be removed, there is no other mode of carrying on trigonometrical operations than by raising both ends of the geodetical line so as to overtop these obstructions. Two towers of 75 feet high each were to this end erected at either limit of the Calcutta base, whereby it was connected with the triangulation, and as this base, which was commenced on the 23rd November 1831 and finished on the 19th January 1832, was the first occasion on which the new compensation bars were brought into use in India, I have not thought it irrelevant to introduce the mention of the circumstance into this volume, with the subject of which it has however otherwise little connection.

The triangulation of this Longitudinal series was not finished until the 2nd July following, and as there were several arrears of business to be brought up, it was not until the end of 1832 that I was in a condition to leave Calcutta for the purpose of resuming the operations of the Great Arc series.

It will be apparent that though I had no persons at my command at this period whom I deemed strictly speaking efficient, yet there were some few members remaining of the old establishment who had a highly useful practical acquaintance with the mode of conducting trigonometrical operations, and as I had to train an entirely new set of young men, I determined to send them into the field under the guidance of Mr. Rossenrode, one of the most skilful of my former subordinates, whom I deputed to carry on an approximate series along the meridian of the Great Arc, whereby the sites of principal stations might be selected beforehand, as far at least as the Chambal river, or if possible farther. I also took measures to have the tract of country to the north of the Chambal explored by Mr. Olliver, who had recently conducted the Calcutta Longitudinal series as already mentioned, and by Captain Boileau, who had for some time been employed as a route surveyor, so that I might obtain a general idea of the direction of the meridian and the points at which it would be most convenient to fix the northern limit of the section and to measure a base of verification.

Mr. Rossenrode performed with considerable ability the work I had entrusted to him. He commenced his operations at my old station of Pardho on the 1st February 1833, and brought up an unbroken series of triangles to the Chambal river, where he was obliged to desist on account of the heavy tropical rains. In each of these triangles two angles were approximately measured, and many secondary points were sufficiently well observed to be retained as topographical matter in the final work. Several other hill stations capable of being arranged into a series of triangles were also selected by Mr. Olliver north of the Chambal, but in these no angles were observed, and as to the work entrusted to Captain Boileau, though it conveyed a general notion of the features of

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the country to be passed through by the meridian, yet it gave no decided information whatever.

What may be termed the elevated plateau of central India terminates on the northern side with the high lands in the vicinity of Gualior, where the valley of the Chambal and its subsidiaries the Kohari and other streams commences. This valley is bounded on the north by a range of old red sand-stone dipping to the north at about 20°, which overhangs the Chambal, and seems to have determined the course of that river, and to have limited its wanderings on the northern side.

Further northward than the range in question there are detached ranges and isolated hillocks cropping out, but the average level of the alluvial surface of the country from which they rise seems to be rather below than above that of the valley of the Ganges. The last of these isolated hills commodiously near to the direct line of the meridian of the Great Arc Series is Usira, after which wherever they do occur they recede to the westward of that line, thereby furnishing inconvenient positions for the continuation of the triangulation. It was therefore absolutely necessary to have the stations of the east flank of the series beyond Usira in flat land totally devoid of all natural elevations, whilst the western flank rested on the yet remaining hills, which gradually decrease in height until they arrive in the neighbourhood of Dehli where they finally cease, their base being washed by the Jumna whose course they seem to arrest, and whose wanderings to the southward they seem destined to limit.

Beyond the sand-stone heights near Dehli on which the last hill station, that of Pir Ghyb, is situated, the stations of both flanks of the series were to be selected in the flat lands of the tract called the Doab, which is comprised between the rivers Ganges and Jumna. This is a wide extended plain remarkable for the richness of its soil, its abundant population, the scorching heats of the winds which blow over it in the season from March till June, the deluging and almost incessant rain which falls in the four succeeding months, the unvarying monotony of its scenery, and the universal deadness of level of its surface. Though there are few or no forests in the tract in question yet it is overspread with thick groves of Mango, Mulberry, Jamin, Tamarind, and other fruit trees intermingled with lofty Pipuls and Banians, all either yielding an annual income to their proprietors, or endeared to them as fancy plants destined to perpetuate the name of him who reared them.

In common with other parts of India, the inhabitants are congregated in villages and towns which vary in extent and character according to the wealth and traffic of the owners, from the veriest hovel composed of straw to the costly four-storied edifice of masonry; but instances of isolated dwellings are rare and hardly ever met with except in the case of Indigo planters, or now and then a temple or mosque, the bare walls of which offer no temptation to the plunderer. The villages however lie so thickly scattered over the surface that it is difficult to trace a line in any direction so as to pass free of all habitations, and quite impossible to calculate on seeing between the breaks which occasionally appear in the dense belt of foliage, for, in the very



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few instances where such do exist, they stand altogether at random and without any regard to the ray between one mound and another. In fact generally speaking the trees form to all appearance a continuous dense belt of foliage at the distance of four or five miles from the eye of the observer, and if an interstitial space is any where found, it as often as not leads to low marshy or other land totally ineligible as a principal station.

The whole tract though coming under the definition of a flat alluvial formation intersected with sluggish streams which overflow their banks annually, and totally devoid of all natural elevations except loose heaps of sand, accumulated by the wind, which overspread its surface promiscuously, has yet many elevated earthen mounds, the partially occupied or abandoned sites of villages or forts which appear to have been raised by the inhabitants in periods gone by as a protection against inundation or external violence.

The smoke from the daily and nightly fires, which, particularly in the cold season, envelopes the villages and clings to the groves surrounding them; that arising from brick and lime kilns and conflagration of weeds; the clouds of dust raised by herdsmen and their cattle in going out to graze in the morning and returning in the evening; by travellers and processions of men, carriages, and cattle, proceeding along the divers roads for business or pleasure, and by the force of the wind, the slightest action of which suffices in this arid parched-up soil to obscure the view, form an assemblage of obstacles which it is only possible in very favourable contingencies to surmount.

Between Aring near the south bank of the Jumna, which appears to be the lowest of my principal stations in this alluvial formation, and Nojhili which is the highest, there is a difference of level of 268 feet which gives an average ascent of about 20 inches per mile; this ascent is of course not entirely regular, but still in looking at the table of heights it will be clear that the rise from each station to that immediately north of it is marked and unmistakeable.

This part of the Doab is bounded on the north by a range of hills to which whether appropriately or not the name of Sewalik has been assigned. It is an irregular mass running N.W. and S.E. nearly, presenting obvious marks of upheavment, and composed chiefly of boulders of quartz, limestone, basalt, and other rocks manifestly rounded by attrition and imbedded in most cases in argillaceous earth, which appears to rest and to have been deposited on a basis of soft friable sand-stone. Occasionally though the cement which retains the boulders together seems to be of a more durable substance than mere clay, yet there is altogether such an appearance of incoherence about the structure that it is inconceivable how the whole is held together. In fact the higher parts of the range are visibly undergoing a daily decay; every rainy season, nay each heavy fall of rain brings down large flakes with a tremendous crash, and exposes a new precipitous face to be acted on by the elements, which when in due course of time it has had its day is destined to be hurled down in like manner into the ravine below, and there mingle its ruins with those of its predecessors.

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The highest point of this range lying within the area embraced by the Great Arc Series is that called Amsot, the only peak which looks down into and commands a full view of the beautiful valley called Dehra Dún lying to its north. My observations assign to it a height of 3,252 feet above the sea, which is 2,208 higher than Nojhili my last principal station in the Doab. There are several other eminences such as that of Doiwala 3,064 feet, of Mohan 3,181, of Lalu 3,119, but in assigning these names I must remark that, with the exception of that of Amsot which is *bonâ fide* employed by the native inhabitants, all the others are quite arbitrarily imposed and are known only to my own department, for the said eminences have literally no known names and lie in the jungles far out of the haunts of men, unknown and unvisited by any body.

On the north of this range lies the beautiful valley called Dehra Dún which is therefore comprised between the so-called Sewalik Hills and the part of the Sub-Himalayan range on which the settlements of Landaor, Masuri, Hatipaon, Bhadraj, &c., so celebrated for their salubrity as to have been selected as Sanataria are situated: the average height of this latter range which bears to the Himalaya Mountains somewhat the same relation that the Jura does to the Alps may be stated at 6,500 feet above the sea. Some of its eminences are indeed much higher than this, my principal station of Banog for example being 7,549 feet above the sea, and the Landaor Hospital exceeding it again by 57 feet, but then there are others considerably lower.

The height of the Dehra Dún varies considerably, as will naturally be supposed from its being between two such large rivers as the Jumna and Ganges flowing so near to each other—the highest part of the valley is that where the town and cantonment of Dehra stand, near the latter of which my office is situated at the height of 2,439 feet above the sea. The height of the west end of my base is as low as 1,886 feet, which is still 842 feet higher than Nojhili my last principal station in the Doab: the east end is at a height again of 2,073 feet; and in general we may fairly assume that the average height of the Plateau of the Dún, which skirts the so-called Sewalik range on the north, exceeds that immediately to the south of the same range by about 1,000 feet. From this description and a reference to the map it will be seen that between the last elevation of Central India (the low sand-stone height near Dehli) and Amsot, the most southern eminence connected with the Himalaya Mountains, the shortest distance in a straight line is 104 miles, through which a series of principal triangles had to be carried over a tract of the nature which I have been above describing.

It was evident that the methods of selecting stations which had been resorted to in hilly countries (and none of those at my command had the slightest notion of any others) would not now serve the purpose,—all those who had tried had met with utter failure, and it was absolutely necessary that I should undertake the task myself, for it was palpable that, besides turning to most advantage the highest mounds which were scattered here and there, permanent artificial elevations must be constructed sufficiently solid and firm to admit of the observing instrument (a 3-feet theodolite) being used at the summits with efficiency; and as such elevations must necessarily be costly edifices

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of masonry, the locality of each must be well and truly determined beforehand, because any defect of position which might subsequently appear would be irremediable. It was quite requisite therefore actually to observe at least two angles of every triangle to within a minute of the truth, in order to determine that every ray passed clear of obstruction, but greater accuracy than this was evidently not needed in the first instance.

To this end I designed* a mast of seasoned timber 35 feet in length, consisting of two parts which could be firmly united by iron bands when necessary, or otherwise taken asunder for more easy transport; of this mast the lower 5 feet were to be buried in the earth, leaving 30 feet above ground; at the summit was a circular table of 40 inches diameter, to be occupied by the instrument on its stand; at the height of 20 feet an iron ring was applied with 4 dead eyes for as many stay ropes, and a like number of antagonizing struts adapted below.

Round this mast a square scaffolding was to be erected, having at each corner a strong upright post of seasoned timber, all of which were to be well supplied with strong stay ropes, the lower ends being also sunk into the ground and otherwise sustained by earth piled above their bases; these posts were intended to form the skeleton of a scaffolding for sustaining an observing tent, the observers, and such attendants as were needed to manage the tent and lights; and all the rest, consisting of the frame-work, ladders, stage, &c., was constructed of large Calcutta bamboos tied together with string.

It will be understood that, agreeably to the original design, the mast for the instrument was to stand quite isolated with respect to the scaffolding, and sustained solely by the parts sunk into the earth and the four stay ropes and lower struts above specified, but on the first occasion of its being put up at the station of Karol this condition was found untenable, because the slightest agitation of the air caused it to vibrate. The only remedy therefore was to sacrifice the isolation of the mast, and to connect it with the four corner posts of the scaffolding, which was done by means of two pairs of diagonal bamboos, the one applied above the centre of oscillation, and the other below it, care being taken at the same time that no part of the ladders or stage work should come in contact with them; this arrangement effectually remedied the vibration, but at the same time rendered it necessary that no person should be allowed to ascend the ladder or stand or move about on the scaffolding whilst the observations were being made, so that, except myself and one person to hold a light, all the attendants were seated and formed a dead weight affecting alike each observation of a distant station and the near object to which it was referred.

With the instrument thus raised above the ground, corresponding arrangements were requisite for elevating the objects at the surrounding stations, for which purpose I contrived to erect masts 70 feet high; the nucleus at the base of each was formed of an upright post of seasoned timber, and the superstructure of bamboos firmly linked together, the protruding ends of those which encased the nucleus forming so many

* A perspective drawing of the scaffolding and an elevation of the mast here spoken of will be found in plate 24.

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points of connection for others immediately above and contiguous to them; a pulley fixed at the top furnished me the means of raising a bamboo staff in a horizontal position to the height of 70 feet as above specified, which bamboo being supplied with a sway rope at one end, and bearing an ignited blue light at the other, enabled me to have the latter displayed at a further height of 20 or 25 feet above the top of the mast, thus supplying a brilliant light at upwards of 90 feet above the surface of the ground.

As time was of great importance to the successful prosecution of my undertaking, it became a great object that there should always be a sufficiency of spare materials at hand at the spot where it was requisite to raise a mast of this kind, and therefore I resolved on collecting bamboos string and timber sufficient for 13 masts besides the scaffolding; but to carry all these about with my camp was to be avoided, not only on account of the great expense which would have attended their conveyance, but because the time taken in their transport would have caused a great deal of delay.

Whoever has travelled in the upper provinces of India knows full well that neither large Calcutta bamboos, nor in fact any of the materials which I have above enumerated, are to be met with any where in large quantities on demand; even for instance at such places as Meerut, Dehli, Muttra, Agra, &c. they need to be collected many days before they are wanted, and to calculate on their being forthcoming at call in small villages would be a very idle speculation, so that it became necessary to establish beforehand depôts at every place in the vicinity of which I was likely to require them. In furtherance of my object I obtained permission from the Government to apply to the Commissariat Officers at all the great stations in my route, to accumulate without loss of time all the large bamboos which were brought up the rivers Ganges and Jumna by the country boats, and forward them to Agra as a temporary depôt. At the same time the officers in charge of the several arsenals were directed to construct the blocks, pulleys, and other articles of timber which I stood in need of, and these together with the necessary supply of rope, twine, &c. were sent to the same station.

Besides the measures thus taken for the triangulation, it was necessary to look out for a convenient spot near the northern termination of the series for the measurement of a base of verification, to which subject my attention had very early been given, and I was not long in giving the decided preference to the Dehra Dùn, not only because of its obvious commodiousness from being near my home and supplies, but from the immense advantage it held out of being at the time I speak of absolutely uncultivated,* thereby liberating me from the necessity of interfering with private rights.

There was manifestly no such tract in the Doab, for it is either highly cultivated

* The tract of which I am speaking was about 1837 apportioned by the Government of India amongst certain English gentlemen; that part in which my base line and its two limits were situated became the property of Captain Kirke, who gave it the name of *Arcadia* in commemoration of and compliment to the *Great Arc* series!!! My station of Hatipaon, where my office stood, looks down on this lovely valley of Dehra, and it was really a beautiful and interesting sight to watch the cultivation growing as if by enchantment. When I left Hatipaon on the 1st October 1843, the whole was a rich and glowing mass of fields and orchards;—fortunately my base line had been already measured!



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and crowded, or else as it verges on the hills it is encumbered with forest trees, and the ground is rugged and precipitous; no instance is ever met with of a portion of cultivated land of any extent being allowed to lie fallow or neglected if free from jungle, and the frequent sand-hills, whilst they in no wise aid as natural elevations, greatly tend to limit the view; but on the contrary the Dún is undulating, and though its surface is intersected by many courses of torrents, yet none of these are of any depth, or have high banks, or are beset with quicksands.

Beyond the stream of the Asan, which flows through the Dehra Dún* with a westerly course into the Jumna, and the forests which skirt the bases of the so-called Sewalik range, there was manifestly a wide extent of open land quite unencumbered with jungle, and accordingly on the 2nd November when I was in marching condition and had all the elements of my plan set in motion to this spot I first bent my course and I was fortunate in the first instance to hit on the very site most suited to the object I had in view. After ten days spent in minutely exploring the whole western side of the valley, this was the conclusion I arrived at for it was then manifest not only that a line nearly $7\frac{1}{2}$ miles in length could be measured therein but that from the undulating nature of the surface one extremity could easily be seen from the other and that the line could be symmetrically transferred to the mountain of Banog and the hill of Amsot near the village of Timli both of which were visible throughout its whole course.

There were certainly many inequalities in the ground but nothing which could not be overcome; and though the gigantic reeds, rank grass, and numerous weeds with which it was overgrown would of course require a clearance, yet there were neither forest trees of any size or number to speak of, nor any fruit trees requiring to be felled; but it was also clear that the Amsot hill must of necessity be adopted as one of the transferring points, as it alone of all the southern hills stood unobscured by intervening ridges, and was visible both from the Dún and the plains of the Doab.

Immediately after this exploration, leaving a party of 20 men to clear the selected line in the Dún, I proceeded towards the southward and on the 5th December I arrived at Muttra, the station appointed for the assemblage of the materials for the masts and scaffolding which all came in on the following day with the exception of the great mast for the instrument and certain of the blocks which were still in the arsenal under the hands of the artificers. Having taken measures to provide carts for the transport of these I divided them into two detachments, and as the information previously obtained enabled me to judge nearly where these would be required, I directed one detachment to proceed along the right flank and the other along the left; a steady native accompanied each party furnished with letters to the head persons of the villages where the divers portions were to be deposited, and the instructions which he received were that each cart, on delivering its load and obtaining a receipt for the same, was to be sent back that it might be paid up and discharged.

It is not perhaps necessary to enter into further explanation respecting the

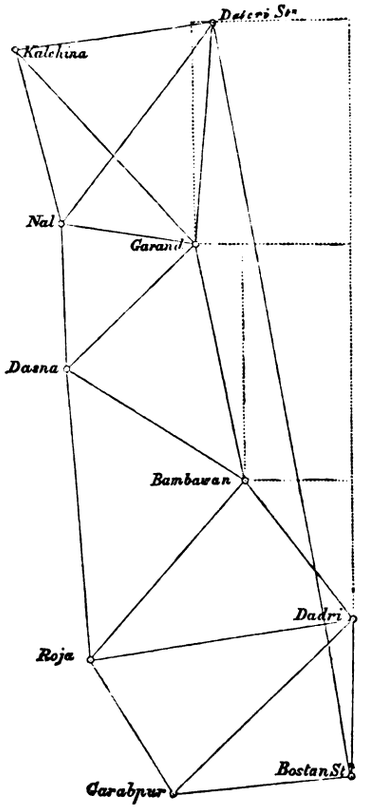
* A plan of that part of the Dehra Dún in which my base line was measured, together with the portion of the so-called Sewalik hills, on which my stations $\alpha$, $\beta$, $\gamma$ are situated, will be found in Plate 30.

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scaffolding and mast, for a reference to the drawings already referred to in note to page xvi will no doubt suffice to make that subject perfectly intelligible. The instrument used at the hill stations was an 18-inch theodolite, and the signals were chiefly heliotropes; that placed on the top of the mast was a 12-inch theodolite of the pattern which Messrs. Troughton and Simms constructed by my direction in 1830 for the Honourable East-India Company. The signals used at the pinnacles of the masts in the plains were blue lights burned by sets of four at ten minutes interval between each lighting, and of course it became a matter of arrangement to prevent the period of one set clashing with that of another, for there were generally three or four and sometimes six stations to be observed at each site where the mast was put up.

As the blue lights were in hardly a single instance during the whole of these operations visible to the naked eye, it was obviously necessary to lay the telescope in the proper direction a full quarter of an hour before the time appointed, so that the luminous point might on its first ignition be within the field; this direction was therefore to be calculated beforehand.

To this end I at first resorted to the method of carrying on a minor series of triangles along the ray, commencing from the station of the eye and terminating at that of the object, wherein by assuming the most commodious of the first two sides as unity and as the line of direct co-ordinates, it is easy to compute not only the angle which the ray makes with this line but also the ratio which they bear to each other all which I will proceed to explain; but this was found to be too dilatory in practice, and if none other had been resorted to there would have been little chance of my completing the approximate work before the accumulated dust and vapour of May and June would shut out for the remainder of the season all prospect of proceeding.




As an example in illustration of the method by minor series I beg leave to cite one of the many practical cases which occurred in these operations, wherein $S$ or Bostan is the station of the eye, and $S'$ or Dateri is that of the object, between which high trees totally intercept the view so that it is impossible to say *a priori* how the telescope at $S$ is to be laid, and which identical trees require to be felled.

Several sites as in the diagram in the margin were chosen, forming a minor series of triangles limited by $S$ and $S'$ at each of which all the angles were carefully observed with a good small theodolite. The side Bostan to Dadri was taken as the line of direct co-ordinates and also assumed as unity, and it is very easy to see that if on this

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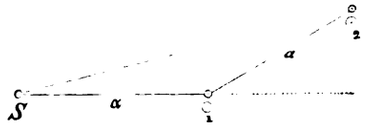
line produced perpendiculars be let fall from Bambawan, Garand, and Dateri, those perpendicular co-ordinates as well as the direct co-ordinates may be calculated in the same terms, whence it is plain that the former divided by the latter will be the tangent of the angle at which the telescope is to be laid with Dadri so that a light burned at $S'$ or Dateri may be in the field, which angle will be negative when it lies to the left of the line of direct co-ordinates.

Any set of these lines may be employed that is deemed preferable subject only to the condition of its having $S$ and $S'$ as its limits, the lines so selected may then be considered as so many links of a chain, and it is plain that the irregular polygon which is thus constituted will be a determinate figure as soon as the relative values of these links and the angles at which they lie with each other are known.

Hence if instead of determining the relative values of the links of such a chain by a minor series of triangles, the length of each be measured by a perambulator, chain, or other implement, the same result will be obtained with a degree of accuracy proportionate to the care taken in measuring the sides and angles particularly the latter; all therefore that is now required is to investigate simple rules and formulæ, whereby the terms sought may be as readily deduced as the operation is susceptible of being speedily performed, for despatch more than accuracy is the object in view.

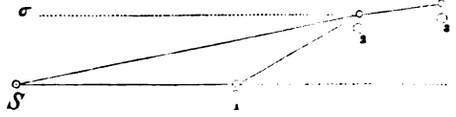
To this end if $S$, ⍜, ⍜ be any three points and the angle at ⍜ (found by subtracting the reading of $S$ from that of ⍜) be called $A$ the following equation of condition exists, the negative value shewing that the angle at $S$ is to the left of ⍜.

$$\frac{-a.\ sin\ A}{\alpha - a.\ cos\ A} = tan.\ S.$$




If $S$, ⍜, ⍜, ⍜ be four points and $A, B,$ be the arcs of azimuth between the direction of each ray and that of $S$ ⍜ called the line of direct co-ordinates, then provided the arcs at ⍜, ⍜ be always found by subtracting the reading of the object in the rear from that of the object in advance, the values of $A$, $B$, will be as follow:

$$A = ⍜$$
$$B = ⍜ + ⍜ - \pi$$




for draw $\sigma$ ⍜ parallel to the line of direct co-ordinates, then $\sigma ⍜ ⍜ = B$ by definition, but $\sigma ⍜ ⍜ = ⍜ - \sigma ⍜ ⍜ = ⍜ - (\pi - ⍜) = ⍜ + ⍜ - \pi$

If $S$, ⍜, ⍜, ⍜.....⍜ be any number of points in a chain of lines, each two of which are at an angle found by subtracting the reading of the point in the rear from that of the point in advance, and if $A$, $B$, $C$.....$N$ be the arcs between the line in advance, and the line of direct co-ordinates, then

$$N = ⍜ + ⍜ + ⍜ \ldots\ldots + ⍜ - (n-1).\ \pi$$

the truth of which will be manifest by observing that if there be any two consecutive

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points in the series ⚲, ⚲ and $N_{,}$, $N$, be their angles with the line of direct co-ordinates, then $N=$⚲$+N_{,}-\pi$, that is the angle $N$ which an advanced line makes with the line of direct co-ordinates at ⚲ is found by adding the angle between the two contiguous lines to the similar angle at the station next in the rear, and diminishing the sum by $\pi$.

Thus, if ⚲ ⚲ ⚲ ⚲ ..... ⚲ be the arcs between contiguous lines, and $A$, $B$, $C$, $D$.....$N$ be the corresponding angles with the line of direct co-ordinates, then

$A=$⚲

$B=$⚲$+$⚲$-\pi$

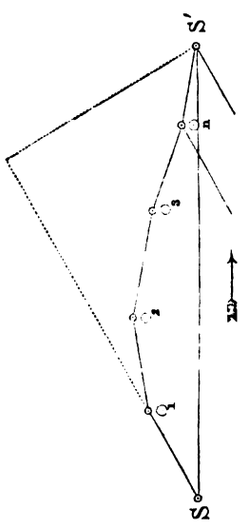
$C=$⚲$+$⚲$+$⚲$-2\pi$

$D=$⚲$+$⚲$+$⚲$+$⚲$-3\pi$

.....

$N=$⚲$+$⚲$+$⚲$+$⚲.....$+$⚲$-(n-1).\ \pi$

If there be a number of lines of which $\alpha$ is taken for the first direct co-ordinate,



$a$, $b$, $c$, $d$, be the lines in succession to $\alpha$, and $A$, $B$, $C$, $D$.....$N$ be the angles which the several advanced lines make with $\alpha$, then (using the negative sign because all angles to the left are subtractive from, and all to the right additive to the reading of ⚲ from $S$) the following expressions will result:

$-a.\ sin\ A-b.\ sin\ B.....-n.\ sin\ N=$Sum of perp. co-ordinates

$\alpha-a.\ cos\ A-b.\ cos\ B.....-n.\ cos\ N=$Sum of direct co-ordinates

$$\frac{-a.\ sin\ A-b.\ sin\ B.....-n.\ sin\ N}{\alpha-a.\ cos\ A-b.\ cos\ B.....-n.\ cos\ N}=tan\ S$$

$$(\alpha-a.\ cos\ A-b.\ cos\ B.....-n.\ cos\ N).\ sec\ S=SS'$$

wherein $S$ denotes the angle at $S$ between ⚲ and $S'$ the last station in the series, or that next in advance of ⚲.

The points $S$, ⚲, ⚲, ⚲.....$S'$ as in the marginal figure, form a polygon of $(n+2)$ sides, consequently the sum of all the internal angles will be $n\pi$, but those internal angles are $(2\pi-$⚲$)$, $(2\pi-$⚲$)$, $(2\pi-$⚲$)$.....$(2\pi-$⚲$)$, $S$, $S'$, whence

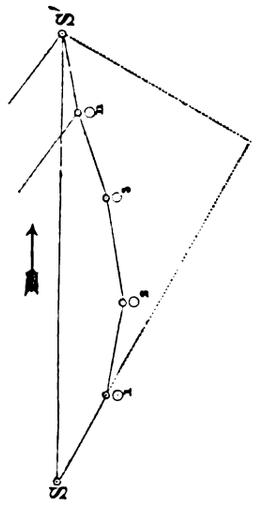
$$S+(2\pi-\text{⚲})+(2\pi-\text{⚲})+(2\pi-\text{⚲}).....+(2\pi-\text{⚲})+S'-n\pi=0,$$

$$\therefore S+S'=\text{⚲}+\text{⚲}+\text{⚲}.....+\text{⚲}-n\pi=N-\pi$$

Whence $S'=N-(\pi+S)$



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If the chain had fallen below the line $S\,S'$ as shewn in the margin, then $\textcircled{1}\,\textcircled{2}\,\textcircled{3}\ldots\ldots\textcircled{n}$ are the internal angles of the polygon, and

$$S+\textcircled{1}+\textcircled{2}+\textcircled{3}\ldots\ldots+\textcircled{n}+S'-n\pi=0$$

$$\therefore\ S'=\pi-(N+S)$$

If the chain begins above the line, and, crossing, descends below it, let $\sigma$ be the intersection after $\textcircled{m}$, then there will be two polygons of $(m+2)$ and $(n-m+2)$ sides, of which the sums of internal angles are $m\pi$ and $(n-m).\ \pi$ whence

1st $S+(2\pi-\textcircled{1})+(2\pi-\textcircled{2})\ldots\ldots+(2\pi-\textcircled{m})+\sigma-m\pi=0$

or $S+m\pi-(\textcircled{1}+\textcircled{2}+\textcircled{3}\ldots\ldots+\textcircled{m})+\sigma=0$

2nd $S'+(\textcircled{m+1})+(\textcircled{m+2})+(\textcircled{m+3})\ldots\ldots+\textcircled{n})-(n-m).\pi+\sigma=0$

whence eliminating $\sigma$ we obtain

$$S'=S-(\textcircled{1}+\textcircled{2}+\textcircled{3}\ldots\ldots+\textcircled{n})+n\pi=S-N+\pi$$

If the chain begins below, and crossing, ascends above the line, then

1st $S+(\textcircled{1}+\textcircled{2}+\textcircled{3}\ldots\ldots+\textcircled{m})+\sigma-m\pi=0$

2nd $S'+(2\pi-\textcircled{m+1})+(2\pi-\textcircled{m+2})+(2\pi-\textcircled{m+3})\ldots\ldots+(2\pi-\textcircled{n})-(n-m).\pi+\sigma=0$

whence eliminating $\sigma$ as before, we obtain

$$S'=S+(\textcircled{1}+\textcircled{2}+\textcircled{3}\ldots\ldots+\textcircled{n})-n\pi=S+N-\pi$$

By the help of these considerations where a ray has been once traced out and the angle $S$ at one extremity computed, we can know the angle $S'$ at the other extremity without the necessity of a second computation, which however is not a work requiring much time.

As to the distances or lengths of the sides which compose the chain, in order that any irregularity committed in the perambulator measurement may have the least effect upon the angles at the two extremities $S$ and $S'$, it is necessary to make those distances as few in number and to keep as close to the line $S\,S'$ as possible.

The angles at the several stations must of course be measured with great accuracy for on them chiefly will the result depend, therefore no pains should be spared in observing and registering them, and with due care it will almost always happen that the angle at S derived from this process will be within half a minute of the truth, which is much nearer than is requisite to enable the observer to lay the telescope so that the light may appear in its field.

The field book on these occasions cannot be of too simple a form; it consists in fact of a mere registry of the readings of the verniers and those of the perambulator at each station of the chain, as also of the differences found by substracting those in the rear from those in advance.

It will not be necessary to enter into further detail, for what has been above offered

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will more than suffice to explain the rationale of the process, and will I fear be deemed by many of my readers verbose and wearisome—it will suffice to say that most of the rays had to be worked out in this manner in the first instance, whence the method whether executed by minor triangulation or perambulator measurement, has derived the name by which it is known of "ray-tracing," under which denomination it has ever since been extensively employed in topographical detail in India.

Now it is easy to see that, whichever method is employed, as in the first instance we only obtain either the relative values of the sides in terms of the first link treated as unity, or else the said values in reference to the unit of the perambulator, which will rarely correspond with that of the geodetical line; therefore when we come by the regular final process to know the true length of the geodetic line $SS'$, each link must in order that it may be applicable to topographical purposes be reduced thereto: but in either case the sum of direct co-ordinates will if multiplied by the secant of the angle at $S$ give the said distance $SS'$ according to the assumed values; therefore if we subtract the logarithm of this assumed value from that of the true value of the geodetic line there results a constant logarithm additive to that of each individual line, whether it be the side of a minor triangle or measured link.

By the beginning of May the stations to the north of the Chambal 35 in number were all selected and this laborious work brought to a satisfactory conclusion by approximately connecting the proposed site of the base of verification in the Dún with that measured by me with the chain in the plains of Seronj in 1824, as detailed in my printed book pages 125-6. It was unquestionably the most harassing duty I ever had to perform, and I had to bear nearly the whole burden of the arduous task myself, for there was at that time no person at my disposal to whom I could depute any portion of the work except under my own immediate supervision and control. Day and night at all hours from the 13th December when my observations commenced at Dimdima, till 4th May when they terminated at Amsot, I was perpetually in a state of excitement and anxiety.

It now remained to give instructions and drawings to the executive officers of the building department to enable them to proceed with the construction of the towers which the Government had authorized me to have erected at the different sites in the plains thus selected as the stations of principal triangles—of these I will beg to offer the following brief description, which, by the aid of the drawings in Plate 25, will probably suffice to render the subject intelligible.

These edifices are of a square form at the base, and average about 50 feet in height, in some instances more and in others less. The wall at the bottom is 5 feet and at the top 2 feet in thickness, whence it appears that the interior is in mathematical language a portion of a square based prism, and the exterior a frustum of a square based pyramid. The roof or terrace is supported on two large stone beams on which rests a cylindrical well of masonry surmounted with a circular slab of sand-stone. At right angles to these stone beams and $3\frac{1}{2}$ feet above them are laid the rafters which support

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the stage whereon the observers tread, so that as the latter do not rest on the same walls with the former, the connection between them is broken off.

Around the stage is a strong hand-railing with rings at intervals to sustain the observing tent, and in one of the angles of the edifice is an appliance whereby a balance crane may be supported, by means of which the instrument is raised into its position on the outside of the building. As the balance crane is a well known implement it needs no description further than that given in the drawing;* mine was made portable and convenient and was constructed by my workmen under my own eye as were also my ropes, for it was impossible to place any reliance in those procurable from the arsenal or the bazar. In the interior prismatic space of the edifice there were wooden stages, two or three in number according to circumstances, to which strong ladders were supplied whereby the observers and others might ascend through the interior of the building.

Here closed the field work of the season 1833-4; the succeeding six months were taken up with the necessary computations, and also with preparations for the measurement of the base selected in the Dehra Dún which could not be commenced until the month of November.

Early in November parties were sent out to prepare materials for constructing platforms of masonry to mark the ends of the base, of which that at the west end was completed before the measurement began; the measurement was commenced on the 1st December and on the 31st January the eastern limit was approximately marked off that the stone platform to mark the site might be commenced, so that the central stone might correspond with the exact termination of the last entire set which was not laid down until the 18th February, the measurement being in the mean time suspended at the last set but one.

Comparisons 50 in number were made at Dehra before the measurement between each of the six compensation bars and the iron standard *A* in a grass shed erected for the purpose. Between the 11th and 16th February similar comparisons, 61 in number, were made under circumstances precisely the same with those under which the bars were used in practice, that is under the same tents and at the same hours of the day. The two standards *A* and *B* were also compared together on the same occasions, in the first instance 45 and in the second 56 times or 101 in all.

The whole length of the base after all reductions is in terms of standard *A* 39183·87343 feet from the western to the eastern limit; the microscopes were compared on 13 different occasions, and the total amount of their small errors was found to be 0·9733417 of an inch; the bar levels were also examined and either adjusted or noted, that allowance might be made for their deviation, on 7 different occasions.

As the apparatus was of recent introduction and the principle of its construction consequently more or less dubious I resolved, since the towers in the Doab were not yet in such a state as to admit of my proceeding with the triangulation, to remeasure the base in its whole length from end to end in the reverse order to that observed in the

* Vide Plate 26.

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measurement. This was commenced on the 19th February and ended on the 28th March under the management of Captains Waugh and Renny.

In the measurement at five intermediate spots in the alignment iron pins had been driven into the ground, to the tops of which flat register-heads were screwed on having a fine dot carefully marked on their upper surface, and as the apparatus passed over each of these in succession in the remeasurement an opportunity was afforded of finding the increment of error generated in each portion; these will be shewn by the following table to be progressively increasing and in no instance decreasing though they certainly are not as precisely in the direct ratio of the spaces passed over as could be desired. The mean temperature during the second process was higher by several degrees than that in the first, and I have come to the general conclusion from this and subsequent trials that the bars were in truth somewhat under compensated, so that they do expand slightly from temperature, the factor of expansion which would serve best being about $\frac{1}{19}$ of that of hammered iron. I have not however deemed it prudent to introduce any correction on this account, nor shall I recommend that being done until long and reiterated experience may seem to confirm the accuracy of my opinion.

Statement exhibiting the discrepancies between the measurement and remeasurement of the Dehra Dún base.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| At pin | No. 1 | marking | 66th set | distance in | feet | 4158 | remeasurement | 0·269 | Inches in | defect. |
| „ | No. 2 | „ | 157th set | „ | „ | 9891 | „ | 0·427 | „ | „ |
| „ | No. 3 | „ | 219th set | „ | „ | 13797 | „ | 0·743 | „ | „ |
| „ | No. 4 | „ | 389th set | „ | „ | 24507 | „ | 1·568 | „ | „ |
| „ | No. 5 | „ | 520th set | „ | „ | 32760 | „ | 1·896 | „ | „ |
| „ | No. 6 | „ | 622nd set | „ | „ | 39186 | „ | 2·396 | „ | „ |

Hence it appears that in this whole base of 7·42 miles or nearly $7\frac{1}{2}$ miles in length, there is an error generated of 2·396 inches, which is at the rate of 0·3 of an inch per mile.

As two of these intermediate pins of reference stood on swelling parts of the undulating ground and were therefore fitly situated for stations of a minor triangulation, I resolved moreover on dividing the base line by their means into three sections and triangulating one section against the other two by means of transferring points selected on the series of swells of the so called Sewalik hills which lie nearest to the Dún, a process which at the same time that it would throw further light on the value of the apparatus would also give me an opportunity of effectually trying the large theodolite and remedying any defects about it such as most new instruments are liable to, before the hour when it must needs be brought into full practice.

In pursuance of this last object, immediately after the base line was at an end on the 31st January I selected three stations so situated from their locality as to from symmetrical triangles with the intermediate points of the base marked $A,B$, and the two ends marked $W,E$, which stations being the eminences so chosen were marked $\alpha, \beta, \gamma$.



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This small triangulation will be found in its proper place at pp. 90 to 92, whence it will seem that the discrepancies are +0·333 of an inch in one portion and −0·078 of an inch in the other portion so that the whole base line deduced in terms of the middle section $AB$ differs from that actually measured by +0·255 of an inch.

Immediately after this remeasurement the bars were compared with the standard $A$ by 66 different trials made under the same circumstances as those last taken, that is to say under the same tents and at the same hours as those in which they had been employed in practice.

The edifices in the Doab being still in an unfinished state it was impossible to do more than complete the observations at the base and the hill stations Amsot and Banog, with which the season's operations terminated.

My health suffered so severely during the whole of this year that I thought it would be necessary to give up the prosecution of my work. Medical men all pronounced it to be all but impossible that I could survive the exertion if I persisted in prosecuting the field operations, but as my presence was indispensably necessary on account of there being no person at that time to whom I could depute them with any security, I resolved in spite of all these warnings to persist; for I did not choose to leave a work in which I felt so deep an interest to be finished or marred by a stranger, and the inherent strength of my constitution enabled me in the end to triumph over my calamities.

The season's operations commenced on the 22nd October and by the beginning of June the horizontal angles of all the principal triangles to the north of the Chambal were completed; it was not possible at the same time to observe the vertical angles at stations in the plains because the refraction was so exceedingly irregular, these therefore were reserved for a future occasion.

The two large theodolites at my disposal each of 3 feet diameter furnished with 5 microscopes, viz., that by Troughton and that constructed by Mr. Barrow at Calcutta, were in the field, and I had the satisfaction to find at the end of the season's operations that the two of my subordinates who had principally participated and aided me in my labours, Captain Waugh and Mr. George Logan, were become highly skilful observers, and that all the rest of my establishment had become so efficient each in his respective duty as to relieve me from much of my anxiety.

In the beginning of the season's operations the site of the observatory at Kaliana* was selected, the ground plan laid down, and the necessary drawings sent to the executive officer of the building department for his guidance in the construction. This building and its meridional pillars were in a sufficient state of forwardness in the ensuing October to enable me to lay down the accurate direction of the meridian by means of $\alpha$ *Ursæ Minoris* which is then in opposition to the sun.

On the 1st October 1836, I again took the field with both large theodolites, one of

* Drawings illustrative of this edifice will be found in Plate 23, that of Damargida having been constructed after the model of that of Kaliana with the exception that the latter had chimneys in the bow rooms whilst the former had not.

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which (that by Troughton) I confided to Captain Waugh, the other being under my own management. I formed two distinct parties each complete in itself and by the 18th February the connection was entirely formed between the base recently measured in the Dehra Dún, and that measured by me in 1824, of which the platforms marking the limits as well as those at my stations of Kalianpúr, Surental, Kamkhera, and Bhaorasa, were fortunately found undisturbed. In 1824-5 I had constructed at Kalianpúr station a small observatory of rough stone laid in mud cement—this was found a complete ruin, not one stone remaining above another; but I immediately took measures to have another constructed of more durable materials,* which will probably exist for centuries. The old meridional pillars of the same period were still standing and with certain modifications and alterations were again made use of.

Though the surfaces of the platforms marking the ends of the base were weatherworn and overgrown with grass and presented every appearance of having been suffered to remain exactly in the state in which I had left them in 1825, yet as I had taken the precaution to lodge central stones buried several feet below the surface, I deemed it prudent to refer to these latter in order to find out whether there was any difference or shifting of position in the upper dots with respect to them. There was in truth a slight difference of some decimals of an inch, and as the platforms were necessarily broken up to enable me to make this reference, in rebuilding them I adjusted the new dots over those found buried; but the angles having been observed before the excavations were made, I have thought it easier and better to apply the small computed correction on this account to the measured base than to the angles. The deviation was in fact so minute that all consideration of it might have been omitted with perfect safety, but the real fact is that where the members of a young establishment have to be trained to habits of extreme accuracy, it is difficult to be too precise.

The remainder of this season was employed in observing over again some of the angles of the principal triangles, which having been taken under unfavourable circumstances were not satisfactory; in subjecting to a thorough examination the two 3 feet astronomical circles by Troughton and Simms, in completing the arrangement for fitting up the observatory at Kaliana and in taking the vertical angles at stations in the plains.

And here let me mention once and for all that in observing angles if there has been any set which was unsatisfactory—if I have had any reason to suspect any defect in the instrument, or any instability in the platform, or any want of precision in the signal observed—or even if I have found on drawing up the angles that they presented any discrepancies for which I could not account, I have always felt not only that I was at liberty but that it was incumbent on me to reject the whole set bodily, and replace it by an entirely new set of angles taken under circumstances free from objection; but to retain part of a set and reject others—to pick and choose what suits a preconceived end is and ever has been since the trigonometrical survey of India first came under my direction utterly prohibited.

* See Plate 22.

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In flat lands where a ray grazes the surface of the earth the irregularities of terrestrial refraction are such that except at the time of the minimum no dependence can be placed on the apparent place of the object observed, but there are many rays in the triangulation of the series of the Great Arc of India which do not pass clear at the time of minimum refraction, and in these it is only after the object has risen and is still rising that it is visible from the eye.

If the object rose equably and were always at the same height at the same hour, or if there were any means by which the correction necessary to reduce each individual observation to this state of equability could be computed and applied, then indeed we might observe angles of elevation and depression at any hour we liked, only taking the precaution to make the observation and its reciprocal at the same hour from noon; but that this is not the case I have abundant proof, wherefore without entering into detail which would swell my book to an inconvenient size, I shall briefly state that if two observers, *A* and *B*, each supplied with a good theodolite and a heliotrope or lamp by its side, be situated one at each end of a ray so that the eye end of one shall be the object end of the other, and *vice versâ*, and in that condition, conformably to preconcerted signals, each takes the vertical angle of the other at the very same instant, the fairest chance is thereby afforded of obtaining a correct result for the difference of height between the two stations.

In the phraseology of the great trigonometrical survey of India, the term "subtended angle" means half the difference between the two depressions observed at each end of a ray or half the sum if one be an elevation; and if there be any truth whatever in the ordinarily assumed hypothesis regarding the amount of terrestrial refraction and mode of applying it, the value of the said subtended angle thus taken contemporaneously ought clearly to be a constant quantity whether the objects be on the rise, or stationary, or on the fall; but even this I grieve to say is not the case in practice, for it has been found that when the object has been in either the first or third of these conditions the successive amounts of subtended angles deduced from the several pairs of observations taken one after another have exhibited a very near approach to a regular arithmetical series increasing or decreasing.

I do not pretend to explain this phenomenon, or even to hint at the cause of it. Its effects have been overcome as far as practicable by selecting those periods for observation at which the object appeared to be stationary.

Four 18-inch altitude and azimuth instruments, each provided with a vertical circle read by two micrometers, were in the field at the same time; with each instrument was one of my subordinates able to manage it satisfactorily, and a party of sufficient strength at his disposal, the whole being placed under the guidance of Captain Waugh my astronomical assistant.

Whilst these simultaneous verticals were in progress my presence was required at the observatory at Kaliana to examine the astronomical circles and prepare them for use in the ensuing cold season. From circumstances which it is not necessary to explain in this place,

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it had happened that until this period I had never had a favourable opportunity of putting them together and adjusting them. I consequently knew not that they were defective: and in the full impression that instruments which had been constructed by so celebrated an artist as Mr. Troughton would be perfectly free from all serious inherent unsteadiness, I had reposed in full confidence that when the hour arrived at which they were to be brought into active use I should find it perfectly within scope of my own means to introduce any small appliances they might need.

From the short and hasty inspection which I had had leisure to bestow on these instruments prior to this period I had seen enough to convince me that they vibrated greatly, and as I attributed this in a great degree to the wooden tripods on which they stood I made up my mind to remove those tripods altogether and in their room to substitute substantial fabrics of masonry surmounted by a circular stone slab, for the better effecting of which I procured two fine slabs at Aring from the neighbouring quarries, and conveyed them up on carts to Kaliana, where I arrived on the 24th March, and immediately commenced the construction of the said small stand of masonry.*

These, one upon each pillar, were neatly and very carefully put together, and were ready on the 9th April, and as it was now evident that the wooden stand could no longer be a source of objection, any residue of vibration which could now be perceptible would of course arise from internal defects in the instruments themselves; accordingly allowing a space of a few days for the pillars to dry I put up both instruments, and then it was clearly manifest that the same defect existed to an extent which would totally frustrate all attempts to observe with the accuracy required.

My first business was to weigh all the superincumbent loads and to adapt each of the friction rollers to the pressure which ought to be imposed on it, all which was a work of some time but was satisfactorily accomplished by the able assistance of my native artist Seid Mohsin.† The next thing was to examine the diameters of the two pivots of the transit axis of each circle which I did by fixing the uprights of a cast iron stand of a transit telescope to a very weighty stone slab, and reversing the pivots $Y$ for $Y$ several times in succession, the readings of both ends of the level being noted on each occasion, whence it appeared that

Of Troughton..... Radius of pivot $B$ exceeded the Radius of pivot $A$ by 0·506.

Of Simms ..... Radius of pivot $B$ exceeded the Radius of pivot $A$ by 0·305.

In reference whereto it must be explained that for perspicuity one of the instruments was called "Troughton," and the other "Simms;" that the faces of each are both

* For an explanation of the alterations described in this and the following pages the reader is referred to the Plates marked Series A.

† Seid Mohsin, the person here named, is a native of Arcot, and came round to Bengal under the patronage of the late Lieut.-Colonel Blacker. I found him on my arrival in Calcutta in 1830, and perceiving that he was a person of great original talent I took him by the hand, and did all in my power to develope his natural genius. He was appointed to succeed Mr. Barrow, and is now mathematical instrument maker to the Honourable East-India Company in India.



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divided, one being marked *A* and the other *B*; that each pivot bears the letter of the face contiguous to it, and that the excesses above noted are in terms of divisions of the level, of which each division is for Troughton 0·9442, and for Simms 0·8870 of a second.

The first trials shewed that in their existing condition no confidence whatever could be placed in these instruments, and it was soon apparent that the axis of each vertical circle was longer between shoulder and shoulder than the space left for it between the *Ys* by 0·5 of an inch, whereby the internal faces of the *Ys* were soon abraded and torn up, also that one of the *Ys* was ricketty in its socket. The first of these defects I proceeded to remedy by putting each circle in succession into a lathe in a horizontal posture, and turning off 0·25 of an inch from each shoulder, a task of great delicacy and which was satisfactorily and ably managed for me by Seid Mohsin, who used the tool whilst I looked on with an eye lens to see that neither too much nor too little was turned away and that the pivots were not touched. As to the ricketty *Y*, as the only immediate remedy I had it plated over with tin foil.

These and other defects of a like nature being remedied of course nothing further remained for me to set to rights. I had done all that lay in my power, and perhaps somewhat more than most persons in my circumstances would have ventured on, and now when the instruments were again put up for observing, it seemed clear that the vibratory motion still existed and that it arose from some radical defect of construction.

And first of all it was evident at a glance that the columns were by far too slender to sustain the great weight imposed on them and that the outriggers extended much beyond the points requisite to ensure firmness and stability, for

1st. The difference between the diameters at bottom and top was only $\frac{1}{17}$ of the length of the shaft, whereas in other instruments to which I had access it varies from $\frac{2}{27}$ to $\frac{2}{13}$.

2nd. The diameter of the bottom was $\frac{1}{7}$ of the length of the shaft, whereas in my other instruments it varies from $\frac{2}{11}$ to $\frac{1}{4}$.

3rd. The distance between the friction roller in the centre of the capital to that point of the outrigger through which the *Y* rises was 4·68 inches, and the half transit axis 10·04 inches, whilst in other instruments in my possession the like quantities are 3·35 and 9·1 inches, and in truth it is clear that to ensure an equilibrium the joint pressure ought to be on the centre of the pillar.

But though these were palpable defects, yet they were not the only causes of unsteadiness, for it soon seemed very evident that the azimuth circle and the tribrach to which it was united were unequal to the weight which they had to bear.

This circle was united by 18 screws (so at least I suppose though no screw heads were visible) to the brass frame on which the whole weight of the instrument pressed: the said brass frame had six radii, of which 3 at 120° asunder were single edge bars, and the other 3 at like spaces asunder were each compounded of a pair of edge bars converging from the centre, and united at the distance of 2·4 inches outside the circumference of the circle (24·35 inches diameter externally) where they held the

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females of the foot-screws which worked in cups or rather prismatic slits of brass and served the purpose of levelling.

The dimensions in inches of the edge bars were—length 9 to 12 inches, depth 1·5 inches, breadth 0·43 of an inch. The length of the male axis of the azimuth circle was 21·8 inches, and its upper diameter 4 inches; it lay all below the plane of the limb and was perforated from top to bottom by a cylindrical aperture the intent of which was partly that it might be correctly centered by means of a look down telescope, and partly that the collimator, which at one time I had thought of applying below, might be referred to through it.

The azimuth circle was of course a fixture to which the female axis was attached, whilst the superstructure containing the vertical circle and its appendages revolved on a male axis united to the table from which the columns rose, and that this revolution in azimuth might be the more glib, three friction rollers were attached to the collar round the female axis in the spaces between the divergent edge bars, each of which was adapted to a pressure of $\frac{1}{4}$ of the whole superincumbent weight leaving the remaining $\frac{1}{4}$ active, a point to which in this case the attention of the artist seemed to have been carefully directed, for I had little or nothing to alter in them.

Now it is evident that in a construction of this kind the strength of the support ought to be considerably greater than what is absolutely necessary to avoid permanent flexure for otherwise it is manifest that a very hair will turn the scale, and such I found to be the case in the present instance as the following detail will establish.

As the microscopes of which there are two divided the circle into two parts, when one of them read 360° the other must be at 180°, and as the three levelling screws divided the circle into three parts, if one of them be at 360° the others will be at 120° and 240° having 180° half way between them. Now the points of 360°, 120°, and 240°, being each directly above a foot which rests on the solid, can neither of them go lower, but the points of 60°, 180°, and 300°, are each half way between two such points of support, and therefore must be the first to sink if there be any tendency that way.

To try this I brought microscope *E* over 360° and *F* over 180°, and in these situations adjusted each to focal distance; having done which I turned the instrument half round in azimuth, in which process it occurred that *F* shewed near parallax and *E* distant parallax, thereby furnishing a sufficient proof of the existence of a defect which I had suspected, for in many trials which I made the reverse never once happened; but that there might be no doubt on the subject and that the fact, though palpable to other people besides myself, might not be imagined to arise from mere ocular deception, I tried the following method—I cut a fine point to the blind end of a cedar pencil and tied it on to the microscope *E* over 360° so that it should just touch the face of the circle and leave no daylight between, when as the instrument revolved in azimuth, daylight was distinctly seen between the point and the plane at 60°, 180°, and 300°, but at 120° and 240° never.

This then clearly indicated that the azimuth circle and the frame to which it was

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united were barely sufficient to sustain the superincumbent weight and had no strength to spare, so that there existed a springiness in the system which the slightest cause sufficed to call into action. This irregularity was more perceptible in the instrument called "Simms" than in that called "Troughton," and the result was, as might have been anticipated from this equipoise, that when it had been fixed for any length of time in one position, before the level would indicate the same division on reversion, it was necessary to give it one or more turns in azimuth, and then all came right.

Now if the divided azimuth circle had not been firmly fixed on to the brass tribrach frame, or even if I could have ventured to loosen it from its fastenings, I should have known how to apply a remedy, for I should either have made a stronger support, or added a collar with six radiating supports to strengthen that frame; but as the face of the limb had obviously been united in this substantial way before it was turned or divided, it was plain that none but a professional artist who could devote his whole attention to the subject could with propriety meddle with the affair. Wherefore when I found that the case was beyond my power to rectify, I lost no time in bringing the subject to the notice of the Government, and requesting that the Mathematical Instrument Maker of the Honourable East-India Company then at Calcutta might be immediately ordered to my head quarters for that purpose.

I now to my dismay learned for the first time that the fact was notorious and universally admitted that the vibratory motion of which I complained was considered inherent in that class of instruments as they were what is termed *top heavy, and therefore to a certain extent unsteady: that the inventor Troughton had done all that his skill and experience could suggest to remedy the evil* and that there was no rational prospect of my meeting with success in a case which had foiled all attempts to devise a remedy.

This was a totally new element in the hypothesis and rather complicated the case, but as the vertical circles were apparently of the highest character, and the microscopes and levels excellent, and it did not appear essential that they should be top-heavy, I determined that they should be rather *bottom-heavy*, and that at any rate I would not quietly sit down with my arms folded to take bad observations whilst there was a fair chance of my devising a method for taking good ones. So I did devise a remedy and took immediate measures to have it carried into effect.

The progress by Captain Waugh and the parties under his orders was at first greatly impeded by bad weather, but as the season advanced the atmosphere improved to an extent quite unusual at that period of the year, and in the month of May was clearer than it had ever been known since my first arrival in the upper provinces; owing to this favourable circumstance all the observations deputed to him were completed by the 7th June two days after which the whole party were again assembled at my head quarters.

The marvels and phenomena of refraction which were experienced by Captain Waugh and those under his orders on the occasion in question were of a similar kind to those of which I have before spoken but of a still more astounding extent, for they seemed to lead to the conclusion that there are actually two trajectories for a ray passing

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between two stations $\alpha$ and $\beta$; that is to say that if at each of those stations an instrument be put up with a heliotrope side by side with it whose centre is of the same height with the eye of the observer, then the illumined disk of the heliotrope at one of those stations $\alpha$ is ofttimes visible by the instrument of $\beta$ a full quarter of an hour before the reciprocal effect takes place. Instances were also brought to my notice wherein of two stations 20 miles and upwards asunder, the observed vertical angle and its reciprocal were both elevations at the same instant; regarding these however I shall leave Captain Waugh to furnish at his leisure such particulars as he may think it desirable to communicate to the public.

It will easily be imagined that the instant the complete connection was formed between the bases of Dehra Dún and Seronj I should avail myself of the new materials then at my command to compute the one base in terms of the other, and my mortification was great in finding that after all my care there was a discrepancy of 3·3 feet by which the latter as deduced from measurement with the chain* in 1824 was in defect when compared with that brought down by computation from the former. I have alluded to this subject before, and as this result concurred with all other tests which had been applied to the Seronj base, the only opinion which I could form was that either the length of the chain or the mean temperature during the old measurement had not been properly known.

As it seemed quite in vain to wander amidst the mazes of hypothesis and conjecture I made up my mind at once to the only satisfactory course to be followed which was to avail myself of the next cold season to remeasure the Seronj base with the same apparatus which had been used in the Dún measurement, which in due course of time was carried into effect; but for the present the operations of the season 1836-7 were brought to a close, whereby the principal triangles of the series were all completed, and their angles horizontal as well as vertical observed as also the azimuths at 6 of the 8 selected stations, leaving only those at the stations of Banog and Usira to be determined.

The Instrument-maker having arrived in September I availed myself of the earliest occasion to point out to him personally the inherent defects of the astronomical instruments, to which end on the 5th October they were both put in position at Kaliana in order that I might practically explain to him the remedies devised by me for rendering them steady and serviceable, and subsequently for dividing the new azimuth circles.

A reference to the drawings marked Series A will enable those who desire more particular information to judge for themselves, but a slight description may nevertheless not be without use, to which end it must be remarked that my first business was to design new columns and to place the upper friction rollers so that the resultant of the pressure upon each of them and its adjacent $Y$ should be in the direction of the axis of the pillar on

* In 1832 all the chains belonging to my department were compared by me with ten lengths of standard bar A, and the base of 1824 reduced to standard A by the data so furnished is 38410·543 feet. The same base brought down by computation from the Dehra Dún base is 38413·956. The same base remeasured with compensation bars in 1837-8 is 38413·363, to which is to be added the correction 0·005 of a foot.



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which they were supported. The base of the new pillar was made 6·95 inches, and the part of the shaft immediately below the capital 2·75 inches in diameter.

The friction rollers were to be removed from the azimuth axis as was also that axis itself, and in lieu of the latter and its appliances one of Ramsden's pattern 32 inches long with flanges $8\frac{1}{2}$ inches diameter was to be constructed. The brass table was to be replaced by one of cast iron, as also the brass azimuth circle by one of the same metal of greater solidity, for all which Captain Waugh kindly made the rough drawings according to my directions during the two days which the party halted at Kaliana to inspect and put in order the measuring apparatus preparatory to proceeding to Seronj.

The main difficulty now seemed to be to get these cast iron tables and azimuth circles constructed, for to all the rest my means would evidently be equal as soon as the sheet brass for the new pillars which I intended to construct came to hand, as my artificers were able to cast brass sufficiently well. Accordingly, when the party resumed its march on the morning of the 8th October, I remained behind at Kaliana to see the models and drawings completed, and having despatched them to Calcutta to the superintendent of the Government Foundry, I myself set out to overtake Captain Waugh and my camp whom I rejoined at Muttra on the 22nd October.

The camp arrived at Seronj on the 17th November and immediately proceeded to Rosali, a village near the base line, and about two miles from the south end. In the neighbourhood of this village two pyramidal pillars which had been constructed by my orders by one of my sub-assistants of exactly the same form and dimensions as those used in the Dehra Dún base, were put up for comparing the compensation bars with the iron standard *A*, which process was gone through in the usual manner both before and after the measurement under the same tents as those used during that operation.

The excavations which had been made the preceding year in the central parts of the platform marking the two ends of the base had by this time been carefully filled up, and the upper stones accurately adjusted above those lodged in the ground, the grass and weeds had also been all cleared from the line, and as there is remarkably little inequality in the surface, no impediment existed to commencing immediately, nor was there any necessity for those ups and downs in the position of the boning instrument.

Also the small observatory at Kalianpur station was now finished, as well as the meridional pillars, so that it was clear that not only the remeasurement would on this occasion be satisfactorily terminated in a manner to set all future doubt at rest, but every thing would be put in order against the time when the astronomical circles should be in condition for making the necessary observations for the Celestial Arc of Amplitude.

The remeasurement was commenced on the morning of the 1st December, and concluded on the morning of the 18th January; as the positions of the limits were already fixed, it was of course not possible to measure with entire sets of bars, wherefore the surplus part was determined as follows. The north limit fell nearly midway between the two ends of the bar *E*, wherefore that bar as also the one usually in advance of it *H* were removed, and a flat register pin driven into the ground, on the surface of which

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a dot was engraved, care being taken by trial that when the brass face was screwed on to the head of its pin, it should be on a level with the dot marking the limit of the base. Between the two dots thus obtained, and as nearly midway as could be contrived, a nail with a polished brass head was driven into the masonry of the platform until its surface was also on a level with the other two, and a line was then traced thereon so that whatever distance was measured might have no lateral deviation. After this with a pair of beam compasses a length of 32 inches was taken off from the brass standard scale by "Cary," at the temperature of 67·7, and set off from each dot on the line so traced, and the small residual space being measured was found to be 0·277 of an inch, so that the whole space beyond the advanced end of bar *D* so measured was 64·277 inches.

There is another minute correction applied to this base of 0·060 parts of an inch of which I have already given the explanation.

The microscopes were compared on eleven different occasions during the measurement, and the bar levels examined three times, the small errors of the former amounted in the aggregate to 3·6809382 inches in excess to the regulated quantity of 6 inches each.

The mean of the comparisons before the base 79 in number gave for the length of a set of bars 0·0325596 parts of an inch in excess to 60 feet, and the mean of 61 such comparisons after the base gave for the like excess 0·0297795 parts of an inch, giving a mean excess of 0·03116955.

The total length of the base after all reductions was found to be 38413·3675260 feet, so that the truth was now made manifest that in spite of all the care bestowed by me on the original measurement with the chain in 1824 it was too short by 2·825 feet, a circumstance which is in my opinion attributable entirely to the want of means of knowing the true length of the chain, and the true temperature at the time of the measurement.

An attempt was commenced similar to that spoken of in the Dehra Dún to triangulate one part of the base against the other by means of one intermediate point in the base and two other stations chosen to the westward, but this was never completed because at the time there was likely to be great delay on account of the unfavourableness of the weather, and having been suspended for a season, some persons unknown, perhaps natives who idly hoped to find gold hidden there, removed the mark-stones and so erased the site.

As circumstances clearly shewed that all hope was at an end of having the astronomical circles ready for use by the season of 1838-9, or even of the requisite alterations ever being effected unless I remained to superintend and insist on them, it became a point for consideration how the establishment allowed for the Great Arc was to be employed with most benefit to the East-India Company.

To the understanding of this question it is necessary to recall to the recollection of my readers that in the section of the Arc between the parallels of 18° 3′ and 24° 7′, which is the subject of my former book, the triangulation was executed with very inferior

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instruments to those now at my disposal, for the portion between Beder and Pilkher was performed with an 18-inch instrument, engine divided and of no great accuracy, whilst in the remaining portion between Pilkher and Seronj the old large theodolite which had been seriously injured was employed, whence in looking over the data the following facts will be noted as also a sufficient clue afforded to guide us to their origin :—

1st. The divers observations from which the general means are drawn exhibit discordancies *inter se* seldom less than 20″, and in one case to so large an amount as 36″5.

2nd. The errors in the triangles in column $\epsilon$ in the former portion frequently amount to 4″ and 5″, and in one case there is an error of upwards of 8″, whilst in another there is an error exceeding 11″, also in the latter portion though the similar errors are generally much smaller, yet there are three instances wherein they amount to upwards of 6″.

3rd. There is a discrepancy between the base measured at Beder and that brought down from computation in terms of the Takal Khera base of upwards of $6\frac{3}{4}$ feet, whilst the comparison between the bases of Takal Khera and Seronj instituted in like manner shews little more than 3 inches.

4th. There is an uncertainty about the azimuths in the whole extent between Beder and Seronj, the observations not having been sufficiently numerous, and adequate care not having been bestowed on the subject.

The time seemed now propitious to rectify these matters, and as this was the favourable season for crossing the Mahadeo Mountains without danger, I determined on detaching Captain Waugh to the southward that he might be in readiness to take advantage of the opening of the season of 1838-9 in October, to begin the revision of the angles in the neighbourhood of Beder with Troughton's large theodolite and proceed northward, whilst I with my large theodolite proceeded southward till we met each other.

It was however by no means certain that the whole discrepancy between the two bases to which I have above alluded was attributable to the triangulation, for what had already been detected in the case of the Seronj base might obviously be equally likely to have happened in that of Beder, so that the question could never be satisfactorily set at rest until that base was also remeasured, wherefore I thought it best to deposit the base line apparatus temporarily in the building erected at Kalianpur until the occasion should serve for removing it the remaining half of the journey to Damargida.

On the 19th January I set out from Seronj on my journey to the northward, and having halted the day of the 26th January at Shadaora to complete the arrangements connected with Captain Waugh's operations we parted, he to proceed with the work I had assigned to him, and I towards Usira station, where I arrived on the 11th February.

The terrestrial operations of this section between Kalianpur and the Himalaya Mountains having been now brought to a close quite equal to my best expectations, and amply rewarding me for all the pains I had bestowed on them, and all the anxiety they

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had cost me, it now only remained in order that the northern of my two sections should be an entire work to complete the astronomical circles, so that I might determine the corresponding Arc of Amplitude between Kalianpur and Kaliana, a task of no ordinary kind, and over the progress of which circumstances manifestly demanded my exercising an incessant vigilance, so that in the end I was necessitated to forego my design of proceeding in person with the large theodolite to the southward; but fortunately this mattered not, for Captain Renny, whom I deputed to execute the portion of the triangulation which I had reserved to myself, completed it with an ability and zeal which left me no room for regret.

The range of mountains through which the rivers Narbada and Tapti flow, where it crosses the series of the Great Arc, may be considered to commence from latitude 23° 30′, and to extend to latitude 21° 20′; that portion which lies to the north of the former of these rivers, and defines the course of its channel is known by the name of the Mirganath range, and is of sand-stone dipping to the north at an angle of about 20 or 30 degrees; the southern portion is generally speaking a basaltic formation overlying sand-stone, the principal station of Dhar and secondary station of Kamla, which are the highest points included in the meridional series are of that rock, and the former of these two eminences looks down on the valley of Berar in pride almost as towering as that which the Himalaya range displays over the plains of the Ganges.

This range, to which I have elsewhere applied the name of the Mahadeo Mountains, though I must mention that the propriety of that appellation is questioned, some calling it the Satpurda others the Gawilgarh range, was when my operations were carried through it in 1824 almost a desert traversed by a wild race called Gonds supposed to be one of the remnants of the aboriginal tribes who inhabited India before the arrival of the Hindu invaders and were driven to seek refuge in these sterile mountain tracts to which the name of Gondwana has been assigned.

The condition of the country appears to have greatly improved since the period 1824 of which I speak, which is a never failing result where any tract in India has for a reasonable period been subject to the steady and systematic controul of British rule; not that I mean to say that the Government of the East-India Company is precisely Utopian or unsusceptible of amelioration; but what I do mean to assert is that in all portions of the tract passed over by the Great Arc series, of which it will be conceded that I am authorized to speak with confidence, the contrast exhibited by the present over the former amount of prosperity is most striking where the British power has been paramount, and is more and more marked in proportion to the influence which that power exerts.*

* As an example: in 1824 all that part of the plain of Seronj in which my base line was measured was a desert; in 1837, when remeasuring the same line, free ground on which my camp could be pitched was not to be found, and it was utterly impossible to carry on the operation without cutting a broad road for three-fourths of the way through growing corn, for all which the owners had to be remunerated. Seronj was a jagir of the celebrated Pindari leader Amir Khan and when I was last there belonged to his heir Wazir Khan but it is under the direct influence of the British resident at Sihor. Other instances without number might be adduced if necessary.



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In the tract I speak of there are two places occupied as civil and military stations viz.: Husangabad on the Narbada and Betul near the Tapti, of which the latter was in 1824 notoriously so unhealthy as to have appropriated to itself *par excellence* the appalling title of the Valley of Death. That valley has since become highly cultivated and flourishing, and is considered one of the healthiest places in the tropical parts of India: this is however not the case with the mountain range in general which continues to be about as deadly a tract in 1840 as it was in 1824.

It is a long and weary journey through this unhealthy range, the inhabitants are scanty, water and provisions are scarce, and it is only at certain seasons of the year that travelling through them can be attempted with any reasonable prospect of impunity—that season is between the beginning of January and the middle of June, and it will be seen from what has preceded that it was with an eye to this that I availed myself of the occasion presented by the termination of the Seronj base to detach Captain Waugh and his party to the southward.

On emerging from the Mahadeo mountains the extensive and fertile valley of Berar is entered and there is little to be apprehended on the score of unhealthiness until arriving at Karanja near the principal stations of Pilkher and Kopdi where a belt called the Mahur jungle commences almost as much to be dreaded as the Mahadeo mountains themselves; so that though it was an easy matter to arrange the journey to the southward, yet some management was needed in combining the movements of the parties so that the terrestrial operations should be carried on precisely in the most fitting season.

From Shadaora where Captain Waugh quitted my camp to Hyderabad, at which latter place he was to take up his quarters until the suitable period arrived for commencing operations, is a journey of upwards of 650 miles the greater part through the tracts above spoken of. The triangulation had been extended by me in 1836-7 as far south as the line Kamkhera to Bhaorasa, between which and the line Damargida to Malgi there is a meridional distance of 426 miles which had to be triangulated over between the opening of the season 1838-9 in October and its close in April, after which both his party and that destined to meet him were to proceed by regular marches to join my head quarters at Dehra Dún a further journey of nearly 500 miles, whence it will be seen that between the end of January 1838 and the beginning of June 1839 Captain Waugh had to travel over nearly 2,000 miles besides carrying a series of principal triangles over a meridional distance of about 260 miles, the remaining 166 being reserved for the party which was to proceed from Kamkhera to the southward to meet him.

I had purposed to conduct this second party myself, but when the season arrived for taking the field the state of the astronomical circles prevented my leaving my head quarters, and I deputed Captain Renny to execute the task; both these gentlemen accomplished the work I had assigned to them in a high style of excellence, and were back at my head quarters at Dehra by the 2nd June, 1839.

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Captain Waugh with the party under his orders proceeded in the latter end of January 1838, viâ Husangabad and Betul to Elichpur, and there taking up the line of the Great Arc series had marched in the first instance to the station of Somtana, which being within a short distance of the meridian had been selected as one of the stations for observing azimuths of verification.

In spite of all precautions that had been taken to ensure a favourable passage through the Mahadeo Mountains, and though the season was decidedly that at which least danger was to be apprehended, yet a great deal of sickness was experienced which as usual pursued the party far beyond the limits of the forests, and Captain Waugh who was one of its victims suffered greatly.

It had been part of my instructions to Captain Waugh to search for the old station of Damargida and erect there a building with meridional apertures and wing rooms similar to that constructed at Kaliana for the reception of the astronomical circle which was eventually to be put in position there, as also for affording shelter to the base line apparatus and other public property, but as soon as the observations at Somtana were concluded, he was constrained to proceed to the nearest military post of Hingoli for medical advice, and Mr. James second principal sub-assistant was in consequence deputed by him to execute this task and lay the foundation of the building.

I had also instructed him to institute a search for the limits of the base line in the valley of the Manjra near Beder called the Beder base, which was measured by Lieut.-Colonel Lambton with the chain in 1815, and ascertain whether the alignment might not be extended sufficiently to increase the angle at Malgi to upwards of 30° for at present that angle was only 26° 15′ 30″, which is $3\frac{3}{4}$ degrees less than that allowed by existing rules.

The attempt proved however unavailing for only the eastern limit could be partially traced, all vestige of the western having been apparently obliterated, and after a rigorous reconnoissance there seemed to be no possibility of improving the objectionable angle without adopting a totally new alignment of which an account will hereafter be given in its proper place.

Captain Waugh's health fortunately recovered in sufficient time to enable him to commence operations early in the season of 1838-9, and to observe azimuths at Damargida at the periodic time of opposition of $\alpha$ Ursæ Minoris which as elsewhere stated is between the 8th and 9th October, this having been achieved he proceeded with the triangulation in a northerly direction, and by dint of great perseverance and energy reached the station of Dhar on the 27th March 1839.

The party under Captain Renny left my head quarters at Dehra on the 9th October and arrived at Seronj on the 24th November, in the neighbourhood of which he commenced the triangulation which he was directed to take up at the line Kamkhera to Bhaorasa, for it will have already been seen that in the season of 1836-7 all the work had been completed to the north of that line.

In the revision of the triangulation I had given instructions to both Captains Waugh and Renny that all the old stations should be preserved and abided by wherever they

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could be found, an arrangement which was rigorously attended to; but besides the angles observed at these on the former occasion of 1824-5, wherever instances offered themselves of observing the angles of rays which form the diagonals of a quadrilateral these were to be made available as correctional equations of condition, and in the case of the figure formed by Gidgarh, Ander, Ranipur, Bhimbet, Ladi, Captain Renny received instructions to select a station to the westward which might put Ladi in the centre of a polygon with the same object in view.

Likewise that the deficiency of intermediate azimuths which had been so prominent in the old work might no longer exist, I selected the following stations of the old series for observing complete sets on such one of my catalogue of circumpolar stars as might from its periodic time be most convenient, viz. Ehmadpur, Bhimbet, Nilgarh, by Captain Renny; Damargida, Somtana, Sakri, Badgaon, by Captain Waugh.

Captain Renny reached the station of Gargaja where his first observations were to be made on the 28th November, and met the party of Captain Waugh in the neighbourhood of Dhar station on the 27th of March 1839, by which date not only all the revision of the triangulation was completed, but full sets of intermediate azimuths had been observed at the seven intermediate and limiting stations specified in my instructions. After this meeting both parties proceeded northward to rejoin my head quarters at Dehra where they arrived as before stated on the 2nd June.

Thus this great difficulty was finally overcome, and when the extent of the actual work performed, of the ground travelled over, as also the various embarrassments presented by the tract in which the operations were conducted are considered, I think the undertaking may be pronounced highly creditable to all parties concerned.

The success of the project was such as fully to equal the expectations which I had formed, for now instead of the portion of the old work between Beder and Seronj being as heretofore a blot on the general accuracy of the Great Arc of India, it may be looked on as quite in keeping with that to the northward, while it is my pride to believe that it is not to be surpassed by the ablest performances of a kindred nature achieved in any part of the world.

The result in fact shewed the necessity of the revision to be most manifest, for in all the work to the south of the line Pilkher to Ikjhera which was executed under the superintendence of my predecessor there were found to be few cases of a mean observed angle being within 1″ of the truth, and abundant instances in which errors of 3, 4, 5, 6 seconds were detected, whilst there were more than one in which those errors came up to the startling amount of 10 to 12 seconds.

In the work north of the line above mentioned, which was executed by myself in 1824-5, there were also detected here and there errors to the amount of 2 to 3 seconds, and in one case so much as 5″, but in most instances the mean angles derived from the revision agreed with those of the former work to the nearest second, and not unfrequently to the nearest tenth.

Therefore the old work between Kalianpúr and the line Pilkher to Ikjhera, a

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distance of 254½ miles along the meridian, even if a revision had been dispensed with, might perhaps have still been on a par as to excellence with most geodetical operations of other countries and other ages, but it would not have been in keeping with the work between Seronj and Dehra Dún, wherefore as the materials then employed were clearly impugnable it was a high-handed measure which I persuade myself will eventually reflect no small degree of lustre on the Honourable East-India Company as the patrons of science, thus to take the only efficient method to wipe out every vestige of suspicion or inaccuracy.

The further conclusion arrived at is that the discrepancy between the computed and measured lengths of the old Beder base of 1815 of 6 feet 7 inches, which I have more than once made subject of comment, arose from an accumulation of errors in excess in the southern or supplemental angles of the triangles, for the sum of those angles as shewn by revision is less than the same sum as given in my book (pp. 257-263) by 28 seconds, whilst the like sum of angles opposite the side to be deduced exceeds the old amount by 44·3 seconds, both of which errors manifestly tend to increase the computed length of the base and bring it nearer to the measured value.

The completion of this revision brought to the desired conclusion all the terrestrial operations between Damargida in latitude 18° 3′ and Banog on the Sub-Himalaya Mountains in 30° 29′ all but the measurement of a base line in the valley of the Manjra and its connection with the triangulation, but in order that the nature and extent of this series of operations may be distinctly understood it will be of use to enter into the following recapitulation.

The station of Takal Khera having been now altogether omitted, the whole line of the meridian is divided into two sections, Kalianpúr in latitude 24° 7′ being the southern limit of the northern and the northern limit of the southern section.

Though Banog the extreme northern point to which the series has been finally extended is as before stated in latitude 30° 29′, yet as the locality of that mountain renders it very unfit for a limiting station of a section it has been used only as a principal station for topographical purposes and for connecting the Dehra Dún base with the triangulation.

In fact it has not been deemed prudent to approach too near to the mighty mountain masses of the Himalaya range, and rather than that I preferred to shorten the northern section by selecting Kaliana as the station for observing amplitudes although it lies 69 miles more southerly than Banog, and 57 miles to the south even of the base measured in the Dehra Dún. Hence the northern of the two sections is comprised between Kalianpúr in latitude 24° 7′ 11″, and Kaliana in latitude 29° 30′ 49″, the latter place being about 1,000 feet (999·212 is the correct value) to the west of the meridian passing through the former.

The computation of the triangulation of this section is supposed to commence at the Seronj base and proceeding northerly to terminate with the Dehra Dún base, the coincidence on completing the connection being as follows:—



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| | Feet. |
|---|---|
| Dehra Dún base brought out by computation from the Seronj base ..... | 39183·273 |
| Dehra Dún base measured ..... | 39183·873 |
| Measurement in excess ..... | 0·600 |

equivalent to 7·2 inches, whence the error generated is nearly 1 inch per mile.

In this section there have been 7 stations selected, the two limits included, for observing azimuths and the computation being still considered as originating from Kalianpur, the following are the comparative results of computation and observation.

| Eye Station. | Object Station. | Observed Azimuth. | Computed Azimuth. | Error. |
|---|---|---|---|---|
| Kalianpur ..... | Surental ..... | 190° 27′ 6″·205 ..... | 190° 27′ 6″·205 ..... | 0″·000 |
| Pahargarh..... | Ranod..... | 236 19 19·295 ..... | 236 19 19·129 ..... | −0·166 |
| Kasri..... | Den..... | 206 41 38·505 ..... | 206 41 41·729 ..... | +3·224 |
| Usira ..... | Madhoni..... | 146 55 26·911 ..... | 146 55 28·666 ..... | +1·755 |
| No ..... | Manpùr ..... | 50 22 36·183 ..... | 50 22 36·683 ..... | +0·500 |
| Dateri ..... | Bostan ..... | 28 44 33·986 ..... | 28 44 37·619 ..... | +3·633 |
| Kaliana..... | Dahera ..... | 164 18 46·052 ..... | 164 18 50·786 ..... | +4·734 |

Besides these a set of azimuth observations was also taken at Banog station but more with the view of experiment as to the probable effect of lateral attraction exerted by the mountains in its vicinity than with any idea of considering the result as verificatory. On the north-east side of this station at a distance of 7 to 15 miles is the mountain range of Tyn all higher than Banog, the eminent peak thereof called Nagtiba at 11 miles exceeding it by 2,500 feet. On the east at 10 miles is the summit of Tóp Tiba higher by 1,126 feet, and at 7 miles Sirkunda Devi higher by 1,639 feet. At 48 miles distance on the north-east is the snow-clad range of the Himalaya Mountains, one of the nearest peaks of which called Bandar Púnch overtops Banog by 12,500 feet, to counterbalance which on the west and south sides there is nought but a dead, flat, and level plain extending beyond the limit of vision which is 6,500 feet lower than the site of the station.

The principal attraction being on the north-eastern side, and the visible superior masses not extending beyond 5° west of north, of course the tendency would be to make the observed azimuths less than those brought up by computation, which will be seen to have occurred to the enormous extent of 20·156 seconds as follows:—

| Eye Station. | Object Station. | Observed Azimuth. | Computed Azimuth. | Error. |
|---|---|---|---|---|
| Banog..... | Amsot ..... | 71° 5′ 54″·690 ..... | 71° 6′ 14″·846 ..... | +20″·156 |

Whether the error of $4\frac{2}{3}$ seconds above noted at Kaliana has arisen from an accumulation of errors in the observed angles or is also attributable to the same cause it is impossible to say: I had hoped to have placed that station far enough to be beyond the influence of that irregularity, but if the celestial amplitude of the section should in the result be smaller than it ought to be, we shall have some clue to direct us to the probable cause.

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The total length of the section from Kalianpúr to Kaliana along the meridian as deduced from the Seronj base is 1961144·037 feet, as will appear from the triangles marked $A$, $A'$, and the synopsis marked $A'$, whence the length deduced from a mean of the two bases of Seronj and Dehra Dún will be 1961157·117 feet*—of the Celestial Arc of Amplitude mention will be made hereafter.

Kalianpur having been selected as the middle station the southern section is also considered to originate from it and to terminate at Damargida a hill station connecting immediately with the base measured in the valley of the Manjra. This section has been already described in my printed book and the present is a revision of the same series with better instruments and the omission of the intermediate station of Takal Khera, but the same principal stations with few alterations have been adopted and by comparing the results in the two cases we may form a tolerably fair estimate of the relative values of the old and new portions of the Indian Arc.

No vestige having been found of the western limit of the base line measured by Colonel Lambton in the valley of the Manjra called the Beder base, of course a comparison cannot be directly instituted, but the central marks of the two nearest stations to the north of that base, Bachapali and Dudala, having been found entire, it may not be uninteresting to employ them instead of the limits of the base, and so obtain a standard whereby to judge of the result to which such a comparison would lead.

Now the logarithm of the side Bachapali to Dudala as given in the printed book, vide Δ 29 series *(F)* page 263, is 4·9092588, but as that has been deduced from computation originating with the base at Takal Khera we must to get it in terms of the Beder base add the log 0·0000925, which is the difference of the logarithms of the same base as computed from the same origin, and found by actual measurement; and the value of the same side as derived from the revised operations now spoken of is to be found in Δ 65, series $B$ of the present work, which may if desired be reduced in a similar manner to the nearest base, viz. that which in 1841-2 was measured in the valley of the Manjra. Referring to the forthcoming data we have

| | Feet. |
|---|---|
| Bachapali to Dudala computed from Takal Khera base of 1841-2 ..... | 81144·26 |
| Ditto ditto ditto by Col. Lambton's Beder base of 1813 ... | 81161·74 |
| Ditto ditto ditto from Seronj base of 1837-8 ..... | 81163·15 |
| Ditto ditto ditto from Beder base of 1841-2 ..... | 81163·88 |

Though it is anticipating on the regular order of events which I am narrating, yet I shall for the sake of uniformity here mention the comparison between the computed and measured values of the base in the valley of the Manjra of 1841-2 which forms part of

| | |
|---|---|
| * By Computation ..... | 1961141·742 |
| Correction for 24½ feet in height of Seronj base ..... | 2·295 |
| Total ..... | 1961144·037 |
| Add correction $\eta$ as explained in the Introduction..... | 13·080 |
| Mean length ..... | 1961157·117 |

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the present work. The computation of the triangulation emanates as I before said from the Seronj base of 1837-8, and proceeds southerly to the Manjra base of 1841-2, the relative values on completing the connection being as follow:—

| | Feet. |
|---|---|
| Manjra valley base by computation from the Seronj base of 1837-8 ... | 41578·536 |
| The same base measured in 1841-2 ..... | 41578·178 |
| Measurement in excess ..... | 0·358 |

Shewing that the error generated is at the rate of about $\frac{1}{2}$ an inch per mile.

In this section there have been 8 stations including the two limits selected for observing azimuths, and taking Kalianpúr still as the origin of the computations, the following are the comparative results of observation and deduction.

| Eye Station. | Object Station. | Observed Azimuth. | Computed Azimuth. | Error. |
|---|---|---|---|---|
| Kalianpúr..... | Surental ..... | 190° 27′ 6″·205 ..... | 190° 27′ 6″·205 ..... | 0″·000 |
| Ehmadpur ..... | Kamkhera ..... | 185 10 54·734 ..... | 185 10 55·387 ..... | +0·653 |
| Bhimbet ..... | Ladi ..... | 194 34 0·363 ..... | 194 34 0·935 ..... | +0·572 |
| Nilgarh ..... | Narwargarh ..... | 173 56 2·825 ..... | 173 56 5·299 ..... | +2·474 |
| Badgaon ..... | Ashti..... | 183 9 0·681 ..... | 183 9 2·091 ..... | +1·410 |
| Sakri ..... | Kopdi ..... | 175 24 37·373 ..... | 175 24 38·144 ..... | +0·771 |
| Somtana ..... | Terban ..... | 186 51 46·572 ..... | 186 51 49·232 ..... | +2·660 |
| Damargida ..... | Burgapali..... | 188 11 58·804 ..... | 188 11 57·314 ..... | −1·490 |

For the better understanding of this comparison of azimuths it is to be remarked that the verificatory stations have been selected generally with a view to two points, first the equality of their distance from each other, and secondly their proximity to the meridian—but as however near they may arrive it is of course not practicable to obtain such sites exactly on the meridian of the origin, therefore the following process of reduction has been resorted to.

The oblique sides of the triangles being produced to meet the meridian in the points $\mu$, $\mu'$, &c. $m$, $m'$, &c. in the manner usual in such cases, vide series $A'$, $B'$, the nearest of such points to the station of observation is taken up, and its angle of intersection (treated as an azimuth), its latitude, and its distance from the point in question are made use of to determine its back azimuth at that point, and as the difference in azimuth between the $m$ or $\mu$ point, and every other surrounding station connected with the station of observation is known, therefore the remainder of the process is merely that of addition or subtraction.

The total length of the section from Kalianpúr to Damargida along the meridian as deduced from the Seronj base is 2202916·900 feet,* as will appear from the triangles

| | |
|---|---|
| * By computation from Seronj base ..... | 2202914·322 |
| Correction for 24½ feet in height of Seronj base ..... | 2·578 |
| | 2202916·900 |
| Add correction $\eta$ ..... | 9·296 |
| Mean length ..... | 2202926·196 |

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marked $B$, $B'$ and the synopsis marked $B'$ whence the length deduced from a mean of the bases of Seronj and Beder will be 2202926·20 feet. In this instance also the Celestial Arc of Amplitude will be reserved for description in its proper place when I come to speak of that part of the operation.

This account will perhaps suffice to explain the manner in which the principal triangles and azimuths were completed, a reference to the plan will shew that the greater part of the whole triangulation, more particularly of the upper section, consists rather of a series of triangles ranging themselves into the form of polygons or quadrilaterals than simple series, and as in the course of these pages there will be found a specific detail of the manner of making them all combine so as to give results in harmony with each other, it will not be necessary to take up the time of the reader with a description in this place.

The part of the season of 1838 which remained after my return to Kaliana, as already mentioned, was occupied in preparing the astronomical circles; and peculiar circumstances not necessary to be detailed in this place having deprived me of the services of the Honourable East-India Company's mathematical instrument maker, whilst the projected alterations were only partially effected — the whole burden of this difficult task of restoration fell on me, whereby I was prevented from leaving my head quarters and the whole of the season of 1838-9 was taken up in the same toilsome affair. By 6th August 1839, the new azimuth circles were however in a fit state to be divided, which operation was effected at my hill station of Hatipaon in the Sub-Himalayan mountains by a method which I believe to be new; as I forwarded a detailed and very precise account of this method accompanied by illustrative drawings and explanatory demonstrations and descriptions to the Royal Astronomical Society, it will be unnecessary to encumber my present work with the minutiæ of the operation which will be best understood by a reference to the drawings forming Series A in the book of plates which accompanies this volume.

It is now proper to enter on the subject of the astronomical observations made with the view to determine the Celestial Arcs of Amplitude of these two sections, but as that is a question of some delicacy which has often occupied the attention of gentlemen of high practical talent and scientific attainments, it is one which I avow that I approach with much hesitation, not only because it is little to be expected that any new light should be thrown thereon by me, but because in a path so trodden the best result that can possibly be hoped for is to have alighted by chance on methods most approved of by others, and not to have left unattended to those precautions which long practice has shewn to be essential to accuracy.

As it is necessary however that all parts of the system which I have pursued should be faithfully developed I shall presently enter into such explanation as I hope will serve that end, leaving to gentlemen more learned than myself the task of pointing out the errors of omission and commission which may be imputable to me, and contenting



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myself with begging them to accept my assurance that I have done my best, and would have done better if I could.

Though the effects on the absolute latitude of a place on the earth of the various inequalities by which the observed positions of stars are affected are to be counteracted only by computation and a previous knowledge of their correct elements, yet the difference of latitude between two places under the same meridian may be obtained independently of them by simultaneous observation; for the former we require to know with considerable precision the mean position of the star and its proper motion, as well as the constants of aberration, precession, and nutation; for the latter we need two good instruments and skilful observers acting at the same time at both places, and except when clouds and other sources of interruption conspire to break the continuity of the series of observations, it would be of small moment to the result whether the earth were at rest or in motion, whether its surface were spherical or spheroidal, for but for refraction and instrumental errors, which would neither be increased nor diminished by these causes, there are no other corrections which may not be treated as equally operative at either station.

But two steady and effective instruments, each well supplied with a barometer, an attached and detached thermometer, delicate levels and a good time-piece, and fixed in a substantial edifice with meridional apertures, and two accurately fixed meridional marks, as also with all the other necessary appliances of an observatory, are indispensably needed, and I now proceed to shew how far these requisites have been attended to.

The divers alterations and amendments which had cost me so much mental and bodily exertion having been successfully brought to pass, the two instruments belonging to the G. T. Survey of India, the one called "Troughton" and the other "Simms," for distinction's sake, as they stood at my disposal on the 15th September 1839, were both alike and consisted of the following portions.

A double vertical circle of 3 feet diameter consisting of two circles united together with a telescope between them in the manner usual to instruments of this class made by Mr. Troughton, both faces hand-divided to 5 minute spaces by Mr. Simms and marked *A* and *B* at the eye end: a telescope 53·84 inches focal length, diameter of object glass 3·46 inches with powers as follows:—

| | |
|---|---|
| Eye tube, No. 1 | 110 |
| Ditto No. 2 | 74 |
| Ditto No. 3 | 53 |
| Diagonal | 75 |

On one side were two fixed micrometric microscopes sustained by bent conical tubes the thick ends of which embraced the shaft of one of the columns immediately below its capital and were made to clasp it tightly by 6 strong iron screws; these microscopes when the telescope was in a horizontal position always stood at Zero of the face to which their optical axes were applied and at 90° when the telescope was directed to the Zenith.

To this pair of bent tubes was attached the level of the body of the instrument or

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azimuth level which was neither swinging nor riding but a fixture adjustable when necessary by means of screws applied in the manner usual on like occasions: the level of the vertical circle or transit axis was a riding level resting on the pivots of that axis, and furnished with a cross level: the following are the values of one of their divisions:—

| | Troughton. | Simms. |
|---|---|---|
| Level of the azimuth motion ... | 73 experiments 0″·7351 ... | 80 experiments ... 0″·8466 |
| Level of the transit axis..... | 44 ditto 0″·9442 ... | 80 ditto ... 0″·8872 |

Towards the opposite face was a pair of revolving microscopes fitted up after the manner of those applied by Mr. Troughton to the instrument formerly well known by the name of the Westbury circle, whereby the position of the point under those microscopes at Zero was susceptible of change. The range of alteration was from 60° of altitude to 30° of zenith distance or in other words amounted to about 60 degrees on either side of Zero, but the arms could not be fixed within 30° either of the Zenith or of the Nadir.

The outriggers one of which surmounted the capital of each column were so adapted that the two points of pressure exerted by the vertical circle, viz. that on the friction-roller, and that on the adjacent *Y* should be at distances from the middle line of the column inversely as the weights allotted to each. It had resulted from all my trials on friction rollers that in large instruments they may safely bear $\frac{3}{5}$ of the whole weight, leaving $\frac{2}{5}$ active, on which hypothesis the centre of the column lay in the line joining these two points of pressure intermediately dividing it into two portions which were to each other in the ratio of 2 : 3.

A plumb-line had been supplied originally by the artist, but it was found to be superfluous, and after many fruitless trials was given up as impracticable for the following reasons:

1st. However accurately an instrument may be adjusted, however solid may be its structure, however steady may be its rotation, and however substantial and isolated may be the foundation on which it rests,—still it is in vain to expect that amidst all the changes of temperature which are perpetually in progress so complicated a mass of parts will retain a perfectly level position.

2nd. Deviations are accordingly perpetually arising which are faithfully indicated both by plumb-line and level, but there is this difference that the former only warns the observer of the existence of any deviation, whilst the latter not only points out the defect but its amount also. Now to eliminate such errors of adjustment which obviously arise from changes of temperature acting unequally on different parts of the system is tantamount to going over the whole adjustment again with no better chance of success than in the first instance, and is not to be thought of because a whole night would in that case be taken up with a succession of fruitless turnings of screws and reversings of faces; so that it only remains after having levelled the instrument prior to commencement either to take it with all its errors for better for worse until the next pause admits

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of a revision or continually to note those errors as indicated by the level both prior and subsequent to each observation and apply the amount so found in the shape of corrections.

As in the whole course of observations it will appear that each end of the level has been read off after every individual observation and the instrument immediately afterwards turned half round in azimuth—as moreover the level is parallel to the face and therefore in the plane of the meridian, the values of the errors reduced to parts of seconds are at once applicable as corrections to observed meridional arcs; but to this end it is manifest that the plumb-line is of no service, and as every useless appliance only tends to complicate what is sufficiently complex already, therefore I eliminated that appendage and disencumbered each of the instruments of it.

The shafts of the columns were frusta of cones of carved sandstone surmounted by capitals of brass which were cemented to them by a compound of quick lime and gúr or molasses: instead of hollowing out these cones whereby the external rounded surface is preserved entire, I had all the cone cut away except two diameters crossing each other at right angles and running the whole length of the shaft, such thickness being given on each side of the line of the diameter as sufficed to give it strength and tenacity, and also massive portions being reserved about the sites of the divers screw holes so that there might be no apprehension of the stone splintering in those points where the bits of brass containing the female screws were soldered into the cavities cut to receive them.

These columns were supported on a cast iron table the lower surface of which was hollowed out to receive the flange of the male axis: one and a half inches above the table was a brass piece called a connecting piece which united the two columns and held a look-down telescope to be placed or displaced at pleasure, to the end that the instrument might be accurately adjusted over the centre of the station, the male axis being (with the same purpose in view) perforated from top to bottom vertically to allow free vision.

The female axis which as before mentioned was of the construction called Ramsden's pattern was attached to the azimuth circle a very substantial frame of cast-iron graduated on gold let into the iron in a circumference described with a radius of 12 inches, regarding which those who desire more precise information will obtain full particulars in the memoir sent by me in 1839 for publication in the Transactions of the Royal Astronomical Society of London.

The transit axis was as usual perforated on one side and the lamps by which the wires were illuminated were of a kind which when I left England in 1830 was peculiar though perhaps they may have long ceased to be so (such is the effect of long absence from the haunts of civilized men) without my being aware of the fact.

Either lamp was furnished with 5 nozzles each having a plano-convex lens, the central nozzle threw the light into the opening in the axis, the next two on either side illuminated the reading microscopes, the external two shone on the ends of the bubble of the level and its divisions, for which purpose small plane mirrors hinging on pivots were attached round the necks of the nozzles by moveable collars to the number of four to

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each lamp, viz. two for the purpose of reflecting the rays on the reading microscopes of the revolving arms on one side, and two for effecting a like object with respect to the level on the other.

These lamps were appended in such manner as to make them independent of all contact with the outriggers, *Ys* or capitals. A small tin tube expanding on each side at its lower extremity so as to grasp one of the projecting diameters of the sandstone shaft was fixed there in position by a screw, and into the upper end which was open was inserted obliquely a wooden rod serving to support the lamp. As a drawing of this was sent with the memoir above alluded to and is also included in Series A I feel the less reluctance in trusting to this meagre description to convey a more correct notion of the manner of this attachment, but the necessity of cutting off all contact between the lamp and the parts of the instrument likely to act as conductors is manifest, to which end this method is I have reason to believe highly effectual.

The building constructed at Kaliana consisted of one room 12 feet broad by 20 feet long with two side rooms on the east and west sides each 12 feet by 16 and terminated at either end by a semicircular bow of 6 feet radius. The side rooms being intended for the reception of instruments and other public property need no particular description, they were each 11 feet in height with 4 small windows and one large door of entrance. The floor of the middle room was boarded and raised 3 feet above that of the side rooms, wooden steps being provided for the ascent from the one to the other—the entrance was by a door on each side 4 feet wide.

At 6 feet distance from the east and west walls of this room as centres circular apertures described with a radius of 2 feet were cut through the boarded floor, whereby space was allowed for two pillars to pass through free of contact with the stage on which the observers and others who tended the instrument trod. The eastern of these pillars was over the site of the station connected with the triangulation; the other which stood 8 feet due west of it was reserved for the astronomical circle used in celestial observations: the forms and dimensions of them and their foundations as well as of the stands of masonry constructed to supply the places of the wooden tripods furnished originally by Messrs. Troughton and Simms will be best understood by a reference to the drawings given in the plates forming Series A.

Below the floor was a vacant space reserved for the pillars which were thus kept quite isolated even to their foundation, and that the building might be well ventilated the northern and southern walls of this space immediately above the plinth were each perforated by 3 semicircular arches of 18 inches radius with wooden gratings, the middle grating opening with a hinge so as to allow access when needed.

Opposite each pillar were two meridional apertures of 24 inches wide provided with shutters reaching from the level of the wooden floor on either side through the whole plane of the meridian, and it must be mentioned that the communication of the rafters which supported the floor with the wall was cut off on both the north and south sides of the meridional aperture of the western pillar, and also that a like severing of



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communication was contrived in the middle parts of the wall where recesses were made to receive the astronomical clocks.

The walls and roof of the central room rise to the height of 4 feet above those of the wing rooms and on either side east or west are two windows 18 inches by 36, which served to admit light and air above the roof of the latter. During periods of observing, the two windows on the leeward side were left open, those on the windward were kept closed as were also the side meridional apertures opposite the instrument, but both the apertures in the roof were left entirely open as was also the upper leeward shutter of the side opening contiguous to the pillar not occupied by the instrument; the object of all which arrangements was clearly to reduce the inside temperature as nearly as may be to a level with that outside without exposing the instrument to sudden gusts or cold blasts.

The meridional marks were 4 in number, viz. 1 for each pillar on the north side at the distance of 7,421 feet, and 1 for each on the south side at a distance of 7,090 feet: each of these presented a horizontal area of 72 inches by 42 inches at top, 112 inches by 72 inches at bottom, and a vertical area facing the observatory of 73 inches high by 72 inches broad at bottom, and 42 inches broad at top—the greater area at the base thus allowing a small flight of steps whereby the persons who tended the lamp, heliotrope, and sight vane might ascend and descend with facility. A small vaulted space at bottom allowed access to the lower mark-stone which was that first laid down whereby the upper mark was adjusted above it, and both marks were dots engraved on brass soldered into slabs of stone imbedded in the masonry of the pillar.

The position of these dots was determined in this wise. The approximate site of the meridian at a suitable spot was first ascertained sufficiently near the truth to allow of the northern structure being erected, which having been done, at the periodic time of opposition of $\alpha$ Ursæ Minoris in October 1836, Captain Waugh and myself with the two large theodolites, one on either pillar in the observatory, took a complete series of observations for azimuth.

The few of these nearest maximum enabled me to settle the deviation sufficiently to lay down sites for the two south pillars approximately which were erected by the executive officer of the building department whilst I was absent, and on my return in 1837 the whole series of observations having been regularly computed, the minute corrections requisite on the north side were known and given, whence those on the south side were determined by regular sets of angles taken over each pillar in the observatory in the usual manner, and the dots engraved on the brass as above mentioned.

From the mention just made of the manner in which the connection was severed between the rafters of the floor and the parts of the wall adjacent to the western of the two meridional apertures it will be apparent that the sill of that aperture furnished a steady support not liable to be agitated by the tread of the observers on which I could place such implement as might serve the purpose of determining the amount of the error of collimation in altitude.

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In that spot I accordingly constructed a pillar of masonry 29½ inches high, separated by a vacant space of 1 inch from the side wall of the aperture, and therefore isolated from the wall of the building excepting at its base—this pillar was surmounted by a flat slab of sandstone cemented to the masonry of the pillar to which I fixed by screws in the usual manner the cast-iron frame of a transit telescope of 31·7 inches focal length designed to serve the purpose of a fixed collimator.

I must remark that though two floating collimators were supplied by Messrs. Troughton and Simms, one for each circle, yet it was entirely contrary to the wishes of Mr. Troughton who pronounced that they would be a failure, and so indeed they proved for though I made several trials I never could bring them to answer the end proposed.

With instruments which turn round in azimuth it is not immediately apparent why a floating collimator is particularly valuable, and it is very clear that by eliminating the principle of fluidity the case becomes greatly simplified without injury to efficiency, for all that is really requisite seems to be a fixed point of reference which shall retain its position steadily during the short period taken up in observing it a sufficient number of times with the face either way, and if that conclusion be admitted a greater power of telescope may be used, and greater scope is gained for contrivance in throwing the light and selecting the object to be observed.

The object used in this course of observations was one to which I have given the name of the Phantom: it consists of a frame of mother-of-pearl with a minute circular hole neatly drilled in its middle, the rim of this hole being blackened; over this hole and as nearly centrical as can be done by the aid of a powerful lens, two of the finest and best defined lines of cobweb or raw silk which can be procured are tightly stretched crossing each other at angles of 60°, and cemented to the mother-of-pearl by tincture of Benzoin, this frame was then put into the place of the cross wires of the transit telescope removed for the purpose in such wise that the 60° angles shall be situated on the right and left of the observer, and in the solar focus of the object glass, the eye tube was replaced by a piece of plane glass, and over the object glass was applied in lieu of its brass cover a diaphragm of tin black-varnished for the occasion, the aperture being as large as could be consistently with distinctness of the cross-wires of the phantom.

Previous to removing the eye tube of the collimator it was made use of to find the reading of the telescope of the circle at which they look directly upon each other, and to adjust the phantom to solar focus, which being done, in the wooden shutter of the meridional aperture a small sight hole was drilled so that the light of day, when the sun was above the horizon, or of a lamp placed behind it during the hours of darkness might have free passage through, and in this state the eye tube being finally removed from the collimator, and the plate of plane glass substituted for it, the image formed was singularly brilliant and beautiful.

It was of course sufficiently easy to place a support for the lamp outside the shutter and a tin covering to protect it from the weather; it will of course be understood that

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during the above process of adjustment the room must be darkened, and that the proper angle at which the collimator was to be set having once been found, it could always be set at the same angle again, but perhaps it may be necessary to advert to one fact which is of importance that there is ofttimes one position of the object glass of a telescope used as a collimator which produces more distinctness in the phantom than any other, and that this identical position must be sought out by turning the object glass round until it is discovered.

The observatory at Kalianpúr differed considerably in structure from that at Kaliana, having no wing rooms, but one pillar, and two meridional apertures, the breadth of the observing room being 10 feet by 20 instead of 12 by 20, the windows on the east and west being 66 inches by 20, and there being but one door of entrance over which was a portico. Of this as well as the meridional pillars and their distances* a detailed account has been given in the description of stations, whence and by the aid of the drawings in the book of plates the subject will be easily understood. The observatory at Damargida was precisely similar to that at Kaliana, and its meridian marks were laid down in a manner exactly analogous to that herein explained, and with equal care, that to the north being at the distance of 8,463 feet; and that to the south at the distance of 7,043 feet; what has been said regarding the levels and phantom is of general application, and where the corrections applied under the designation of error of collimation in altitude or level error are introduced they will be understood to imply what has been explained in the above description.

In either observatory Kaliana or Kalianpúr throughout the course of observations were two barometers each with an attached thermometer; two detached thermometers at Kaliana, one only at Kalianpúr—inside the building; and two outside, of which latter one had a wetted muslin rag over its bulb. The following particulars which are extracted from the records of the G. T. Survey will serve to throw light on the manner in which these were employed.

Memorandum relating to the registry of barometers and thermometers during the celestial observations at the Kaliana observatory in the season of 1839-40:—

1st. The barometers with their attached thermometers were hung on brackets fixed to the internal S.E. wall of the observatory and marked Nos. 1 and 2. No. 1 barometer was upon the new construction or open cistern. No. 2 barometer of the old construction or closed-cistern principle—both were registered alike. The mercury in the cistern was 4 inches in height above the level of the pillar on which the instrument stood.

2nd. The attached thermometers were screwed on to the brass tubes which incase the barometer tubes and each takes the number of its attachment.

3rd. The internal thermometers Nos. 1 and 3 were those registered in the column for detached thermometers: previous to the 9th December 1839 these were hung between the brackets holding the barometers, but on that and every subsequent day

* That is to say, North meridional pillar, 5,774 feet.
South ditto ditto 6,057 feet.

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they were suspended in the meridional aperture on the north side of the astronomical circle at the height of its object glass when directed to the zenith.

4th. The external dry and wet bulb thermometers Nos. 4 and 5 were placed outside the building on the north side, being duly protected from the effects of radiation either from the sky, the ground, or the wall during the night, as well as from reflected heat during the day, but still exposed to a free access of air.

These thermometers, viz. 1, 3, 4, 5, by Messrs. Troughton and Simms, latest sent out from England, are of the bent-neck construction, the bulb being long and at right angles to the capillary tube. Their comparisons with the English standard were made by the makers in London, and will be found subjoined.*

The thermometers 1 and 2 attached as also 1 and 3 detached were likewise compared† from May 14th to 18th inclusive at the station of Hatipaon and at temperatures as near as circumstances allowed to those prevalent during the observations with a standard thermometer marked *A* by Messrs. Troughton and Simms belonging to the Surveyor-General's office.

There does not appear that perfect conformity which might be desired, for at the temperature of $\frac{1}{2}\cdot(49\cdot5+58\cdot7)=54\cdot1$ the artist's comparisons give for the reading of our thermometer No. 1 detached 0·25 in excess of his standard, and the mean 115·014 of his observations 22 in number from 31·9 to 211·4 gives an excess in reading of 0·131, whilst at the temperature of $\frac{1}{2}\cdot(51\cdot8+55\cdot4)=53\cdot6$ the comparisons in May 1840 at Hatipaon give for No. 1 detached a reading 0·3 in excess of our standard, and the mean 57·41 of our observations 9 in number from 62·7 to 51·0 gives a reading 0·30 in excess of our standard, whence we are led to the conclusion that our standard *A* is very nearly in accordance at the temperature prevalent in our observations with the standard used by the artists, differing from it in fact only by 0·05 the latter reading in excess.

This conclusion is not however supported by the similar comparisons of No. 3 detached, for at the temperature of $\frac{1}{2}\cdot(49\cdot3+58\cdot7)=54\cdot0$ the artist's comparisons give the reading of our thermometer No. 3 detached 0·05 in excess of his standard and the mean 114·323 of his observations 22 in number from 31·9 to 211·4 gives a defect in reading of 0·037, whilst at the temperature of $\frac{1}{2}\cdot(51\cdot8+55\cdot4)=53\cdot6$ the comparisons in May 1840 give for No. 3 detached a reading 0·25 in excess of our standard and the mean 57·41 of our observations 9 in number from 62·7 to 51·0 gives a reading 0·29 in excess of our standard, whence it would be supposed that our standard *A* differs from that used by the artists at the temperature prevalent at the time of our observations by 0·20, the latter being that quantity in excess.

The similar particulars with these relative to the Kalianpúr observatory are as follow:—

1st. The barometers with their attached thermometers were hung inside the building, their cisterns being 22·7 inches below the axis of the instrument or 48·8 inches above

* See note *A* at the end. † See note *B* at the end.



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the station mark, and marked Nos. 3 and 4. No. 3 barometer is upon the new construction or open-cistern. No. 4 barometer is of the old construction or closed-cistern principle. In the course of observations barometer No. 3 only is inserted. No. 4 was used for keeping a meteorological register.

2nd. The attached thermometers were screwed on to the brass tubes which incase the barometer tubes, and each takes the number of its attachment. No. 3 only is inserted in the course of observations.

3rd. The internal thermometer No. 6 is that used as a detached thermometer: previous to the 2nd December 1839 it was hung on the wall of the room, but on that day it was suspended in the meridional opening near to and at the same level as the object glass of the telescope, so as to give the temperature of the last stratum of air passed through by the rays.

4th. The external and wet bulb thermometers marked Nos. $1\frac{1}{2}$ Troughton and Simms, and No. 4 Troughton London were placed outside the building on the north side being duly protected from the effects of radiation either from the sky, the ground, or the stone wall during the night, or from reflected heat during the day, but being at the same time exposed to a free access of air.

The thermometers above specified were all compared* in January 1840 with a standard thermometer by Troughton and Simms which was sent by me with Captain Waugh, and the comparisons 5 in number will be found subjoined, but there is reason to suppose that the standard used on that occasion reads in excess to the standard $A$, with which the thermometers used at Kaliana were compared, by the quantity 0·61.

By some oversight in the hurry attending Captain Waugh's departure from head quarters the precaution was omitted of comparing together the two standards in question under the idea that being both by the same maker they would agree with each other; but a desire having subsequently arisen to settle their relative readings by trial the method employed was to compare with the standard $A$ the only two forthcoming thermometers which had been previously compared† with the standard with Captain Waugh marked $\frac{\sigma}{6}$. These two thermometers belonging to the iron standard $B$, and characterized $\gamma$, $\delta$, were accordingly compared with standard $A$ in May 1840, and the comparisons‡ 22 in number are subjoined as also the prior comparisons 25 in number of $\gamma$, $\delta$, with the standard $\sigma$ made in April 1835, whence the above conclusion has been arrived at.

This correction though small in its effects on stars so near to the zenith as those used both at Kalianpúr and Kaliana needs nevertheless to be taken into account, but it is so easy to introduce this by a differential process that I have deferred all consideration of it in the expectation that I should eventually§ have an opportunity to determine the amount of reduction with greater precision and certainty, and in the mean time the refraction both at Kalianpúr and Kaliana were computed precisely as if the two standards were perfectly equivalent.

Though each party was provided with two barometers, one with a closed and one

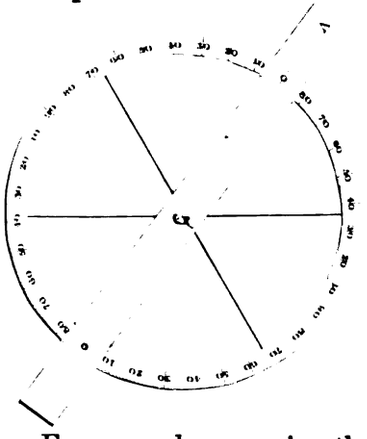
* See note *C* at the end. † See note *D* at the end. ‡ See note *E* at the end.
§ See note *F* at the end.

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with an open cistern, yet the latter only was used in the course of the observations, because it was deemed preferable on many accounts. In the first place the tubes of the latter had been carefully and recently filled by my pump under my own eye at Hatipaon, whereas the others had been filled some years before in England; in the second place it is easier by means of a dipper to adjust the surface of the mercury in the reservoir, and probably owing to the former cause the mercury stood higher in the open-cistern barometers than in those closed. These two were compared by Captain Waugh previous to his departure and the barometer used at Kalianpúr was found to read higher than that used at Kaliana by 0·021 of an inch which has been taken into account.

The formula employed for refraction is that given by Mr. Henry Atkinson in vol. 2 of the transactions of the astronomical society of London for the year 1825, to which reference may be so easily made that all detail of the manner of applying the same will be superfluous: in fact it seems to be a matter of small importance what tables of refraction are used, seeing that our greatest zenith distance is less than 11°.

The stars selected to be observed simultaneously at Kaliana and Kalianpúr were 36 in number of which the times of transit of the 1st, 8th, 14th, 22nd, 27th, 33rd, and 36th were appointed for noting the barometers and thermometers, the rest being supplied by interpolation.



Each face of the vertical circle is divided into four quadrants, and the divisions of whichever quadrant all run in the same direction so as to be continuous up to 90°; those of faces *A* and *B* being similarly situated, it is plain that when the two faces are made to change places by transposing the pivots *Y* for *Y*, as the semicircle which was above comes below the horizontal line and *vice versâ*, therefore a change of position which would have caused an increment of altitude or vertical arc before shifting causes a decrement after that operation.

For example supposing the telescope to be first laid to a point $\alpha$ in the horizon and afterwards to a point $\beta$ 10° above it, with face *A* to the fixed microscopes, that the arc is at its origin which is known by every motion of the object end upwards or the eye end downwards producing an increase in the reading of the vertical arc; then $\beta$ will read 10° of altitude, and if without making any other change the pivots be transposed it is plain that the very same motion i.e. from $\alpha$ to $\beta$ will be retrograde or tend to decrease the reading on face *B*, so that $\beta$ will read 90°—10° or 80°, and hence the micrometer whose readings were direct in the first instance would be reverse in the second.

The heads of two of the micrometers are graduated in reverse order to those of the other two, whereby in reading altitudes as those nearest the object glass read to the graduation next below in appearance or next above in reality (because the microscope inverts), and those nearest the eye glass read to the graduation next above in appearance

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or next below in reality, therefore as is plain all the microscopes may be made to read direct, to effect which after shifting the pivots $Y$ for $Y$ the heads must be made to change places also.

The arc is said to be at its origin when with the telescope directed to the horizon the graduations below the object glass run in direct order or 10°, 20°, &c. consequently that one of the fixed microscopes which is contiguous to the object glass in that condition is considered to be the microscope of the origin, whilst the other which is contiguous to the eye tube is called the microscope of the limit, because it becomes contiguous to the object glass when at 180° from the origin, a position which is to be recognized by the graduations below the object glass running in the reverse order 80°, 70°, 60°, &c.

Viewed in this light it appears that all arcs from the origin up to the zenith are altitudes, and that after passing through the division 90° the zenith distance which is read off is merely a continuation of the vertical arc from the same origin diminished by 90°. If as is usual in the G. T. Survey of India we employ the characteristic $a$ to denote altitude, and $\underset{(,)}{a}$ to express zenith distance, then $a$, $(\frac{\pi}{2}+\underset{(,)}{a})$ will denote arcs measured from the origin, and thus it will appear why the microscope which reads direct for the one will also read direct for the other.

The transposition of the pivots in the $Ys$ will as is plain shift the origin to the opposite point of the horizon, but if the graduated heads be made to change places at the time, and the characteristic letters be engraved on those heads and not on the bodies of their microscopes the same characteristics will belong to the origin and limit as before the change, so that if after these alterations have been effected the instrument be turned half round in azimuth all matters will revert to precisely the same state in which they were except that face $B$ will be now towards the fixed microscopes.

In respect to the revolving pair of microscopes, though the degree at which they are set will differ from that shewn by the fixed microscopes, yet their micrometers ought to be made to read the same number of minutes and seconds as nearly as possible to avoid confusion, and especial pains should be taken to see that when the instruments issue from the artist's hands this adjustment is practicable without moving the body of the microscope far from the middle of its socket by the 3 pressure screws applied to it. The revolving arms belonging to the two instruments of which I am speaking had not due scope for this agreement when I first tried them at Kaliana in 1837, and it cost me some trouble to make them effective.

As to the degree itself under those microscopes if we desire to know it at any position, all that is necessary is to note the degree which they read at the origin whether altitude or zenith distance, and add that to the degree shewn by the fixed microscopes omitting 90° whenever the sum exceeds that value, the truth of all which will easily be perceived from the figure.

The various errors to which observations made with instruments of this class are liable seem to be attributable to the following sources:—

1st. The effect of raising the $Ys$ in adjusting the transit axis.

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2nd. The effect of an error of collimation in the prime vertical.

3rd. The effect of an error of level in the transit axis.

4th. The effect of a deviation from the perpendicular in the axis of rotation in the prime vertical.

5th. The effect of a deviation from the plane of the meridian.

6th. The effect of a deviation from the perpendicular in the axis of rotation in the direction of the meridian.

7th. The effect of an error of collimation in the plane of the meridian.

I have investigated each of these cases individually, but on a subject so well known do not think it necessary to swell my book with demonstrations in detail which most readers will deem superfluous, therefore I shall confine myself to stating the conclusions arrived at, viz. that in respect to vertical arcs such as those in question, the first five are with my assumed limits of no moment; that the 6th is to be counteracted by the level corrections in column 8; and that the 7th is from the nature of the instruments employed to be applied with the same sign to both observed altitudes and zenith distances: that is to say, if $a$, $\underset{(\cdot)}{a}$ represent the true altitude and zenith distance of any star $\sigma$; $a'$, $\underset{(\cdot)}{a'}$ the same quantities observed and $\varkappa$ denote the error of collimation in altitude, then

$$\underset{(\cdot)}{a'}+a'=\underset{(\cdot)}{a}+a-2\varkappa=\tfrac{\pi}{2}-2\varkappa, \text{ because } \underset{(\cdot)}{a}+a=\tfrac{\pi}{2} \therefore \varkappa=\tfrac{1}{2}\cdot\{\tfrac{\pi}{2}-(\underset{(\cdot)}{a'}+a')\};$$

The error of collimation herein spoken of is the difference between the positions given by the mean readings of the micrometers and the telescopic axis, and it is manifest that as long as both these lines maintain a constant relative position, its effects will be entirely eliminated by reversion. Now in reality there seems very little reason to suspect that generally speaking the position of the telescopic axis alters sensibly in short intervals, or even from one night to another; the change most to be apprehended is in the micrometers, for should the reading of any one of these alter it will have as sensible an effect on the observed vertical arc as if the wires of the telescope had been altered by the $n^{th}$ part of the variation, $n$ being the number of micrometers. Hence the necessity that each of the microscopes and its micrometer should retain the same situation during each pair of observations made *F. E*, and *F. W*, on the same star, and as that is a subject which causes more irregularity than any other, whilst at the same time it is of a more dubious nature, therefore every means should be resorted to, to guard against its effects: a more minute examination therefore of this important error is desirable.

The latitude $\lambda$ is always equal to $\text{æ}\pm\underset{(\cdot)}{a}$* for any star $\sigma$, the upper sign being used when $\sigma$ is between *Æ* and *Z*, and the lower when *Z* is between *Æ* and $\sigma$, hence in the first hypothesis:

* The symbols in use in the Great Trigonometrical Survey of India differ from those ordinarily employed and therefore need explanation. We put *Æ* to denote the equator; æ for declination; $a$ for hypothetical altitude; $\lambda$ for terrestrial latitude; $\underset{(\cdot)}{\text{æ}}$, $\underset{(\cdot)}{a}$, $\underset{(\cdot)}{\lambda}$ for the complements thereof; $a'$, $\underset{(\cdot)}{a'}$ for observed quantities, and so forth.



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Origin to the South with face one way ..... $\lambda = \alpha + \frac{\pi}{2} - (a' - \varkappa)$

Origin to the North with face opposite way ..... $\lambda = \alpha + \underset{(1)}{a'} - \varkappa$

The mean of which gives ..... $\lambda = \alpha + \frac{1}{2} \cdot \{\frac{\pi}{2} - a' + \underset{(1)}{a'}\}$

which is independent of $\varkappa$ as long as it is unaltered during both observations.

In the second hypothesis

Origin North with the face one way ..... $\lambda = \alpha - (\frac{\pi}{2} - (a' - \varkappa))$

Origin South with the face the opposite way ..... $\lambda = \alpha - (\underset{(1)}{a'} - \varkappa)$

The mean of which gives ..... $\lambda = \alpha - \frac{1}{2} \cdot \{\frac{\pi}{2} - a' + \underset{(1)}{a'}\}$

Which is also independent of $\varkappa$.

Although the quantity $\varkappa$ may have been carefully determined by the method previously detailed, it will not however necessarily be the true value of the error, because it is obtained at one part of the circle whilst the observations on $\sigma$ are made at another; let $(\varkappa + \delta\varkappa)$ therefore be the correct value on any one night, and $(\varkappa' + \delta\varkappa)$ that on the succeeding night; $\varkappa$, $\varkappa'$ denoting quantities determined by the phantom or other method;

Then with the face one way ..... $\lambda = \alpha + \frac{\pi}{2} - (a' - (\varkappa + \delta\varkappa))$

And with the face the opposite way ..... $\lambda = \alpha + \underset{(1)}{a'} - (\varkappa' + \delta\varkappa)$

The mean of which gives ..... $\lambda = \alpha + \frac{1}{2} \cdot \{\frac{\pi}{2} - a' + \underset{(1)}{a'} + \varkappa - \varkappa'\}$

and in like manner when $Z$ is between $\sigma$ and $\mathcal{E}$.

The mean value will be ..... $\lambda = \alpha - \frac{1}{2} \cdot \{\frac{\pi}{2} - a' + \underset{(1)}{a'} + \varkappa - \varkappa'\}'$

Now each of the quantities $\varkappa$, $\varkappa'$ is found by observation, consequently their difference is known, and as $\delta\varkappa$ is supposed to be a constant quantity applied to compensate for the difference of graduation in different points of the circle, therefore it appears that observing by pairs the error of collimation will in this wise be eliminated in two nights observation.

The quantity $\delta\varkappa$ being introduced as a correction to compensate for the difference of graduation between the parts of the limb at which the observations to determine $\varkappa$ and those on $\sigma$ were made, will only vary from irregular expansion of the circle or some such cause, and therefore may be considered as constant for every star as long as the revolving microscopes occupy the same position, but it will vary for different stars and for different positions of those microscopes.

Let us consider the case of a star being obscured at culmination or missed from some other cause on any particular night whereby, of the 4 observations as prescribed at that position of the revolving microscopes, one is wanting, leaving two with the face one way, and only one with the face the other way.

Then $\varkappa$, $\varkappa'$, $\varkappa''$ being the observed errors of collimation of which the first and last are on the same face we have

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With the face one way on the 1st night .....$\lambda = \alpha e + \frac{\pi}{2} - (a' - (\varkappa + \delta\varkappa))$

With the face the same way on the 3rd night.....$\lambda = \alpha e + \frac{\pi}{2} - (a'' - (\varkappa'' + \delta\varkappa))$

With the face opposite way on the 2nd night.....$\lambda = \alpha e + \underset{(i)}{a'} - (\varkappa' + \delta\varkappa)$

If we add the two first together and take half the sum we get

For the mean, face one way.....$\lambda = \alpha e + \frac{\pi}{2} - \frac{a' + a''}{2} + \frac{\varkappa + \varkappa''}{2} + \delta\varkappa$

For the single observation, face the other way .....$\lambda = \alpha e + \underset{(i)}{a'} - \varkappa' - \delta\varkappa$

And putting .....$\frac{1}{2}\cdot(a' + a'') = \alpha'$; $\frac{1}{2}\cdot(\varkappa + \varkappa'') = \beta$

We get as before .....$\lambda = \alpha e + \frac{1}{2}\cdot\{\frac{\pi}{2} - \alpha' + \underset{(i)}{a'} + \beta - \varkappa'\}$

It appears therefore that there is an absolute necessity to have at least one observation with the face each way in order to eliminate the quantity $\delta\varkappa$.

Though the terms $\varkappa$, $\varkappa'$, &c. be ever so carefully observed and registered, yet it will hardly happen that their actual amount will be obtained to the extreme accuracy required, but we may eliminate the errors with which they are burdened by the method of reversing the instrument in Azimuth after each star which it will be of use to examine.

If there be two stars $\sigma'$, $\sigma''$ whose declinations are $\alpha e'$, $\alpha e''$, both on the south side of the zenith but observed in opposite positions of the origin of the arc immediately subsequently to each other, then ($m$ and $p$ being such that $p$ is a whole number and $m = 2p+1$) by the first or $\sigma'$

With face east on the $n^{th}$ night .....$\lambda = \alpha e' + \frac{\pi}{2} - (a' - (\varkappa + \delta\varkappa))$

With face west on the $\overline{n+m}^{th}$ night.....$\lambda = \alpha e' + \underset{(i)}{a'} - (\varkappa' + \delta\varkappa)$

Whence.....$\lambda = \alpha e' + \frac{1}{2}\cdot\{\frac{\pi}{2} - a' + \underset{(i)}{a'} + \varkappa - \varkappa'\}$

And by the second or $\sigma''$

On the $n^{th}$ night .....$\lambda = \alpha e'' + \underset{(i)}{a''} - (\varkappa + \underset{,}{\delta}\varkappa)$

On the $\overline{n+m}^{th}$ night .....$\lambda = \alpha e'' + \frac{\pi}{2} - (a'' - (\varkappa' + \underset{,}{\delta}\varkappa))$

Whence.....$\lambda = \alpha e'' + \frac{1}{2}\cdot\{\frac{\pi}{2} - a'' + \underset{(i)}{a''} + \varkappa' - \varkappa\}$

The mean of which gives

$\lambda = \frac{1}{2}\cdot(\alpha e' + \alpha e'') + \frac{1}{2}\cdot\{\frac{\pi}{2} - a' + \underset{(i)}{a'} - a'' + \underset{(i)}{a''}\}$ a result independent of the values of $\varkappa$, $\varkappa'$, $\varkappa''$, $\delta\varkappa$, $\underset{,}{\delta}\varkappa$, &c.

This method therefore combined with the other produces a result which is quite as free from the error of collimation as if no such error existed, and if both methods could be attended to without fail it would be supererogatory to trouble ourselves with that term, but as clouds or other causes must naturally in a long series of observations disturb the perfect system of regularity on which these theorems depend, it becomes desirable to ascertain which of the two principles when violated produces effects most and which least to be deprecated.

It is manifest that by attending to the first of the two principles we eliminate the term $\delta\varkappa$, but not the term $(\varkappa - \varkappa')$ which we have supposed to be known to a sufficient

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degree of accuracy, but $\varkappa$, $\varkappa'$ are observed quantities and in common with all other terms so determined must be burdened with some inherent error; if for $\varkappa$ we write $\varkappa+e$, and for $\varkappa'$, $\varkappa'+e'$, then $(\varkappa-\varkappa')$ becomes $(\varkappa-\varkappa')+(e-e')$, of which the second term is totally unknown, and remains to vitiate the mean of the observations on $\sigma$.

If on the contrary we attend to the second principle and neglect the first, we more immediately eliminate $\varkappa$, $\varkappa'$ but not $\delta\varkappa$, $\delta_1\varkappa$, the difference of which will still remain as an error.

Now it has been shewn that an uneven number of observations, provided there be one with the face in the opposite position to the other two, may be used as if it were even, and the following rules were established in the series of observations of which I speak so that both principles might be attended to as closely as possible.

As long as circumstances admit, the instrument is to be turned round in azimuth after each observation, so that the star $\sigma'$ which follows $\sigma$ shall be observed with the face the opposite way to it.

On the next succeeding night $\sigma$ must be observed with the face the opposite way to what it was on the preceding night, and as the instrument after this observation is to be turned half round in azimuth, $\sigma'$ will also be subject to the same condition.

If any star $\sigma^{(a)}$ should be obscured or the observation be lost on any night, it will be kept in mind that all that is necessary in the way of attention to the first principle is that of the three observations taken at that position of the revolving microscopes, one at least must be on the opposite face to the other two, and amidst all the combinations which may occur this point must be so accommodated as to interfere the least with due regard to the second principle.

If at any position of the revolving microscopes after the lapse of the 4th night there should still be several gaps and deficiencies, the following was laid down as the rule to be attended to by both parties:—

The position of those microscopes is on no account to be changed until every star of the set has been observed at least once with the face each way.

If the defects reach upwards of one-fourth of the catalogue or 10 stars, and by retaining the revolving microscopes in their actual position for one night longer, there is a prospect of rendering the whole set complete, to the number four, i.e. (two with the face each way) then also those microscopes are not to be shifted until the object is attained or attempted.

But if there should be less than one-fourth or even 9 only in this predicament (provided one of each be observed on one face and one on the other) then the change of position may be made.

And if by the deficiencies even when amounting to or exceeding the number 10, the principle of observing each star once with the face each way has not been vitiated; as for example, if there be already one observation face east and another face west on the same star, then it is not desirable to waste a night for the sole purpose of obtaining a third observation at that position of the revolving microscopes, and they should be shifted.

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As all substances and metals in particular appear from some undivinable cause to have an aptitude to settle themselves into some favorite position, any other than which they cannot be forced to occupy permanently, therefore it is desirable that the screws which act on the wires of the telescope should be touched as little as possible.

For the same cause interference with the feet-screws of the instrument is to be avoided as much as may be, for it does not follow even though those screws should be managed with surpassing delicacy that the fractional parts of a second of error will be eliminated by their means, nor if this result of extreme skill were attained would it be at all a necessary consequence that the several parts of this complex mass would so maintain their relative positions that this perfect condition would endure through the night.

With reference to these and foregoing considerations the following rules were established for adjusting and using the instruments, and for noting the level errors and other fundamental terms of correction.

The instrument is in the first instance to be levelled with the extremest accuracy in the morning prior to use and then left to stand.

On revisiting it, which ought to be at least an hour prior to commencing a set of observations, the level of the body of the instrument is to be carefully examined in the four cardinal positions in azimuth, and the readings of both its ends in each position accurately read off with a powerful lens of long focus.

If the readings so noted shew a greater error than two divisions in the plane of the meridian or than five divisions in the plane of the prime vertical they must be eliminated, and the same operation gone through over and over until they fall within those limits.

If on revisiting the instrument on any occasion prior to use, the errors are found to be within the limits above specified, no attempt is to be made to correct them by adjustment, but the reading of each end of the bubble together with the position of the face at the time is to be carefully registered as the result of the examination.

The body of the instrument having been examined and adjusted if necessary, the level of the transit axis is to be put on and afterwards reversed, both ends of the bubble being read off in this case also. The limit allowed in this case is five divisions, which if not exceeded is to be registered as part of the examination, but otherwise reduced to within that limit prior to registry.

The lamps are to be put in their places and kept lighted during the process of examining the adjustments of the body of the instrument, but extinguished when those of the transit axis are under investigation lest their heat should affect the level. The instrument in the latter case is to be laid in the plane of the meridian, and its telescope raised as near the zenith as convenience allows, in fact it is an object to find the errors as nearly as may be in the same state of circumstances which prevails during the observations.

The process of examination and adjustment if necessary having been gone through, the phantom is to be laid at the proper altitude and there firmly clamped, after which it is



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to be observed 4 or 6 times, half with the face of the instrument one way and half with the face the other way, the readings of all the microscopes and both ends of the bubble being registered each time. The first of these observations will be taken with the face in the same position with that of the first observed star of the series, and after every observation the instrument will be turned half round in azimuth, so that the phantom may be observed alternately with the face of the instrument to the east and west, and as many times face one way as face the other, the mean of the whole being taken as the error of collimation in altitude prior to commencement.

As this preliminary series terminates in this wise with the face the opposite way to that of the commencement of the star observations, the last readings of the level will be used to deduce the level error for the first star observed—it is desirable in fact that the reading taken with the view of determining the level error at any observation of a star should be separated by as short an interval of time as may be from the reading taken subsequent to the reversion with which it is to be compared, and it is a general rule that the last reading whenever taken prior to reversion shall be used in comparison with the first reading subsequent to reversion.

The phantom is to be observed exactly in like manner immediately after the last star has passed and been read off, whence will be obtained the error of collimation in altitude subsequent to the termination of the night's work, and half the sum of the errors prior and subsequent will be considered as the mean error to be applied as a correction during the series of that night's observations.

The transit axis level is to be employed after the last observation precisely in the same manner as before the first, except that its errors whatever they may be are simply to be registered but not eliminated.

The readings of the level of the body of the instrument last taken when observing the phantom will suffice for the after examination as far as the plane of the meridian is concerned, but it still remains to note the analogous errors in the prime vertical which must be carefully registered after the night's work is terminated and immediately after those of the transit-axis level.

Immediately after any star has been intersected and the four microscopes have been duly read off and registered, both ends of the level are to be also read off and registered, after which the instrument is to be turned half round in azimuth and laid at the proper altitude for the next star, which process is to be attended to throughout.

Great care having been taken to fix the meridional marks it is to be presumed that no error sufficient to have a sensible effect on the vertical arc can be caused by laying the instrument in the plane of the meridian by them. A lamp with a convex lens by night, and heliotrope with $\frac{1}{4}$ of an inch aperture by day, both placed centrically by the plumb line as has been previously explained, are adjusted one over each pillar and carefully tended. By means of these the reading of either microscope of the azimuth circle can be known corresponding to the position in which the plane of the small circle or locus of the line of collimation in altitude is parallel to the plane of the meridian on either side;

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both marks therefore are to be carefully observed before beginning, and the instrument after each half rotation relaid in azimuth through the night with the reading thence derived.

The time of transit of each star over the middle wire is to be noted and registered, but those over the other four wires are only to be observed in some cases which will be especially mentioned: the intervals however even under these circumstances will be quite sufficiently near the truth to point out any deviation from the meridian which may arise should the instrument be erroneously set in azimuth.

From what has been stated in the early part of this description it will be seen that an instrument of the kind I have been speaking of presents the features of two instruments having the telescope, levels, azimuth circle, and axis common to both, but the graduation and microscopes of the vertical circle, and the error of collimation in altitude entirely independent of each other.

The divided faces being marked *A* and *B*, if *A* is to the fixed microscopes they will always read to the zero of that face at the origin, because they are not susceptible of change of position; but *B* will then be to the revolving microscopes which may be set at the origin to any position from 0° to 60° on either side of zero, and as the object of these revolving microscopes is to enable the observer to read arcs on different parts of the limb whereby to compensate for the errors of graduation, therefore as it has been decided that after half the series of observations has been achieved with the face *A* to the fixed microscopes, the pivots shall be transposed so that the remaining half may be made with the face *B* to those microscopes, it follows as a necessary consequence that to set the revolving microscopes to the division 0° at the origin would be supererogatory, because at that position on whichever face, two of the four microscopes will have been used through half the number of observations.

On this principle the revolving microscopes are to be set successively at 20°, 40°, 60° of altitude, and 30°, 50°, 70° of zenith distance with face *B* towards them; the pivots will then be transposed, after which they will be set at the like divisions of face *A* which will then be turned towards them.

At each position of the revolving microscopes every star of the set will be observed 4 times, viz. 2 with the face west, and 2 with the face east; the term face in this case implying the face which happens to be directed to the fixed microscopes without reference to its characteristic letter.

The change of face by transposition of the pivots is evidently an event which takes place but once during the series of the season and marks the completion of half the labour, whilst the change of position of the revolving microscopes occurs, if there be no interruption from clouds or other causes, at the end of every fourth night. Both operations but particularly the former tend to unhinge the instrument as a fixture, and on account of the peculiar propensity which metals seem to evince for preferring particular positions in which alone they will remain steadily, it becomes an object that after every such operation has been effected as long a time as may be conveniently spared

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should be suffered to elapse prior to use. It will be evidently understood that after the first mentioned of these operations the whole of the 4 microscopes will require to be reset and that after the change of position of the revolving microscopes, they will also require to be reset and their runs duly taken. This will be carefully attended to and registered.

From what is above stated it will appear that to complete a set of observations as proposed, 48 clear nights are required viz. 24 with each of the two faces to the fixed microscopes; that of the whole 48, 24 or one half will be at the zero of either face, and four at each of the divisions 20°, 40°, 60° of altitude, 30°, 50°, 70° of zenith distance, so that each individual observation will be read off by means of one pair of microscopes at 0° on one face, and another pair of microscopes at one of the divisions here specified on the other face.

This involves what may be termed an incongruity, for as on each face the division 0° has been employed 6 times as often as any other division, therefore it would be decidedly illogical to give the same weight to the mean derived from the former as to that derived from either of the latter, whilst to add the whole four readings together, and given as they are by absolutely independent instruments to take the mean precisely as if they were made on the same divided circle does not seem entirely free from objection.

The latter however is the plan which I have pursued, but that the question may be open for revision at any time the means have also invariably been taken by pairs whether in observing stars or the phantom, so that each result may be separately deduced if needed.

From a few observations which I took with these instruments in March 1839, there seemed reason to suspect the existence of a constant error in each of an opposite tendency whereby the latitude deduced from stars north of the zenith was greater than that deduced from those to the south and *vice versa*; without pretending to account for this circumstance I deemed it prudent to select the stars of the series so that as many should be situated on one side of each zenith as on the other, but as it is at the same time a vast object to be out of reach of irregularities of refraction, therefore the fifth degree on either side of each zenith was assumed as a limit.

Kaliana is in latitude 29° 30′ 48″, Kalianpúr in latitude 24° 7′ 11″, all between which parallels were excluded by the above rule whilst they formed the limits of the two belts, the other two being 34° 30′ 48″ and 19° 7′ 11″.

After each observation to read off and register all four microscopes and the two ends of the level, and then to reverse and reset the instrument both in azimuth and altitude for the next star is an operation which cannot well be performed even in the best of circumstances in less than 3 minutes, therefore to guard against accidents the interval between two stars was generally fixed at 5 minutes, and was in no instance less than four.

The limiting declination circles were assumed on the following principles which may perhaps admit of a little extension.

It was estimated that stars of the 6th magnitude, which are the best objects for

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observing in clear weather, cannot in these latitudes be seen distinctly earlier than half an hour after sunset or later than half an hour before sunrise; the earliest star which comes ought therefore to have such right ascension that on the last day of observing it shall be within the first of these limits, and the latest so that on the first day of observing it shall not exceed the latter limit, the southern station of Kalianpúr being taken as the criterion.

The party under Captain Waugh left my head quarters at Dehra on the 9th October 1839, and as they had 44 marches to make before they could arrive at Kalianpúr, therefore allowing for halting days it was estimated that they would reach their destination on the 25th November, and that barring accidents the instrument at that limit of the section would be quite in order for observing on the 4th December.

Forty-eight clear nights will probably be encumbered by several cloudy nights, and the proportion of the latter for which it seemed prudent in this case to make allowance was 15, whereby the last day of observing would be 4th February 1840.

On the 4th February the sun sets at Kalianpúr at $5^h\ 30^m$ therefore when the sun is 6 hours from the meridian the earliest star is on the meridian, and as his *A.R.* is then $21^h\ 9^m$ therefore $3^h\ 9^m$ is the *A.R.* of the earliest star of our catalogue. On the 4th December at Kalianpúr the sun's hour angle from nearest noon at rising is $5^h\ 18^m$ or $18^h\ 42^m$ from the preceding noon, therefore $18^h\ 12^m$ is the latest solar time at which a star of the series must be on the meridian, and as the sun's *A.R.* on that day is $16^h\ 41^m$ therefore $10^h\ 53^m$ is the limit for the latest star, and hence the limiting declination circles are those whose right ascensions are $3^h\ 9^m$ and $10^h\ 53^m$.

Thirty-six stars were selected, of which all but the last were taken from the catalogue of the Royal Astronomical Society; that last (216) 61 Cancri was taken from Piazzi's catalogue, of which I had in my possession some extensive extracts transcribed by me many years ago, but though it was not to be found in the society's list, it was found to be in existence, and better deserving a place than many others.

The following is the description of the lithographed sheets of which the books were composed for registering the observations:*

In the title is inserted

1st. The name of the star to which the page is appropriated.
2nd. The approximate zenith distance to the nearest minute of space.
3rd. The sidereal time of transit to the nearest minute.
4th. The name of the station of observation.
5th. The name of the circle "Troughton" or "Simms."
6th. The characteristic letter of the face on the side of the fixed microscopes.

Of these particulars all are common to both pages allotted for each star except the last, which as it will vary on the occasion of transposing the pivots is different in pages 1 and 2.

* See skeleton form *G* in Appendix.



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The columns 17 in number, besides a space for remarks, are arranged as follow:

In the 1st column is inserted the day of the month: in the 2nd the position of the face whether west or east, by which is implied the face viewed at that time by the fixed microscopes: in the 3rd the observed minutes, seconds, and tenths of seconds of the star's passage over the middle wire: in the 4th, 5th, and 6th, the readings of the fixed microscopes to one place of decimals, and their mean to two places, that of the microscope of the origin standing first: in the 7th, 8th, and 9th, like terms for the revolving microscopes: in the 10th the letter characteristic of altitude $a$, or zenith distance $a_{(0)}$, according as may be: in the 11th the general arithmetical mean of all 4 microscopes to 3 places of decimals: in the 12th and 13th the readings of the left and right ends of the bubble of the level of the body of the instrument regarding which it is necessary to observe that with the face west the left end is to the north, and the right end to the south, and with the face east the left is on the south, and the right on the north: in the 14th column is inserted the height of the barometer at the time of transit of such stars as have been marked for the purpose; these are 7 in number, viz., the 1st, 8th, 14th, 22nd, 27th, 33rd, 36th of the selected catalogue: in the 15th column is the temperature shewn by the attached thermometer: in the 16th that shewn by the inside detached thermometer: in the 17th the observer's initials, and in the column of remarks such peculiarities connected with the observations as it may be desirable to note: amongst these is to be specified the degree of the revolving microscopes corresponding to the origin of the arc which remains constant until a new note on the subject is inserted.

Two additional columns were subsequently ruled opposite the stars above enumerated for the purpose of inserting the temperatures shewn by the external dry and wet bulb thermometers.

For all observations of the phantom separate sheets ruled precisely in the same manner as above detailed were bound up, as also several blank sheets to be ruled as occasion might require, in which were inserted as in a diary the previous and subsequent observations of the levels of the transit axis, and the body of the instrument as follows:—

| Date. | Level of the body of the Instrument. | | | | | | | | | | | | | | | | Axis Level. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Previous to the Observations. | | | | | | | | After the Observations. | | | | | | | | Previous to the Observations. | | | | | After the Observations. | | | | |
| | F.E. | | F.W. | | F.N. | | F.S. | | F.E. | | F.W. | | F.N. | | F.S. | | Face. | L. at F. | O. at R. | L. at R. | O. at F. | Face. | L. at F. | O. at R. | L. at R. | O. at F. |
| | L. | R. | L. | R. | L. | R. | L. | R. | L. | R. | L. | R. | L. | R. | L. | R. | | | | | | | | | | |
| Dec. 5 | 82·1 | 82·3 | 82·4 | 82·1 | 82·0 | 82·5 | 79·9 | 85·0 | 84·5 | 91·8 | 86·1 | 90·1 | 85·2 | 91·1 | 84·1 | 92·0 | E. | 65·0 | 58·5 | 66·4 | 57·9 | E. | 75·0 | 67·6 | 75·5 | 66·5 |
| „ 6 | 83·3 | 83·1 | 83·5 | 82·7 | 83·0 | 83·2 | 81·6 | 84·6 | 84·0 | 90·5 | 84·1 | 90·5 | 85·8 | 89·5 | 84·0 | 91·1 | E. | 67·4 | 59·8 | 65·2 | 62·0 | E. | 74·6 | 64·2 | 71·4 | 67·0 |

In explanation of which it may be proper to mention that in the case of the body of the instrument the letters *L*, *R* mean the left and right ends of the bubble of the

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level, and *F.E*, *F.W*, &c. mean face east, face west, &c. whilst in the case of the transit axis which is furnished with a cross-level, the letter *L* implies the end contiguous to that cross-level, and the letter *O* the end opposite to it, the letter *F* implies the fixed microscopes or face, and the letter *R* the revolving microscopes, so that by *L* at *F* or *O* at *R* is to be understood that position in which the cross-level end is contiguous to the fixed microscopes, and the opposite end contiguous to the revolving microscopes, &c.

In cases where any star of the series was missed from the intervention of clouds or other causes the ends of the level were observed and noted precisely as if the observation had been complete: these were registered apart in one of the blank sheets ruled for the purpose, and in another sheet similarly prepared were inserted the readings of the barometers and thermometers whenever the stars missed were of those selected for noting those instruments.

With the view of enabling the party proceeding to the southward to travel as lightly as possible, I thought it preferable instead of encumbering Captain Waugh with an astronomical clock to supply him with a chronometer which was adjusted to sidereal time by moving the weight screws on the balance wheel. This experiment did not answer my expectations, for the rate of the chronometer though very equable before the alteration was by no means so afterwards, and hence will appear in the series of observations at Kalianpúr of 1839-40 discrepancies in the observed times of transit which would not otherwise have occurred.

That those discrepancies are apparent and entirely attributable to this defect of the time-keeper will be evident by taking the differences of the times of transit of successive stars, and comparing them with the like differences on other nights, or the differences of right ascension, whence it will be easily seen that no error has been incurred which could possibly affect the observed zenith distances.

Owing to this cause both of the clocks at my disposal, one by Earnshaw, and one by Mr. Jones the celebrated optician of Charing Cross, were retained in use at Kaliana during the observations of 1839-40.

In the season of 1840-41 the clock by Jones was fixed and employed in the observatory at Damargida which is in latitude 18° 3′ 15″ north, longitude 77° 42′ 31″ east, and at the height of 2026 feet above the sea. That by Earnshaw having been at the same time put up in the observatory at Kalianpúr, which is in latitude 24° 7′ 11″ north, longitude 77° 41′ 47″ east, and 1854 feet in height above the sea, and a comparison of the rates which they were found to have in their new sites with those which they had at Kaliana may perhaps be instituted at some future occasion with a view of determining the increments of gravity in the two sections which are the subject of this volume.

Though the data have all been registered in the manner above detailed and two books kept at each station, of which one pair has been deposited in the India House for reference, yet I have not thought it necessary to burden the press with all these minutiæ, and the following is the form used in the present publication.

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Each star has one page allotted to it, of which the first half contains the observations with face *A* and the second with face *B* towards the fixed microscopes.

The columns ruled are 11 in number, of which

No. 1 is occupied with the date.

No. 2 with the direction of the face.

No. 3 with the position of the revolving microscopes when at zero.

No. 4 with the observed zenith distances which, where altitudes have been observed, have been found by substracting them from 90°.

Nos. 5, 6, 7, 8, 9 with the corrections for refraction, star's place, collimation, level, and the sum of the same.

No. 10 contains the corrected zenith distance or the sum in column 9th applied to each term in column 4.

No. 11 contains the mean of all the observations made in each position of the revolving microscopes.

These sheets of deduced observations are followed by a Synopsis Sheet with 8 columns containing

1st. The number of each star as it occurs in the order of these observations.

2nd. The position whether south or north of the zenith.

3rd and 4th. The mean zenith distances of the two limits.

5th. The Arc of Amplitude.

6th. The mean declination to January 1st, 1840 or 1841.

7th and 8th. Latitudes of the limits.

The corrections for the star's places have been found in the usual manner by using the co-efficients *A*, *B*, *C*, *D*, as given in the Nautical Almanack, having first reduced them to the upper culmination at the meridian of 77° 41′ 45″ east longitude: the constants *a*, *b*, *c*, *d*, *a′*, *b′*, *c′*, *d′*, have been computed afresh with the mean places of the stars as given in the catalogue of the Royal Astronomical Society, brought up to 1st January 1840. These terms might in fact have been dispensed with entirely if all the observations had been absolutely simultaneous but in a long series of observations this is not to be looked for, and as clouds will intervene at one limit of the section whilst the sky is clear at the other, it only remains either to introduce the corrections or reject all observations liable to this objection.

Either plan might have been pursued in this instance, for of the whole series about 1,500 at either station have been actually observed at the same culmination, but I have a great dislike to rejecting any observation which was taken with no such intention in view, and therefore I have retained all and registered them exactly as they were taken.

It remains now only to detail how these measures were all carried into effect:

Captain Waugh with the party under his orders, Mr. Logan as an assistant, and the instrument "Troughton," set out from Dehra Dún on the 9th October, and reached Kalianpúr on the 25th November following. The instrument arrived without accident and was immediately put in position, so that by the night of the 30th, which was earlier

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by 4 nights than the period specified, his first observations were made. As he was but little interrupted by clouds, his series was finished by the 23rd January.

I proceeded from my head quarters at Dehra to Kaliana on the 7th November accompanied by Captain Renny and arrived there on the 13th November, when the instrument "Simms" and the two astronomical clocks were immediately put in position.

The first 8 stars were observed by me for practice on the 30th November and every successive day, and had I been aware that the southern party were engaged with their work I should from that day forward have observed all the stars of my series; as it was, the 4th December which was the day specified, was punctually abided by, and the work kept up nightly with as much regularity as the clouds permitted by my able assistant Captain Renny and myself.

The vicinity of Kaliana to the great northern range of mountains brought my observatory under the influence of clouds, storms, and vapours, from which that at Kalianpúr was free, and thus Captain Waugh's series was completed full 11 days before mine and was less tattered and more uniform; as it is however the series taking it as a whole is about as entire as I had expected, and as it is (so at least I believe) the first instance in the history of Geodesy of a series of simultaneous observations so complete and numerous taken with a view of determining the Arc of Amplitude of a Section of the Meridian, so if the principles I have detailed should meet with the approval of my learned cotemporaries I hope it will not be the last.

On the conclusion of the astronomical observations of the season of 1839-40 on the 27th January, Captain Waugh with the party under his orders proceeded along the course of the Great Arc Series by Husangabad, Betul, and Elichpúr, to Damargida, where his head quarters were established. Besides the astronomical circle called "Troughton" recently used at Kalianpúr the base line apparatus which in the beginning of 1838 had been deposited at that station, as also the large theodolite by "Troughton and Simms" accompanied this party to the southward.

The party reached their destination without accident on the 21st March, 1841, and as the building constructed was ready for its reception, the base line apparatus was safely deposited in the side rooms. The remainder of the working portion of this season was taken up with putting the observatory into a fitting state for the simultaneous astronomical observations, tracing out the course of the proposed base line, and making the necessary arrangements for its measurement and connection with the principal triangles to the north and south.

In the opening of the season 1840-41 I proceeded with the northern party accompanied by Captain Renny and my sub-assistants to Kalianpúr near Seronj, which my camp reached on the 21st November, having quitted Dehra on the 1st October. November 24th was the day fixed on for commencing the series of simultaneous astronomical observations, and accordingly on that night both instruments being ready, one at Kalianpúr and the other at Damargida, the first observations were made at both stations.



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The observations of this season were so precisely alike to those of the preceding year, that the description already given of the method of conducting the one, will equally serve for the other, the chief point of difference being, that on the present occasion, the number of selected stars was 32 instead of 36, and that the whole began on the same day, 24th November, ended on the same day, 11th January, and with hardly an exception were literally simultaneous throughout. As to the observatories at Kalianpúr and Damargida they have been already explained sufficiently to render any further description of them superfluous.

We are now in a condition to give the complete amplitudes of these two sections in the following synopsis, on examining which, it will be remarked that in the section Kalianpúr to Kaliana all the stars south of the zeniths give a greater amplitude than those to the north, whilst the reverse takes place in the section Kalianpúr to Damargida; whence we may see the expediency of having taken the precaution to make the amplitude depend on as many stars on one side as on the other side of each zenith. If as was the practice in former years, all the stars selected had been between the two zeniths each resulting amplitude would have been liable to be burdened with the sum of the errors constant to the two instruments, and if these had been both positive, or both negative, they would have tended to shew a large excess or defect, which is mainly counteracted by the actual arrangement, for now we see that the difference between greatest and least results is not more than may in fairness be attributable to errors of graduation, such as no instrument is exempt from.

SYNOPSIS, SECTION KALIANA TO KALIANPUR, 1839-40.

| Number in R.A.S.C. | Star observed. | Mean Zenith Distance 1st January, 1840. Kalianpur. | Kaliana. | Amplitude. | Number in R.A.S.C. | Star observed. | Mean Zenith Distance 1st January, 1840. Kalianpur. | Kaliana. | Amplitude. |
|---|---|---|---|---|---|---|---|---|---|
| | South Stars. | | | 5° 23′+ | | North Stars. | | | 5° 23′+ |
| 362 | 61 Arietis $\tau'$.... | 3° 33′ 15″·499 | 8° 56′ 52″·915 | 37″·416 | 400 | Persei ..... | 7° 39′ 20″·293 | 2° 15′ 43″·669 | 36″·624 |
| 376 | 66 Arietis..... | 1 52 19·207 | 7 15 57·624 | 38·417 | 430 | 44 Persei $\zeta$ .... | 7 16 56·879 | 1 53 20·163 | 36·716 |
| 383 | 7 Tauri..... | 0 11 50·089 | 5 35 27·678 | 37·589 | 497 | Tauri ..... | 6 57 5·251 | 1 33 28·700 | 36·551 |
| 418 | 27 (Pleiadum $f$) | 0 33 39·710 | 5 57 17·425 | 37·715 | 570 | 3 Aurigæ $i$ .... | 8 47 8·566 | 3 23 32·750 | 35·816 |
| 448 | 37 Tauri $A'$ .... | 2 28 50·249 | 7 52 27·464 | 37·215 | 612 | 14 Aurigæ $a$.... | 8 22 30·766 | 2 58 54·184 | 36·582 |
| 471 | 50 Tauri $\omega^2$ .... | 3 56 27·357 | 9 20 5·402 | 38·045 | 637 | Aurigæ..... | 6 52 1·045 | 1 28 25·021 | 36·024 |
| 543 | Tauri $\tau$ ..... | 1 28 33·779 | 6 52 11·477 | 37·698 | 661 | 25 Aurigæ $\chi$ .... | 7 56 47·610 | 2 33 10·840 | 36·770 |
| 585 | 102 Tauri $\iota$..... | 2 45 53·307 | 8 9 30·606 | 37·299 | 687 | 26 Aurigæ $l$ .... | 6 16 12·850 | 0 52 37·193 | 35·657 |
| 594 | Tauri..... | 0 4 21·539 | 5 27 59·713 | 38·174 | 727 | Aurigæ..... | 7 32 59·278 | 2 9 24·007 | 35·271 |
| 749 | 1 Geminorum $H$ | 0 51 16·820 | 6 14 54·607 | 37·787 | 774 | 44 Aurigæ $\kappa$.... | 5 25 47·824 | 0 2 10·778 | 37·046 |
| 760 | 3 Geminorum.. | 0 59 13·617 | 6 22 52·352 | 38·735 | 800 | 48 Aurigæ $z$.... | 6 27 52·671 | 1 4 16·166 | 36·505 |
| 790 | 13 Geminorum $\mu$ | 1 31 50·635 | 6 55 28·180 | 37·545 | 846 | 34 Geminorum $\theta$ | 10 1 36·843 | 4 38 0·813 | 36·030 |
| 900 | 55 Geminorum $\delta$ | 1 50 57·050 | 7 14 33·906 | 36·856 | 871 | Geminorum.. | 5 28 43·452 | 0 5 6·842 | 36·610 |
| 945 | Geminorum.. | 1 20 57·742 | 6 44 34·836 | 37·094 | 881 | 46 Geminorum $\tau$ | 6 22 50·816 | 0 59 14·158 | 36·658 |
| 956 | 82 Geminorum $B$ | 0 35 19·657 | 5 58 58·840 | 39·183 | 918 | 62 Geminorum $\rho$ | 7 58 32·664 | 2 34 56·414 | 36·250 |
| 989 | 9 Cancri $\mu'$.... | 1 1 59·037 | 6 25 36·712 | 37·675 | 927 | 66 Geminorum $\alpha$ | 8 6 45·165 | 2 43 8·526 | 36·639 |
| 1037 | 33 Cancri $\eta$ .... | 3 8 24·132 | 8 32 1·307 | 37·175 | 999 | 15 Cancri $\psi^1$.... | 6 0 37·543 | 0 37 0·564 | 36·979 |
| 1060 | 43 Cancri $\gamma$ .... | 2 4 50·144 | 7 28 27·989 | 37·845 | *216 | 61 Cancri ..... | 6 43 24·617 | 1 19 48·709 | 35·908 |
| | | | Mean .. | 5° 23′ 37″·7479 | | | | Mean .. | 5° 23′ 36″·3686 |
| | | | | | | | | General Mean .. | 5 23 37·0583 |

* This star is not in the R. A. S. C. but is taken from Piazzi's Catalogue.

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SYNOPSIS, SECTION KALIANPUR TO DAMARGIDA, 1840-41.

| Number in R.A.S.C. | Star observed. | Mean Zenith Distance 1st January, 1841. Kalianpur. | Mean Zenith Distance 1st January, 1841. Damargida. | Amplitude. |
|---|---|---|---|---|
| | North Stars. | | | 6° 3′+ |
| 253 | 12 Trianguli $c$.. | 4° 50′ 8″·420 | 10° 54′ 6″·003 | 57″·583 |
| 277 | 33 Arietis ..... | 2 15 14·907 | 8 19 12·721 | 57·814 |
| 298 | 39 Arietis $b$.... | 4 27 45·134 | 10 31 42·213 | 57·079 |
| 326 | 49 Arietis ..... | 1 42 31·638 | 7 46 28·129 | 56·491 |
| 351 | 56 Arietis $i$.... | 2 31 57·513 | 8 35 54·729 | 57·216 |
| 359 | Tauri ..... | 4 20 49·425 | 10 24 46·770 | 57·345 |
| 369 | 64 Arietis $g$.... | 0 2 10·802 | 6 6 7·436 | 56·634 |
| 392 | 11 Tauri ..... | 0 41 23·738 | 6 45 21·478 | 57·740 |
| 404 | 18 (Pleiadum $m$) | 0 12 55·429 | 6 16 52·323 | 56·894 |
| 423 | (Pleiadum).. | 0 58 26·644 | 7 2 24·250 | 57·606 |
| 541 | Tauri ..... | 4 10 49·881 | 10 14 47·071 | 57·190 |
| 575 | 98 Tauri $k$ .... | 0 40 42·687 | 5 44 40·136 | 57·449 |
| 642 | 112 Tauri $\beta$ .... | 4 20 46·813 | 10 24 44·178 | 57·365 |
| 688 | 125 Tauri ..... | 1 40 51·762 | 7 44 49·131 | 57·369 |
| 722 | 136 Tauri $C$.... | 3 26 52·280 | 9 30 49·534 | 57·254 |
| 737 | 139 Tauri ..... | 1 48 27·011 | 7 52 24·322 | 57·311 |
| | | | Mean .. 6° 3′ | 57″·2713 |

| Number in R.A.S.C. | Star observed. | Mean Zenith Distance 1st January, 1841. Kalianpur. | Mean Zenith Distance 1st January, 1841. Damargida. | Amplitude. |
|---|---|---|---|---|
| | South Stars. | | | 6° 3′+ |
| 262 | 29 Arietis $\omega$.... | 9° 47′ 33″·289 | 3° 43′ 37″·562 | 55″·727 |
| 307 | 43 Arietis $\sigma$.... | 9 41 48·178 | 3 37 53·539 | 54·639 |
| 314 | 46 Arietis $\rho^3$ ... | 6 44 6·492 | 0 40 11·530 | 54·962 |
| 342 | 53 Arietis ..... | 6 51 29·107 | 0 47 33·561 | 55·546 |
| 441 | Tauri ..... | 6 22 46·576 | 0 18 52·151 | 54·425 |
| 454 | Tauri ..... | 7 12 38·024 | 1 8 42·998 | 55·026 |
| 463 | 48 Tauri ..... | 9 7 21·122 | 3 3 27·121 | 54·001 |
| 478 | 54 Tauri $\chi$ .... | 8 52 54·184 | 2 48 58·861 | 55·323 |
| 492 | 64 Tauri $\delta^2$ .... | 7 2 59·343 | 0 59 5·856 | 53·487 |
| 510 | 77 Tauri $\theta^1$ .... | 8 30 58·630 | 2 27 3·961 | 54·669 |
| 523 | 86 Tauri $\rho$ .... | 9 36 54·775 | 3 33 1·108 | 53·667 |
| 555 | 96 Tauri $K$.... | 8 29 55·853 | 2 26 0·996 | 54·857 |
| 589 | 11 Orionis $y^1$ .. | 8 56 34·951 | 2 52 40·366 | 54·585 |
| 604 | 15 Orionis $y^2$ .. | 8 43 54·773 | 2 39 59·199 | 55·574 |
| 670 | 35 Orionis $u$ ... | 9 55 53·638 | 3 51 59·590 | 54·048 |
| 704 | 129 Tauri ..... | 8 21 56·411 | 2 18 2·143 | 54·268 |
| | | | Mean .. 6° 3′ | 54″·6753 |
| | | | General Mean .. 6 3 | 55·9733 |

It may not be uninteresting to remark that the amplitude of the section Kalianpúr to Damargida 6° 3′ 55″·973 now deduced differs by the small quantity 0″·197 only in excess from that given in page 112 of my printed book of 1830, viz., 6° 3′ 55″·776; but we must not be led astray to impute this coincidence to aught but accident and the merest good fortune, for the former value of the amplitude was made up of two parts, viz.: 1st, the amplitude of the portion Takal Khera to Kalianpúr determined by the same set of stars observed by me at those stations, at the same season of the two successive years 1824 and 1825, which next to actual simultaneity seems unquestionably the best principle to be attended to, but all the stars selected were situated between the two zeniths, which as already shewn is objectionable, and 2ndly, the amplitude of the portion Damargida to Takal Khera depended on the difference of two sets of absolute latitudes, the one derived from observations made by Colonel Lambton at the former station in 1815 on one set of stars, and the other derived from observations made by me at the latter station in 1824 on a totally different set of stars, which is about as objectionable in principle as well can be, and was merely had recourse to as an expedient in the absence of better data.

Instances of this felicitous sort of compensation of errors so frequently occur that men are apt to look on precision of principle as less worthy of regard than it merits, but that is a great mistake, and when errors combine instead of compensating, we learn the true value of a rigorous attention to accuracy in principle as well as practice.

It may not be out of place to mention that there is a coincidence almost as singular between the length of the terrestrial arc from Damargida to Kalianpúr deduced from the revised operations, and that derived from the former work; for on referring to my printed book and to the synopsis of projections derived from the present triangulation, it will

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appear that there is a difference of only 17·78 fathoms in excess above the value formerly assigned, the present being 367154·37 fathoms in length, and the other 367136·59 fathoms, so that the numerous errors of the former work, which have been so fully exposed by the revision must have mainly tended to counteract each other.

Thus were brought to a conclusion the astronomical observations for determining the amplitudes of the two sections, and on their termination I detached Captain Renny and one of my sub-assistants to join the party under Captain Waugh that they might be in readiness to co-operate in the measurement of the base line in the following season. I myself returned to my office at Dehra where my presence was indispensably necessary in order to bring up the computations and other arrears of business which had accumulated as usual during my absence in the field to a serious extent.

It is now necessary to revert to the operations of the southern party under Captain Waugh to whom as elsewhere mentioned I had intrusted the delicate task of tracing out an entirely new alignment for the base to be measured in the valley of Beder and dividing it into sections in a manner similar to that put in execution in the case of the Dehra Dún base.

This trace had been selected between the 21st March 1840, when the party arrived at Damargida, and the 13th April following, and the length of the whole base as well as the sectional points were fixed on the 16th of that month, when parties were set to work in constructing the necessary platforms of masonry.

On the 24th of April the clock by Jones, which had recently arrived at Damargida, was put in position, as also the astronomical circle, and the various appendages of the observatory were put in order, preparatory to the simultaneous observations of 1840-41 already detailed. At the same time other parties were employed in fixing the subsidiary stations of the small triangulation, whereby the sections of the base were to be verified by comparison with each other, all which being effected by the 22nd May 1840, the party went to the nearest cantonment.

Captain Waugh had been instructed by me, after having connected the new base line with the principal triangles of the Great Arc Series, and completed the subsidiary triangulation about the base to employ any spare time which might remain in revising the work to the southward which had been executed in former years by Lieut.-Colonel Lambton, and to continue this revision if possible until he met with some side of continuation of which the limits were still in a state of preservation—the sides of a series of triangles it must be remarked are known in my late department, by the terms "flanking sides," and "sides of continuation," of which the former appear only in the triangle by which they are deduced, and the latter not only appear in that triangle as computed quantities, but are employed in one or more of the succeeding triangles as bases to continue the work.

Of Colonel Lambton's stations Shilapali, Goraegat, and Kotamarpali, no traces were to be discovered, but those of Dudala, Tadmanur, and Topkonda were in existence, whence it would appear to have been impossible to meet with any side of continuation

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without proceeding as far as Kota Kodangal at least, even if that had sufficed for the attainment of the end in view; the only resource therefore was to content myself with a comparison of the three flanking sides formed by Bachapali, Dudala, Tadmanur, Topkonda, of which the results will be adverted to in due time.

On the 9th June the party returned to Damargida to take shelter from the rainy season, and the succeeding three months were employed in drilling the establishment with the base line apparatus, and making other necessary preparations for the measurement.

On the 11th October the necessary pillars for comparing the compensation bars with the standard having been steadily put up, the usual comparisons were made 57 in number prior to the commencement of the measurement, which gave in parts of an inch 0·0402633 for the excess of a set of bars above 6 lengths of the standard *A*.

On the 19th October the measurement was commenced and was continued unremittedly Sundays excepted until the 4th December when it was brought to a conclusion, having occupied 39 working days of 9½ hours each. On the first day 8 sets only were measured; on the 2nd December 23 sets were finished, which was the greatest number measured in one day: as the whole base comprises 660 sets therefore the average daily rate was 17 sets per day, or 1 set in 33½ minutes.

On the completion of the measurement agreeably to usage comparisons to the number of 57 were made between the compensation bars and the standard, whence the excess of a set of bars above 6 lengths of the standard *A* was deduced in parts of an inch 0·0390388: the mean of the two values herein found 0·0396511 is taken as the mean excess during the operation.

The microscopes were compared with their scales on 7 different occasions including those prior and subsequent to the measurement, and the total amount of their deviation is 3·6654167 inches additive.

The bar levels were compared on 4 different occasions.

| | |
|---|---|
| The total length of the base after all corrections, reduced to the level of the sea for 2,039 feet of elevation is in feet ..... | 41578·536 |
| The base brought out by computation from that at Seronj is ..... | 41578·178 |
| Shewing a difference generated in the triangulation of ..... | 0·358 |

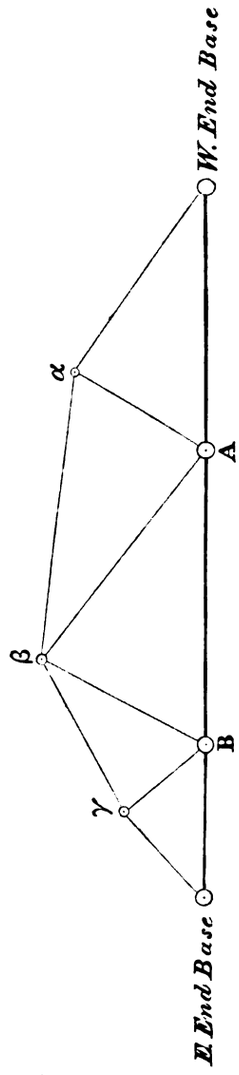
or 4·296 inches, which is in the ratio of 0·54, &c. parts, or about one half of an inch per mile which, considering that the two bases of Seronj and Beder are separated by a direct meridional distance of 425⅔ miles and connected by 85 principal triangles, may be looked on as a satisfactory result and strongly confirmatory of the accuracy of the whole series of operations.

The detailed description already given in speaking of the operations of 1834-35 of the measurement of the base line in the Dehra Dún, will be sufficiently explanatory to enable me to dispense with a minute description in this place, for the operations I am now detailing were precisely similar.

It will be understood on a reference to that and to the small plan in the margin that the points *A* and *B* are in the alignment, and having been previously marked, their



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distances from each other and from the limits of the base are measured as the work progresses; also that $\alpha$, $\beta$, $\gamma$ are points detached from the line, which are so selected as to form a series of triangles as nearly as may be symmetrical, whence it will be immediately apparent, that if the middle section *A* to *B* be used as an independent base, both the other sections may be determined in terms thereof, and the values so found when compared with those given by actual measurement will expose any errors generated in the operation.

These comparisons shew the following results :—

| | By measurement. | | By computation. | | Error. |
|---|---|---|---|---|---|
| *A* to *B* in inches ..... | 207133·672 | ..... | | ..... | |
| *A* to *W* in inches ..... | 184458·509 | ..... | 184459·509 | ..... | +1·000 |
| *B* to *E* in inches ..... | 107350·252 | ..... | 107351·074 | ..... | +0·822 |

The effectual training which my subordinates generally had received in prior measurements of a similar kind and particularly in that of Dehra Dún where the difficulties of the ground were more than ordinary, greatly tended to facilitate the present operation and preclude the chance of failure. It was evident that a steady attention to the principles inculcated both by precept and practice was alone requisite to ensure success, which quality combined with a zealous desire to merit my approbation and that of their employers was I felt assured possessed to the fullest extent by Captains Waugh and Renny, (of whom it has so frequently been my grateful office to speak in terms of applause) and animated all the members of my department whom I had placed under the orders of the former officer. It would therefore have been supererogatory for me to proceed as I should otherwise have done to the spot to superintend a work which either of these gentlemen was equally qualified and willing to perform fully as well as I could, and my absence at a distance of upwards of a thousand miles from my office might have caused great obstruction to public business and thereby absolutely prevented my bringing up the computations and completing the manuscript volumes of the General Report from which this work has been composed, before my departure from India.

It has been mentioned that conformably to my instructions the triangulation was carried by Captain Waugh a short distance to the southward, as far in fact as Topkonda station, by way of more effectually connecting the section to the north of Damargida with that to the south formerly carried on by Lieut.-Colonel Lambton and his subordinates, and the following are the only results of this nature which have been attainable for in general the old central marks appear to have been obliterated or removed.

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| | Old work. | New work. | Error. |
|---|---|---|---|
| Bachapali to Dudala ..... | Feet 81161·3 ..... | 81163·15 ..... | 1·85 |
| Dudala to Topkonda ..... | „ 168985·2 ..... | 169000·45 ..... | 15·25 |
| Topkonda to Tadmanúr ..... | „ 113530·4 ..... | 113541·15 ..... | 10·75 |
| Dudala to Tadmanúr ..... | „ 56685·3 ..... | 56686·84 ..... | 1·54 |

Immediately on the conclusion of the base-line operation the apparatus was all packed up and the party commenced their march on the 11th January to rejoin my head quarters where they arrived on the 1st April, having in their way through Agra deposited the large instruments and base-line apparatus in the garrison of that place under charge of the Commissary of Ordnance.

Thus were brought to a close the operations of the Great Arc of India, which combining the labours of Colonel Lambton with those of myself and our assistants now extend from Punnæ near Cape Comorin the southernmost extremity of Kishwar Hind or India to Banog in the sub-Himalaya Mountains.

From what has preceded it will doubtless have been thoroughly understood that the work now described depends entirely for its unit of measure on the iron standard bar *A* of 10 feet and brass standard scale *A* of 6 inches belonging to the Honourable East-India Company, which are susceptible of reference at will to the standards of Europe, for

1st. All the bases three in number were measured with compensation bars and microscopes.

2nd. The compensation bars and microscopes were compared with the said standards *A* with due frequency and rigour.

3rd. There are two iron standards *A* and *B* of 10 feet and two brass scales *A* and *B* of 6 inches the property of the Honourable East-India Company, which have been rigorously compared *inter se* so that their relative lengths are thoroughly known.

4th. The iron standard bar *B* of 10 feet and brass scale *B* of 6 inches were by order of the Court of Directors of the East-India Company sent at my recommendation to England in the year 1843-4, and were conveyed by me to Southampton in December 1844, where they were deposited under charge of Captain Yolland, R. E., for the purpose of being compared with the other standards now there in the possession of Colonel Colby, and the results when forthcoming will be given to the public.*

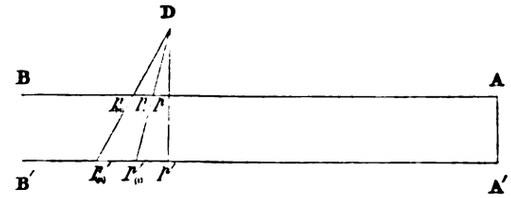
It is now therefore desirable that some description should be given of the compensation bars and microscopes and the methods of using them, for though I delivered a lecture to the Asiatic Society of Calcutta in 1831 in which this apparatus was described with tolerable minuteness and which was subsequently published in the transactions of that society, yet as it is possible that my readers may not have access to those volumes it is desirable that the present work should stand independent of them the more

* It would be manifestly as impossible as useless even if the correct relative values were now known to alter the whole computations in this work so as to correspond with them—the variations will certainly be of the nature of differential quantities and can when determined be at once introduced into the results at the pleasure of those who interest themselves in this subject.

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especially as if I mistake not no fully descriptive detail has yet been given to the public.

This apparatus is the invention of Colonel Colby of the Royal Engineers, and is founded on the principle of eliminating the errors arising from changes of temperature by compensation or self-correction. Let the two lines $AB$, $A'B'$, be firmly united at the line $AA'$, so as to admit of no variation on that side longitudinally, and let a third line $Dpp'$ cut these two lines in $p$ and $p'$; then if both those points progress outwards from the line $AA'$ in such wise that $\frac{pp_{(1)}}{p'p'_{(1)}} = \frac{pp_{(n)}}{p'p'_{(n)}} = \frac{Dp}{Dp'}$ it is manifest that the point $D$ will be a nodal or neutral point into which all the lines drawn through $p'_{(1)}p_{(1)}$, such as $p'_{(1)}p_{(1)}D$ must meet, and the same must happen if instead of receding from $AA'$ the points advance towards that line. Let $AB$, $A'B'$ be the traces of two parallel planes on a third plane perpendicular to them, of which the first passes longitudinally through a bar of iron and the second through a bar of brass, and let the lines $Dp$, $Dp'$ be in the ratio of the expansions of those metals (2 : 3 nearly) then as from the effect of variation of temperature the points $p$, $p'$ will recede from or approach to $AA'$ also in that proportion, we have before us the case above adverted to, but it will be remarked that the same hypothesis requires when reduced to practice that if $Dpp'$ be a trace made by a plane passing perpendicularly through a metallic bar the expansion of that metal should be such that $\frac{Dp_{(1)}}{Dp'_{(1)}} = \frac{Dp_{(n)}}{Dp'_{(n)}} = \frac{Dp}{Dp'}$.




What happens on one side of $AA'$, will equally happen on the other, so that if $D$, $D_{(1)}$ be two dots or points similarly situated with respect to $AA'$, but on opposite sides of that line the distance between them will be invariable and not liable to be affected by changes of temperature.

Such then is the hypothesis on which the construction of the bars is based: the practical fulfilment of it is as follows:

Two bars,* one of brass and one of hammered iron, each of 10 feet 1½ inch in length, 0·55 of an inch in breadth, and 1½ inch in depth nearly, are firmly clamped together near their middle parts by two cylindrical pieces of iron, so that no motion can take place towards the centre, and any expansion arising from change of temperature must have effect towards the extremities.

At each of the extremities of both bars an aperture is worked out at 0·9 of an inch high, and 1·1 inch longitudinally nearly, extending through the whole breadth and leaving 0·3 of an inch of the metal above and below; the parts thus remaining being perforated so as to admit a double conical pivot or axis to work in the two concentrically.

* For the better elucidation of the nature and construction of the compensation bars and microscopes the reader is referred to the drawings marked series *E* in the Book of Plates.

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To a flat tongue of iron $\frac{1}{4}$ of an inch thick, 1·1 inch broad, and $6\frac{1}{4}$ inches in length nearly, are adjusted two of these double pivots or axes, one of which rotates in the bar of iron, the other in that of brass, and as both extremities of the bars are circumstanced alike, that which would cause expansion at one end would have a like effect at the other, so that if the true positions of the nodal points can be detected and marked by a dot on each tongue the distance between those dots will be the true measuring length of the bar.

The compound bar thus formed is placed upon two brass rollers which revolve each upon an axis fixed into a deal box enclosing the whole metallic apparatus except the tongue which protrudes at one side and is protected by a cylindrical cover of brass tube, part of which may be turned round thereby bringing a circular aperture over the dot which marks the neutral point. The box is of deal and painted white on the outside, it is lined with white cloth, and there is an inner box covered on both surfaces with white serge, fitted in so that a stratum of air may pass between the outer box and its interior lining.

At each end of this deal box there is a common brass sight which serves to lay the bar approximately; there is also a brass plate with screw holes, by means of which are fixed to the box the arms intended to support the microscopes: between the two bars and near the point where they are clamped together a level is fixed of tolerable delicacy and that this may be easily inspected without the necessity of thereby exposing the apparatus to the external air an aperture is cut in the lid of the box to which a small pane of glass nicely fitted and a small wooden shutter opening and closing with a hinge are applied.

Further that the bars may occupy the same position laterally on one occasion that they do on another, a small cross level is adapted by screws outside the cover of the box and near the middle part, but it would have been a great improvement if instead of the coarse approximation thus afforded by a level fitted on to the outer surface of the wooden box two small cross levels had been fixed to the bars themselves, one at about a quarter of the whole length from either extremity, and admitting of inspection in the same manner with the long level above described.

The box rests on a pair of supports called camels, each of which stands on a trestle about a quarter of the whole length from either end; the camel is surmounted with a roller so that the box may be moved freely by the hand longitudinally; that towards the rear end is furnished with a differential motion in the direction of three co-ordinates; that at the advanced end of only two, viz. in the vertical and lateral; but besides these appliances, the camel stands on a tribrach with 3 levelling screws, each working in a cup placed on the surface of its trestle.

The only adjustment which these bars admit is that of making the long level coincident with the plane passing through the dots on the tongues, or which amounts to the same thing ascertaining the readings of the two ends of the bubble when that plane is level; this is accomplished in this wise:—let the bar be raised to a convenient height so that in fact the dots may be on a level with the eye of an observer when looking



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through the telescope of an instrument which has an azimuth motion, and in that condition let it be placed horizontal by means of its own level which is always nearly true.

Now to the end that any little vertical deviation in the line of collimation to which the telescope is liable may be of no effect, and also that there may be no necessity for altering its focal length, the point selected for the instrument to stand over should be such as to form an isosceles triangle with those vertically below the two dots on the tongues. Let this condition be complied with, and in that position, with the instrument duly levelled and its line of collimation made coincident with the level hanging on the two pivots of its telescope, let this latter in its horizontal position be directed first towards one dot and then towards the other, a minute cone of brass being placed over the dot at the time of observation by way of affording a clearly defined object: in this manner by a few trials the dots are easily brought to the horizontal position by means of the vertical screws of their camels, and so is found the error of the level on the bars with relation to them, which error it is better not to correct unless it be very large, because that cannot be done without taking off the lid of the box and letting in the air.

The tongues as it will have been already comprehended project through an opening in one side of the box, and the line of measurement is consequently not that which passes through the bars themselves but through the dots marked upon the upper surface of those tongues; consequently when two or more bars are used contiguously, there will manifestly be a space of several inches between the rear dot of the bar in advance, and the advanced dot of the bar next following it. This distance, which in its correct state is 6 inches, requires of course to be as accurately measured as that between the two dots of the bar itself, and the same principle of compensation which has been above described has here also been introduced into practice.

If two microscopes be united together by two bars, that nearest the eye end of brass and that nearest to the object end of iron in such wise that the distances from the focal points to the two points of fixture may be in the ratio of the expansions of those metals, then the two focal points become nodal or neutral points, and the length of the imaginary line which separates them will not be affected by changes of temperature.

If the uniting bars be perforated in the middle, and an eye glass and object glass be adapted to a tube passing through that perforation, an intermediate telescope will be formed between those two microscopes, the line of collimation of which will also be unaffected by changes of temperature, but this intermediate telescopic tube may by a little contrivance and accurate turning be converted further to the purpose of a male axis of revolution, and we have now only to supply a female axis standing erect over a tribrach perforated in the middle, and the apparatus becomes composed as is seen in the drawing of two microscopes which revolve in azimuth with a telescope fixed midway between them.

This compound microscope must be levelled, for which purpose three levelling or feet screws are applied to the ends of the tribrach in the manner usual in like cases, and

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a level is attached which revolves with the system; it must be placed in a direction parallel to the line of measurement, for which end a small telescope with the necessary adjustments is added at the side which can be turned over in altitude, but has not an independent motion in azimuth: moreover the whole of the upper part of the system must be susceptible of differential motion independent of the tribrach in two co-ordinates lateral and longitudinal; the object glass of the middle telescope must admit of easy removal at pleasure, so that one focal length may readily be substituted for another; and the lines of collimation both of the microscopes and telescope must be capable of being set if not coincident at least convergent with the axis of rotation.

The levelling screws of the tribrach stand on another tribrach fitted with radiating slits into which they work, one of the arms of which is considerably longer than the other two, whereby it may be united to a brass plate screwed on to the end of the box which holds the bar; this latter tribrach and plate therefore form part of the appertenance of the bar with which they are connected, and the former being perforated by holes larger than the screws which fix them to the projecting pieces of the latter, admit of a small change of position whenever those screws are slackened, all which will be easily understood by a reference to the drawings in series E, whence it will be seen very clearly that the microscope in its entire state may be lifted off from the apparatus by the hand at any instant without unfastening any screw or undoing anything.

The first or rear bar has two microscopes attached to it, viz. one to each end of its box, of which the first or rear-most of all looks with its central telescope upon the dot at the limit of departure or on that of the register which has been fixed by the set in the measurement previously laid off. All the other bars have one each attached to their advanced end only, and the last or most advanced of these looks with its central telescope downwards and so serves to settle the position of the dot on a new register head, which it is the business of the person in charge of that microscope to place and arrange; hence it will be immediately seen that there are only two positions in a set of 6 bars in which the central telescope is required, viz. the first and last; for of all the other compound microscopes which are appended to the intermediate bars each looks with one microscope on the advanced dot of its own bar, and with the other on the rear dot of the bar contiguous to it, whereas the two external microscopes look each with its central telescope on a register dot, and with one microscope on the dot of the bar to which it is appended.

An instrument called a boning instrument adjusted in the rear of and as near the the rear bar as focal distance will allow, serves to align the whole apparatus, for which purpose a small implement called a director is placed upright in the aperture left for the central telescope of the compound microscope, each of which in turn is thus brought into its true lateral position by signals from a person observing and directing.

To the front and in the middle of the boning instrument is screwed a tin frame with two broad pieces projecting upwards like horns so prominently situated that they can be seen by the side telescope of each compound microscope, and as the distance

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between those horns is as exactly as may be the double of the distance between the optical axis of the side telescope and the axis on which the compound microscope revolves, therefore if the line of collimation of that telescope correspond as it should as to parallelism with the plane passing through the focal points of the two microscopes, it is plain that with the central telescope in alignment, with the advanced dot of the rear bar under one microscope, and the side telescope also in alignment, the rear dot of the advanced bar in order to occupy its true position has only to be brought under the other microscope which it evidently can be by the differential screws of the camel supporting the bar.

The boning telescope is fixed and adjusted in this wise; the point of commencement is first very accurately and solidly but delicately marked, and according to the features of the ground a certain number of positions are taken up in the direction selected for the line of measurement whereon intermediate marks are made, the object in this case being that one point of the line in advance at least shall be always in sight.

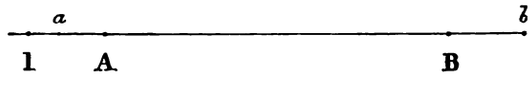
Now the upper part of the boning instrument is furnished with an apparatus which communicates a sliding motion in the direction of two horizontal co-ordinates, that is one perpendicular and the other parallel to the axis of its telescope; so that placing the instrument approximately by the eye at 20 feet or thereabouts in rear of the selected starting point, it is manifestly an easy matter by the help of that point and one of the distant marks to bring the line of collimation of the telescope truly into alignment; in that position it is again levelled and the trial repeated if necessary until all semblance of deviation disappears.

It is obviously a matter of moment to keep the boning instrument always as close up to the rear of the apparatus as can be conveniently contrived, and therefore it is an invariable rule after every second set of bars to take up a new position for it wherever that is practicable. The shortest distance at which the telescope admits of distinct vision is 18 feet, but in such matters as extremes ought to be avoided it is rarely placed nearer than 21 feet which value is chosen for its suitableness in other respects as thus.

The screw which communicates the lateral sliding motion as aforesaid has like all other screws only a limited extent, and it greatly saves time to be able in taking up a new position to select a spot which shall be decidedly within that limit. Now in every set of bars the central telescope of the compound microscope belonging to the 4th bar is precisely 21 feet from the dot on the register in advance, and if instead of a telescope, which as I have before shewn is not required in that position, there be substituted a mere perforated tube, a slight plumb line may be suspended through the orifice intended for the eye tube, and the point below it will be very nearly indeed the site adapted for the boning instrument to take up. To avoid hammering and impact of all kind which could not be commodiously effected without shaking the apparatus, and at all events would induce the necessity of its temporary displacement, a piece of lead circular and flat with a central hole drilled through its surface is placed underneath the plummet so suspended, and thus the purpose is so effectually served that very frequently it is unnecessary to use the sliding motion appliance.

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Care must be taken to adjust the line of collimation of the boning instrument, to keep it constantly level especially in the direction perpendicular to the alignment, to allow for the difference of the diameters of the pivots, and especially to observe that in changing the focal length from near to distant vision or *vice versâ* the milled head which moves the pinion of the rack-work is always turned from one to the other by a continuous motion. Thus $A$ and $B$ being the two points and $I$ the instrument, if it be intended to look first at $A$ and afterwards at $B$ the focal length must be first suited to a point $a$ nearer to $I$ than $A$ is, and then by an unbroken motion adapted to $A$ and $B$ in succession: if on the contrary $B$ is the object to be first viewed, the focal length must be first suited to a point $b$ beyond $B$ and then brought up by an uninterrupted motion to suit the point $A$.




The objects of the microscopes and boning instrument will it is hoped have been explained and a general notion of the principles on which they are constructed and the manner of application have been conveyed by the foregoing description. In fact the former are intended to measure the distances by which the dots of the bars are separated from each other or from those on the register, and the latter is solely for the purpose of preserving an undeviating adherence to the line of measurement. But it must be understood that every set of bars stands complete in itself, and quite independent of others, for both the commencement and end of each is marked by the dot on a register resting on the ground.

The register used in the first construction was a mere equilateral triangular slab of cast iron, side 15½ inches, thickness 2½ inches; rather hollowed out in the lower surface so as to leave the metal towards the angular points prominent, and furnished in the upper surface with an enamelled plate carrying a round dot which admitted of motion from three pushing screws. This device though commendable for its simplicity was soon found insufficient, because the inequalities presented by every sort of ground perpetually induce the necessity of communicating to the dot a motion in the vertical co-ordinate as well as laterally and longitudinally.

Accordingly a register was devised to meet this desideratum, consisting of a cast-iron frame in a triangular pyramidal shape surmounted at top with a brass plate perforated in the middle and otherwise so adapted as to sustain and give passage up and down to a brass sliding tube carrying a dotted plate moveable laterally and longitudinally by 4 antagonizing key screws with milled headed keys. The plan and elevation of this are shewn in the drawings of series E, whence it will be easily seen that the dot can always be raised approximately to the height required so as to be within the limits of the change of focus of the central telescope which looks down on it.

As long as the measurement is carried on unremittedly these registers are used in preference to any other; to protect them from disturbance it is usual to have at hand several square boxes of sizes furnished with an iron spike at each corner serving thereby to lay hold of the ground when the box is inverted over the object it is intended to



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shelter. Also since the registers as they are laid successively shew the extent to which the measurement has proceeded, and the accidental displacement or concussion of either of the two leading ones would induce the necessity of reverting to some determined point in the rear and rejecting all the work in advance thereof, therefore it is always usual by way of precaution to leave at least two registers standing in the rear of those on which the apparatus is employed at any given instant.

But a tall and massive object of the nature above described though it may rest immoveably on the ground for a short time, yet always conveys an idea of insecurity, and therefore when the measurement is likely to be suspended, as in the interval allowed between 11 and 1, or in leaving off at night, some mark more snug and compact is certainly desirable. For this reason on the first occasion of my using this apparatus in India I caused to be forged several iron pins of sizes from 18 inches to 4 feet long of a triangular pyramidal shape, and about 3 inches side, which were to be driven with the point downwards to within a few inches of the surface of the ground. The head left exposed had a male screw cut on it, to which was adapted a female screw, at the bottom of the frame work of a register having a face either figured or plain.

Of the former of these an idea will be formed from the drawings in Series E better than from a verbal description, and it will thence be seen that there are two pairs of pressure screws each pair acting at right angles to the other pair, and all furnished with an antirotatory plate serving the double purpose of keeping the figured face in a parallel position and of preserving the surface pressed by the ends of the screws from laceration.

The principle of this figured face is that as it is a more difficult matter to drive a pin accurately into the ground especially when rocky than to fix a register which being laid thereon is moveable to and fro, therefore more space for after-adjustment is likewise requisite; but the space for after-adjustment by a single dot cannot be augmented beyond certain limits without giving a most inconvenient length to the pressure screws as well as enlarging other parts of the frame-work in a manner which would vitiate its form and frustrate the object proposed, viz. compactness and snugness; therefore the dots have been increased in quantity, arranged in squares, and numbered each with its own figure in such wise that each of the pressure screws only needs a motion somewhat more than one half the distance between any two of them.

As to the plain register it is simply a flat head of brass circular and polished screwed on to the top of an iron pin driven into the ground as above described, on which a dot is engraved when wanted immediately below the central telescope—this requires a person of steady hand and clear sight of short focus, and is accomplished by moving a slip of paper with a dot pierced on it to and fro until it comes into the right position, when with a finely pointed dotter held perpendicularly in the hand the mark is engraved.

The plane-faced register is used when it is desired to retain a point in the measurement for a longer period than it is convenient to spare a figured register, which latter is universally applied whenever the measurement is suspended for a time. The box used

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to shelter these is small and low, and is always carefully weighted with stones and other heavy substances, and sometimes protected by a fence of thorns or briars.

The trestle is a mere 3-legged stool with diagonal braces and a circular aperture in the middle through which the vertical screw of the camel passes, and each bar requires two of them. As every set of bars whether complete or partial is laid off horizontally, it is necessary (to prevent delay) that a set of trestles should be previously laid in line and levelled, and the more accurately this can be done the quicker the measurement will proceed.

Now it has been already observed that the line of measurement is that passing through the dots on the tongues, not through the bars themselves; and consequently the trestles must not be laid in the line but at such distances from it laterally that when the bars are placed on them those dots shall be so nearly so as to be within the compass of the lateral differential screw of the camel.

To meet this exigency a working party is always sent in advance provided with a long level, a second boring instrument and a chain of 63 feet long, together with digging implements of sorts and several small square pieces of wood of divers thicknesses; the chain is of a simple form, containing at the proper distances isosceles triangular projections over the vertex of each of which a trestle is placed by a plumb line suspended through a central point in a wooden stopper, which is fitted for that purpose to the circular aperture. The chain itself is therefore stretched in the line of measurement, and the line passing through the vertices is that for laying the trestles.

Trestles of sizes must also be provided for the principal boring instrument which must be manifestly of sufficient height to command the whole apparatus: when the ground is tolerably even the same height of trestle will often answer with very little deviation, but in ascending a slope, it has been sometimes necessary to place the instrument on one of 10 feet, and in descending to scoop out a place from the ground in order to enable the person directing it to look through the telescope.

As the principle of compensation indispensably requires that no one portion of either the compound bar or microscopes shall be subjected to greater heat than another, it becomes necessary that the apparatus when in use should be protected from the direct rays of the sun, for which purpose tents with wooden frames are provided of the following form, dimensions and number, so that one set may always be ready in advance to shelter the bars by the time they are about to move forward, and that the whole may be as light and portable as possible:—

3 end pieces of 4 feet long with flaps or curtains to close the ends.

4 middle pieces of 8 feet 6 inches long } open at both ends.
8 middle pieces of 10 feet 6 inches long }

All the frames have the same height and the same angular slope and the section is that of an isosceles triangle having the angle at the base that which is defined by $\cot A = \sqrt[3]{\frac{a}{b}}$, where $a$ and $b$ denote two co-ordinates, the former horizontal the latter vertical.

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The values of $a$ and $b$ are assumed, so that at the distance of 3 feet from the middle of the tent the height shall be 6 feet, which leaves a clear square of 6 feet for the bars and persons employed at them to stand erect in, hence $a=3$ feet and $b=6$ feet, $\cot A=\sqrt[3]{\frac{1}{2}}$ and $A=51°\ 33'\ 42''$.

This gives for the fly of the tent the smallest convenient superficies and weight, the side of the isosceles triangle composing it is 12 feet $5\frac{3}{4}$ inches, the whole breadth is 15 feet $6\frac{1}{4}$ inches, not including the thickness of the frame, the height is 9 feet $9\frac{1}{3}$ inches, each fly may be taken off from the frame or rolled up to any desired height, every pair of frames is made to close and expand by hinges at the summit, and is stayed in its proper position by two horizontal bars at the height of 6 feet removeable at pleasure; and lastly, that the whole may easily be transported from place to place on the backs of camels or elephants, the bars of each frame are united to one another by nut screws, on loosening which the whole may be disconnected into its component parts.

It will be clear from this description that a space of at least 20 feet in width must be cleared of all incumbrances, that all hollows must be more or less filled up, and all steep banks of ravines or rivers cut down to a sufficiently equable and gentle slope. Where that is not practicable which does sometimes though rarely occur the measurement cannot be continued in entire sets, but the sets must be broken into parts.

In swampy or other ground unsteady to the tread the registers cannot be allowed to stand in the usual manner on the surface, but pickets of 5 to 6 feet long shod with iron at top and bottom are driven in by threes leaving a few inches protruding to prevent contact with the soil; but as there has in all my bases been a person at each microscope to watch the dots, and no set was ever considered complete until all were right at the same instant, it has been deemed needless to use these pickets generally in any other parts of the apparatus.

In working with an apparatus so complicated as that above described it is manifest that great order and method must be observed. Every middle bar is carried by two men on the shoulder, the two extreme ones by three men each, every camel with its cups is carried by one man; therefore when the apparatus is to be moved forward there are no less than 20 men, besides the 7 assistants with microscopes in their hands actually within the bar-tents, the middle of which is occupied by trestles, and though there is room for these and more when nicely disciplined yet as the least shock to either register would totally throw out the work performed, and the least injury to any part of the mechanism would be liable to derange it, persons unaware of where they ought to go or stand can on no account be admitted; the place of each individual must be duly assigned to him before-hand, he must occupy that and no other, and the whole change of position must be effected with as much precision and after as much previous drilling as a manœuvre on a military parade.*

* It has not been deemed necessary to encumber the press with the system of drill here adverted to as practised in the G. T. Survey of India because it is presumed that every person entrusted with such operations will be fully equal to the task of laying down his own regulations.

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Though a general notion will already have been formed of the manner in which a measurement of this sort is conducted, yet it may not be unadvisable to give a more precise account of the various adjustments requisite for the microscopes, the method of effecting them, the errors to which they are liable, and the manner in which the corrections to compensate those errors are ascertained and applied.

The compound microscope as explained above is in fact an optical system, and by means of its level, and its axis of rotation can always be so ordered as to revolve in a horizontal position; if therefore a 6-inch brass scale be also placed in a horizontal position by means of a small spirit level, and arranged underneath the tribrach, it is plain that of the limiting dots of the scale one may be brought to be intersected by each microscope, and both will be in focal distance provided the microscopes be properly set.

The tube of each microscope is held in position by 6 pointed screws, 3 of which pass through the collar of the brass bar, and 3 through that of the iron bar; by loosening these the tube may be moved upwards or downwards at pleasure, and thus we may always set both microscopes at an equal height.

Any alteration on this account is however rarely needed, except previous to commencement or in the event of any derangement during the measurement, for the positions in which the tubes are held are always determined by trial, and the tables of expansion of the two metals; and having once been fixed ought to be constantly brought back to the original marks as nearly as can be.

The condition requires as I have elsewhere said, that when the microscope is free from parallax, the distance from the object viewed by it to its two points of fixture shall be in the ratio of the expansion of iron to that of brass; also that when the two microscopes are thus fixed the distance between their optical axes at the points of distinct vision shall be exactly equal to 6 inches at the temperature of 62° of Fahrenheit set off on a line perpendicular to the axis of rotation.

But in dealing with optical instruments certain embarrassments arise: practically we know that lines of collimation, take what pains we please, never remain in the same position, and there is so much room for irregular expansion and deviation in every complex apparatus, that it would be unreasonable to hope for this condition being always fulfilled; therefore it is essential that the means should be at hand to detect those errors and apply corrections to compensate them by as near an approximation as the case admits.

That the scale of reference may be reduced to the temperature of 62° of Fahrenheit, it is furnished with a thermometer the bulb of which comes into contact with it, and the comparison of the microscopes is conducted in the manner which I proceed to describe.

The compound microscopes are characterized by the following letters *M, N, O, P, R, S, T, U* of which one is always supernumerary, seven only being actually in use at the same time. Of the pair of microscopes composing any one of these, one, as *M* for

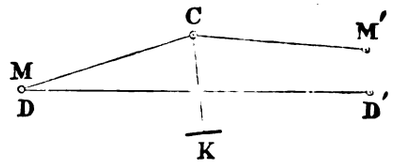


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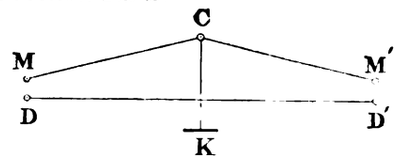
example, is marked $M$ and the other $M'$, and as what applies to one is equally applicable to all, it will simplify the subject to consider the case of compound microscope $M$ only.

The microscope and scale being approximately levelled and freed from parallax are brought in the first instance into position No. 1, wherein $D, D'$ represent the dots on the scale, $M, M'$ the projections of the lines of collimation, $C$ that of the axis of rotation, and $CK$ the direction of the lateral screw, $M$ and $D$ being coincident.

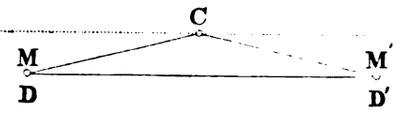
*Position N°. 1.*



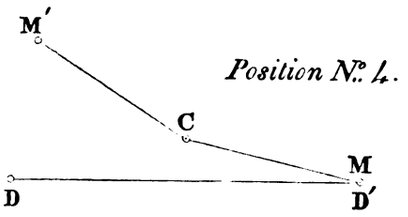

*Position N°. 2.*




*Position N°. 3.*




*Position N°. 4.*




The whole is then made to revolve on $C$ through a space equal to $\frac{1}{2}\ M'D'$, in such wise that $M$ and $M'$ shall be equidistant laterally from $D$ and $D'$ as in position No. 2, wherein as the direction of $CK$ is at right angles with $DD'$ the body of the microscope which carries $M, C, M'$, can easily be brought, by turning the milled head $K$, into position No. 3, after which the whole is levelled with the utmost accuracy.

Now if $M, C, M'$, be not in one straight line, when the body of the system is turned half round in azimuth in such wise that $M$ shall stand over $D'$, then because $D, C, D'$, are not altered by this change, $M'$ will be separated from $D$ by the whole space $DM'$ which is equal to quadruple the deviation of $C$ from the right line joining $MM'$.

If this deviation be large as it sometimes is previous to setting the microscopes, though rarely generated during the progress of a measurement and indeed never except by an accidental shock, it must of course be eliminated, but otherwise it is better not to disturb the positions assumed by the system.

The elimination when necessary is effected in this wise :—In position No. 4, though $M'D$ is made large for the sake of perspicuity, yet it can always be reduced by trial to such dimensions that both those points shall be in the field of the microscope, and when that is the case the fourth part of the quantity can be estimated by the eye. By the collimating screws move the wires of $M$ and $M'$ each to the extent of the said fourth, in the same direction with regard to the line $DD'$, whereby $M', C, M$, come into one straight line; make the body of the microscope rotate through an arc equivalent to one half, whereby $M$ and $M'$ become equidistant from and on the same side of $DD'$, and by turning the screw $K$ communicate a lateral motion to the system until $M$ and $M'$ intersect $D$ and $D'$.

To estimate the amount of error arising from this species of deviation we must remark that on every line of 6 inches set off, the maximum error is equivalent to the

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effect of half $DM'$ on a radius $DD'$ of 6 inches; whence if $x=\frac{1}{2}\cdot DM'$, $DD'=r$, and $n$ denote the number of such measures the correction is $\epsilon=\frac{nx^2}{2r}$. Now in each set of bars there are 6 such sources of error, and consequently for a base of 622 sets, $n=6\times 622$, whence $\epsilon=\overline{311}.x^2$, but the utmost value which $x$ is recorded to have attained in practice is ·01 of an inch, therefore the maximum amount of error is $\epsilon=0\cdot3$ of an inch on the whole line; a quantity evidently of no moment, even if it prevailed universally.

If however the error in its maximum state be thus rejectaneous that to be apprehended in practice must for reasons hereafter shewn, *a fortiori*, be absolutely of no consideration whatever, for it must be kept in mind that in all intermediate microscopes the distance $MM'$ is that absolutely used, and not $MC+M'C$, the point $C$ being only employed for the alignment: hence therefore if it be demonstrable that we can arrange the line $MM'$ in such wise that it may be parallel to the direction of the measured base as in positions Nos. 2 and 3, wherein a parallel to $DD'$ drawn through $C$ may stand for part of that line, the only remnant of this species of error will be in the two extreme microscopes. The method of bringing this about will be explained when the subject of the side telescope comes to be treated of.

A more serious source of error is that arising from the deviation of the points $M$ and $M'$ longitudinally, for the ascertainment of which no means whatever were originally applied when the apparatus first came from the artist's hands to India. The inconvenience and embarrassment arising from this defect were very early felt, and in the first base measured in India, viz. that near Calcutta the only remedy was to estimate the minute errors in terms of the wire in the microscope, of which it may not be without interest to speak on this occasion.

The wire as seen in the focus of the eye-tube is magnified only by the power of the system of lenses which compose it, but the same wire if it had been placed on the scale itself would have been magnified by the whole power of the microscope, and as the latter represents the true space which would be measured by a micrometer attached to the scale, therefore the apparent thickness of the wire is relatively diminished, or in other words it occupies a space in the field of the microscope which is to its true space as the magnifying power of the eye tube is to the magnifying power of the whole microscope. But if the micrometer screw used in the microscope and that applied to the scale both have the same number of threads to an inch, it is very clear that one revolution of the micrometer head of each will move the wire connected with it through precisely the same real space, whence the number of turns of the micrometer heads requisite to move the wire of each through an apparent space common to both will determine the ratio of the real to the apparent space.

Let $n$ denote the number of revolutions given to the graduated head of the scale micrometer, $m$ the like number with reference to the microscopic micrometer, both of which suffice to move the wire through the same apparent space, then the magnifying powers of the two will be inversely as those quantities, and of any wire whose absolute

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diameter is $D$, the apparent space occupied in the focus of the eye tube is $\frac{n}{m} \cdot D$. From a mean of several trials made on this principle it resulted that 1 revolution of the microscopic micrometer was equivalent to 0·48 of a revolution of that attached to the scale, therefore $\frac{n}{m} = 0{\cdot}48$.

To determine the value of $D$ a portion of wire 100 feet long was carefully drawn off the reel and weighed in the exceedingly delicate scales of the mint by Captain Wilcox and Mr. James Prinsep and was found to be equal to 5·3037 grains troy, whence if $W$ be the weight in ounces of 1 cubic foot of water, and $S$ be the specific gravity of silver, then $S.W. \frac{437{\cdot}5}{12^3}$ will be the weight in grains troy of 1 cubic inch of silver, and if $w$ be the weight in grains troy of a cylindrical silver wire whose length is $l$, and diameter $D$, both in inches, then since $\frac{\pi}{4} \cdot D^2 . l$ is the corresponding magnitude we have

$$S.W. \frac{437{\cdot}5}{12^3} : 1 :: w : \tfrac{\pi}{4} \cdot D^2 . l \therefore D = \frac{48\sqrt{3w}}{\sqrt{437{\cdot}5 . S.W. \pi l}}$$

Let $\lambda$ be the value of $l$ in feet then $12\lambda = l$

$$\text{and } D = \frac{\overline{48} . \sqrt{3w}}{\sqrt{437{\cdot}5 . \pi . S.W. \overline{12} . \lambda}} = \frac{\overline{24} . \sqrt{w}}{\sqrt{437{\cdot}5 . \pi . S.W. \lambda}}$$

wherein putting $w = 5{\cdot}3037$, $\lambda = 100$, $\pi = 3{\cdot}14159$, &c. $W = 1000$ and $S = 10{\cdot}5$ there results $D = {\cdot}001453$ of an inch.

Whence ${\cdot}001453 \times 0{\cdot}48 = {\cdot}0006974 = {\cdot}0007$ of an inch nearly is the value of the apparent image of the wire.

The values of $S$ and $W$ as also the term 437·5 above used are taken from Thompson's Chemistry 5th edition vol. 2 page 13, and hence has been derived the simple rule of multiplying all the discrepancies registered as above described by the term ·0007 to get the corresponding values in parts of an inch.

The value of $D$ as above found corresponds to 688 wires in an inch, or 69 nearly to 0·1 of an inch; the winding process gave for the same term 66 and a fraction, thereby shewing that the small gaps which were discernible under a microscope had made the value $D$ larger than it ought to be as might have been expected.

Immediately after the conclusion of that base I had 6-inch brass scales six in number constructed, one for each compound microscope provided with a thermometer and a level, and having at one end a micrometer screw of about 100 threads to an inch graduated to 100 parts. The plate moved by this screw was made to carry a minute circular aperture in which were fixed two very delicate scales of transparent mica carrying between them two fine cross threads of silk which were so adjusted as to intersect the dot nearest to them when the screw was in its middle so as to have half its play on each side.

Two minute pyramids of a triangular base and of such shape that one face was nearly perpendicular to the base were arranged in such wise, that a black line traced

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thereon should coincide with the centre of the dot next it. Of these one was made a fixture on the scale whilst the other was united to the plate carried by the micrometer and moved with it, the object being that by looking over the two projecting apices the line passing through the dots might be directed to any point required.

The scales, 6 in number, were all very nicely fitted up by the H. E. I. C.'s mathematical instrument maker at Calcutta in January 1832; the precaution was taken of casting them all from the same crucible, and the dots were set off 6 inches asunder at a time when the temperature was as nearly as could be 62° of Fahrenheit, not that I thereby expected to dispense with the necessity of an accurate comparison with the original standard scale *A*, nor with that of rigorously determining the runs of the micrometer, all which was accordingly effected on the earliest practicable occasion in the month of June 1835 at my station of Hatipaon.

As to the comparisons to determine the relative values of the scales with regard to each other and the standards *A* and *B*, they were conducted in a manner so similar to all others that it is hardly necessary to encumber my subject with a minute detail of them; this peculiarity merely deserves to be noted that the microscopes both stood on the same slab of limestone, the expansions of which during the operation were not taken into account, first for want of data as to the factor of expansion of that rock, and second because as the lengths sought were relative not absolute, the effect was supposed to have but a trifling influence on the result.

The determination of the runs of the scale micrometer was conducted precisely on the principle already adverted to, that is to say:—A microscopic micrometer whose runs to $\frac{1}{10}$ of an inch were previously ascertained was adjusted at focal distance over the micrometer of the scale in such wise that its moveable wire coincided with the cross threads enclosed between the scales of mica; the rest is obvious.

There is another source of error affecting however the end microscopes only, which is of this nature:—The points $M, C, M'$, may be in one straight line, and the total distance $MM'$ may correctly correspond with that between the dots, but nevertheless the two parts $MC, M'C$, may not be equal to each other; when the difference between them is considerable it is better to correct the microscopes accordingly, but otherwise it is better not to meddle with the lines of collimation, and to bisect the difference by estimation as the measurement proceeds.

I have above spoken of the side telescope which occupies a position in the system on the side opposite to the level and by means of which the two points *M*, *M'* are placed in alignment. This telescope is united by two small screws to a collar projecting from a horizontal axis which works into a socket connected with the compensating bars sustaining the microscopes; by means of the two pairs of screws 3 in each which connect the female axis, the telescope is adjusted so that its axis may be truly horizontal and at right angles with the line passing through the dots, parallel to which and by means of the two small screws which fix it in the collar the line of collimation is set.

The line of collimation is in the first instance set accurately perpendicular to its



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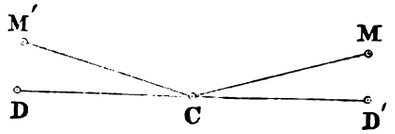
axis of rotation by placing the telescope so that it may be truly between two small theodolites previously adjusted so as to intersect each other's wires at solar focus, for which purpose* the screws in the collar are what are called key-headed, the key being in the form of a T with the leg very long and the arms very short. The object of this form is that as one screw is situated between the telescope and the body of the system, there is but very scanty space for a turning implement to be introduced, which difficulty is surmounted by the long leg with a key at the extremity and the observer at the same time is enabled to communicate motion to the optical axis of the telescope without taking his eye off the object.

The next point is to set the axis horizontal which is done by making the telescope pass up and down a plumb line suspended in front for the purpose, and the third point is to set the axis perpendicular to the line passing through the dots which is done in this wise :—

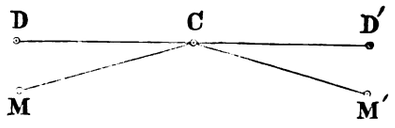
Three lines are drawn on a piece of paper equidistant from each other, the space between the two extreme ones being equal to the distance which separates the lines of collimation in two positions differing 180° in azimuth. The line of dots on the scale is adjusted to the middle of these three lines by means of the apices of the two minute pyramids above spoken of, the microscopes are brought each over one dot, and the side telescope is directed towards the paper, of which if it does not intersect its proper external line, it must be made to do so by the screws provided for both this and the last-mentioned adjustment.

It will now be apparent how the line $MM'$ may be so adjusted as to retain a position parallel to the measured base without eliminating the small lateral error; for when by means of positions Nos. 3 and 4 the quantity $DM'$ which is quadruple the eccentricity or distance from $C$ to $MM'$ is known, if by means of the lateral screw $KC$ the body of the microscope be moved through a space equivalent to one fourth of $DM'$, the effect will be to bring the point $C$ of position No. 4 into the line $DD'$, to draw the point $M'$ nearer to $DD'$, and to throw the point $M$ to the opposite side of that line both by the same one fourth of $DM'$ all which would be very obvious by drawing a parallel to $DD'$ through $C$. If now the body of the microscope be made to rotate through an arc equivalent to half $DM'$, its effect will evidently be to bring the points $M', M$ both on the same side of the line $DD'$ and each distant from the points $D, D'$ contiguous to them by one fourth of the quantity $DM'$, as shewn in position No. 5, whereby also if the system be turned half round in azimuth the points $M, M'$ will fall still on the same side of the line $DD'$ in respect

*Position N°. 5.*




*Position N°. 6.*




* The arrangements of the screws and key here described are I believe peculiar to the apparatus used in the G. T. Survey of India having been designed and introduced by the Surveyor General.

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to each other as in position No. 6, but on the opposite side to that which they previously occupied, and it is in these two positions Nos. 5 and 6 that the side telescope ought to be adjusted.

I have already said in speaking of the boning telescope that a plate of tin with two side pieces projecting upwards like horns is fixed to the front of that instrument; these serve for the persons in charge of microscopes to adjust their side telescopes wherewithal, being conspicuous from all parts of the apparatus, whilst the object glass of the telescope which protrudes between them furnishes a sufficient point of guidance for the person who lays the trestles, and any deviation which may be generated in the side telescope is easily detected by reversion.

As to the two extreme microscopes there does not seem to be any method of eliminating the difference between $CM'$ and $CD$, but the difference between $CM$ and $CM'$ is rendered nugatory by making the system turn half round and bringing $M$ as much to one side of the dot as $M'$ is on the other.

It will be plain that the nearer the dot can be brought to the central telescope by which it is laid and intersected, the less will be the influence of any deviation in the level and the line of collimation; but room must be allowed for the bar to slide freely over the register on which account a less focal distance than 4 inches cannot be applied: the list in the margin will shew the provision made for cases of this kind, and it will of course be borne in mind that whenever the object glass is changed the line of collimation becomes deranged relatively to the axis of revolution and requires to be reset.

| | | | | | |
|---|---|---|---|---|---|
| 2 | Object | Glasses of | 4 | inches | Focal length. |
| 2 | ,, | ,, | 4½ | ,, | ,, |
| 2 | ,, | ,, | 5 | ,, | ,, |
| 2 | ,, | ,, | 5½ | ,, | ,, |
| 2 | ,, | ,, | 6 | ,, | ,, |
| 2 | ,, | ,, | 6½ | ,, | ,, |
| 2 | ,, | ,, | 6¾ | ,, | ,, |
| 2 | ,, | ,, | 7 | ,, | ,, |
| 2 | ,, | ,, | 7½ | ,, | ,, |
| 2 | ,, | ,, | 8½ | ,, | ,, |
| 2 | ,, | ,, | 10 | ,, | ,, |
| 2 | ,, | ,, | 12 | ,, | ,, |
| 2 | ,, | ,, | 15 | ,, | ,, |
| 1 | ,, | ,, | 24 | ,, | ,, |
| 1 | ,, | ,, | 7 feet to 20 feet. | | |

On as many occasions during the measurement as are available without delay to the operation the microscopes should be compared with their scales and the several adjustments examined. The excess or defect longitudinally of each is noted as well as the temperature, which with the constant quantities requisite to reduce each scale to the standard $A$ form a list of corrections at the time of making the comparisons.

The sum of the errors characterized by the letters $S.E.$ contains half the error of each extreme microscope added to the whole error of each intermediate microscope, and the correction applied to the number of sets of bars measured between the date of any one set of comparisons and that made next prior or subsequent to it, is considered as an arithmetical mean between the sums denominated $S.E.$ on each occasion.

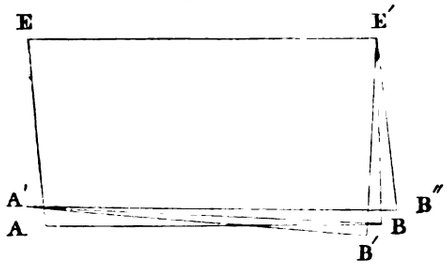
In cases where any microscope is so much in error as to need adjustment, the comparison is made both before and subsequent to any alteration, in which case the unadjusted value becomes $S.E.$ and serves to form the arithmetical mean with the preceding sets, whilst that after adjustment becomes $S'.E'.$ and is applicable to the subsequent sets.

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A similar process takes place when any microscope is shifted in position, and in fact every one of these minute errors, which becomes of importance only owing to its frequent recurrence, is thus taken into account in the reduction of the whole base line, except the lateral errors which are neglected for reasons previously given as not meriting the trouble of computation, and those which have occurred in one or two instances of derangement from shock or injury where, as there is an obvious impossibility of examining the microscope previous to adjustment, the next prior error is treated as the true one.

The above description will probably suffice to convey a tolerably distinct idea of the method of adjusting and using the microscopes and introducing the corrections necessary to compensate their various errors. It is now desirable to discuss the subject of the compensation bars, and to explain the method by which they are referred to the iron standard which is accomplished by the well known means of two microscopes each fixed on an independent pillar whereof one is provided with a micrometer wire.

Now in every microscope there is a certain dubious space whether above or below the true focal point in which an object can be placed so that no parallax shall be perceptible, the vision shall be distinct and the image colourless as to sense, yet the runs of its micrometer shall be variable; if $AB$ be a line passing through the dots in the true foci of two microscopes whose optical axes are $EA$, $E'B$, then because of this dubious space $A$ may stand at $A'$ whilst $B$ stands either at $B'$ or $B''$, whence it will evidently result that the length of the bar will appear to be variable whilst in fact it is not so.




The standard bar of the G. T. Survey of India is supposed to be 10 feet, therefore in inches $AB=120$, also in the microscopes used in our comparisons $EA=2{\cdot}46$ inches, and the runs are $\overset{R}{20}{\cdot}09$ to $0{\cdot}1$ of an inch with which data and further supposing that $AA'=\frac{1}{60}$ of an inch my investigations go to shew that it is perfectly possible to make a discrepancy between two consecutive comparisons of 27 divisions of the graduated head of the micrometer.

If it were possible to make the lines of collimation of the two microscopes perfectly perpendicular to $AB$, for example if $AB$ being duly levelled each microscope were also supplied with a level and an axis of rotation whereby the latter might be made coincident with the normal, and in that condition the lines of collimation $EA$, $E'B$ could also be made coincident therewith, then the sole discrepancy to be apprehended from the dubious space would be that arising from the increased or diminished values of the runs of the micrometer, but to accomplish this is obviously impossible, for though any line may be made parallel or convergent with another yet it cannot be made coincident by the motion of one only of its ends.

The easiest and most perfect method of overcoming this difficulty is as it seems to me that recently adopted by Colonel Colby now in progress at Southampton, whereby an

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equality is preserved between the lines $EA$, $E'B$; I confess my regret that this ingenious contrivance did not occur to me, but in the absence of this more perfect method I have adopted that just adverted to, and accordingly my microscopes of comparison have all been supplied with a level and axis of rotation, and my bars have always been laid by means of a level previously set to correspond with the line passing through the dots.

In the original construction of the bars it was found that irregularities were produced from the circumstance that the brass and iron components did not part with their heat equably, which was attempted to be remedied by the partial application of coatings of varnish; I am not satisfied that the result contemplated was ever attained to the extent anticipated, indeed it has always appeared to me that the corrective power of this varnish was more imaginary than real.

In all my comparisons connected with this work whether of the compensation bars with the standard $A$ or of the standards $A$ and $B$ with each other it has been the universal practice to immerse the bulbs of the thermometers in fluid mercury—there are two thermometers attached to each iron standard, and cavities being cut into the bar to receive their bulbs which are attached to the tubes by bent necks, the residual spaces between the bulbs and the cavities are filled with this metal, whereby heat may be the better conducted from the bar to the thermometer.

The following is the formula which I have employed in deducing the relative values of the compensation and standard bars.

Let $D$ be the distance between the optical axes of the microscopes at zero.

$b'$ ... the length of the standard bar when observed.

$s$ ... the micrometer reading of the standard—positive.

$t$ ... the temperature.

$n$ ... the factor of expansion for the iron bar.

$b$ ... the true length of the bar at 62° of Fahrenheit.

$A$ ... the true length of the compensation bar $A$ at any temperature.

$a$ ... the micrometer reading of the microscope for the same—positive.

Then 1st $b'=D+s$

And 2nd $b'=b+nb.\ (t-62°)$

$\therefore\ b+nb.\ (t-62°)=D+s$

Also $A=D+a$, whence $D=A-a$,

$\therefore\ b+nb.\ (t-62°)=A-a+s$

whence we get $A=b+nb.\ (t-62°)-s+a$

and consequently the excess of $A$ above $b$ is $nb.\ (t-62°)-s+a$, wherein taking $b=120$ inches, there results for the value of the correction to be applied to every length of the bar $A$ set off in the measurement $120.n.\ (t-62°)-s+a$.

The formula for comparing standards or simple rods or scales with each other is analogous to the above, and is as follows:—

Let $D$ be the distance between the optical axes at zero.



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$t$ ... the temperature of the standard bar or scale .....$A$
$t'$ ... the like ..... of .....$B$
$s$ ... the micrometer reading of .....$A$
$s'$ ... the like ..... of .....$B$
$b$ ... the mean length of either bar or scale whose difference is minute.
$n$ ... the factor of expansion common to both.

Then $D+s$ is the value of $A$ at $t$
$D+s'$.....of $B$ at $t'$
$D+s-nb.\ (t-62°)$ is the value of $A$ *at* 62°
$D+s'-nb.\ (t'-62°)$ ..... of $B$ *at* 62°
$\therefore$ calling $A$ and $B$ the correct values at 62° we have,
$B-A=s'-s+nb.\ (t-t')$

By the first of these formulæ the correction due to each individual comparison was deduced in the bases both of Dehra Dún and Seronj, but in the instance of the Beder base, as sufficient data had been already collected to enable me to form an estimate of the degree of confidence to be reposed in the principle of compensation, I introduced a greatly abbreviated form whereby the resulting values are found collectively as will appear from the explanation subjoined.

The former notation gives for each individual comparison

$$A-b=nb.\ (t-62°)-(s-a)$$

but in practice the standard is noted before and after observation of the bar $A$ and the mean of the two temperatures as also that of the two micrometer readings of the standard is employed in the comparison. That is to say if $t_{'}$, $t_{''}$ be the temperatures and $s_{'}$, $s_{''}$ the micrometer readings of the standard before and after, and $a_{'}$ the reading of the compensation bar $A$, then the reduction will be

$$A-b=nb.\ \left(\frac{t_{'}+t_{''}}{2}-62°\right)-\left(\frac{s_{'}+s_{''}}{2}-a_{'}\right)$$

At any particular period let there be a set of $m$ trials of bar $A$ made in succession and let $t_{'}$, $t_{''}$, $t_{'''}$.....$t_{m+1}$ be the temperatures; $s_{'}$, $s_{''}$, $s_{'''}$.....$s_{m+1}$ the micrometer readings of the standard; $a_{'}$, $a_{''}$, $a_{'''}$.....$a_{m}$ those of the compensation bar $A$ then the successive values of $A-b$ thence derived will each have a similar expression and may be arranged as follow:

$$m.\ (A-b)=n\,b.\ \left\{\begin{array}{l}\frac{t_{'}+t_{''}}{2}-62°\\ \frac{t_{''}+t_{'''}}{2}-62°\\ \frac{t_{'''}+t_{^{iv}}}{2}-62°\\ \ldots\ldots\ldots\ldots\\ \frac{t_{m}+t_{m+1}}{2}-62°\end{array}\right\}-\left\{\begin{array}{l}\frac{s_{'}+s_{''}}{2}-a_{'}\\ \frac{s_{''}+s_{'''}}{2}-a_{''}\\ \frac{s_{'''}+s_{^{iv}}}{2}-a_{'''}\\ \ldots\ldots\ldots\ldots\\ \frac{s_{m}+s_{m+1}}{2}-a_{m}\end{array}\right\}$$

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whence the mean result of this set will be

$$A-b=nb.\left\{\frac{1}{m}\cdot\left(\frac{t+t_{m+1}}{2}+t_{,,}+t_{,,,}..+t_{m}\right)-62^{\circ}\right\}-\frac{1}{m}\left\{\begin{array}{l}\frac{s+s_{m+1}}{2}+s_{,,}+s_{,,,}.....+s_{m}\\ -(a+a_{,,}+a_{,,,}.....+a_{m})\end{array}\right\}$$

Let $\delta_{,}A$, $\delta_{,,}A$, $\delta_{,,,}A$..... $\delta_{p}A$ be a series of values of $A-b$ found in the above manner, then if $p$ denote their number, the mean value, if each component set were equally numerous, would be

$$A-b=\frac{1}{p}.\{\delta_{,}A+\delta_{,,}A+\delta_{,,,}A.....+\delta_{p}A\}$$

But if $\delta_{,}A$ be derived from $m_{,}$ comparisons; $\delta_{,,}A$ from $m_{,,}$ comparisons; $\delta_{,,,}A$ from $m_{,,,}$ comparisons; $\delta_{p}A$ from $m_{p}$ comparisons; then the more correct expression will be

$$A-b=\frac{1}{m_{,}+m_{,,}+m_{,,,}.....+m_{p}}.\{m_{,}\delta_{,}A+m_{,,}\delta_{,,}A+m_{,,,}\delta_{,,,}A.....+m_{p}\delta_{p}A\}$$

which has been the formula employed in reducing the comparisons prior and subsequent to the Beder base.

I need say but little of the mode of determining the runs of the micrometer used, for it is as familiarly as universally known, but it may not be amiss to advert to the fact that if a micrometer be tried without changing the position of its microscope a constant error is liable to be incurred. Let a microscope be placed by the eye so as to be free from parallax and to all appearance unexceptionable, and as long as its position remains unaltered the runs of its micrometer to $\frac{1}{10}$ of an inch by an unblemished eye be read off successively to certainly one division of the graduated head and often to a much smaller quantity; but after each reading let the microscope be thrown out of focus and adjustment and then reset by the eye as a test, and I have never yet seen the person whose successive readings would not present great discrepancies *inter se;* this I attribute to the dubious space of which I have above spoken.

Moreover it seems to be a fact though I allow my inability to account for it, that the displacement and subsequent replacement of the eye tube also cause discrepancies of the same nature though smaller in amount, and hence ever since I have arrived at this conclusion I have either had the runs determined by the eye of the same person who used the micrometer in the comparisons and the eye tube retained in the same position, or else in every series of trials the positions and adjustments have all been frequently and habitually shifted.

It will be noticed of course that the term $n$ introduced into all formulæ of the above nature is highly important and effective, for on it will mainly depend the value of each correction: now it is a fact generally known and received that two rods even if of simple metal and to all appearance perfectly alike will not have the same factor of expansion, because the degrees of porosity and hardness acquired in the processes of casting or hammering will be various, and if this be a probable supposition in that instance, how much more likely must it be to happen in the case of such compounds as

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brass, where copper and zinc enter in proportions not certainly always the same, since a greater or smaller quantity of the latter invariably passes off in the state of vapour in the process of fusion.

Want of means has prevented my determining the value of the factor of expansion for any of the brass scales used in India, and in the absence of better data I have invariably used that for cast brass by Smeaton as given in the tables of Mr. Francis Baily ·0000104166, but that of the iron standard bar *A* I was enabled to arrive at satisfactorily by a method for which I am mainly indebted to the ingenuity and kindness of the late Mr. James Prinsep then Assay Master of the Honourable East-India Company's Mint in Calcutta.

I caused to be constructed two tubes of tin of such diameters that the smaller could be soldered within the larger thus forming a double case, the interior of which was fitted up with rollers for the standard bar to rest on. The inner tube was left open at both ends so that the extremities of the iron bar and its dots which protruded might be brought under two microscopes of comparison in the usual way.

It is easy to level the focal points of two microscopes of the kind, either by means of an instrument with an azimuth motion directed alternately to two points placed in their axes of revolution, or by a level adjusted to the bar itself so as to correspond with the line passing through its dots; the latter plan was adopted on this occasion as most convenient, and the positions of the microscopes having been thus fixed were treated as invariable because of the necessity of afterwards removing the level.

Both tubes were perforated in the two spots which were opposite the cavities cut in the bar to receive the thermometers; in each perforation a small cylindrical tube was soldered so as to give admission to two thermometers to pass through and obtain lodgement in those cavities.

The microscopes were fixed on isolated piers of stone, accurately levelled, and their lines of collimation duly placed in adjustment; and they as well as the thermometers having been read off and registered, the stop cock of a pipe which communicated with the boiler of a small steam-engine was turned, and a stream of steam entering at one end was made to pass longitudinally along the whole space between the tin tubes, and discharge itself at the opposite end.

In these experiments the propriety first became apparent of enveloping the bulbs of the thermometers in fluid mercury as above described, for prior to that arrangement it was soon manifest that though lodged in the cavities of the bar, they indicated a boiling heat long before the bar gave any indications of the kind. It was remarked too universally that when the force of the steam first took full effect on the metal of the bar, the increment of length overshot the limit at which it remained constant, and that a sudden small revulsion followed without any corresponding indication by the thermometers. When the steam had been applied for a sufficient period, and both thermometers and micrometers continued to agree in indicating no change, the readings of both were again noted, and the communication being cut off by turning the stop cock, the whole

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was allowed to cool down to the ordinary temperature of the room, in which state the readings were made for a third time.

The subjoined table marked *A* will serve to shew the result arrived at by me on that occasion, making the factor of expansion for the iron standard bar *A* ·0000068007 for 1° of Fahrenheit, which has been accordingly used in all operations wherein that bar and also standard *B* are concerned: it is a subject of regret with me that the number of experiments should have been so limited, but the truth is that I was then in the hurry and bustle of quitting Calcutta for the Upper Provinces, and the preparations requisite for despatching the large establishment of which I was the chief, some in one direction, some in another, together with the arrangements for my own journey and removal for some years to a part of the country upwards of 1,000 miles distant, created so many distractions and calls on my time that it was with difficulty I was able to accomplish even these few, the greater part of which I was necessitated to execute by deputy, reserving to myself only the general superintendence. The practical part of the performance was entrusted chiefly to my able assistant Captain R. Wilcox since appointed astronomer to the King of Lucknow, who was mainly assisted by Mr. James Prinsep; and indeed it must be noted that without the co-operation of the latter of these gentlemen, even these few could not have been contrived.

I have never had another opportunity of the kind, but the process is so simple that its introduction into general practice wherever there is leisure to attend to the minutiæ of its execution may be confidently looked to.

## TABLE A.

Containing Results, as deduced by the Surveyor General of India, of Experiments made at the Calcutta Mint in 1832 to determine the Factor of Expansion of Iron Standard Bar A.

| | | |
|---|---|---|
| No. 1 | ·00000679029 | |
| ,, 2 | 693644 | |
| ,, 3 | 678034 | *Note.*—·0000067789 is the result given in Uré's table 272 on the authority of Lavoisier and Laplace for soft iron forged; for the increment due to 180° is ·00122045 and the length of the rod being unity at 32° must at 62° be 1·00020341 therefore $\frac{\cdot 00122045}{180 \times 1 \cdot 00020341} = \cdot 0000067789$ is the factor of expansion corresponding with the above data. |
| ,, 4 | 682275 | |
| ,, 5 | 680969 | |
| ,, 6 | 676790 | |
| ,, 7 | 678386 | |
| ,, 8 | 675017 | |
| ,, 9 | 676453 | |
| Mean | ·00000680066 | |

Those who desire a more circumstantial detail of these and other experiments conducted on the occasion herein alluded to are referred to Article III. page 130, No. XV. of the Asiatic Journal for March 1833 edited by Mr. James Prinsep, where the whole



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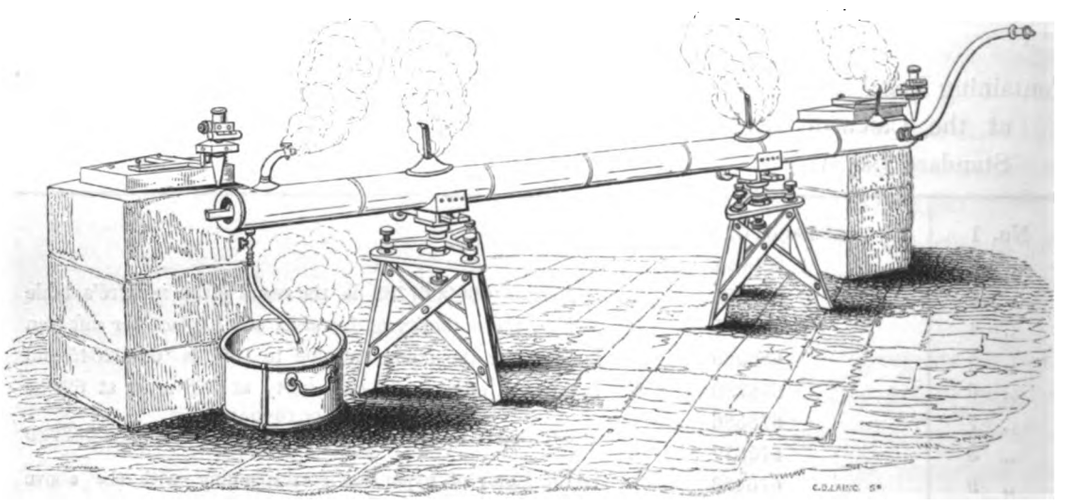
process is described with great precision and elegance accompanied by a lithographed drawing which I have taken the liberty to copy. I must remark however that in pp. 138 and 143 which follow, that gentleman arrives at results somewhat different from mine, which are as specified below in Table marked B.

## TABLE B.

Containing Results, as deduced by Mr. James Prinsep, of the same Experiments extracted from the Asiatic Journal of 1832, edited by that gentleman.

| | Increment between 32° and 212°. | Factor of Expansion. |
|---|---|---|
| By the whole set of experiments | ·001218 | ·0000067667 |
| By omitting Nos. 7 and 8 of 21st November | ·001213 | ·0000067389 |
| By former trials on a 25 feet rod | ·001256 | ·0000069778 |
| By contemporary trials in November 1832 | ·001216 | ·0000067556 |

The deviation is smaller however than that of my able and accomplished co-operator's own results *inter se*, and the conclusion which may be arrived at after all our trouble is that the factor given in Mr. Ure's tables of ·0000067789 derivable from an increment of ·00122045 between 32° and 212° might with great safety have been universally employed.



We now see how fallacious is the hope of eliminating the consideration of temperature even supposing that in the origin the bars had been perfectly compensated—minute irregularities will in fact creep in in spite of us and though each of these as an independent quantity might be treated as rejectaneous, yet their frequent repetition demands that they shall be each as scrupulously computed as if they were of large value.

It is no doubt very true that the totality of the discrepancies arising from these

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causes combined is but minute in comparison with those to which every measurement made with a steel chain as in former years was liable, but it is not my business to advocate any particular theory or support any particular system, and I must therefore endeavour to place this subject and every other connected with my operations in the clearest point of view, that scientific gentlemen may judge for themselves: but when it is considered how vast is the increase of expense incurred, how incessant the care and labour required, and how many persons of a certain degree of mechanical skill and proficiency are now rendered necessary to tend and manage the new apparatus, I cannot but lament that a nearer approach to accuracy and one more proportionate to the means should not have followed this serious deviation from simplicity.

No pains have been omitted on my part to take all the minute portions of error into account as will I trust appear from the various numerical details connected with this subject: both immediately prior and subsequent to each measurement an extensive series of comparisons has been invariably made to determine the length of each compensation bar relative to the standard, and the mean of the two results so derived has been used as the true value during the measurement: the adjustments of the longitudinal levels attached to the bars have been frequently examined during the progress of the work, as have those of the compensation-microscopes; and in all operations of this kind connected with the Great Arc the precaution has been taken of conducting these processes under circumstances as nearly similar as possible to those of the actual measurement, that is to say; under the shelter of the bar tents; at the same hours as those ordinarily allotted for actual work; with microscopes fixed on isolated stone pillars each revolving on an axis and provided with a level, and one of the said microscopes being furnished with a micrometer whose runs were ascertained by repeated comparisons with a brass standard scale by Cary, well known as the old standard scale of the G. T. Survey of India: but after all I must avow it as my conviction that the conclusion which will inevitably be arrived at by those who take the trouble to study, and have an opportunity practically to examine the subject, will assuredly be that whereas in former years by the use of simple glass or metallic rods considerable deviations existed of which the law was known, so now by the principle of compensation those deviations though decimated or still further subdivided seem to follow a law of which we are ignorant.

With the precaution which I have above adverted to of enveloping the bulbs of both the thermometers sunk into the metal of the iron standard with fluid quicksilver, the temperature of the metal itself can now be determined to so great an approach to accuracy as to render it comparatively easy to ascertain the relative lengths of two simple rods reduced to 62° of Fahrenheit to within more narrow limits than those between which the distance which separates the dots of a compensation bar are found to vary; from which the conclusion seems to me unavoidable that simple rods would have given greater accuracy provided the measurement were conducted under the shelter of tents as at present, so that the direct influence of the sun's rays should be entirely kept off: not that I mean to impugn the present apparatus on the score of accuracy; I think

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on the contrary that as great a portion of that essential requisite has been attained as will or can be arrived at by other means, but at the same time nothing short of an absolute elimination of error can in my opinion warrant the vast augmentation in expense and complexity.

If indeed it had been possible by means of this new application to set aside all regard to the variations of temperature and their consequences, there would have been much less reason for objection—the notion of being able to measure a line at pleasure under all circumstances with an accuracy needing no correction, and which would be perfectly independent of physical changes is not only a magnificent conception as far as theory is concerned, but would in reality have been deserving of a great increase of trouble and precaution by way of an offset to the saving of computation which it caused; but it would be a great mistake to suppose that this has been the case, for the practical difficulties are such as to render not only the entire elimination of errors, but even their reduction to the rejectaneous state a hopeless expectation, and the result has been that instead of one mass of simple corrections, we are now burdened with an overwhelming accumulation of minute particles of computation, each of which tends in its turn to fritter away the time and occupy the attention of two skilful computers.

In the process of measurement it has always been the usage to measure with a brass scale the height of each end of a set of bars above the dot on the register head immediately below it, whence in the reduction of the measured length to the level of the sea the following formula has been employed.

Let $H$ be the height above the sea of the starting point or origin and $H+h$ that of the advanced end of the first set of bars whose measured length is $b'$ and reduced length $b$ the correction being $\delta b$, then that set of bars is measured at a mean height of $H+\frac{h}{2}$ above the sea; also let $R$ be the radius and $\delta R$ the increment corresponding to this elevation so that $\delta R=H+\frac{h}{2}$.

Then $R+\delta R : R :: b' : b'-\delta b$ or $R+\delta R : \delta R :: b' : \delta b$

$$\text{Whence } \delta b=b'\cdot\frac{\delta R}{R}\cdot\left(1-\frac{\delta R}{R}\ \&c.\right)=\frac{b'}{R}\cdot\left(H+\frac{h}{2}\right)\cdot\left(1-\frac{H+\frac{h}{2}}{R}\ \&c.\right)$$

so that on account of the minuteness of the decrement $\frac{H+\frac{h}{2}}{R}$ of the last factor we may put $\delta b=\frac{b'}{R}\cdot\left(H+\frac{h}{2}\right)$.

If we consider $b'$, $R$, $H$ as constants, the corrections will be

For the 2nd set of bars ..... $\underset{(1)}{\delta} b=\frac{b'}{R}\cdot\left(H+\frac{h+h'}{2}\right)$

For the 3rd ..... $\underset{(11)}{\delta} b=\frac{b'}{R}\cdot\left(H+\frac{h'+h''}{2}\right)$

.....

For the $n^{th}$ ..... $\underset{(n-1)}{\delta} b=\frac{b'}{R}\cdot\left(H+\frac{h^{n-2}+h^{n-1}}{2}\right)$

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and consequently the sum of the corrections for $n$ sets of bars will be

$$\Sigma\,\delta\,b=\frac{b'}{R}\cdot\left(n\,H+\frac{h}{2}+\frac{h+h'}{2}+\frac{h'+h''}{2}\ldots\ldots+\frac{h^{\overline{n-2}}+h^{\overline{n-1}}}{2}\right)\text{ or its equal}$$

$$\Sigma\,\delta\,b=\frac{b'}{R}\cdot\left(n\,H+h+h'+h''\ldots\ldots+\frac{h^{\overline{n-1}}}{2}\right)$$

wherein $h^{\overline{n-1}}$ denotes the height of the advanced end of the $n^{\text{th}}$ set.

Now if $m^\circ$, $m^\circ_{(i)}$, $m^\circ_{(ii)}\ldots\ldots m^\circ_{(n-1)}\ldots\ldots$denote the heights measured above the ground of the rear end of each set, and $m'$, $m'_{(i)}$, $m'_{(ii)}\ldots\ldots m'_{(n-1)}$ the like heights of the advanced ends, then it is plain that

$$m^\circ-m'=h$$

$$m^\circ-m'+m^\circ_{(i)}-m'_{(i)}=h'$$

$$m^\circ-m'+m^\circ_{(i)}-m'_{(i)}+m^\circ_{(ii)}-m'_{(ii)}=h''$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$m^\circ-m'+m^\circ_{(i)}-m'_{(i)}+m^\circ_{(ii)}-m'_{(ii)}\ldots\ldots+m^\circ_{(n-1)}-m'_{(n-1)}=h^{\overline{n-1}}$$

whence we get for the value of the correction

$$\Sigma\,\delta\,b=\frac{b'}{R}\cdot\left(n\,H+\frac{2n-1}{2}\cdot(m^\circ-m')+\frac{2n-3}{2}\cdot(m^\circ_{(i)}-m'_{(i)})\ldots\ldots+\frac{1}{2}\cdot(m^\circ_{(n-1)}-m'_{(n-1)})\right)$$

As soon after the conclusion of the Calcutta base in 1832 as circumstances permitted I instituted a series of comparisons to determine the values with respect to my iron standard $A$ of all the 100 feet steel chains belonging to my department, amongst which were the standard and measuring chains used in all former operations of the G. T. Survey of India by Colonel Lambton and myself, which as they were 100 feet long and the bar was 10 feet, was accomplished by setting off the length of the latter ten times in succession, then putting up each chain in its turn, and measuring the surplus spaces by a micrometer of a given run.

It will need but little explanation to convey by the help of the drawings in Series E an accurate notion of the method by which these comparisons were accomplished. Eleven microscopes each supplied with the means of differential motion in three co-ordinates, a level, an axis of rotation, and means of adjustment to make the line of collimation convergent with this axis, were fixed on so many isolated pillars at 10 feet asunder, and in line approximately both laterally and vertically by a boning telescope. The final adjustments were given in this manner:—Pyramidal frusta of wood weighted with lead at bottom and surmounted with a piece of copper ground flat and somewhat smaller than a half-penny on the surface of which a dot was marked, were placed on a level by the boning instrument adjusted for observing so that its site formed with each two in turn the vertex of an isosceles triangle; in this position the two microscopes under which care had been taken to place the dots were adjusted to focal distance.

By this process the vertical co-ordinates were all provided for, and as to the lateral co-ordinates, if Nos. 1 and 3 be assumed as true and a fine wire be stretched from one



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to the other of them, it is plain that by means of this wire No. 2 may also be corrected; again if Nos. 2 and 3 be now taken up for the direction of the line, No. 4 may be corrected and so forth to the eleventh—in fact the wire in that short distance bellies so imperceptibly that the same process might serve for the vertical as well as lateral co-ordinates.

The longitudinal co-ordinate can only be set off by means of the bar itself by two persons one watching each microscope, for which purpose it was provided with a level and two thermometers both of which were noted, and as care had been taken that the differential motions might be given without deranging the adjustments of the microscopes, this process was very easily carried on in succession to the 11th, which had a micrometer wire applied to it.

The bar and its appendages were then removed to make way for the coffers in which the chain was laid, and according to the well known system in that species of measurement, a fixed fulcrum having been previously provided at one end and a weight and fixed pulley at the other, the arrow head under No. 1 was drawn duly to intersection, and the chain being stretched by the free action of a weight of 68 lbs. the arrow head at the opposite end was brought under No. 11, and there intersected by the micrometer.

Thermometers 10 in number, all of which had been duly compared with the same standard as those let into the bar, were laid by the side of the chain, and after a sufficient interval had been allowed for an equilibrium to establish itself, the micrometer reading as well as the indications of the thermometers were simultaneously noted.

Now as long as the chain to be compared is of such length that with one of its arrow heads intersected by No. 1 the other shall be within the compass of the micrometer of No. 11, this apparatus is evidently completely effective for the end in view, but it will sometimes happen that these conditions cannot be complied with, and in fact of the two chains used in India of old, that which had been reserved as a standard was alone susceptible of this complete comparison, for the other which had been universally employed as a measuring chain, had so much increased by wear and friction that when stretched its arrow-head at the weight end was not even in the field of the 11th microscope. Hence a new appliance came to be needed of which a sufficient general idea will be formed from the drawing given in plate 29 of the book of plates without my going through the wearisome verbiage of description for which in truth I have not room in this volume.

The mode used of deducing the lengths of the two chains in terms of the bar from these data at the temperature of 62° of Fahrenheit is analogous to those which have preceded.

Let $t$ be the mean temperature of the 10 bars
$t'$ that of the chain ..... } each with the corr. due to its thermoms. applied.

then if $m$ denote the factor of expansion of the metal of which the steel chain is composed and $l$ its length in feet $ml.(t-t')$ will be the term to reduce them both to the same

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temperature $t$. To this correction must be applied the excess shewn by the micrometrical process reduced to the denomination of feet, whereby is obtained the excess of the standard chain above 10 lengths of the bar in that denomination at the temperature $t$, and if $n$ denote factor of expansion of the iron bar, $(t-62°)\cdot(n-m)\cdot l$ will be a quantity additive to that excess to reduce it to the temperature of 62° of Fahrenheit.

Here $l$ is assumed at 100 feet whether for bars or chains, $m$ is taken from the known tables at ·0000063596, and $n$ at ·0000068007 as before shewn, consequently $(n-m)\cdot l$=·00004411 parts of a foot.

In this manner 64 comparisons were made with the standard chain from the mean of which it appeared that it exceeded ten lengths of the standard bar $A$ by ·00842586 parts of a foot=·10111032 of an inch; also 65 comparisons made with the measuring chain shewed its like excess to be 0·02876504 parts of a foot=·34518048 of an inch.

The difficulty of comparing chains in this way to any degree of nicety is very great because of the utter impossibility of knowing the temperature of the metal. The ten thermometers laid by its side in the coffers have not been found to differ much from each other, but still there are occasional discordancies amongst them, and after all, the mean which they give is the temperature of the air not of the metal. Now 1° of Fahrenheit would cause an error of ·000636 parts of a foot, and an error of 3·1 degrees of temperature in the case of the standard chain or of 4·4 degrees in the instance of the measuring chain would suffice to account for the extreme discrepancies in this long course of experiments. I here suppose the assumed factor of expansion to be faultless, which it may or may not be according to circumstances.

The details* are too long to be inserted in this volume where there is no room for them; reverting however to the experiments made for a similar purpose in former times I must remark that the present display a vast increase in accuracy whether we refer to those made by Colonel Lambton or myself. I have described the method employed on those occasions in pp. 51 to 53 of my former work, and it has also been detailed by Colonel Lambton with considerable precision in the Transactions of the Asiatic Society of Calcutta, but from having had free and familiar access to all the records of the G. T. Survey I can bear testimony to the fact that the experiments which were made on that principle present discordancies *inter se* which must for ever preclude all reliance on the certainty of the results thence derived within limits of accuracy suited to the occasion.

The data derived from this course of experiments put us in a condition to deduce the base measured by me at Seronj in 1824 in terms of the iron standard $A$, all except the increase by wear and friction during that measurement, for which it is still necessary to resort to the old trials recorded at pp. 121 to 123 of the book above cited—the computation will then stand as follows:—

* My reason for omitting the details is clearly that no inference affecting the present operations is drawn from them: they are all forthcoming however, and perhaps I may eventually refer to them at my leisure.

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| | |
|---|---|
| By the above exp$^{n}$ the length of stand$^{d}$ chain in terms of the iron stand$^{d}$ A at 62° Fahr$^{t}$ is | 100·00842586 |
| And that of the measuring chain is | 100·02876504 |
| Therefore the measuring chain exceeds the standard by | 0·02033918 |
| The excess found at Kalianpúr vide p. 123 of my book is | 0·01986100 |
| Therefore the present surpasses the former excess by | 0·00047818 |
| The increment of the measuring chain during the base at Seronj from wear and friction as derived from p. 123 of the same book is ·000710 in parts of a foot, the half of which is subtractive or | −0·00035500 |
| The mean length of the measuring chain is therefore | 100·02841004 |

COMPUTATION.

| | |
|---|---|
| 384 chains × 100·02841004 = | 38410·90945536 |
| The sum of the deductions from column 6th pp. 125 and 126 is 0·453447 which augmented in the ratio of 100 to 100·02841004 becomes | −0·45357582 |
| The correction for expansion of the form $(t-62°)\cdot nlB = (12°\cdot53 \times 384\cdot109 \times \cdot00063596$ becomes | +3·06080216 |
| The reduction to the level of the sea for 1620·6 feet is | −2·97370 |
| Uniting which the length of the base is finally in feet | 38410·5429817 |

It will not have escaped the notice of those who are acquainted with the progress of the Trigonometrical Survey of India up to the period of which I am speaking that great embarrassment has been perpetually occasioned for want of knowing the true lengths of the chains and their true temperature at the time of any measurement. For example when the standard chain was referred to the standard scale by Lieut.-Colonel Lambton at Hydrabad in 1821 the result shewed an excess in the former of 0·020670 reduced to the temperature of 50 or 0·015932 to that of 62° Fahrenheit; but a set of comparisons made for a like purpose also at Hydrabad on an occasion previous to the measurement of the Beder base in 1815 gave the excess of ·01574 at 50° or ·01100 at 62°, whilst the experiments made by myself at Kalianpúr in 1825 subsequent to the measurement of the Seronj base gave for the same excess 0·013279 at 50° or 0·008541 at 62°.

The insufficiency of the former method of comparison is quite enough in my opinion to account for all these discrepancies without seeking for more recondite causes, but according to which of the above terms is employed the length of the Seronj base will be greater or less in amount; in the absence of better data, in making the computations of my former work printed in 1830 it seemed to me fairest to use a mean of the two last results, because as to my own I was very certain that the trials on which it rested were made with care, and of all those made in the time of my predecessor the series of 1821 was considered by him the most worthy of confidence. Using this mean term or 0·012237 at 62° it will appear in page 126 that the base at Seronj thence reduced is 38411·89912 which exceeds the value given above by 1·35614 feet, and employing the same term also in the reduction of the base of Takal Khera, which prior to the year 1838 was the next in order to the south, the Seronj base deduced from the computation of the triangles is (vide p. 223) 38412·16 feet agreeing with the measurement to 0.26

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of a foot the latter in defect, but if the same value for the excess of the chain which had been employed by Colonel Lambton in correcting the Beder base be still used, and the triangulation be extended without interruption from Beder to Seronj, the computed length of the Seronj base would be 38420·58 feet, the latter still being in defect 10·037 feet.

Hence it seems that all the bases with which it is connected tend to the common conclusion that the base at Seronj as given by measurement was shorter than it is in reality, a circumstance which may arise from one of the following causes, either the mean of the ten thermometers did not shew the proper mean temperature of the metal during my measurement of 1824, or in my experiments made to determine the excess of the chain in 1832; or in the period of $7\frac{1}{2}$ years which elapsed between December 1824 and May 1832, the chain used had permanently shrunk from some cause not previously contemplated: accumulation of rust at the joints may for ought I can see to the contrary be sufficient to account for such a shrinking, or it may have happened that the metal from the constant action for several days and nights of the weight upon it had lost in 1824 part of its elasticity which it had recovered by long lying by in 1832, but these are speculative subjects from which no conclusion can properly be drawn, and it will be seen in the sequel that as a similar tendency to be in defect was developed when the triangulation dependent on the Dehra Dún base was carried southward to Seronj, I resolved in 1837-8 on remeasuring the base in that valley as the only remedy likely to set all doubts effectually at rest, and found it to be 38413·3675260 feet as already detailed.

Enough has I presume now been said relative to the instruments and apparatus used in the present and former bases to convey an adequate idea of the confidence to be reposed in each. It is now time that I should describe the instruments employed in observing the angles of principal triangles which were two in number, viz.:—

1st. The large theodolite by Troughton, and 2nd, the large theodolite by Cary, renovated according to a design of my own in Calcutta by Mr. H. Barrow, the mathematical instrument maker sent out to India by the H. E. I. Company in 1830.

The large theodolite by Troughton was constructed to the order of the East-India Company between the years 1827 and 1830 by that celebrated artist, who was left to follow his own judgment subject only to such supervision as I might venture to exercise, and consisted of an azimuth circle of 34 inches diameter divided to 5-minute-spaces on silver inlaid in a strong brass limb with nine conical radii. This brass limb was united to three radiating cones which carried the levelling or feet screws of the instrument, and in its central part was a nonagonal well three inches deep formed by the junction of the convergent radii, at the bottom of which space was left for a male axis to rest on. This male axis was 2·4 inches in diameter at bottom, 1·6 inch at top, and 11 inches long; it was perforated from top to bottom by a cylindrical aperture whereby the vertical rays from the station or other dot could pass freely to the object glass of a small look-down telescope, and as it descended 2·7 inches below the plane of the limb, there were 8·3 inches projecting above that plane—in the well and round the male axis stood an imple-



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ment called a camel furnished with three friction-rollers and three spiral springs the nature of which will be better understood by a reference to the drawings in series *B* than by any description which I can offer—these three rollers pressed against the bottom of the drum which carried the female axis and upper portions of the instrument, and thereby relieved the male axis of such portion of the superincumbent weight as would unless so counteracted have rendered the motion in azimuth unendurably stiff and all but impracticable. The drum was 14·4 inches in diameter, and 7 inches high—from its upper surface rose the two brass columns which supported the telescope with its vertical circle and two microscopic micrometers, all which are so like what are seen in other instruments of our days and therefore so well and generally understood as to need no particular description.

The outer surface of the drum was a cylinder from the perpendicular sides of which radiated five conical arms each sustaining at its extremity a microscopic micrometer which served to read off the graduations of the azimuth circle.

The stand was a wooden tripod surmounted by a cast-iron frame 35 inches diameter with six radii, and the space formed round the centre was left hollow to admit room for a camel with three friction rollers, the object of this arrangement being that the zero might be changed when required, for at the lower surface of this central space were three mill headed screws one of which acted on the spiral spring of each of the friction rollers, so that it might be compressed or relaxed at pleasure, whereby the whole superincumbent weight of the instrument might be made to rest with its three feet on the surface of the cast-iron frame or else be entirely borne off by the counteracting pressure of the camel.

To the outer surface of each of the three legs of the wooden tripod was united by 4 screws a brass support, which served to sustain an annular wooden table of $4\frac{1}{2}$ inches breadth, the object of this appliance being that the lamps used in reading the micrometers of the azimuth circle might find a steady support always prepared for their reception.

The levels were four in number, viz. two at right angles to each other fixed to the upper surface of the drum by adjusting screws; one swinging on pivots attached to the arms which sustained the microscopes of the vertical circle; and one riding on the pivots of the axis of the telescope—the two latter were each furnished with a cross-level and were sufficiently delicate.

The diameter of the graduated circle attached to the telescope was 18 inches; the focal length of the telescope was 39·4 inches: I can find no memorandum of the powers of its two eye tubes but the values given by the dynameter were I believe 49 and 98.

To shew how necessary it is to keep a watchful eye over the workmanship of even first-rate and universally celebrated artists such for example as my esteemed and valued friend the late Mr. Troughton, I deem it not out of place to extract from my journal a detail of my undergoings with respect to the instrument which I am now describing: I

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was one of those who when I went to India in 1830 had not yet learned the necessity of this precaution, and as no convenient opportunity had offered of trying this instrument whilst the approximate series and base line measurements were in progress, I looked without uneasiness to the result, fully confiding that all would be perfectly correct, or if not exactly so that any existing defects would be trifling and susceptible of easy remedy.

The termination of the first measurement of the base line in the Dehra Dún was the first occasion on which this Capo d'opera of Mr. Troughton was called into use and accordingly a steady foundation having been made for this beautiful instrument to stand on, I forthwith proceeded to adjust and observe with it, but a very few trials shewed me that in its existing condition it was utterly unworthy of any confidence for the angles taken with it could not be depended on to within 50 seconds of the truth; an immediate examination was therefore necessary, and as on the surface there was no appearance of aught but what was remarkable for excellence of workmanship and adaptation, therefore the only method that remained was to search for the vitiating cause in the interior arrangement of the instrument—and first as the friction-rollers applied to the transit axis were intended to bear each a portion of the weight of the upper circle and its telescope, it was manifest not only that an equal weight ought to press upon each, but that the residual quantity acting on the *Ys* should be sufficient in amount to ensure steadiness and stability. To effect this it became essential to mark the lowest points to which the friction-rollers in question were required to descend and then by means of hooks and weights attached to them to ascertain what weight would suffice to bring down each roller in its socket to the point so marked, which desideratum being determined it was easy to adapt the springs by means of their screws to the proper degree of tension.

But this though successfully remedied did not suffice to cure the evil complained of, and on closer examination it appeared that of the two *Ys* one was ricketty in its socket whilst both as well as their outriggers were rather more flimsy than they ought to be to sustain the superincumbent weight. The only present remedy for this was to apply a milled-headed screw to press through the socket on the tail piece of either *Y* with a circular anti-rotatory plate interposed between the end of the screw and the surface of the tail piece that the latter might not be abraded, this as a temporary remedy effectually cured the ricketty condition of the *Ys* but did not nevertheless produce the desired degree of efficiency: something else therefore must now be thought of.

It will be remembered that in speaking of this instrument I mentioned that the bottom of the axis of its azimuth circle rested upon a circular frame with 3 rollers and 3 springs called a camel which sustained great part of the weight which would otherwise press upon the axis itself. Now that this camel should answer the purpose for which it was designed, it was clearly indispensable that every one of these springs should require an equal weight to lower it to the mark down to which the axis pressed it, for in any other case the whole superincumbent weight must be lopsided and therefore the telescope

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and upper works have more or less of a waddling motion. The camel was therefore taken off and examined, on which it appeared that the relative tensions of the three springs in their existing state were as 8, 11, 15, which inequality being corrected, the instrument not only gave no further uneasiness, but was as perfect in performance as beautiful in appearance.

I must here remark that at the time in question I sought in vain for information regarding friction-rollers, and could nowhere learn either from books or orally what was considered the proportion of the weight which they ought to bear: the following rules which I at that time formed for my own guidance and that of my subordinates may perhaps not be unacceptable.

Each of the two friction-rollers applied to the transit axis ought to require $\frac{3}{10}$ of the whole weight to bring it down to the position which it occupies when the *Ys* are at their lowest point whereby $\frac{3}{5}$ of the weight of the telescope and its appendages will be borne by the friction-rollers leaving $\frac{2}{5}$ active, wherewith the pivots press upon the *Ys* to ensure steadiness.

Of the three springs which belong to a camel applied to sustain on rollers the weight of the azimuth axis, each should be adapted to $\frac{1}{4}$ of the whole superincumbent weight leaving the remaining $\frac{1}{4}$ active to ensure steadiness.

I must remark however that although friction-rollers seem to me an admirable contrivance for dispersing the weight through the system yet they require constant inspection and cleaning, without which they are perpetually liable to be a source of great mischief: and though in respect to a transit axis there seems no method of dispensing with them in heavy instruments without the liability to wear away both *Ys* and pivots, yet in the case of the azimuth axis I am clearly of opinion that the axis by Ramsden is a far preferable expedient, and that their introduction has been rather a disadvantage. Even however when applied to a transit axis, care should be taken that the resultant arising from the pressure on each friction-roller, and that on the *Y* nearest to it should fall on the centre of the column, and not on the outside which it is made to do whenever the roller is inserted through the centre of the capital. Instead of this which is the arrangement generally resorted to, the friction-roller should occupy a position inside and the *Y* outside the column, the two distances of the points of pressure from the centre of the capital being inversely as the weight to be sustained, that is to say the distance of the roller which bears $\frac{3}{10}$ of the weight and that of the *Y* which bears $\frac{2}{10}$ of the same weight (each measured from the centre of the pillar) should be in the ratio of 2 to 3, in which case not only may the outriggers be made shorter and braces be dispensed with, but the column even if the screws which unite it to the table were removed would stand erect by the mere force of equilibrium.

But there was another defect which in the course of time made itself manifest in this grand instrument; in the bottom of the drum, at the part on which the friction rollers of the camel press, an air hole made its appearance in the brass, to remedy which I caused a flat circular collar of polished steel to be constructed and united with screws

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so as to cover the drum in that part where the rollers traversed. This was a very great improvement and whereas before it was applied the instrument when brought up to intersect an object from left to right could rarely be brought back by the reverse motion to the same reading, so latterly when these divers small matters were corrected and provided for, its returns to its own readings were as regular as could be desired.

I proceed now to detail the restoration of the large theodolite of which I have spoken in my book pp. 45, 46.

This instrument was constructed by Cary for the East-India Company and was a fac simile of that designed by the celebrated Ramsden for the Board of Ordnance of which the several parts are minutely described by the late Colonel Mudge in his book on the Trigonometrical Survey of Great Britain, all except the axis, of the peculiarity of which I can find no mention.

However appropriate this instrument might have been in its original state, yet after the accident which it met with in Tanjore, it ought evidently never to have been employed again until it had been fitted up with a new azimuth circle. The detail of angles which I observed with it in 1823-4-5 (vide pp. 141 to 172 and 207 to 213) fully establish that point of which indeed I had long been convinced, but as it was the best instrument then at my disposal there was no alternative between employing it or suspending operations until another had been constructed to replace it.

I recommended in 1825 that this old instrument should be sent to England to be renovated; it may be doubted however whether any artist of celebrity would have had any thing to say to such a procedure, for it was in a sadly ricketty condition, and as it was deposited at the time of my departure in 1825 in one of the Government store-rooms so I found it on my return in 1830, not having been used in my absence, and therefore neither in a better nor worse state than when I had last seen it.

When I left India in 1825 I had seen no instruments larger than this old theodolite and my zenith sector from which my ideas were formed: when I returned there in 1830 I had visited and familiarized myself with the finest instruments of the day and gone through the workshops of the ablest and most celebrated artists of civilized Europe; my taste and mode of viewing things of the sort had undergone a thorough change and my old acquaintance certainly did make but a sorry display in my eyes. Its distorted limb, its wooden frame work partly broken and patched up with an iron plate on which the marks of the original injury were still apparent, its mahogany 4-legged stand and table, cracked, time-worn, and scarred from many a hard day's journey and exposure to the damp and drought of an Indian climate, all acted against its good looks, and it was a subject of surprise to me how I could have managed with an apparatus so crazy to produce observations even of the order given in my book.

There is much however to admire about the structure of the instrument as shewn in Colonel Mudge's work, which as a first bold attempt must ever confer honor on the memory of its inventor; nor is the axis, though not therein described, the least worthy in my opinion of applause, for though I have examined the principle of many axes and not



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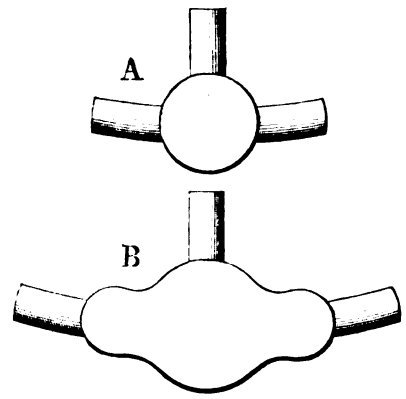
only considered well the arrangement of those constructed by Troughton, but practically tried them repeatedly, yet none that it has ever fallen to my lot to meet with has been comparable to that by Ramsden.

The brass tripod too and its elevating screws are admirable for their lightness, strength, and stability, and the arrangement whereby the feet of the stand are supplied with the means of levelling the basis on which the instrument is to rest independently of the instrument itself are highly commodious: moreover the lightness and airy appearance of the azimuth circle with its twelve radiating cones, and surmounted with a magnificent telescope of 36 inches focal length, convey an idea of elegance and just proportion, whilst even the wooden stand and frame work covered with green baize, through which the lower telescope peers and the single column in the middle rising upwards like a monument combine to form a whole of a very imposing and philosophical appearance.

To modernize an instrument of this kind, so as to preserve what called forth my admiration and (rejecting what was objectionable) combine it with what was more convenient in practice cost me much thought and anxiety, but I succeeded in the end to my entire satisfaction, and the instrument* when received from the H. E. I. C.'s mathematical instrument maker's workshop in 1835 according to my design was certainly not inferior but as is generally thought by the members of the G. T. Survey of India superior to the 3 feet theodolite by Troughton which that renowned artist regarded as his capo d'opera.

One of the great advantages presented by Ramsden's construction of 1790 was that the instrument admitted of being lifted out of its box without danger and with perfect ease by means of 4 slings passing each through an iron handle attached to the wooden frame whereby none of the vital parts could be affected: this advantage I determined on no account to relinquish, and though I resolved nevertheless on dispensing with the wood-work of the frame, yet I designed at the same time an appliance analogous to it.

To this end I had a circular frame formed of 6 gun barrels each bent to an arc of 60° with 6 radii of the same materials; three pieces of the form *A* and an equal number of the form *B* were constructed of iron, whereby all these were united at the circumference, the latter being adapted to the peculiar shape of the foot screws by Ramsden; and by means of circular plates analogous to the nave of a wheel, the whole parts were consolidated at the centre and formed into a frame quite as substantial as the wood-work which they were intended to replace. Against this central plate which I call the nave, the friction rollers of the camel attached to the stand for the




* The drawings marked series C in the Book of Plates will it is hoped serve to convey a sufficient idea of the instrument herein spoken of.

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purpose of changing zero were made when slackened to press, and by means of the felloes of the circumference, the operation of lifting the instrument was accomplished without any danger or inconvenience.

As to the wooden stand, I preserved the advantage given by Ramsden's construction of levelling its surface independently by means of lower feet-screws, but at the same time instead of four feet I had the new stand constructed with 3 feet, each formed of two bars diverging upwards and united at the lower extremity in such wise that the elevating screws worked between them on the same principle as that shewn in Colonel Mudge's drawing. I had the stand so formed surmounted by a substantial cast-iron frame which was fabricated for me in the foundry of Messrs. Jessop and Co. of Calcutta, and to the centre thereof which was left hollow for the purpose, I had a camel with 4 friction rollers applied, as also an equal number of long screws for differential centering in the usual manner.

As it was an object to me to preserve Ramsden's form of the axis which I look on as unsurpassed by any that I have ever seen, and in fact unsurpassable; I had the old female axis taken off, shortened and inverted, and a new male axis fitted to it, whereby I had room above the azimuth circle for a brass table and two columns, with space between them for a vertical circle to revolve in altitude.

On assuming charge of the office of Surveyor-General of India in 1830 I found in deposit as useless lumber, several instruments of divers sorts, and amongst them an altitude and azimuth by Harris, which had a vertical circle of 24 inches diameter; as I had employed the azimuth circle of this instrument in constructing a 2nd class theodolite this vertical circle was disposable, and as it was sufficiently well divided I determined to apply it to the new large theodolite, but as its telescope was short and of insufficient power it would not have answered the purpose I had in view to use it without modification. Accordingly I had the tube of this small telescope cut off at both ends, and as the object and eye glasses of the upper telescope belonging to the old large theodolite by Cary were available I had a sufficient length of tube cut off at both ends and fitted on to the remaining parts of the tube enclosed between the two planes of the vertical circle.

The azimuth circle required to be made entirely new, for which purpose I had 3 rings cast by a native in one of the bazars in Calcutta, conformable to a model which was constructed by Seid Mohsin the native artist of my office, of which the best was chosen: this was made light and slender as it had no weight to sustain and was agreeably to my design to revolve with the male axis, and as the conical radii of the old circle were in good condition I had them applied to this ring, thereby forming a new azimuth circle as nearly similar as could be to the old one of which a drawing is given in Colonel Mudge's work above referred to.

Five fixed microscopes with micrometer readings were applied to the azimuth circle by means of as many radiating arms, from the extremity of each of which an upright pillar was made to rise in the way shewn in the drawings of series C; also two

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other microscopes were adapted to the vertical circle in the usual way with bent arms.

I contrived to make the old brass tripod and its admirable levelling screws available by raising 3 elevated iron pillars on the gun barrel frame for the latter to stand on, and lastly I had an annular table constructed for supporting the lamps used in reading the divisions of the azimuth circle.

The principal arrangements connected with this restoration were effected under my own eye before I left Calcutta on 24th December 1832, and for the completion of the remainder I left explicit and distinct instructions with the H. E. I. C.'s mathematical instrument maker; the instrument reached me when I was in the field in November 1835, and I must do that artist the justice to say that for excellence of workmanship, accuracy of division, steadiness, regularity, and glibness of motion, and the general neatness, elegance and nice fitting of all its parts, not only were my expectations exceeded, but I really think it is as a whole as unrivalled in the world as it is unique.

The azimuth circle was divided according to Troughton's method, and I have heard (though that was never brought to my notice authentically) that there was one failure if not more, but be that as it may, the artist met with a success eventually which proves him to be a first-rate person in his line of business: as usually happens however in such cases, when the instrument came to hand there were many defects about it which required to be remedied, and which but for my having at my elbow the person whom I have previously mentioned by name Seid Mohsin, I should have been very much at a loss to rectify. It would be useless to specify these, I only advert to them in further proof of how necessary it is for Astronomers and Geodists to keep a watchful eye over all instruments issuing from an artist's hands: I managed to rectify all defects in this and other instances, and all my brethren must be prepared to do the like.

I have expressed my opinion that the instrument last described is superior rather than otherwise to that by Troughton, and the reasons may probably be partly those which follow:—In Troughton's instrument it is a most troublesome operation to level the surface of the iron frame which surmounts the wooden tripod because though there is a large level supplied for the purpose yet there are no lower screws and consequently the levelment if accomplished at all must be brought to pass by hammering at the surfaces of the stones on which the tripod stands: in the instrument which I designed this operation is manifestly perfectly easy.

In Troughton's instrument the five microscopes rotate with the telescope, consequently as the graduated heads of the micrometers must be turned round by the hand there is danger lest the touch of the observer should communicate motion to the drum and other parts connected with it, whereby the telescope is liable to be thrown off the object intersected, and the observation totally deranged in consequence; an evil only to be counteracted by screwing the clamp very tightly which every body knows is in itself most objectionable in practice. This is one of the evils inseparable from what Mr.

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Troughton was used to call internal readings, and another is that as the reading microscopes change their positions with the motion of the telescope in azimuth the direction of the light is perpetually varying and consequently the illuminators have to be always set afresh to suit each new position. Now it is clear that in the instrument which I designed neither of these results is to be apprehended, for the five microscopes being fixtures whilst the divided circle moves in azimuth, the clamp need never be drawn tighter than sufficient to allow the tangent screw to act, and the reading positions are never changed except when the zero is shifted.

In moving the telescope in azimuth the hand must be applied to some part connected with it; some persons lay hold of the pillars for this purpose, others prefer the periphery of the azimuth circle, others communicate the motion by means of the arm carrying the clamp where such exists; but of these all are more or less objectionable chiefly because they communicate the heat of the body or apply a force where there is least strength and most likelihood of torsion. The plan adopted by me in both the instruments I have been speaking of is to affix a flat wooden handle over the circular part of the central table which separates the bases of the two columns, by means of which the necessary motion is communicated at the strongest parts of the moveable mass.

I need say no more I apprehend to explain fully the construction of both the large theodolites by means of which the angles of all the principal triangles were observed, for a reference to the drawings marked Series B and C will suffice to explain all the rest. They were superb instruments certainly, and considering that one of them, all but its levels and lenses was entirely constructed in India, a tolerably good idea will be formed of the skill and docility of the natives of that country under active guidance and tuition.

The large theodolite by Troughton was first brought into active employment in the field in 1835 in observing the angles of the small triangles about the Dehra Dún base which work was taken in hand as soon as that instrument had been put to rights: now it must be remarked that in a triangulation of which the sides are very small, 2 to 3 miles for example, the necessity of centering the object to be observed is scarcely of less importance than that of centering and adjusting the instrument itself: no signals previously in use had ever been calculated for the degree of nicety requisite in such cases, for an instrument well divided with the hand will give angles to a great degree of minuteness which if the observed object be not equally susceptible of delicate arrangement is thrown away; for example, at $3\frac{1}{4}$ miles an inch subtends a second, but the large theodolite being furnished with five micrometers will give readings to a small fraction $\frac{1}{10}$ or $\frac{2}{10}$ of a second; therefore unless in the signal used the means of detecting a deviation to $\frac{1}{10}$ of an inch from the centre be provided, the accuracy of the observed object cannot be considered as on a par with that of the observing instrument.

To carry on the small series of triangles of which I have above spoken, it accordingly became necessary to devise some new form of signal which I accomplished in this wise: I constructed triangular frames six feet high, the skeleton of each of which



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was of wooden bars neatly joined; the frame was covered with canvass painted black, and surmounted with a small kalas or apex of sheet iron, from the top of which a plumb line was suspended: on the front of this frame, a white line was traced upon the canvass which divided the figure perpendicularly into two parts, and upon this line about 17 inches from the bottom a circular aperture with a radius equal to $\frac{1}{4}$ of an inch was described which formed a limiting diaphragm for the rays of a heliotrope placed behind it to pass through.

The frame thus formed was called a sight vane: by placing it over the centre of the observed point, for which the plumb line provided the means, it was plain that bating any parallax, only those rays would fall on the object-glass of the telescope, the axes of which actually passed over the centre of the station; or when the sun did not shine, the kalas of the sight vane was just as distinct an object for intersection as could be desired, and equal in point of accuracy to the heliotrope disk.

The success of this plan was very great; I carried it into effect in all the small triangulation about the base which I have above adverted to, and subsequently introduced the principle generally into practice wherever it could be resorted to, by increasing the height of the sight vane to 8 feet, and the diameter of the aperture to 2 inches; but I must remark that in those triangles which are situated in the flat lands of the Doab, I was in many cases forced to abandon it, and use the bare heliotrope placed over the centre of the station, because not only vast care and patient attention are necessary in those who direct the heliotrope through so small an aperture, but the sky must needs be very clear, and the ray totally unobstructed by dust, smoke, haze, or any other obstacles in order that the disk may be distinct enough for intersection.

A modification of this principle was at the same time applied to the referring mark of which I have elsewhere spoken, for as that was generally within two miles, the slightest deviation would evidently tend to vitiate the whole of the observations referred to it. This implement is of the form shewn in the drawings in plate 20, and stands on a tribrach formed by one bar 18 inches long united perpendicularly to the middle of another bar 24 inches long. The whole height is 33 inches—at the height of 3 inches an aperture of 1 inch diameter is made to receive the nozzle of a lamp provided with a lens, and at the height of 12 inches an aperture of $\frac{1}{4}$ of an inch diameter is provided for the rays of the heliotrope to pass through; the kalas or apex may be used in the day-time when the sun does not shine, and for referring secondary points is always sufficiently accurate, but is rarely depended on for principal triangles. This apparatus is adjusted over a centre engraved on a stone, for effecting which with extreme nicety each end of the tribrach has a levelling screw, and a plumb line is provided which is made to pass centrically through both the apertures; but as this object is liable to be used in hilly countries where both lamp and heliotrope have often to be directed at an angle of elevation in order that the rays from them may fall on the object glass of the observing telescope, a cylindrical rod of brass 4 inches long projects from the face of the vane from which the plumb line hangs, and in that case care is requisite that the eye of the

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person adjusting it may be directed quite perpendicularly, for otherwise there would be a slight parallax.

In order that this referring sight vane may be laid in the proper direction, an iron pin 14 inches long with a ring 3 inches diameter at its upper part intersected by cross wires is placed between it and the station of observation in such wise that the intersection of the wires when viewed by an eye at the centre of the lamp aperture may be projected on the place occupied by the object glass of the telescope which is to observe the angles; the lamp should then be lighted and the refracted rays of white light from the flame of the lamp should be made to fall on the cross wires of the ring which can best be judged of by placing the eye at the intersection of those wires and looking back at the lamp, the levelling screw at that branch of the tri. ach which is in the rear furnishing the means of bringing this to pass.

As to the heliotrope it is adjusted by signals made from the observing tent by means of flags; for example a flag displayed to the right shews that the disk is too bright, and one to the left shews it is not bright enough; and hence the distance never ought to be such that the person who manages the sight vane of the referring mark cannot easily discern those signals, for when they are well attended to, the light from the heliotrope through that small aperture is in the form of a beautiful planetary disk not dazzling to the eye but of a pale golden hue, and supplies the most exquisite object for intersection that can be imagined.

Before I quit these subjects it may not be amiss to mention the reverberatory lamps of which two dozen were supplied by Messrs. Troughton and Simms before I left England. The drawing in plate 21 will convey an accurate idea of the construction of these, whence it will appear that they were each furnished with an Argand's burner or circular wick the rays emitted from which when lighted were reflected by a paraboloidal mirror of plated copper 12 inches in diameter and 4·9 inches in depth, but though the luminous disk thus presented seemed to be by no means deficient in brightness in a calm atmosphere, yet when they were first tried they were pronounced by everybody to be an utter failure because the slightest agitation of the air caused the flame to flare against the glass chimney, and by blackening it with smoke render the reflected image also black, even when the light escaped immediate extinction and the chimney remained uncracked.

For a long time I tried in vain all kinds of remedies: I had a wire-gauze frame constructed wherewith to cover over the top of the glass chimney, and tried by keeping off the action of the external air to prevent the evil of which I speak, but in proportion as these approximated to that desired end the light burned more and more feebly, and at last the case seemed almost desperate; at length I bethought me of enclosing the whole lamp in a wooden case air-tight all but a round hole at top through which a tall tin chimney removeable at pleasure might be placed directly above the glass chimney of the lamp—at the front there was a door opening with hinges, in the middle of which was a circular glass pane of 11·6 inches diameter; at the upper surface were two projecting

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sights whereby the lamp box could be directed in any particular ray and a circular frame with a centre marked on it, fitting over the glass pane, furnished the means of adjusting the box and luminous disk over the centre by means of a plumb line. This arrangement succeeded to admiration, for in the severest storms of wind these lamps have been used without any fear of their being extinguished, and if the circular aperture near the chimney be sheltered, even heavy rain will not interfere with them; but it rendered this part of the plan very complete to make the wooden house which thus sheltered the lamp when in use serve also for a packing case for it in travelling.

All these arrangements which I have just mentioned, whether as regards the large theodolite, sight vanes, or lamps, were made whilst the measurement of the base line was in progress, and it is to my native artist Seid Mohsin that I am chiefly indebted for the felicitous issue of my plans: I consulted all books in the libraries of myself or my friends and sought for information in all likely quarters to which I had access, but in vain, for I could no where obtain data to guide me regarding friction-rollers or Argand's lamps, so that I was left entirely to my own resources, and unless I had had a person like Seid Mohsin at hand as able to enter into my ideas as willing to co-operate with me and give efficiency to my schemes, it is hardly to be expected that amidst so many calls on my time to distract me I should ever have been able to give them a fair trial.

Thus it will be seen that the objects chiefly used as marks of observation or signals were either heliotropes, sight vanes, or lamps, but in some cases, as in the dense atmosphere of the plains for example, these were not found sufficiently powerful, and as the Drummond's lights were by far too delicate to be entrusted to the management of ordinary people, the only remedy was to resort to blue lights burned at intervals, for which purpose I had large frames of sheet iron in which circular apertures of 6 inches diameter were hollowed out and furnished with a circular wooden stopper with a centre and plumb line whereby they might be truly adjusted over the centre of the station observed. As the blue lights used were very large, the flame was more than sufficient to fill this orifice, but by this arrangement it is plain that all the rays except those which passed over the centre were excluded.

I must not omit to explain the method universally abided by in observing the angles of principal triangles which though very similar to that described in my printed book of 1830 differs from it in certain respects.

The large theodolite being furnished with 5 microscopic micrometers at 72° in arc apart, it is plain that in any one position of the zero ($A$ at $O°$ for example) microscope $D$ will read 216°, and when the telescope is turned over in altitude, and the same object is intersected, the same microscope will read $216°+180°=36°$; from which property peculiar to an uneven number, it results that at any one zero, by observing face left and face right, every 36th degree of the divided face will come under one or other of the microscopes.

This arrangement not only tends to compensate for errors committed in the division but also as may be shewn the reversion of the face eliminates those arising from

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eccentricity, want of horizontality in the transit axis, and deviation in the line of collimation; it is not however prudent to trust to the extent of 36° to the skill of the artist, and therefore after a sufficient number of trials at one zero, the zero point is changed so that other series of divisions may in their turn fall under the miscroscopes. The rule which I have introduced into practice and which has been invariably attended to is to observe 3 times at each zero with the face left, and as many face right, then to change the zero 3 times by 9° each time, and at each position go through a like operation, whereby it is evident that every 9th degree will in turn fall under one or other of the microscopes.

If angles were all observed entire and every one contained between two contiguous stations stood independent of all others, it would not much matter at what parts of the limb the zero stood, for provided the above rule were abided by, the result would be the same, that is to say every 9th degree would fall under some one of the microscopes; but many circumstances make against this happening in practice, and first of all it must be noted that the atmosphere may be obscure in one direction and transparent in another, so that from this or other such cause, the angle between two stations, $\alpha$, $\beta$ cannot be observed because one of them ($\alpha$ for example) is not visible.

Now if we are to wait until both $\alpha$ and $\beta$ are visible simultaneously we shall have to wait a very long time indeed, for perhaps one of them ($\beta$ for example) may be susceptible of being seen night and day, whilst $\alpha$ makes its appearance only by night, wherefore to make the two contingent on each other is at any rate to be avoided, even if this were to be done at option; but that it is not so, is quite clear when blue lights have to be resorted to as the only light sufficiently intense to perforate the dense medium of the Doab atmosphere, for these are burned at intervals, and if the observer is to be occupied in intersecting a light at $\beta$ rendered more or less feeble by distance whilst the blue light at $\alpha$ is blazing, the latter will be displayed to very little purpose.

I have taken the instance of two stations by way of illustration, but it must be remarked that it not unfrequently happens that at any one station there are sometimes 6 or more different principal points to be observed, so that the case becomes then highly complicated, and the only method of contending with it is to establish at some convenient distance in the way I have above spoken of, a mark of reference which shall be perpetually clear and prepared for delicate observation at all hours of the day and night.

This enables us at once to make each distant point independent of all the others, but to put us in a condition to apply our theory of probabilities the divers independent observations ought to be susceptible of combination in such wise that the readings of the referring mark may in the end be entirely eliminated, and each angle stand as if it had been observed entire and no referring mark had existed.

Now we cannot do this entirely, but we may very nearly in this wise which is the method that has been implicitly followed in all these operations. Taking the former example of two stations $\alpha$ and $\beta$ by way of illustration, let it be supposed that the first of these $\alpha$ has been observed the prescribed number of times with the referring mark,



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that is to say 3 times at each of the following zeros which are the readings of the latter, 0°, 180°, 9°, 189°, 18°, 198°, 27°, 207°; then if we take the mean of the observations at each of these zeros as one arc we have 8 different readings which we can combine with a like number taken in a similar way to $\beta$, and thus we shall have 8 entire angles at different parts of the limb between $\alpha$ and $\beta$ which will be very nearly such as they would have resulted if taken direct between those two points without the intervention of a referring mark, in all which it will of course be understood that at whatever readings the referring mark has stood in the observations of $\alpha$, to the very same readings precisely must it be brought back when those of $\beta$ are made. This method of combination is I believe the nearest approximation to the desired end that can be attained; properly speaking in the calculation of probabilities each of the 24 observations should be used as if taken independently, but it will be seen from the above explanation of the method that to adopt this practice generally is not possible though in particular cases it may be, and as to apply one principle at one time and another at another would generate greater irregularities than those which it is intended to supersede, therefore I have introduced the above principle into practice as the nearest approximation of universal application, which after all is liable only to the objection that instead of considering the probabilities of error as functions of all those which arise whether from bad observation, instrumental defects, or lateral refraction, they are treated as if functions of the errors of division only.

This discussion will serve to explain the manner in which my observed angles are registered and their probabilities of error computed, for though in very many instances those angles have been observed direct yet they have rarely been observed without a referring mark, which latter implement has eventually become a sort of necessary appendage without which no observations are commenced, and the fit provision and locality for which have always been considered as a subject of paramount importance. In fact as such an appendage, whatever may be thought of terrestrial angles, furnishes the only possible method of observing azimuths and connecting them with the triangulation, therefore the more care is habitually bestowed in keeping it in a state of efficiency the more likely it will be to be accurate when required.

I believe it will be unnecessary to say any thing further respecting the instruments employed, for those who have done me the honour to follow me thus far will assuredly by the aid of the drawings be fully able to arrive at a thorough understanding of that part of my subject.

I may now therefore enter on the methods employed in the computations and shall begin by explaining the apportionment of errors in the observed horizontal angles of triangles, for as is well known every observation whatever is burdened with some portion of inherent error greater or less in proportion to the means taken to ensure accuracy.

Those means may be classed into the material and personal, the first of which consist in the delicacy and correctness of the instrument employed; in the stability of the foundation on which it stands; in the means of centering and levelling it; in the

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efficiency of its protection against the weather; in the power of throwing a steady light on the wires of the telescope and the reading microscopes; in the due arrangement of the skeleton forms for registry; in the form of the object to be observed and its susceptibility of being connected with the centre of the station: whilst the personal may be comprised in the care which is taken to see the observed object truly on the cross wires; to ascertain the runs and absence of parallax in every one of the microscopes; to read each micrometer to the nearest tenth of the graduated head; to have all the readings examined and verified to the nearest second, after being read and registered; to have the means and angles drawn out by two independent persons at least; to have those who superintend the day and night signals instructed in the method of centering them; and to employ no person in any part of the duty on whose fidelity reliance may not be placed.

By a careful attention to all these and other such minutiæ equally essential, the amount of error may be greatly reduced, but there is little chance that it can ever be entirely eliminated, for first of all it must be remarked that every observation is made on a ray passing through a medium of very uncertain consistency and variable temperature, and there is no reason to conclude that the refraction is all in the normal of either extremity of its trajectory; but supposing this to be a rejectaneous consideration still the smoke and various vapours which are perpetually rising from the earth have palpably not an uniform density at a given height above the surface, and the ray in its passage through these must unquestionably be liable to lateral as well as vertical refraction; we see in fact both by night and day that this cause is perpetually in operation, for the small disk of the reverberatory lamp which is only 12 inches in diameter, and in a clear settled atmosphere is reduced to a luminous point, swells out sometimes for whole nights in succession into a broad ill-defined disk subtending occasionally 2 minutes of the horizon, and vibrating more like a sheet of fire than an object intended for accurate intersection, whilst the visible disk of the heliotrope formed by limiting the rays to an aperture of 2 inches diameter is even wilder and more straggling.

The only method of overcoming these sources of irregularity is to await a favourable state of the atmosphere and be prepared to profit by every such opportunity which offers itself; such occasions occur for day observation almost every sunny day for a shorter or longer period between $4\frac{1}{2}$ o'clock and sunset, and sometimes but rarely the lamp is beautifully adapted to intersection from sunset till past midnight or even later, so that the patience has to be tried though not to that extent which was requisite when masts,* flag-staves, and other opaque objects were the only marks to be intersected, for then days and days often passed away without a glimpse of the distant object.

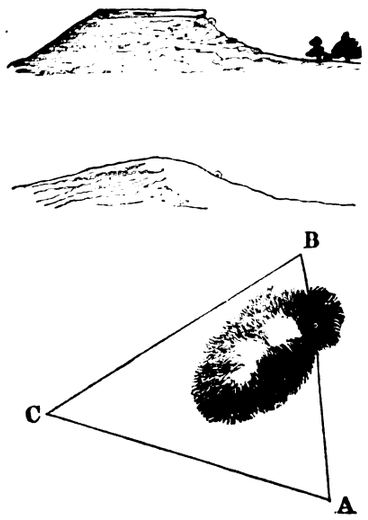
* This was the usage in the time of my predecessor. The rainy season being the only period of the year at which the atmosphere in India (generally speaking) admits of steady intersection of distant opaque objects, the standing order of the late Lieutenant-Colonel Lambton to me his chief assistant and his other subordinates was to wait till the first heavy fall of rain and then take the field. It is easy to conceive what a reckless waste of life and health was caused by this exposure to the pitiless pelting of the tropical rains, in forest tracts teeming with miasma: no constitution European or Asiatic could bear up for any length of time against such a complication of hardships as thence arose—eternal watchings by day to the prevention of all regular exercise—tents decomposing into their original elements—servants—cattle—baggage—clothes—bedding—*La Cuisine*—all daily dripping

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The state of the atmosphere immediately after sunrise though often highly promising in appearance is rarely to be depended on, for then it would seem that lateral refraction acts most insidiously: the disk of the heliotrope then often shews small and round through the leaden medium near the horizon like a candle shining dimly through a hole in a curtain, but whilst the observer is occupied in intersecting this object another image exactly similar to it rises to the right or left, above or below, after which the first disappears, thus puzzling and perplexing the eye with following the mazy wanderings of an Ignis fatuus.

Whenever this happens the only possible way is to give up observing for the time being, for there is no chance of success until after the noon-day sun has thoroughly warmed the earth, and in the few instances wherein observations made under these circumstances have been recorded, the discrepancies they present all go to prove that lateral refraction is then irregularly at work.

These are all instances of momentary deflection which may be mainly circumvented by care, attention, and patience: there is however a case wherein a lateral deviation seems to be produced permanently and to be always liable to happen—when the ray grazes an uneven surface intervening between the eye and the object. For example let the figures in the margin represent sections through a mass of elevated land made by a plane perpendicular to the ray at its nearest point of approach, the projection of the ray on this plane being denoted by the little circle with a dot in its centre, then it would seem that the ray is liable to be deflected from the sloping side in a greater or less degree according to the local intenseness of this cause, the effect of which is to produce an error in the sum of the three observed angles against which no prudence can guard: for let $ABC$ be a triangle of which the two rays, $AC$, $BC$, pass high up above the land, whilst the third ray $AB$ grazes the sloping side of an elevation as in one of the sections; then it is clear that whilst the angle $C$ remains unaffected by this deflection its tendency will be to make



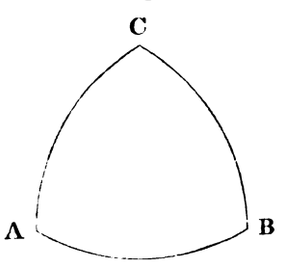

with rain—every comfort which the indwellers of cities and leaders of regular lives deem essential to happiness and even to existence remorselessly sacrificed—and yet strange to say, except when under the actual influence of jungle fever which, as I have told in my former book, sometimes swept like a destroying angel over us and prostrated the whole camp in one night, we hardly ever knew what it was to have a sorry hour. Surely the G. T. Survey of India in those days was the proper school to teach men how to laugh at the calamities and nothingness of life. The introduction of lamps and heliotropes has totally changed the face of things and by rendering the rainy season the least fitting period for observing luminous objects, especially those dependent on cloudless skies, has afforded an opportunity of which I eagerly availed myself to spare the health of my valuable subordinates by ordering them to desist from field operations at the very period which in the early part of my career and my four years' heavy apprenticeship used to be chosen *par excellence* for their commencement.

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both the other angles vary by a quantity either positive to both or negative to both according to the direction in which the deflection operates; and moreover as the refractive power of the atmosphere varies and the image of the distant object recedes from, by ascending, or approaches towards, by descending, the deflecting mass, the effect will also be variable in amount.

Without allowing a degree of latitude to the individual judgment of the director of operations of this nature such as none ought either to expect or grant, and which cannot be conceded without great liability to abuse, it seems impossible to devise any method of neutralizing the effects of this source of error; the safest plan as it seems to me is to class all such discrepancies under the head of column $\varepsilon$, and to make them counteract each other as often as is practicable by the process of crossing or double series, the two principal forms of which though the varieties of combination are nearly unlimited are the quadrilateral whose two diagonals intersect each other and the polygon within the area of which the vertices of the triangles composing it meet.

These processes of which I propose to speak in order obviously do not take effect in a simple series where the only equations applicable are



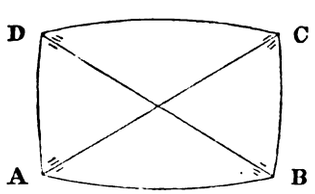

$$A_{(i)}+B_{(i)}+C_{(i)}=\pi+e+\varepsilon$$

$$A+B+C=\pi+e$$

$$A=A_{(i)}-\frac{p_{(a)}}{P}\cdot\varepsilon;\ B=B_{(i)}-\frac{p_{(b)}}{P}\cdot\varepsilon;\ C=C_{(i)}-\frac{p_{(c)}}{P}\cdot\varepsilon\ldots\ldots\ldots\ldots(\alpha)$$

wherein $A_{(i)}$, $B_{(i)}$, $C_{(i)}$ are the observed angles; $A$, $B$, $C$ those corrected to the surface of a sphere whose radius is the mean normal to the minor axis of the computed aqueous ellipsoid of revolution, $e$ the spherical excess, $\varepsilon$ the error, $p_{(a)}$, $p_{(b)}$, $p_{(c)}$ the probabilities of error of the sets of observations from which $A_{(i)}$, $B_{(i)}$, $C_{(i)}$ are derived, and $P$ their sum. These equations are known by the name of the triangular equations.

In a quadrilateral $ABCD$ whose two diagonals $AC$, $BD$ cross each other, there will if the whole angles as well as the partial ones composing them are observed connectedly be obviously a double set of triangles formed, viz. $ABC$ & $ACD$; $ABD$ & $BCD$, in each of which the triangular equations above given apply; but besides these, we have now to consider that though in observing, each of the sums of the partial angles is necessarily equal to the entire angle which they compose, yet when we apply the triangular portion of column $\varepsilon$, this equality is disturbed, and as in the process of double computation each partial angle enters independently in its turn as well as the whole angle, therefore it would involve an anomaly to use at one time two angles as of one value, and at another the sum which they compose as of a greater or less value.




If each saliant angle of the figure be placed in turn nearest us, and the right-hand



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component be characterized by one accent, the left-hand by two accents, then the following order of equations will exist.

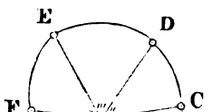
$$A'+A''=A+x$$
$$B'+B''=B+x'$$
$$C'+C''=C+x''$$
$$D'+D''=D+x'''$$

wherein $A', A'', A$; $B', B'', B$; &c. are the angles corrected by the triangular equations, and $x$, $x'$ &c. imply the discrepancies generated by the application of the latter; therefore denoting by $p'_{(a)}, p''_{(a)}, p_{(a)}$ the probabilities of error in $A', A'', A$, and by $p^s_{(a)}$ their sum—by $p'_{(b)}, p''_{(b)}, p_{(b)}, p^s_{(b)}$ the like values for $B', B'', B$; and so forth for the rest; we obtain

$$\left.\begin{aligned}
&A'-\frac{p'_{(a)}}{p^s_{(a)}}\cdot x \;+A''-\frac{p''_{(a)}}{p^s_{(a)}}\cdot x \;=A+\frac{p_{(a)}}{p^s_{(a)}}\cdot x\\
&B'-\frac{p'_{(b)}}{p^s_{(b)}}\cdot x' \;+B''-\frac{p''_{(b)}}{p^s_{(b)}}\cdot x' \;=B+\frac{p_{(b)}}{p^s_{(b)}}\cdot x'\\
&C'-\frac{p'_{(c)}}{p^s_{(c)}}\cdot x'' \;+C''-\frac{p''_{(c)}}{p^s_{(c)}}\cdot x'' \;=C+\frac{p_{(c)}}{p^s_{(c)}}\cdot x''\\
&D'-\frac{p_{(d)}}{p^s_{(d)}}\cdot x'''+D''-\frac{p''_{(d)}}{p^s_{(d)}}\cdot x'''=D+\frac{p_{(d)}}{p^s_{(d)}}\cdot x'''
\end{aligned}\right\}\quad\ldots\ldots\ldots\ldots\ldots\ldots(\beta)$$

correctional equations which are known by the name of the equations of partial angles, and are necessary to be attended to in all cases where an angle enters independently into one part of the computation and in another part as a component portion of another angle.

In a polygon formed by a series of spherical triangles whose vertices meet within the area at a point $O$ whilst their bases form its periphery, if the angles about the central point are designated in succession by the characteristic accents, 0, I, II, III, IV, V, &c. then




$$O^0_{(i)}+O'_{(i)}+O''_{(i)}+O'''_{(i)}+O^{IV}_{(i)}+O^{V}_{(i)}=2\pi$$

is an equation which must of necessity exist in all observed angles, and as this equality will be also disturbed by the operation of the triangular equations, therefore its restoration is indispensable by counteracting the effects of the latter.

Suppose for example that after the application of the triangular equations, the individual terms be such as to form the equation

$$O^0+O'+O''+O'''+O^{IV}+O^{V}=2\pi+y$$

then putting $p^0_{(o)}, p'_{(o)}, p''_{(o)}$ &c., to denote the probabilities and $p^s_{(o)}$ their sum as before;

$$O^0-\frac{p^0_{(o)}}{p^s_{(o)}}\cdot y+O'-\frac{p'_{(o)}}{p^s_{(o)}}\cdot y+O''-\frac{p''_{(o)}}{p^s_{(o)}}\cdot y+O'''-\frac{p'''_{(o)}}{p^s_{(o)}}\cdot y+O^{IV}-\frac{p^{IV}_{(o)}}{p^s_{(o)}}\cdot y+O^{V}-\frac{p^{V}_{(o)}}{p^s_{(o)}}\cdot y=2\pi\ldots\ldots(\gamma)$$

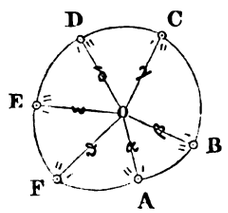
is an equation to which it is quite as necessary to attend as either of the preceding and which goes by the name of the central equation.

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The above equations and others of a similar kind only relate to the angles, but though they should be all complied with, still it will not follow as a necessary consequence that the series will re-enter, that is to say that commencing with any triangle of the polygon as $ABO$, and calculating round the point $O$, the value of the side $AO$ resulting from the first triangle and that from the last shall be the same.

This will be evident from considering that any one triangle, the last for example, may either be $FAO$, or $FaO$ or $Fa'O$ without violating the conditions required for the triangular or central equations, and the same may manifestly occur in the quadrilateral although the equation of partial angles be attended to, whence as distortion and contradiction are as much to be avoided in one respect as in another, it is incumbent that the last triangle of the computation shall terminate at the point whence the first triangle started. From these considerations arises another set of equations called re-entering equations which we will proceed to investigate in their application to the quadrilateral and polygonal figures above adverted to.

1st. Let $ABCDEF$ be a polygon on the surface of a sphere formed by a certain number of spherical triangles whose vertices unite at an internal point $O$, then in order that each of the angular points of the polygon may be common to any two contiguous triangles, the following equation must subsist.




$$\frac{\sin A'.\ \sin B'.\ \sin C'.\ \sin D'.\ \sin E'.\ \sin F'}{\sin A''.\ \sin B''.\ \sin C''.\ \sin D''.\ \sin E''.\ \sin F''}=1$$

wherein $A'$, $A''$, $B'$, $B''$, &c. mean the right and left hand parts of the whole external angles of the polygon supposed to be mathematically correct.

For denoting the sides $AO$, $BO$, &c. by the letters $\alpha$, $\beta$, &c. as in the figure, it is plain that the following equations subsist.

$$\sin\beta=\frac{\sin A'}{\sin B''}\cdot\sin\alpha;\ \sin\gamma=\frac{\sin B'}{\sin C''}\cdot\sin\beta;\ \sin\delta=\frac{\sin C'}{\sin D''}\cdot\sin\gamma;$$

$$\sin\varepsilon=\frac{\sin D'}{\sin E''}\cdot\sin\delta;\ \sin\varphi=\frac{\sin E'}{\sin F''}\cdot\sin\varepsilon;\ \sin\alpha=\frac{\sin F'}{\sin A''}\cdot\sin\varphi;$$

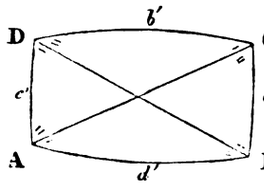
combining all which we get

$$\sin\alpha=\frac{\sin F'.\ \sin E'.\ \sin D'.\ \sin C'.\ \sin B'.\ \sin A'}{\sin A''.\ \sin F''.\ \sin E''.\ \sin D''.\ \sin C''.\ \sin B''}\cdot\sin\alpha$$

$$\text{or}\ \frac{\sin A'.\ \sin B'.\ \sin C'.\ \sin D'.\ \sin E'.\ \sin F'}{\sin A''.\ \sin B''.\ \sin C''.\ \sin D''.\ \sin E''.\ \sin F''}\cdot=1$$

and the same must manifestly happen if the polygon be plane.

2nd. Let $ABCD$ be a quadrilateral described on the surface of a sphere whose two diagonals cross each other; then the partial angles being accentuated as before described and the exterior sides each marked with the small letter and single accent corresponding to the capital letter of the angle opposite to it, there results




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$$\frac{\sin A'}{\sin C''}=\frac{\sin a'}{\sin d'};\ \frac{\sin B'}{\sin D''}=\frac{\sin b'}{\sin a'};\ \frac{\sin C'}{\sin A''}=\frac{\sin c'}{\sin b'};\ \frac{\sin D'}{\sin B''}=\frac{\sin d'}{\sin c'}$$

$$\therefore \frac{\sin A'.\ \sin B'.\ \sin C'.\ \sin D'.}{\sin C''.\ \sin D''.\ \sin A''.\ \sin B''.}=\frac{\sin a'.\ \sin b'.\ \sin c'.\ \sin d'}{\sin d'.\ \sin a'.\ \sin b'.\ \sin c'}$$

$$\text{or } \frac{\sin A'.\ \sin B'.\ \sin C'.\ \sin D'}{\sin A''.\ \sin B''.\ \sin C''.\ \sin D''}=1$$

which is a result analogous to that of the polygon above given and will like it manifestly be equally true whether the quadrilateral be spherical or plane.*

It is now necessary to explain how these theorems are to be reduced to easy practical application; we see that they are mathematically true, and as it is almost infinity to one against the observations being so thoroughly free from error as that the rectangle under the sines in the numerator shall be perfectly identical with that in the denominator, therefore the question is how to disperse the errors through the system in the most favourable manner.

Now it is legitimate to suppose that if the quotient be greater than unity each of the terms composing the numerator will be greater and each of those composing the denominator less than its true value, a supposition which does less violence to the data than any other; whence if the observed angles be designated

$A'$, $A''$, $B'$, $B''$, $C'$, $C''$, &c. then we shall have $\underset{(i)}{A'}=A'+\delta A'$; $\underset{(i)}{A''}=A''-\delta A''$; $\underset{(i)}{B'}=B'+\delta B'$; $\underset{(i)}{B''}=B''-\delta B''$; $\underset{(i)}{C'}=C'+\delta C'$; $\underset{(i)}{C''}=C''-\delta C''$, &c. the characters $A'$, $A''$, $B'$, $B''$, $C'$, $C''$, &c. denoting the accurate or mathematical angles.

Hence substituting these values, and making $z$ the excess of the quotient above unity we get

$$\frac{\sin (A'+\delta A').\ \sin (B'+\delta B').\ \sin (C'+\delta C')\ \ldots\ldots\ldots\ldots\sin (F'+\delta F')}{\sin (A''-\delta A'').\ \sin (B''-\delta B'').\ \sin (C''-\delta C'')\ldots\ldots\ldots\ldots\sin (F''-\delta F'')}=1+z$$

But $\sin (A'+\delta A')=\sin A'.\ \cos \delta A'+\cos A'.\ \sin \delta A'=\sin A'.\ (1+\cot A'.\ \delta A')$ nearly

also $\sin (A''-\delta A'')=\sin A''.\ (1-\cot A''.\ \delta A'')$; the increments being extremely minute;

Whence as $\frac{\sin A'.\ \sin B'.\ \sin C'\ldots\ldots\ldots\sin F'}{\sin A''.\ \sin B''.\ \sin C''\ldots\ldots\ldots\sin F''}=1$ as has been already shewn

$$\therefore \frac{(1+\cot A'.\ \delta A').\ (1+\cot B'.\ \delta B').\ (1+\cot C'.\ \delta C')\ldots\ldots\ldots\ldots(1+\cot F'.\ \delta F')}{(1-\cot A''.\ \delta A'').\ (1-\cot B''.\ \delta B'').\ (1-\cot C''.\ \delta C'')\ldots\ldots\ldots\ldots(1-\cot F''.\ \delta F'')}=1+z$$

Now all these incremental terms are exceedingly minute and as the natural logarithm of any quantity $1\pm z$ so constituted is $\pm z$ therefore

$\dagger\cot A'.\ \delta A'+\cot A''.\ \delta A''+\cot B'.\ \delta B'+\cot B''.\ \delta B''\ldots\ldots\ldots+\cot F'.\ \delta F'+\cot F''.\ \delta F''=z$

wherein $\delta A'$, $\delta A''$, $\delta B'$, $\delta B''\ldots\ldots\delta F'$, $\delta F''$ and $z$ are all in parts of the radius.

* It will not escape observation that as the polygonal equation is independent of a central point the truth of the quadrilateral equation is a corollary thereof; but it appeared better to give an independent proof than to leave any room for doubt or cavil, when these equations were first introduced into the Surveyor-General's office in 1838.

† This assumption can only be admitted within certain limits, to ascertain which it must be remarked that in the tables of common logarithms every number of a value below 5 in the eighth place of decimals is rejecta-

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Pursuing the previous notation for the probabilities of error, that is to say, putting $p'_{(a)}, p''_{(a)}, p'_{(b)}, p''_{(b)}$ to denote those of $A'_{(i)}, A''_{(i)}, B'_{(i)}, B''_{(i)}$, &c. then the errors $\delta A', \delta A'', \delta B', \delta B''$, &c. will be to each other as those terms so that if $\delta A' = p'_{(a)} y$, then $\delta A'' = p''_{(a)} y$; $\delta B' = p'_{(b)} y$; $\delta B'' = p''_{(b)} y$, &c. whence

$$y = \frac{x}{\cot A' . p'_{(a)} + \cot A'' . p''_{(a)} \cdots\cdots\cdots + \cot F' . p'_{(f)} + \cot F''' p''_{(f)}}$$

Also

$$\frac{y}{x} = \frac{1}{\cot A' . p'_{(a)} + \cot A'' . p''_{(a)} \cdots\cdots\cdots\cdots + \cot F' . p'_{(f)} + \cot F''' . p''_{(f)}}$$

And as

$$\left.\begin{aligned}
A' &= (A'_{(i)} - \delta A') = A'_{(i)} - p'_{(a)} y = A'_{(i)} - x \cdot \frac{p'_{(a)}}{\cot A' . p'_{(a)} + \cot A'' . p''_{(a)} \cdots\cdots + \cot F' . p'_{(f)} + \cot F''' . p''_{(f)}} \\
A'' &= A''_{(i)} + \delta A'' = A''_{(i)} + x \cdot \frac{p''_{(a)}}{\cot A' . p'_{(a)} + \cot A'' . p''_{(a)} \cdots\cdots\cdots + \cot F' . p'_{(f)} + \cot F''' . p''_{(f)}} \\
B' &= B'_{(i)} - \delta B' = B'_{(i)} - x \cdot \frac{p'_{(b)}}{\cot A' . p'_{(a)} + \cot A'' . p''_{(a)} \cdots\cdots\cdots + \cot F' . p'_{(f)} + \cot F'' p''_{(f)}} \\
B'' &= B''_{(i)} + \delta B'' = B''_{(i)} + x \cdot \frac{p''_{(b)}}{\cot A' . p'_{(a)} + \cot A'' . p''_{(a)} \cdots\cdots\cdots + \cot F' . p'_{(f)} + \cot F''' . p''_{(f)}} \\
&\text{\&c.} \qquad\qquad \text{\&c.} \qquad\qquad \text{\&c.}
\end{aligned}\right\} \ldots(\delta)$$

neous; now we virtually assume that $L(1 + \cot A . \delta A) = M . \cot A . \delta A$ although the assumption is apparently $l(1 + \cot A . \delta A) = \cot A . \delta A$; the letter $L$ meaning the common logarithm and $l$ the hyperbolic log; and it is the limit of the former which is to be ascertained from the tables of logarithms.

Putting $L(1 + \cot A . \delta A) = x$, there results

$$M . \left\{ \cot A . (\delta A) - \frac{\cot^2 A . (\delta A)^2}{2} + \frac{\cot^3 A . (\delta A)^3}{3} - \frac{\cot^4 A . (\delta A)^4}{4} \text{ \&c.} \right\} = x$$

Hence in assuming $M . \cot A . \delta A = x$ we suppose that

$$\frac{M}{2} \cdot \cot^2 A . (\delta A)^2 < \frac{\cdot 0000001}{2} \text{ or } \cot A . \delta A < \cdot 00047985$$

But $\delta A$ if equivalent to $n$ seconds is denoted by $\frac{n}{206264 \cdot 8}$

$$\therefore \cot A = \frac{\cdot 00047985 \times 206264 \cdot 8}{n} = 98''.977 \text{ whose log is } 1.9955330$$

This is the log. cotangent of 0° 34′ 44″ up to which extent provided $n < 1''$ the hypothesis holds good

The same thing happens when we assume $L(1 + x) = Mx$

$$\text{for } L(1 + x) = M \left\{ x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} \text{ \&c.} \right\} = y$$

$$\text{Then } x = \frac{y}{M} + \frac{y^2}{1.2.M^2} + \frac{y^3}{1.2.3.M^3} + \frac{y^4}{1.2.3.4.M^4} + \text{\&c.}$$

$$\text{or } Mx = y + \frac{y^2}{1.2.M} + \frac{y^3}{1.2.3.M^2} + \frac{y^4}{1.2.3.4.M^3} + \text{\&c.}$$

wherein the term $\frac{y^2}{1.2.M}$ is rejectaneous and $< \frac{\cdot 0000001}{2}$

$\therefore y < \sqrt{\cdot 0000001} . \sqrt{M} < \cdot 0002084$; up to which limit only the assumption is legitimate.



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both the angles and their incremental terms being in parts of the radius unity, therefore if we have the former $A'$, $A''$, $B'$, $B''$, &c. in seconds we must reduce the latter to that denomination by multiplying each of them by the constant 206264″·8 or *cosec* 1″, or what amounts to the same thing by multiplying the term $z$ by that coefficient.

Now the value of $z$ is obtained from the equation of the observed angles which as has already been shewn is

$$\frac{\sin A'_{(1)}.\ \sin B'_{(1)}.\ \sin C'_{(1)}.....\sin F'_{(1)}}{\sin A''_{(1)}.\ \sin B''_{(1)}.\ \sin C''_{(1)}.....\sin F''_{(1)}}=1+z$$

Whence $z$ being in seconds

$$L(\sin A'_{(1)})+L(\sin B'_{(1)})\cdots\cdots+L(\sin F'_{(1)})-L(\sin A''_{(1)})-L(\sin B''_{(1)})\cdots\cdots-L(\sin F''_{(1)})=Mz''.\sin 1''$$

$M$ being the inverse of the modulus of the natural logarithms or 0·4342944819 &c.
So that if $L_{(1)}$ be the logarithmic resultant on the left-hand side of the equation we get in seconds

$$x''=\frac{L_{(1)}}{M.\sin 1''}=L_{(1)}\times 474942.$$

In the above investigation it has been assumed that the rectangle under the series of the right-hand parts exceeds that under the series of the left-hand parts, but as the reverse is just as likely to happen therefore whichever of those rectangles turns out to be the greater must to avoid confusion be put into the numerator.

It is also to be noted that although in the present disquisition the two principal cases only have been adverted to, yet many other combinations will frequently occur which may give rise to equational corrections of a similar nature to the foregoing and as every such combination is equally important, therefore none can be consistently overlooked.

It will now be in place to explain how these computations which are ofttimes long and tedious may with most facility be effected, to which end it will be remarked that in the simple series as no secondary process is resorted to, the distribution becomes reduced to a plain matter of multiplication and division, while in all other cases wherein correctional equations are resorted to, it is advisable to tabulate the various quantities in order to abbreviate the frequent repetitions of those processes.

Thus for example in the equations of the form ($\alpha$) if we put $\epsilon=1$, then $\frac{p_{(a)}}{P}, \frac{p_{(b)}}{P}, \frac{p_{(c)}}{P}$ become the radical tabular quantities or portions of 1 second of error due to each angle $A$, $B$, $C$, which radical quantities multiplied successively by 2, 3, 4,.....9 give the materials for each column of the table corresponding to the equation $A+B+C=\pi+\epsilon$.

In like manner in the equations of the form ($\beta$) if $x$ be put equal to unity then $\frac{p'_{(a)}}{p^{x}_{(a)}}, \frac{p''_{(a)}}{p^{x}_{(a)}}, \frac{p_{(a)}}{p^{x}_{(a)}}$ become the radical tabular values representing the portions of 1 second of error due to each angle $A'$, $A''$, $A$, &c. which multiplied by 2, 3, 4.....9 give the terms for filling the columns of the table for each of those equations.

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So also equations of the form ($\gamma$) may be tabulated by making $y$ in the first instance equal to unity, and multiplying the values so found successively by 2, 3, 4.....9.

The tabulation of equations of the form ($\delta$) is also analogous to the foregoing and is contrived by first finding the common denominator represented by

$$(cot\ A'.\ p'_{(a)} + cot\ A''.\ p''_{(a)} \ldots\ldots + cot\ F''.\ p'_{(f)} + cot\ F'''.\ p''_{(f)}) = N;$$

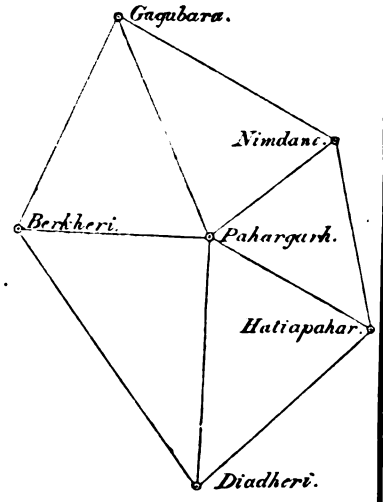
Then $\frac{p'_{(a)}}{N}, \frac{p''_{(a)}}{N}, \frac{p'_{(b)}}{N}, \frac{p''_{(b)}}{N}$, &c. are found and tabulated exactly in the same manner with those already described by supposing $z$ successively equal to 1, 2, 3, 4,.....9 seconds; but in these instances a peculiar arrangement is necessary because of the necessity of perpetual reference to the logarithmic series in order to determine the value of $z$ in seconds.

The form which I have adopted as most convenient in practice is that subjoined, wherein it will be seen that column No. 1 contains the characteristic letter designating each angle; column No. 2 the integral number of seconds in each; column No. 3 the logarithmic sines; column No. 4 the increment between the successive logarithmic sines as given in Taylor's or Bagay's tables; column No. 5 the decimal parts in excess to the seconds in column No. 2; column No. 6 the proportional parts resulting from the multiplication of the numbers in columns No. 4 and No. 5, which products are carried to 1 place of decimals beyond the seventh or tabular limit, that the seventh place may be true: now there will be two logarithmic sums, one for the sines in the numerator, the other for those in the denominator, of which the former is the larger, and each is found by adding the amounts in columns 3 and 6 together, after which the smaller substracted from the larger sum, will leave a residual logarithmic decimal quantity which treated as a natural number and multiplied by the constant factor 474942· or $(M.\ sin\ 1'')^{-1}$ will give the true value of $z$ in the denomination of seconds as shewn in column 7th.

From this explanation it will be easy to understand how the value of $z$ in seconds is found in the first instance, after which each succeeding operation is more simple and is limited to three columns, viz. one for the incremental portion of seconds, one for the logarithmic increment corresponding to it, and the third for the new value of $z$; the rationale of which will appear from considering that it is always the last found value of an angle, all other corrections having been applied, which is made use of, and that as those corrections in ordinary observation rarely alter the value of the integral second, the first four columns of the original computations will generally suffice throughout, and it must be noted that whenever any angle exceeds 90° the proportional part of column 6th is negative.

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FORM OF REFERENCE.




POLYGON OF WHICH PAHARGARH STATION IS THE CENTRAL POINT.

| Characteristic Letters of Angles. | Next Lower Seconds. | Logarithmic Sines to complete Seconds. | Logarithmic Increment for 1″. | Decimals in excess to column No. 2. | Proportional Logarithmic Increments. | $M.\sin 1''.z''=0\cdot00000378$ $\therefore z''=474942\times0\cdot00000378=1''\cdot795$ | Decimals of Seconds. | Proportional Parts. | $M.\sin 1''.z=0\cdot00000\ldots$ $\therefore z''=474942\times0\cdot00000\ldots=\ldots\ldots$ | Decimals of Seconds. | Proportional Parts. | $M.\sin 1''.z''=0\cdot00000\ldots$ $\therefore z''=474942\times0\cdot00000\ldots=\ldots\ldots$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $G''$ | 35″ | 9·7840490 | 27 | ·705 | 19·0 | | | | | | | |
| $B''$ | 58″ | 9·9698584 | 8 | ·966 | 7·7 | | | | | | | |
| $D''$ | 3″ | 9·7880534 | 27 | ·835 | 22·5 | | | | | | | |
| $H''$ | 11″ | 9·9740406 | 8 | ·746 | 6·0 | | | | | | | |
| $R''$ | 35″ | 9·9546149 | 10 | ·243 | 2·4 | | | | | | | |
| Sum | | 9·4706163 | | | 57·6 | | | | | | | |
| $G'$ | 45″ | 9·8814497 | 18 | ·716 | 12·9 | | | | | | | |
| $B'$ | 17″ | 9·8946744 | 17 | ·319 | 5·4 | | | | | | | |
| $D'$ | 37″ | 9·8584676 | 21 | ·639 | 13·4 | | | | | | | |
| $H'$ | 16″ | 9·8826854 | 17 | ·414 | 7·0 | | | | | | | |
| $R'$ | 46″ | 9·9533371 | 10 | ·213 | 2·1 | | | | | | | |
| Sum | | 9·4706142 | | | 40·8 | | | | | | | |

From this process the value of $z$ being known, its distribution amongst the several angles with which it is connected is precisely similar to that already described for equations of the forms ($\alpha$), ($\beta$), ($\gamma$), and it will be manifest that although the case referred to is that of a pentagon and therefore one of a particular value, yet the principle will admit of an extension to all instances involving angular errors which are like functions of the sines of those angles to which they appertain.

By these formulæ the data become so ordered that all the sides as well as the angles lead to a common result which will be the same whether we deduce the former from the latter or *vice versâ*, and this is what would happen if the observations were all quite free from error and what ought to be aimed at; it has hitherto been the usage in the Great Trigonometrical Survey of India and other like series of operations to deduce the sides in terms of the angles by independent processes and make the different values so obtained stand in contrast to each other as a test whereby to try the accuracy of the performance, but besides that coincidences in such cases are mere matter of fortune, and therefore afford but a fallacious criterion, there are also in this instance the objections existing that if the common side (taken as a mean of all those deduced) were to be used as a base the reverse processes would each give a different value for that first used as the fundamental line, and again that there are several triangles necessarily formed by the crossing of rays which however much they may deviate from all rules of symmetry must either go to form the general conclusion in common with others or be rejected, procedures of which the first is illogical as giving to what is unsymmetrical the same weight with what is symmetrical, whilst the second supposes a dispensing power in the hands of the indi-

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vidual conducting the operations, which it were always better to avoid conceding and which I persuade myself every faithful observer will agree with me in saying that he would much prefer being relieved from.

The processes which I have been above describing place it in the power of the observer to make use of all materials whatever without exception, attaching to each precisely the degree of weight which is its due, and all that we lose by its adoption is the satisfaction of arraying the common sides in contrast against each other, thereby shewing off what is ofttimes taken as a proof of the excellence of the observer's skill, but is as it seems to me only a specimen of the good fortune by which he has been favoured; it cannot be too often repeated that the utmost that can be expected from any man is to make the best use of the instruments and means at his disposal and to give a faithful and candid account of what he executes; he who plumes himself on more than this and aspires to a degree of skill, dexterity, sensitiveness of touch or delicacy of vision not attainable by other men can if his pretensions be conceded to the full only stand pre-eminent in vulgar minds which are not worth the conquest, and is very liable either to deceive himself or mislead others.

If however a test of the accuracy of any work of this sort be desired it will I conceive be best found, 1st in the amounts inserted in column $\epsilon$; 2nd, in the contrast between the observed and computed azimuths; 3rd, in that presented by the deduced and measured bases: of these the two last might perhaps in fact have been also introduced into the correctional processes so as to bring about an identity there also, but there are certain reasons which have deterred me from doing this, the chief of which is that there is always an uncertainty about azimuths because those computed are on the principle of an assumed aqueous ellipsoid, whilst those observed are under the influence of irregular local attraction.

I am not insensible to the imputation to which this style of correction is liable of tampering with data, but that objection seems to me to be fairly met by the argument that it is illogical to introduce one set of corrections and evade others equally necessary to consistency.

For example though it is an undeniable truth that the sum of the three angles of any triangle is correctly expressed by $\pi+e$, $e$ being the spherical excess, yet the truth that the sum of the parts is equal to the whole is of prior date to this amongst human discoveries, nor is that of the ratio of the rectangle of the sines being a ratio of equality less founded in fact.

Whilst however the introduction of a correction to compensate for the errors in excess to the requisite sum of the three angles has by common consent been for nearly half a century reduced to practice and generally applauded, I am not aware that the other correctional processes have received like attention; yet I think it cannot be denied me that there are but two courses open: either to use in computation the observed data with all their errors in the crude state, or to correct them through and through so as to bring about a consistent result.



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Of the consequences attendant on the latter course a sufficiently accurate estimate may be formed from the preceding description, but as the former may not be without its advocates it is perhaps not out of place to inquire into its effects.

As long as we have only to deal with a single series of triangles there seems little to be said in favour of one mode which is not equally applicable to the other, but it is rare that cases do not occur wherein favourable opportunities present themselves of verifying the triangular process by the crossing of rays, and of such it is unquestionably the duty of an accurate observer to avail himself whenever circumstances permit.

Let it be supposed for example that four principal stations all mutually visible from each other range themselves into the form of a perfect square; then as either diagonal will form this quadrilateral into a pair of triangles not only perfectly unexceptionable but equally trust-worthy with the other pair, it argues a latitude of selection which is not legitimate to select the one and reject the other—both ought in fairness to be observed and used alike.

Now in this instance of perfect parity it may be the less objectionable to add the common sides together and use their arithmetical mean as the true value, but at the same time it must be remembered that every computation ought to admit of a reverse process, and if we were to try this, the chances are almost infinity to one against our reproducing the element from which we originally started.

Though such exact parity as that here supposed is never to be met with in practice yet it is often sufficiently approached to make it a matter of doubt which pair of triangles is preferable, and then the same argument will apply, but even if there be not this desired approximation to equal symmetry can it be legitimately assumed that one pair is to be set aside, whilst the whole weight is assigned to the other ?

But circumstances may occur as in the quadrilateral formed by Dahera, Godhna, Begarazpur, Kaliana, and many others of a like kind which render it an object to observe triangles with very acute angles, and when this is the case how will the results be made to harmonize? It is obviously contrary to all sound reason to take as true the arithmetical mean between the sides deduced from the triangle Dahera Begarazpur Kaliana and those derived from the other pair of which the vertices unite at Godhna, because in the former, one of the angles only amounts to 0° 38′ 28″·6 and the other to 0° 47′ 52″·7, and yet Kaliana is that very site which it is most desirable to know with accuracy.

The logarithmic increment due to 1″ in the sines of the smaller of these angles is ·0001881, whilst the like value at the 60th degree is ·0000012, whence an error of 1″ in the former would be equivalent to 157″ in the latter, and to treat data fraught with results so vastly disproportionate as if they were of equal weight is obviously inadmissible, yet this is what is done in taking the arithmetical mean of the sides common to each computation, and there is no mode of evading the difficulty except by either rejecting this small triangle just as if its angles had never been observed or attaching to it precisely the degree of weight which is its due and no more.

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To me either procedure is alike acceptable and accordingly though I have gone through the more laborious process of computing the corrections on the principles above explained wherever an opportunity has offered itself, yet I have also given the observations exactly as they occurred, in order that the choice may be open to those who deem my method objectionable, to apply any other which may seem to them preferable; and this I conceive is all that can possibly be expected, for though I am no advocate for allowing an undue degree of latitude to the judgment of the individual who happens to be entrusted with the conduct of these and other like scientific operations, yet I must ever consider it perfectly legitimate for him to use his own data to what he conceives the best purpose, provided always that he does not make his conclusions binding on others who interest themselves in the subject.

To the better understanding of this matter by those who concur with me in opinion I here subjoin a specimen of one of these computations being a selection from that portion of the series lying in the southernmost of the two sections between the lines Bhimbet to Rampur, and Dhaba Deo to Narwargarh, in explanation of which it will be in place to remark that

1st. The stations Morpani, Tek, Dhaba Deo, Narwargarh, form a quadrilateral whose diagonals cross each other.

2nd. Morpani is an internal point to the triangle formed by Bhimbet, Tek, Narwargarh.

3rd. The stations Bhimbet, Ranipur, Tek, Morpani, form a quadrilateral whose two diagonals cross each other.

4th. The stations Bhimbet, Ranipur, Tek, Dhaba Deo, Narwargarh, form an irregular pentagon of which Morpani is an internal point.

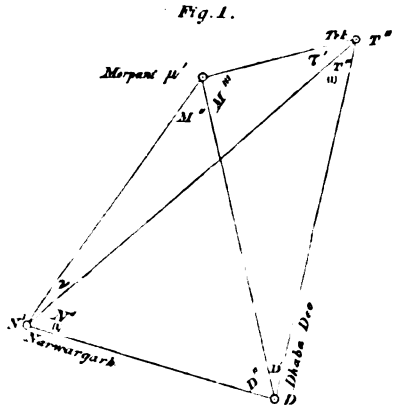
The stations of Ranipur and Narwargarh, are not mutually visible, neither are Bhimbet and Dhaba Deo, therefore there is no triangle in which either of these pairs enters, but from the combination which the crossing of the other rays produces there arise 9 distinct triangles giving as many triangular equations, 4 of the nature called re-entering and 9 others in which either the angles round the central point are equated to 360°, or the sums of angles used at one time partially and in another as a whole are reduced to equality, giving in all 22 distinct equations of condition for reducing the data to a consistent result.

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## DIAGRAMS of the MORPANI POLYGON.

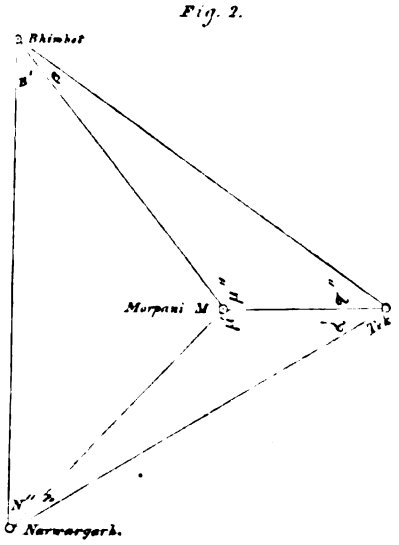
| References to Fig. 1. | |
|---|---|
| Morpani | $\mu'$ |
| Tek | $\tau'$ |
| Narwargarh | $\nu$ |
| Dhaba Deo | $D$ |
| Tek | $T'''_{(1)}$ |
| Narwargarh | $N'_{(1)}$ |
| Tek | $T''$ |
| Morpani | $M'''$ |
| Dhaba Deo | $D'$ |
| Narwargarh | $N'$ |
| Morpani | $M''$ |
| Dhaba Deo | $D''$ |

*Fig. 1.*



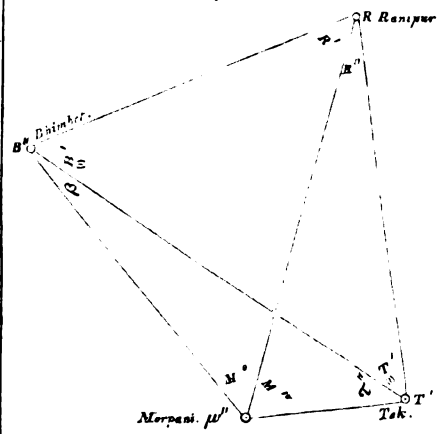

| References to Fig. 2. | |
|---|---|
| Morpani | $\mu'$ |
| Tek | $\tau'$ |
| Narwargarh | $\nu$ |
| Morpani | $\mu''$ |
| Tek | $\tau''$ |
| Bhimbet | $\beta$ |
| Morpani | $M'$ |
| Bhimbet | $B'$ |
| Narwargarh | $N''$ |

*Fig. 2.*



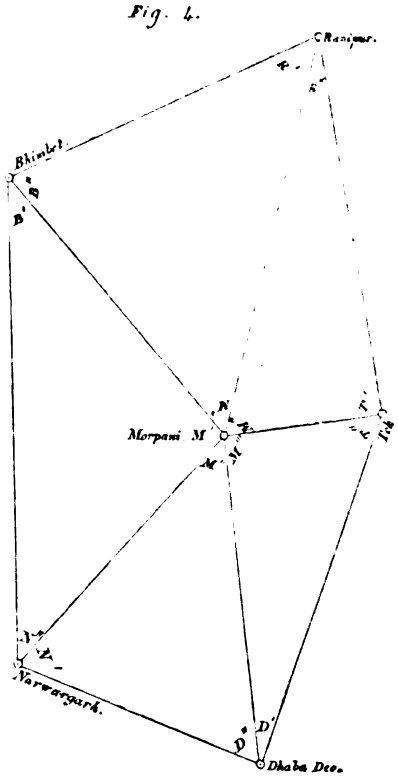

| References to Fig. 3. | |
|---|---|
| Morpani | $\mu''$ |
| Tek | $\tau''$ |
| Bhimbet | $\beta$ |
| Ranipur | $R$ |
| Tek | $T'_{(1)}$ |
| Bhimbet | $B'_{(1)}$ |
| Tek | $T'$ |
| Morpani | $M'^{IV}$ |
| Ranipur | $R''$ |
| Bhimbet | $B''$ |
| Morpani | $M°$ |
| Ranipur | $R'$ |

*Fig. 3.*




| References to Fig. 4. | |
|---|---|
| Morpani | $M°$ |
| Ranipur | $R'$ |
| Bhimbet | $B''$ |
| Morpani | $M'$ |
| Bhimbet | $B'$ |
| Narwargarh | $N''$ |
| Morpani | $M''$ |
| Narwargarh | $N'$ |
| Dhaba Deo | $D''$ |
| Morpani | $M'''$ |
| Dhaba Deo | $D'$ |
| Tek | $T''$ |
| Morpani | $M'^{IV}$ |
| Tek | $T'$ |
| Ranipur | $R''$ |

*Fig. 4.*




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## TRIANGLES.

| No. | Names of Stations. | Character Mark. | Observed Angles. | Probability. | Spherical Excess. | Compensation of Error. | Spherical Angles. |
|---|---|---|---|---|---|---|---|
| 1 | Morpani | $\mu'$ | 141° 12′ 23″·430 | 0·223 | 1″·484 | −0″·004 | 141° 12′ 23″·426 |
| | Tek | $\tau'$ | 25 35 20·381 | 0·347 | | −0·033 | 25 35 20·348 |
| | Narwargarh | $\nu$ | 13 12 17·706 | 0·233 | | +0·004 | 13 12 17·710 |
| | Sums | | 180 0 1·517 | 0·803 | | −0·033 | 180 0 1·484 |
| 2 | Dhaba Deo | $D$ | 87 12 13·644 | 0·246 | 4″·659 | +0·204 | 87 12 13·848 |
| | Tek | $T'''_{(1)}$ | 36 18 14·065 | 0·333 | | +0·050 | 36 18 14·115 |
| | Narwargarh | $N'_{(1)}$ | 56 29 36·531 | 0·236 | | +0·165 | 56 29 36·696 |
| | Sums | | 180 0 4·240 | 0·815 | | +0·419 | 180 0 4·659 |
| 3 | Tek | $T''$ | 61 53 34·446 | 0·304 | 2″·531 | +0·017 | 61 53 34·463 |
| | Morpani | $M'''$ | 92 13 54·752 | 0·214 | | −0·139 | 92 13 54·613 |
| | Dhaba Deo | $D'$ | 25 52 33·382 | 0·283 | | +0·073 | 25 52 33·455 |
| | Sums | | 180 0 2·580 | 0·801 | | −0·049 | 180 0 2·531 |
| 4 | Narwargarh | $N'$ | 69 41 54·237 | 0·119 | 3″·613 | +0·170 | 69 41 54·407 |
| | Morpani | $M''$ | 48 58 28·679 | 0·335 | | +0·134 | 48 58 28·813 |
| | Dhaba Deo | $D''$ | 61 19 40·263 | 0·294 | | +0·130 | 61 19 40·393 |
| | Sums | | 180 0 3·179 | 0·748 | | +0·434 | 180 0 3·613 |
| 5 | Morpani | $\mu''$ | 121 44 17·027 | 0·247 | 2″·254 | −0·179 | 121 44 16·848 |
| | Tek | $\tau''$ | 40 24 36·978 | 0·283 | | −0·132 | 40 24 36·846 |
| | Bhimbet | $\beta$ | 17 51 8·638 | 0·385 | | −0·078 | 17 51 8·560 |
| | Sums | | 180 0 2·643 | 0·915 | | −0·389 | 180 0 2·254 |
| 6 | Morpani | $M'$ | 97 3 19·679 | 0·359 | 4″·972 | +0·048 | 97 3 19·727 |
| | Bhimbet | $B'$ | 38 38 42·506 | 0·196 | | +0·301 | 38 38 42·807 |
| | Narwargarh | $N''$ | 44 18 2·331 | 0·143 | | +0·107 | 44 18 2·438 |
| | Sums | | 180 0 4·516 | 0·698 | | +0·456 | 180 0 4·972 |
| 7 | Ranipur | $R$ | 75 18 17·861 | 0·830 | 6″·220 | +0·376 | 75 18 18·237 |
| | Tek | $T'_{(1)}$ | 49 13 4·251 | 0·262 | | +0·236 | 49 13 4·487 |
| | Bhimbet | $B'_{(1)}$ | 55 28 43·375 | 0·460 | | +0·121 | 55 28 43·496 |
| | Sums | | 180 0 5·487 | 1·552 | | +0·733 | 180 0 6·220 |
| 8 | Tek | $T'$ | 89 37 41·229 | 0·283 | 2″·961 | +0·103 | 89 37 41·332 |
| | Morpani | $M^{IV}$ | 67 22 42·499 | 0·241 | | −0·050 | 67 22 42·449 |
| | Ranipur | $R''$ | 22 59 39·273 | 0·322 | | −0·093 | 22 59 39·180 |
| | Sums | | 180 0 3·001 | 0·846 | | −0·040 | 180 0 2·961 |
| 9 | Bhimbet | $B''$ | 73 19 52·013 | 0·248 | 5″·513 | +0·044 | 73 19 52·057 |
| | Morpani | $M^{o}$ | 54 21 34·527 | 0·252 | | −0·128 | 54 21 34·399 |
| | Ranipur | $R'$ | 52 18 38·589 | 0·434 | | +0·468 | 52 18 39·057 |
| | Sums | | 180 0 5·129 | 0·934 | | +0·384 | 180 0 5·513 |



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TABLE containing the elements of the tabulated values as explained in the Introduction.

| No. of Table. | Form $\alpha$. | Figures referred to. | Denominators of Generating Fractions and their components. |
|---|---|---|---|
| 1 | $\mu' + \tau' + \nu = \pi + 1''\cdot 484$ | 1 & 2 | $0\cdot 223 + 0\cdot 347 + 0\cdot 233 = 0\cdot 803$ |
| 2 | $D + T''_{(1)} + N'_{(1)} = \pi + 4\cdot 659$ | 1 | $0\cdot 246 + 0\cdot 333 + 0\cdot 236 = 0\cdot 815$ |
| 3 | $T'' + M''' + D' = \pi + 2\cdot 531$ | 1 & 4 | $0\cdot 304 + 0\cdot 214 + 0\cdot 283 = 0\cdot 801$ |
| 4 | $N' + M'' + D'' = \pi + 3\cdot 613$ | 1 & 4 | $0\cdot 119 + 0\cdot 335 + 0\cdot 294 = 0\cdot 748$ |
| 5 | $\mu'' + \tau'' + \beta = \pi + 2\cdot 254$ | 2 & 3 | $0\cdot 247 + 0\cdot 283 + 0\cdot 385 = 0\cdot 915$ |
| 6 | $M' + B' + N'' = \pi + 4\cdot 972$ | 2 & 4 | $0\cdot 359 + 0\cdot 196 + 0\cdot 143 = 0\cdot 698$ |
| 7 | $R + T'_{(1)} + B'_{(1)} = \pi + 6\cdot 220$ | 3 | $0\cdot 830 + 0\cdot 262 + 0\cdot 460 = 1\cdot 552$ |
| 8 | $T' + M^{IV} + R'' = \pi + 2\cdot 961$ | 3 & 4 | $0\cdot 283 + 0\cdot 241 + 0\cdot 322 = 0\cdot 846$ |
| 9 | $B'' + M^{\circ} + R' = \pi + 5\cdot 513$ | 3 & 4 | $0\cdot 248 + 0\cdot 252 + 0\cdot 434 = 0\cdot 934$ |

| No. of Table. | Form $\beta$, $\gamma$. | Figures referred to. | Denominators of Generating Fractions and their components. |
|---|---|---|---|
| 10 | $M'' + M''' = \mu'$ | 1 | $0\cdot 335 + 0\cdot 214 + 0\cdot 223 = 0\cdot 772$ |
| 11 | $M' + \mu' + \mu'' = 2\pi$ | 2 | $0\cdot 359 + 0\cdot 223 + 0\cdot 247 = 0\cdot 829$ |
| 12 | $M^{\circ} + M^{IV} = \mu''$ | 3 | $0\cdot 252 + 0\cdot 241 + 0\cdot 247 = 0\cdot 740$ |
| 13 | $\tau' + T'''_{(1)} = T''$ | 1 & 3 | $0\cdot 347 + 0\cdot 333 + 0\cdot 304 = 0\cdot 984$ |
| 14 | $\tau'' + T'_{(1)} = T'$ | 3 | $0\cdot 283 + 0\cdot 262 + 0\cdot 283 = 0\cdot 828$ |
| 15 | $N'_{(0)} + \nu = N'$ | 1 | $0\cdot 236 + 0\cdot 233 + 0\cdot 119 = 0\cdot 588$ |
| 16 | $D' + D'' = D$ | 1 | $0\cdot 283 + 0\cdot 294 + 0\cdot 246 = 0\cdot 823$ |
| 17 | $\beta + B'_{(1)} = B''$ | 3 | $0\cdot 385 + 0\cdot 460 + 0\cdot 248 = 1\cdot 093$ |
| 18 | $R' + R'' = R$ | 3 | $0\cdot 434 + 0\cdot 322 + 0\cdot 830 = 1\cdot 586$ |

| No. of Table. | Form $\delta$. | Figures referred to. | Denominators of Generating Fractions and their components. |
|---|---|---|---|
| 19 | $\dfrac{\sin M'''.\sin T''_{(1)}.\sin D''.\sin \nu}{\sin M''.\sin \tau'.\sin D'.\sin N'_{(1)}} = 1$ | 1 | $\left\{\begin{matrix} 0\cdot 214.\cot M''' + 0\cdot 033.\cot T''_{(1)} + 0\cdot 294.\cot D'' + 0\cdot 233.\cot \nu \\ + 0\cdot 335.\cot M'' + 0\cdot 347.\cot \tau' + 0\cdot 283.\cot D' + 0\cdot 236.\cot N'_{(1)} \end{matrix}\right\}$ $= \left\{\begin{matrix} -0\cdot 00834 + 0\cdot 45326 + 0\cdot 16077 + 0\cdot 99301 \\ + 0\cdot 29148 + 0\cdot 72461 + 0\cdot 58344 + 0\cdot 15624 \end{matrix}\right\} = 3\cdot 35447$ |
| 20 | $\dfrac{\sin \tau'.\sin N''.\sin \beta}{\sin \tau''.\sin \nu.\sin B'} = 1$ | 2 | $\left\{\begin{matrix} 0\cdot 347.\cot \tau' + 0\cdot 143.\cot N'' + 0\cdot 385.\cot \beta \\ + 0\cdot 283.\cot \tau'' + 0\cdot 233.\cot \nu + 0\cdot 196.\cot B' \end{matrix}\right\}$ $= \left\{\begin{matrix} 0\cdot 72461 + 0\cdot 14653 + 0\cdot 19537 \\ + 0\cdot 33240 + 0\cdot 99301 + 0\cdot 24513 \end{matrix}\right\} = 3\cdot 63705$ |
| 21 | $\dfrac{\sin \beta.\sin R'.\sin T'_{(1)}.\sin M^{IV}}{\sin B'_{(1)}.\sin R''.\sin \tau''.\sin M^{\circ}} = 1$ | 3 | $\left\{\begin{matrix} 0\cdot 385.\cot \beta + 0\cdot 434.\cot R' + 0\cdot 262.\cot T'_{(1)} + 0\cdot 241.\cot M^{IV} \\ + 0\cdot 460.\cot B'_{(0)} + 0\cdot 322.\cot R'' + 0\cdot 283.\cot \tau'' + 0\cdot 252.\cot M^{\circ} \end{matrix}\right\}$ $= \left\{\begin{matrix} 1\cdot 19537 + 0\cdot 33530 + 0\cdot 22601 + 0\cdot 10043 \\ + 0\cdot 31640 + 0\cdot 75880 + 0\cdot 33240 + 0\cdot 18069 \end{matrix}\right\} = 3\cdot 44540$ |
| 22 | $\dfrac{\sin R'.\sin B'.\sin N'.\sin D'.\sin T'}{\sin R''.\sin B''.\sin N''.\sin D''.\sin T''} = 1$ | 4 | $\left\{\begin{matrix} 0\cdot 434.\cot R' + 0\cdot 196.\cot B' + 0\cdot 119.\cot N' + 0\cdot 283.\cot D' \\ + 0\cdot 283.\cot T' + 0\cdot 332.\cot R'' + 0\cdot 248.\cot B'' \\ + 0\cdot 143.\cot N'' + 0\cdot 294.\cot D'' + 0\cdot 304.\cot T''' \end{matrix}\right\}$ $= \left\{\begin{matrix} 0\cdot 33530 + 0\cdot 24513 + 0\cdot 04403 + 0\cdot 58344 \\ + 0\cdot 00184 + 0\cdot 75880 + 0\cdot 07426 \\ + 0\cdot 14653 + 0\cdot 16077 + 0\cdot 16237 \end{matrix}\right\} = 2\cdot 51247$ |

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| No. | Equation. | Table 1. | | | Equation. | Table 2. | | | Equation. | Table 3. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\mu'$ | $\tau'$ | $\nu$ | | $D$ | $T''_{(1)}$ | $N'_{(1)}$ | | $T'''$ | $M''''$ | $D'$ |
| 1 | $\mu'+\tau'+\nu=\pi$ | 0·27771 | 0·43213 | 0·29016 | $D+T''_{(1)}+N'_{(1)}=\pi$ | 0·30184 | 0·40859 | 0·28957 | $T'''+M''''+D'=\pi$ | 0·37962 | 0·26717 | 0·35331 |
| 2 | | 0·55542 | | | | | | | | | | |
| 3 | | 0·83313 | | | | | | | | | | |
| 4 | | 1·11083 | | | | | | | | | | |
| 5 | | 1·38854 | | | | | | | | | | |
| 6 | | 1·66625 | | | | | | | | | | |
| 7 | | 1·94396 | | | | | | | | | | |
| 8 | | 2·22167 | | | | | | | | | | |
| 9 | | 2·49938 | | | | | | | | | | |
| Generating Fractions | | ·223/·803 | ·347/·803 | ·233/·803 | | ·246/·815 | ·333/·815 | ·236/·815 | | ·304/·801 | ·214/·801 | ·283/·801 |

| No. | Equation. | Table 4. | | | Equation. | Table 5. | | | Equation. | Table 6. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $N'$ | $M''$ | $D''$ | | $\mu''$ | $\tau''$ | $\beta$ | | $M'$ | $B'$ | $N''$ |
| 1 | $N'+M''+D''=\pi$ | 0·15909 | 0·44786 | 0·39305 | $\mu''+\tau''+\beta=\pi$ | 0·26995 | 0·30929 | 0·42076 | $M'+B'+N''=\pi$ | 0·51433 | 0·28080 | 0·20487 |
| 2 | | 0·31818 | | | | | | | | | | |
| 3 | | 0·47727 | | | | | | | | | | |
| 4 | | 0·63636 | | | | | | | | | | |
| 5 | | 0·79545 | | | | | | | | | | |
| 6 | | 0·95454 | | | | | | | | | | |
| 7 | | 1·11363 | | | | | | | | | | |
| 8 | | 1·27273 | | | | | | | | | | |
| 9 | | 1·43182 | | | | | | | | | | |
| Generating Fractions | | ·119/·748 | ·335/·748 | ·294/·748 | | ·247/·915 | ·283/·915 | ·385/·915 | | ·359/·698 | ·196/·698 | ·143/·698 |

| No. | Equation. | Table 7. | | | Equation. | Table 8. | | | Equation. | Table 9. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $R$ | $T'_{(1)}$ | $B'_{(1)}$ | | $T'$ | $M^{IV}$ | $R''$ | | $B''$ | $M^{\circ}$ | $R'$ |
| 1 | $R+T'_{(1)}+B'_{(1)}=\pi$ | 0·53479 | 0·16882 | 0·29639 | $T'+M^{IV}+R''=\pi$ | 0·33452 | 0·28487 | 0·38061 | $B''+M^{\circ}+R'=\pi$ | 0·26552 | 0·26981 | 0·46467 |
| 2 | | 1·06959 | | | | | | | | | | |
| 3 | | 1·60438 | | | | | | | | | | |
| 4 | | 2·13917 | | | | | | | | | | |
| 5 | | 2·67397 | | | | | | | | | | |
| 6 | | 3·20876 | | | | | | | | | | |
| 7 | | 3·74356 | | | | | | | | | | |
| 8 | | 4·27835 | | | | | | | | | | |
| 9 | | 4·81314 | | | | | | | | | | |
| Generating Fractions | | ·830/1·552 | ·262/1·552 | ·460/1·552 | | ·283/·846 | ·241/·846 | ·322/·846 | | ·248/·934 | ·252/·934 | ·434/·934 |

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| No. | Equation. | Table 10. $M''$ | Table 10. $M'''$ | Table 10. $\mu'$ | Equation. | Table 11. $M'$ | Table 11. $\mu'$ | Table 11. $\mu''$ | Equation. | Table 12. $M^{\circ}$ | Table 12. $M^{IV}$ | Table 12. $\mu''$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $M''+M'''=\mu'$ | 0·43394 | 0·27720 | 0·28886 | $M'+\mu'+\mu''=2\pi$ | 0·43305 | 0·26900 | 0·29795 | $M^{\circ}+M^{IV}=\mu''$ | 0·34054 | 0·32568 | 0·33378 |
| 2 | | 0·86788 | | | | | | | | | | |
| 3 | | 1·30181 | | | | | | | | | | |
| 4 | | 1·73575 | | | | | | | | | | |
| 5 | | 2·16969 | | | | | | | | | | |
| 6 | | 2·60363 | | | | | | | | | | |
| 7 | | 3·03757 | | | | | | | | | | |
| 8 | | 3·47150 | | | | | | | | | | |
| 9 | | 3·90544 | | | | | | | | | | |
| Generating Fractions | | ·335/·772 | ·214/·772 | ·223/·772 | | ·359/·829 | ·223/·829 | ·247/·829 | | ·252/·740 | ·241/·740 | ·247/·740 |

| No. | Equation. | Table 13. $\tau'$ | Table 13. $T''_{(1)}$ | Table 13. $T'''$ | Equation. | Table 14. $\tau''$ | Table 14. $T'_{(1)}$ | Table 14. $T'$ | Equation. | Table 15. $N'_{(1)}$ | Table 15. $\nu$ | Table 15. $N'$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $\tau'+T'_{(1)}=T'''$ | 0·35264 | 0·33842 | 0·30894 | $\tau''+T''_{(1)}=T'$ | 0·34179 | 0·31642 | 0·34179 | $N'_{(1)}+\nu=N'$ | 0·40136 | 0·39626 | 0·20238 |
| 2 | | 0·70528 | | | | | | | | | | |
| 3 | | 1·05793 | | | | | | | | | | |
| 4 | | 1·41057 | | | | | | | | | | |
| 5 | | 1·76321 | | | | | | | | | | |
| 6 | | 2·11585 | | | | | | | | | | |
| 7 | | 2·46850 | | | | | | | | | | |
| 8 | | 2·82114 | | | | | | | | | | |
| 9 | | 3·17378 | | | | | | | | | | |
| Generating Fractions | | ·347/·984 | ·333/·984 | ·304/·984 | | ·283/·828 | ·262/·828 | ·283/·828 | | ·236/·588 | ·233/·588 | ·119/·588 |

| No. | Equation. | Table 16. $D'$ | Table 16. $D''$ | Table 16. $D$ | Equation. | Table 17. $\beta$ | Table 17. $B'_{(1)}$ | Table 17. $B''$ | Equation. | Table 18. $R'$ | Table 18. $R''$ | Table 18. $R$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $D'+D''=D$ | 0·34386 | 0·35723 | 0·29891 | $\beta+B'_{(1)}=B''$ | 0·35224 | 0·42086 | 0·22690 | $R'+R''=R$ | 0·27364 | 0·20303 | 0·52333 |
| 2 | | 0·68773 | | | | | | | | | | |
| 3 | | 1·03159 | | | | | | | | | | |
| 4 | | 1·37545 | | | | | | | | | | |
| 5 | | 1·71932 | | | | | | | | | | |
| 6 | | 2·06318 | | | | | | | | | | |
| 7 | | 2·40705 | | | | | | | | | | |
| 8 | | 2·75091 | | | | | | | | | | |
| 9 | | 3·09477 | | | | | | | | | | |
| Generating Fractions | | ·283/·823 | ·294/·823 | ·246/·823 | | ·385/1·093 | ·460/1·093 | ·248/1·093 | | ·434/1·586 | ·322/1·586 | ·830/1·586 |

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Table 19.

| No. | Equan. | $M'''$ | $T'''_{(1)}$ | $D''$ | $\nu$ | | $M''$ | $\tau'$ | $D'$ | $N'_{(1)}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $\frac{\sin M'''.\sin T'''_{(1)}.\sin D''.\sin \nu}{\sin M''.\sin \tau'.\sin D'.\sin N'_{(1)}} = 1$ | 0·06380 | 0·09927 | 0·08764 | 0 06946 | | 0·09987 | 0·10344 | 0·08437 | 0·07035 | |
| 2 | | 0·12759 | | | | | | | | | |
| 3 | | 0·19139 | | | | | | | | | |
| 4 | | 0·25518 | | | | | | | | | |
| 5 | | 0·31898 | | | | | | | | | |
| 6 | | 0·38277 | | | | | | | | | |
| 7 | | 0·44657 | | | | | | | | | |
| 8 | | 0·51036 | | | | | | | | | |
| 9 | | 0·57416 | | | | | | | | | |
| Generating Fractions | | $\frac{\cdot214}{3\cdot35447}$ | $\frac{\cdot333}{3\cdot35447}$ | $\frac{\cdot294}{3\cdot35447}$ | $\frac{\cdot233}{3\cdot35447}$ | | $\frac{\cdot335}{3\cdot35447}$ | $\frac{\cdot347}{3\cdot35447}$ | $\frac{\cdot283}{3\cdot35447}$ | $\frac{\cdot236}{3\cdot35447}$ | |

Table 20.

| No. | Equan. | $\tau'$ | $N''$ | $\beta$ | | | $\tau''$ | $\nu$ | $B'$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $\frac{\sin \tau'.\sin N''.\sin \beta}{\sin \tau''.\sin \nu.\sin B'} = 1$ | 0·09541 | 0·03932 | 0·10585 | | | 0·07781 | 0·06406 | 0·05389 | | |
| 2 | | 0·19081 | | | | | | | | | |
| 3 | | 0·28622 | | | | | | | | | |
| 4 | | 0·38163 | | | | | | | | | |
| 5 | | 0·47703 | | | | | | | | | |
| 6 | | 0·57244 | | | | | | | | | |
| 7 | | 0·66785 | | | | | | | | | |
| 8 | | 0·76326 | | | | | | | | | |
| 9 | | 0·85866 | | | | | | | | | |
| Generating Fractions | | $\frac{\cdot347}{3\cdot63705}$ | $\frac{\cdot143}{3\cdot63705}$ | $\frac{\cdot385}{3\cdot63705}$ | | | $\frac{\cdot283}{3\cdot63705}$ | $\frac{\cdot233}{3\cdot63705}$ | $\frac{\cdot196}{3\cdot63705}$ | | |



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Table 21.

| No. | Equan. | $\beta$ | $R'$ | $T'_{(1)}$ | $M^{IV}$ | | $B'_{(1)}$ | $R''$ | $\tau''$ | $M^{\circ}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $\frac{\sin\beta \cdot \sin R' \cdot \sin T'_{(1)} \cdot \sin M^{IV}}{\sin B'_{(1)} \cdot \sin R'' \cdot \sin \tau'' \cdot \sin M^{\circ}} = 1$ | 0·11174 | 0·12597 | 0·07604 | 0·06995 | | 0·13351 | 0·09346 | 0·08214 | 0·07314 | |
| 2 | | 0·22348 | | | | | | | | | |
| 3 | | 0·33523 | | | | | | | | | |
| 4 | | 0·44697 | | | | | | | | | |
| 5 | | 0·55872 | | | | | | | | | |
| 6 | | 0·67046 | | | | | | | | | |
| 7 | | 0·78220 | | | | | | | | | |
| 8 | | 0·89394 | | | | | | | | | |
| 9 | | 1·00569 | | | | | | | | | |
| Generating Fractions | | ·385 / 3·44540 | ·434 / 3·44540 | ·262 / 3·44540 | ·241 / 3·44540 | | ·460 / 3·44540 | ·322 / 3·44540 | ·283 / 3·44540 | ·252 / 3·44540 | |

Table 22.

| No. | Equan. | $R'$ | $B'$ | $N'$ | $D'$ | $T'$ | $R''$ | $B''$ | $N''$ | $D''$ | $T''$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $\frac{\sin R' \cdot \sin B' \cdot \sin N' \cdot \sin D' \cdot \sin T'}{\sin R'' \cdot \sin B'' \cdot \sin N'' \cdot \sin D'' \cdot \sin T''} = 1$ | 0·17274 | 0·07801 | 0·04736 | 0·11264 | 0·11264 | 0·12816 | 0·09871 | 0·05692 | 0·11702 | 0·12100 |
| 2 | | 0·34548 | | | | | | | | | |
| 3 | | 0·51822 | | | | | | | | | |
| 4 | | 0·69095 | | | | | | | | | |
| 5 | | 0·86369 | | | | | | | | | |
| 6 | | 1·03643 | | | | | | | | | |
| 7 | | 1·20917 | | | | | | | | | |
| 8 | | 1·38191 | | | | | | | | | |
| 9 | | 1·55465 | | | | | | | | | |
| Generating Fractions | | ·434 / 2·51247 | ·196 / 2·51247 | ·119 / 2·51247 | ·283 / 2·51247 | ·283 / 2·51247 | ·322 / 2·51247 | ·248 / 2·51247 | ·143 / 2·51247 | ·294 / 2·51247 | ·304 / 2·51247 |

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From the above detail the nature of the computation will no doubt be clearly comprehended; it is tedious certainly but by no means so difficult or appalling as it seems at first sight, and only demands a suitable degree of patience, without which no modern geodist can hope to render his work commensurate with the expectations of posterity. The following list will shew that considerable pains have been taken to bring the sections of the Great Arc of India to the state of consistency proposed by me, and will convince my readers that in recommending this laborious method to their notice I have not dealt in empty profession or unmeaning advice, but have steadily followed the doctrine which I advocate.

1st. The west end of the Dehra Dún base is an internal point to the triangle formed by Banog, Amsot, and the east end of the same base.

2nd. The points Dahera, Godhna, Kaliana, Begarazpur, form a quadrilateral of which the two diagonals cross each other.

3rd. Commencing with the line Dateri to Pir Ghyb and proceeding southwards a series of polygons extends all the way to the side Madhoni—Alipur, the stations Bostan, Karol, Pahera, Manpur, Rasia, being so many points internal to one polygon of the series and external to that contiguous to it.

4th. Gurjapahar is the internal point of an irregular heptagon.

5th. Den is the internal point of an irregular hexagon.

6th. Pahargarh is the internal point of an irregular pentagon.

7th. A complicated figure is formed about the Seronj base by the stations of Pardho, Surental, Bhaorasa, Kamkhera, Kalianpur, N. end Base, S. end Base; most of the rays crossing each other.

8th. A pentagon is formed at the external angles of which are Gidgarh, Ander, Ranipur, Bhimbet, Samasgarh, the internal point being Ladi.

9th. Next follows the complicated figure wherein Morpani is internal, of which I have already spoken at length.

10th. Dhaba Deo, Narwargarh, Alampur, Nilgarh, form a quadrilateral whose diagonals cross.

11th. Dhaba Deo, Alampur, Nilgarh, Jagdhar, also form a quadrilateral whose diagonals cross.

12th. Jagdhar, Nilgarh, Dhar, Salbaldi, form a quadrilateral whose diagonals cross.

13th. Dhar, Salbaldi, Ashti, Ner, form a quadrilateral whose diagonals cross.

14th. Badali is the internal point of a pentagon formed by Ner, Ashti, Badgaon, Ikjhera, Wirur.

15th. Yemsha, Shivalingapa, Baktapur, Yenagapali, form a quadrilateral whose diagonals cross.

In all these there are 237 correctional equations of condition of which

119 ..... are of the order called triangular.
64 ..... of that called equation of partial angles.
19 ..... of that called central.
35 ..... of that called re-entering.

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To these must be superadded the equations of condition relative to that portion of the work which was performed subsequent to the completion of this article, and which though not included in the above statement and therefore not counted will probably be about one half as numerous as those just detailed. The complicated figures on which they depend will stand in order as follow:

16th. Burgapali is the internal point of a pentagon formed by Baktapur, Yenagapali, Bachapali, Damargida, Munganal.

17th. Damargida is the internal point of a hexagon formed by Burgapali, Bachapali, Dudala, Malgi, W. end Beder base, Munganal.

18th. Damargida is the internal point of a hexagon formed by Burgapali, Bachapali, Dudala, E. end Beder base, W. end Beder base, Munganal.

19th. Damargida is the internal point of a heptagon formed by Burgapali, Bachapali, Dudala, Shilapali, Malgi, W. end Beder base, Munganal.

20th. Damargida, Dudala, Shilapali, and Malgi, form a quadrilateral whose diagonals cross.

21st. Dudala, Tadmanur, Goraegat, Shilapali, form a quadrilateral whose diagonals cross.

22nd. Dudala, Tadmanur, Topkonda, Goraegat, form a quadrilateral whose diagonals cross.

With this statement I shall close my description of the apportionment of errors in the observed angles of triangles,* hoping that I have succeeded in the object I proposed to myself, viz. to explain the principle on which this part of my computations has been conducted. I will now proceed to detail in like manner other parts of my proceedings.

In respect to azimuths a material change has been introduced by me since my last return to India in 1830 into the system followed, which as it has been scrupulously abided by in the operations I am at present describing, and has in fact become universally prevalent in the department of the G. T. Survey of India, may not be undeserving of a more precise description.

In all the operations of Lieut.-Colonel Lambton and his assistants the azimuth of the first side was, as is well known, determined by a few observations made on the pole star at the time of its greatest elongation in azimuth on either side of the pole, whichever happened to occur most conveniently in respect to time; this system I modified when I succeeded to office in 1823 by employing the three circumpolar stars $\alpha$, $\beta$ Ursæ Minoris,

* In my book of 1830 the principles of the equations of condition ($\alpha$) ($\beta$) ($\gamma$) are fully developed; those of the equation ($\delta$) were not introduced by me till 1836-7 into the computations of my late department: had I prior to that period seen the paper communicated by Mr. Galloway to the R. A. S. of London I might have spared myself the trouble of working out this method for the guidance of myself and my subordinates and adopted at once the more perfect method of my erudite associate. But I did not meet with this valuable paper until some time after my last arrival in England when my computations were already all in a complete state, and without incurring the charge of inconsistency I could not avoid giving a full explanation of the method on which they had been conducted.

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and β Cephi, instead of relying on the first of these only; which practice remained in force until my return to India in 1830.

Both these methods were attended with many evils of which it is merely necessary to specify the two most prominent, viz. that as (except at particular periods) only one such maximum elongation is visible during the 24 hours, several days must elapse and those too of an unclouded sky before the completion of a set sufficiently numerous to be in keeping with the terrestrial angles could be effected; and again that if the elements employed in computing the azimuth (the star's polar distance and latitude of the place to wit) were as almost necessarily happens more or less erroneous, the errors thereby involved would constantly affect the deduction.

To remedy these defects I selected from the various catalogues to which I had access a numerous set of circumpolar stars, all within 8° of the pole, and all situated with respect to right ascension at such convenient distances asunder that frequent opportunities might be available of observing one or other of the set on both sides of the pole, a case which clearly happens when the star chosen is either in conjunction or opposition with the sun; for as is well known in the Indian climate no dependance can be placed on seeing even stars of the first magnitude when the sun is much above the horizon.

Instead of limiting my observations to one per diem taken at the exact time of maximum elongation, I decided that a sufficiently numerous series should be made on the star selected at or about the period of that phenomenon, the time of each individual observation being carefully noted to the nearest second, so that the deviation from maximum position of each individual observation might be accurately computed, and as it was manifestly an object to be desired that there should be as many observations prior as subsequent to maximum, and as many face left as face right, therefore I laid it down as a rule that these points should be kept in view and attended to as closely as circumstances permitted.

In order that the observations so made might be in keeping with the other parts of my operations, I decided that the number 8, viz. 4 with the face right and 4 with face left, should suffice to form a set final and complete at each zero on each side of the pole; and it is evident that if the condition above prescribed be attended to, after a set of this nature has been made on one side of the pole in the afternoon, a corresponding set may be made on the same star on the opposite side of the pole on the following aftermidnight, giving 16 observations at each zero: whence as there have as previously mentioned been always 4 changes of zero therefore 64 observations at least were required to constitute what is called a complete set at each station fixed on for observing azimuths.

Such was the rule originally laid down from which no departure could be admitted, but practically in these operations we have seldom had less than 12 observations and very often as many as 16 at each zero on each side of the pole; and in several cases it has not been thought sufficient to trust to one star but two and sometimes three have been employed: this was however whilst the system was of recent introduction when we



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doubted our own powers as well as the efficacy of the method, for subsequent to the period when the degree of confidence to be reposed in these had been determined by a long series of trials, instances of more than one star are rare.

I have already shewn the various instances both in the northern and southern of the two sections, in which observations made by this method at different stations have been applied as verificatory tests of the accuracy of the triangulation, but it may not be amiss to cite the cases in which sets on different stars made at the same station can be put into direct contrast with each other; and these I will now proceed to detail that a more complete idea may be formed of the degree of accuracy attainable.

1st. I took a set of observations on ε Ursæ Minoris at the station of Pahargarh with my large theodolite* in December 1836, but as the method was then new and required practical proof of its efficacy, I requested Captain Waugh would in the following January take a like set on λ Ursæ Minoris at the same station with the large theodolite by Troughton. In this instance the instruments were changed, the observers were changed, the stars were changed, the object and eye stations alone being constant, and the two resulting values of the azimuth of the referring lamp are as follow:

| | ° | ′ | ″ |
|---|---|---|---|
| By 100 observations on ε Ursæ Minoris in December 1836, by Colonel Everest ... | 179 | 25 | 47·775 |
| By 70 observations on λ Ursæ Minoris in January 1837, by Captain Waugh..... | 179 | 25 | 47·678 |
| Discrepancy in Azimuth ..... | 0 | 0 | 0·097 |

2nd. At Kalianpúr station in December 1836 with the view of obtaining further practical examples in illustration of the extent of confidence to be reposed in my method I selected for observation the circumpolar stars δ Ursæ Minoris, 4 Ursæ Minoris Bode, and 51 Cephi, and the resulting values of the azimuth of the referring lamp thence derived are as follow:

| | | ° | ′ | ″ |
|---|---|---|---|---|
| By 130 observations on δ Ursæ Minoris by Colonel Everest ..... | | 179 | 59 | 53·120 |
| By 115 observations on 4 Ursæ Minoris Bode | ditto ..... | 179 | 59 | 53·565 |
| By 128 observations on 51 Cephi | ditto ..... | 179 | 59 | 53·420 |

3rd. At Usira station in February 1838 with the same object in view I selected for observation three circumpolar stars, viz. 29 and 30 Camelopardalis and 32 Cephi Hevelii, and the resulting values of the azimuth of the referring lamp so derived are as follow, viz.:

| | ° | ′ | ″ |
|---|---|---|---|
| By 109 observations on 29 Camelopardalis by Colonel Everest ..... | 168 | 56 | 1·672 |
| By 106 observations on 30 Camelopardalis by ditto ..... | 168 | 56 | 1·947 |
| By 108 observations on 32 Cephi by Col. Everest and G. Logan, Esq. | 168 | 56 | 1·930 |

4th and lastly. At the station of Somtana Captain Waugh conformably to my

* I have called this instrument by my name, because it was designed by me throughout and commenced undertaken and finished entirely on my responsibility, but I must add that it was constructed under my directions by Mr. H. Barrow, Mathematical Instrument Maker to the H. E. I. Company and the public artificers under his orders and divided by himself. G. E.

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instructions made a set of observations on $\alpha$ Ursæ Minoris in April 1838, but as the individual observations of the series presented certain discrepancies *inter se* of which it was impossible to say *a priori* whether they arose from vital defects such as unsteadiness in the foundation or were merely facial and therefore calculated to correct each other by counteraction, therefore by my desire he took another and entirely new set on 41 Rangifer. in the November subsequent whence are derived the following values of the azimuth of the referring lamp at Somtana station:

| | ° | ′ | ″ |
|---|---|---|---|
| By 100 observations on $\alpha$ Ursæ Minoris by Captain Waugh ..... | 186 | 51 | 46·629 |
| By 104 observations on 41 Rangifer. by ditto ..... | 186 | 51 | 46·514 |
| Discrepancy ..... | | | 0·115 |

The first series of observations therefore must have been free from all vital defect and the discrepancies must have been purely facial.

These are all I have to produce, for as I have above said when the efficacy of the method had been thus practically tested, it became a work of supererogation to subject it to further trial, it will now therefore not be out of place to explain the principles upon which the reductions to maximum position are computed, and as in so doing I must needs enter into a vast deal of elementary matter which has often been discussed before, I must trust to the indulgence of my readers to forgive this intrusion on their patience.

Every star whose declination is greater than the terrestrial latitude of the eye on the earth's surface arrives at its greatest elongation in azimuth from the elevated pole when its angle of position is a right angle; that is to say when the angle at $Z$ contained between $P$ and $\sigma$ attains its greatest value, the angle at $\sigma$ is 90°.

The symbols used in the Great Trigonometrical Survey of India are

$\text{æ}$ for declination, $\lambda$ for latitude, $a$ for altitude.

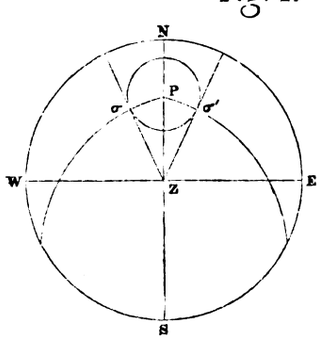
$\underset{(i)}{\text{æ}}$ Polar distance, $\underset{(i)}{\lambda}$ co-latitude, $\underset{(i)}{a}$ zenith distance.

$P$ horary angle, $Z$ angle at zenith, $\sigma$ angle of position.

employing which it is clear by Napier's rules that

$$\cos P = \tan \underset{(i)}{\text{æ}} \cdot \cot \underset{(i)}{\lambda}; \quad \sin Z = \frac{\sin \underset{(i)}{\text{æ}}}{\sin \underset{(i)}{\lambda}}; \quad \cos \underset{(i)}{a} = \frac{\cos \underset{(i)}{\lambda}}{\cos \underset{(i)}{\text{æ}}}$$

*Fig. 1.*




which equations will be the same for either side of the pole, and if instead of $P$ we write its value in time 15. $t^s$ these will be reduced to

$$\left.\begin{aligned} 1^{st}\ &\cos (15.\, t^s) = \tan \underset{(i)}{\text{æ}} \cdot \tan \lambda \\ 2^{nd}\ &\sin Z = \sin \underset{(i)}{\text{æ}} \cdot \sec \lambda \\ 3^{rd}\ &\sin a = \sec \underset{(i)}{\text{æ}} \cdot \sin \lambda \end{aligned}\right\} \ldots\ldots\ldots\ldots\ldots\ldots (A)$$

Though the quantities denoted by $\underset{(i)}{\text{æ}}$ and $\lambda$ have been above considered as constant, yet they may vary from the following causes. 1st. Between two successive elongations the place of $\sigma$ will vary; 2nd. both $\lambda$ and $\underset{(i)}{\text{æ}}$ may have a

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value assumed in computation which is merely approximate: if therefore we differentiate the above equations first with respect to $\lambda$ and afterwards with respect to $\varphi_{(0)}$ there results the following set of equations:

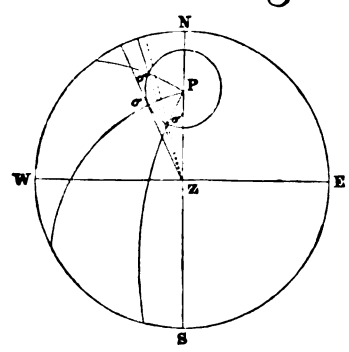
$$\left.\begin{array}{ll}
1^{st}\ d(t') = -\dfrac{\tan \varphi_{(0)}}{15.\sin P.\cos^2\lambda}\cdot d\lambda = -\dfrac{d\lambda}{15}\cdot \tan Z.\sec\lambda & \\
2^{nd}\ dZ = \dfrac{\sin \varphi_{(0)}}{\cos Z}.\ \dfrac{\sin\lambda}{\cos^2\lambda}\cdot d\lambda = d\lambda.\tan Z.\tan\lambda & \\
3^{rd}\ da = \dfrac{\cos\lambda}{\cos a.\cos\varphi_{(0)}}\cdot d\lambda = \dfrac{d\lambda}{\sin P.\cos\varphi_{(0)}}\cdot = d\lambda.\sec Z &
\end{array}\right\}\ \lambda \text{ variable}$$

$$\left.\begin{array}{ll}
4^{th}\ d(t') = -\dfrac{\tan\lambda}{15.\sin P.\cos^2\varphi_{(0)}}\cdot d\varphi_{(0)} = -\dfrac{\tan\lambda}{15.\cos Z.\cos\varphi_{(0)}}\cdot d\varphi_{(0)} = -\dfrac{d\varphi_{(0)}}{15}\cdot \tan a.\sec\varphi_{(0)} & \\
5^{th}\ dZ = \dfrac{\cos\varphi_{(0)}.\sec\lambda}{\cos Z}\cdot d\varphi_{(0)} = d\varphi_{(0)}.\sec\lambda.\operatorname{cosec} P & \\
6^{th}\ da = \dfrac{\sin\lambda.\sin\varphi_{(0)}}{\cos a.\cos^2\varphi_{(0)}}\cdot d\varphi_{(0)} = d\varphi_{(0)}.\tan a.\tan\varphi_{(0)}. &
\end{array}\right\}\ \varphi_{(0)} \text{ variable} \qquad \ldots(B)$$

By means of these equations we can both compute the required elements with the approximate values of $\lambda$ and $\varphi_{(0)}$ and afterwards apply the corrections corresponding to their variations without the necessity of going through the whole computations again, also having computed the values of $P$, $a$, $Z$ for one night, we are enabled in like manner to ascertain their values for a series of successive nights.

Though the above formulæ are only applicable to the particular position of $\sigma$ when

*Fig. 2.*




the angle at $Z$ is a maximum, yet if we know the time of culmination of the star by a good clock or watch it will be easy to compute the variation of $Z$ corresponding to any elapsed interval before or after the period of maximum, and provided that interval be not too long, so that in fact the term $\varphi_{(0)}$ may be considered as constant, the correction $\delta Z$ requisite to reduce any observed value $Z'$ to the maximum value $Z$ will be accordingly known.

Let for instance $PZ\sigma$ be the polar triangle of maximum western elongation; $\sigma'$, $\sigma''$ two positions of the star equally distant from it, the former prior and the latter subsequent thereto; then if $\sigma$, $\sigma'$; $\sigma$, $\sigma''$ be joined by arcs of great circles, two equal and similar isosceles triangles $P\sigma\sigma'$, $P\sigma\sigma''$, will be formed, of which the angle at the vertex is $\delta P$; whilst if the vertical circles $Z\sigma'$, $Z\sigma''$ be drawn, $\sigma Z\sigma'$ or $\sigma Z\sigma''$ will be the corresponding variation $\delta Z$.

Put

$S$ to denote $P\sigma\sigma'$ or $P\sigma\sigma''$

$2x$ .....$\sigma\sigma'$ or $\sigma\sigma''$

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Then

$$\left.\begin{aligned} 1^{st} \ldots\ldots tan\ S = cot\ \tfrac{1}{2}\delta P.\ sec\ \underset{(i)}{\text{æ}} \\ 2^{nd} \ldots\ldots sin\ x = sin\ \tfrac{1}{2}\delta P.\ sin\ \underset{(i)}{\text{æ}} \end{aligned}\right\} \ldots\ldots\ldots (C)$$

But because

$$P\sigma Z = \tfrac{\pi}{2}$$
$$\therefore\ Z\sigma\sigma' = \tfrac{\pi}{2} - S;$$
$$Z\sigma\sigma'' = \tfrac{\pi}{2} + S$$

And generally

$$cos\ Z\sigma\sigma' = \pm\ sin\ S$$

Whence in the triangle $Z\sigma'\sigma$ the general expression for either place $\sigma'$, or $\sigma''$ will be

$$tan\ \delta Z = \frac{cos\ S}{cot\ 2x.\ sin\ \underset{(i)}{a} \mp sin\ S.\ cos\ \underset{(i)}{a}}$$

the upper sign being used when the star is above and the lower when below maximum position.

But

$$cos\ \underset{(i)}{a} = \frac{sin\ \lambda}{cos\ \underset{(i)}{\text{æ}}};$$
$$tan\ \underset{(i)}{a} = \frac{cos\ Z}{tan\ \lambda};$$
$$sin\ \underset{(i)}{a} = \frac{cos\ Z.\ cos\ \lambda}{cos\ \underset{(i)}{\text{æ}}}.$$

$$\therefore\ tan\ \delta Z = \frac{cos\ S.\ cos\ \underset{(i)}{\text{æ}}}{cot\ 2x.\ cos\ Z.\ cos\ \lambda \mp sin\ S.\ sin\ \lambda} = \frac{cot\ S.\ cos\ \underset{(i)}{\text{æ}}}{sin\ \lambda} \cdot \frac{1}{\dfrac{cos\ Z}{tan\ 2x.\ tan\ \lambda.\ sin\ S} \mp 1}$$

$$= \frac{cos^{\,2}\underset{(i)}{\text{æ}}.\ tan\ \tfrac{1}{2}\delta P}{sin\ \lambda} \cdot \left\{ \frac{cos\ Z}{tan\ 2x.\ tan\ \lambda.\ sin\ S} \mp 1 \right\}^{-1}$$

If using the upper sign which prevails in the western elongation before and in the eastern after the instant of maximum, we put

$$sin^{\,2}\varphi = \frac{tan\ 2x.\ tan\ \lambda.\ sin\ S}{cos\ Z}$$

Then as

$$\left(\frac{cos\ Z}{tan\ 2x.\ tan\ \lambda.\ sin\ S} - 1\right)^{-1} = (cosec^{\,2}\varphi - 1)^{-1} = cot^{-2}\varphi = tan^{\,2}\varphi$$

$$\therefore\ tan\ \delta Z = \frac{cos^2\ \underset{(i)}{\text{æ}}.\ tan\ \tfrac{1}{2}\delta P}{sin\ \lambda} \cdot tan^2\ \varphi$$

or if using the lower sign which prevails in the western elongation after and in the eastern before maximum we put

$$tan^2\ \varphi' = \frac{tan\ 2x.\ tan\ \lambda.\ sin\ S}{cos\ Z}$$



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Then as

$$\left(\frac{\cos Z}{\tan 2x.\ \tan \lambda.\ \sin S}+1\right)^{-1}=(\cot^2\phi'+1)^{-1}=\sin^2\phi'$$

$$\therefore \tan \delta Z=\frac{\cos^2 \underset{(i)}{\alpha}.\ \tan \frac{1}{2}\delta P}{\sin \lambda}\cdot \sin^2\phi'$$

This method is quite rigorous, but rather more operose than the nature of the case ordinarily requires; there are however cases wherein it must be employed unless we consent to neglect as superfluous all consideration of decimals of a second, but as that does not suit with the principles usually followed in like cases, it is advisable to seek for such modes of abbreviation as will facilitate the labour of computation without detracting from the accuracy of the result.

To this end it will be observed that after having deduced $\tan S$ and $\sin x$ by the formulæ ($\alpha$) we next proceed to employ $\sin S$, $\tan 2x$, so that if tables of a convenient form can be arranged whereby the latter can be found from the former functions by inspection, or by an easy method of proportioning, the laborious process of searching through logarithm tables, may be more or less dispensed with.

Now when the tangent of an angle is very large its variations are also large, but those of the sine are at the same time very small, and as the logarithms not the arcs themselves or the natural numbers of those its functions are needed, therefore tables of the sort will best be constructed so that the logarithm of one function may be deduced from that of the other without the intervention of natural numbers.

Upon the same principle it is easy also to see that for given values of $L$ ($\sin x$) the corresponding values of $L$ ($\tan 2x$) may be found and tabulated as also that tables may be continued of $L$ ($\sec^2\theta$) whereby $L$ ($\sin^2\theta$) may be transformed into $L$ ($\tan^2\theta$) and *vice versâ*, all which will be clearly developed in the following formulæ, wherein $M$ is the inverse of the Modulus and $\theta$ is any small arc.

$$\left.\begin{aligned}
1^{st}\ L\ (\sec^2\theta)=L(1-\sin^2\theta)^{-1}&= M.\left\{\sin^2\theta+\frac{1}{2}\sin^4\theta+\frac{1}{3}\sin^6\theta+\frac{1}{4}\sin^8\theta+\frac{1}{5}\sin^{10}\theta\ \&c.\right\}\\
2^{nd}\ L\ (\sec^2\theta)=L(1+\tan^2\theta)&= M.\left\{\tan^2\theta-\frac{1}{2}\tan^4\theta+\frac{1}{3}\tan^6\theta-\frac{1}{4}\tan^8\theta+\frac{1}{5}\tan^{10}\theta\ \&c.\right\}\\
3^{rd}\ L(\operatorname{cosec}\theta)=L(1+\cot^2\theta)^{\frac{1}{2}}&= \frac{M}{2}\cdot\left\{\cot^2\theta-\frac{1}{2}\cot^4\theta+\frac{1}{3}\cot^6\theta-\frac{1}{4}\cot^8\theta+\frac{1}{5}\cot^{10}\theta\ \&c.\right\}\\
4^{th}\ L\ (\tan 2\theta)-L\ (2\sin\theta)&=\frac{3}{2}M.\left\{\sin^2\theta+\frac{7}{6}\sin^4\theta+\frac{5}{3}\sin^6\theta+\frac{31}{12}\sin^8\theta+\frac{21}{5}\sin^{10}\theta\ \&c.\right\}
\end{aligned}\right\}\ldots(\alpha)$$

of which the three first are evident and the 4th may be demonstrated thus—

Since $\tan 2\theta=\dfrac{2.\tan\theta}{1-\tan^2\theta}=\dfrac{2.\sin\theta}{(1-\sin^2\theta)^{\frac{1}{2}}}\times\dfrac{1}{1-\dfrac{\sin^2\theta}{1-\sin^2\theta}}=2.\sin\theta.(1-\sin^2\theta)^{\frac{1}{2}}.(1-2\sin^2\theta)^{-1}$

$$\therefore L\ (\tan 2\theta)-L\ (2\sin\theta)=\left\{\begin{array}{l} M.\left\{2\sin^2\theta+\frac{4}{2}\sin^4\theta+\frac{8}{3}\sin^6\theta+\frac{16}{4}\sin^8\theta+\frac{32}{5}\sin^{10}\theta\ \&c.\right\}\\ -\frac{M}{2}\cdot\left\{\sin^2\theta+\frac{1}{2}\sin^4\theta+\frac{1}{3}\sin^6\theta+\frac{1}{4}\sin^8\theta+\frac{1}{5}\sin^{10}\theta\ \&c.\right\}\end{array}\right\}$$

whence the truth of the equation above given is manifest.

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Now if in each of the four above equations ($\alpha$) in turn we put $N$ to denote the left-hand member they will be transformed to the following:

$$\left.\begin{aligned}
1^{st}\ \frac{N}{M} &= \sin^2\theta+\frac{1}{2}\sin^4\theta+\frac{1}{3}\sin^6\theta+\frac{1}{4}\sin^8\theta+\frac{1}{5}\sin^{10}\theta\ \&c.\\
2^{nd}\ \frac{N}{M} &= \tan^2\theta-\frac{1}{2}\tan^4\theta+\frac{1}{3}\tan^6\theta-\frac{1}{4}\tan^8\theta+\frac{1}{5}\tan^{10}\theta\ \&c.\\
3^{rd}\ \frac{2N}{M} &= \cot^2\theta-\frac{1}{2}\cot^4\theta+\frac{1}{3}\cot^6\theta-\frac{1}{4}\cot^8\theta+\frac{1}{5}\cot^{10}\theta\ \&c.\\
4^{th}\ \frac{2N}{3M} &= \sin^2\theta+\frac{7}{6}\sin^4\theta+\frac{5}{3}\sin^6\theta+\frac{31}{12}\sin^8\theta+\frac{21}{5}\sin^{10}\theta\ \&c.
\end{aligned}\right\}\ldots\ldots\ldots(\beta)$$

all coming under the general following form:—

$$a^2=\alpha y^2+\beta y^4+\gamma y^6+\delta y^8+\varepsilon y^{10}\ \&c.$$

wherein if we assume

$$y^2=Aa^2+Ba^4+Ca^6+Da^8+Ea^{10}\ \&c.$$

we shall obtain the following values for the coefficients:

$$A=\frac{1}{\alpha}$$

$$B=-\frac{1}{\alpha^3}\cdot\beta$$

$$C=\frac{1}{\alpha^5}\cdot(2.\beta^2-\alpha\gamma)$$

$$D=-\frac{1}{\alpha^7}\cdot(5.\beta^3-5.\alpha\beta\gamma+\alpha^2\delta)$$

$$E=\frac{1}{\alpha^9}\cdot(14.\beta^4-21.\alpha\beta^2\gamma+3.\alpha^2\gamma^2+6.\alpha^2\beta\delta-\alpha^3\varepsilon)$$

&c. &c. &c.

And consequently

$$L(y^2)=L\left(\frac{a^2}{\alpha}\right)+L\left\{1-\frac{\beta}{\alpha^2}\cdot a^2+\frac{2.\beta^2-\alpha\gamma}{\alpha^4}\cdot a^4-\frac{5.\beta^3-5.\alpha\beta\gamma+\alpha^2\delta}{\alpha^6}\cdot a^6+\frac{14.\beta^4-21.\alpha\beta^2\gamma+3.\alpha^2\gamma^2+6.\alpha^2\beta\delta-\alpha^3\varepsilon}{\alpha^8}\cdot a^8\ \&c.\right\}$$

$$\text{or } L(y^2)=L\left(\frac{a^2}{\alpha}\right)-M\cdot\left\{\frac{\beta}{\alpha^2}\cdot a^2-\frac{3.\beta^2-2.\alpha\gamma}{2.\alpha^4}\cdot a^4+\frac{\overline{10}.\beta^3-\overline{12}.\alpha\beta\gamma+3.\alpha^2\delta}{3.\alpha^6}\cdot a^6-\frac{\overline{35}.\beta^4-\overline{60}.\alpha\beta^2\gamma+\overline{10}.\alpha^2\gamma^2+\overline{20}.\alpha^2\beta\delta-4.\alpha^3\varepsilon}{4.\alpha^8}\cdot a^8\ \&c.\right\}$$

$$\text{or } L(y)=\frac{1}{2}\cdot L\left(\frac{a^2}{\alpha}\right)-\frac{M}{2}\cdot\left\{\frac{\beta}{\alpha^2}\cdot a^2-\frac{3.\beta^2-2.\alpha\gamma}{2.\alpha^4}\cdot a^4+\frac{\overline{10}.\beta^3-\overline{12}.\alpha\beta\gamma+3.\alpha^2\delta}{3.\alpha^6}\cdot a^6-\frac{\overline{35}.\beta^4-\overline{60}.\alpha\beta^2\gamma+\overline{10}.\alpha^2\gamma^2+20.\alpha^2\beta\delta-4.\alpha^3\varepsilon}{4.\alpha^8}\cdot a^8\ \&c.\right\}$$

To apply this expansion it must be remarked that

$$M=0\cdot4342944819,\ \&c.$$

$$\therefore\ L(M)=\overline{1}\cdot6377843113,\ \&c.$$

Also $N$ denotes the left-hand member of that one of the equations ($\beta$) which is under consideration, whence are obtained the following particular values of the coefficients in those equations:

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Formula No. 1 $N=L\,(sec^2\,\theta)$; $\frac{N}{M}=a^2$; $y^2=sin^2\,\theta$; $\alpha=1$; $\beta=\frac{1}{2}$; $\gamma=\frac{1}{3}$; $\delta=\frac{1}{4}$; $\epsilon=\frac{1}{5}$ &c.

„ No. 2 $N=L\,(sec^2\,\theta)$; $\frac{N}{M}=a^2$; $y^2=tan^2\,\theta$; $\alpha=1$; $\beta=-\frac{1}{2}$; $\gamma=\frac{1}{3}$; $\delta=-\frac{1}{4}$; $\epsilon=\frac{1}{5}$ &c.

„ No 3 $N=L\,(cosec\,\theta)$; $\frac{2N}{M}=a^2$; $y=cot\,\theta$; $\alpha=1$; $\beta=-\frac{1}{2}$; $\gamma=\frac{1}{3}$; $\delta=-\frac{1}{4}$; $\epsilon=\frac{1}{5}$ &c.

„ No. 4 $N=[L(tan2\theta)-L(2.sin\theta)]$; $\frac{2N}{3M}=a^2$; $y=sin\,\theta$; $\alpha=1$; $\beta=\frac{7}{6}$; $\gamma=\frac{5}{3}$; $\delta=\frac{31}{12}$; $\epsilon=\frac{21}{5}$ &c.

By applying which we obtain a new set of equations of the following form:

$$\left.\begin{aligned}
&\text{Formula No. 5 } L\,(sin^2\,\theta)=L\left(\frac{N}{M}\right)-\frac{1}{2}N+\frac{1}{24}\cdot\frac{N^2}{M}-\frac{1}{2880}\cdot\frac{N^4}{M^3}\ \&c.\\
&\text{„ No. 6 } L\,(tan^2\,\theta)=L\left(\frac{N}{M}\right)+\frac{1}{2}N+\frac{1}{24}\cdot\frac{N^2}{M}-\frac{1}{2880}\cdot\frac{N^4}{M^3}\ \&c.\\
&\text{„ No. 7 } L\,(cot\,\theta)=\frac{1}{2}\cdot L\left(\frac{2N}{M}\right)+\frac{1}{2}N+\frac{1}{12}\cdot\frac{N^2}{M}-\frac{1}{360}\cdot\frac{N^4}{M^3}\ \&c.\\
&\text{„ No. 8 } L(sin\,\theta)=\frac{1}{2}\cdot L\left(\frac{2N}{3M}\right)-\frac{7}{18}N+\frac{1}{12}\cdot\frac{N^2}{M}-\frac{2^5}{3^7}\cdot\frac{N^3}{M^2}-\frac{\overline{89}}{2^3.5.3^6}\cdot\frac{N^4}{M^3}\ \&c.
\end{aligned}\right\}\ldots\ldots(\gamma)$$

It will be seen that the equations ($\alpha$) and those marked ($\gamma$) are in inverse order to each other, whereby if the former give the value of $F(\theta)$ in terms of $f(\theta)$ the latter will give the value of $f(\theta)$ in terms of $F(\theta)$, of which the object proposed may be thus explained: the terms $f(\theta)$ (implying thereby the functions in the right members of equations ($\alpha$), the expressions $F(\theta)$ meaning those on the left of the same equations) are the given quantities, and it greatly facilitates computation if we are enabled to take out their corresponding corrections or values in $F(\theta)$ by simple inspection; this can be conveniently accomplished to a certain extent by the equations ($\gamma$), in fact as long as the variations of $F(\theta)$ are small in comparison with those of $f(\theta)$; but when that ceases to be the case the pages to contain the tables would be inordinately extended so as to produce a greater evil than that which it is sought to remedy.

Let it be supposed for example that we have the value of $L\,(sin\,^2\theta)$ and that we require to know the correction or $L\,(sec\,^2\theta)$ to be applied to it to obtain $L\,(tan\,^2\theta)$; in this case when $\theta$ is small the variations of the correction are minute in comparison with those of $L\,(sin\,^2\theta)$ and if we know the limiting values of the latter corresponding to any increment of the former, we can take the correctional terms out by simple inspection as thus:

$L\,(sin^2\,\theta)=\bar{5}\cdot3622107\ldots\ldots L\,(sec^2\,\theta)=0\cdot0000100\ldots\ldots L\,(tan^2\,\theta)=\bar{5}\cdot3622207$

$L\,(sin^2\,\theta)=\bar{5}\cdot3665321\ldots\ldots L\,(sec^2\,\theta)=0\cdot0000101\ldots\ldots L\,(tan^2\,\theta)=\bar{5}\cdot3665422$

whence we see that whilst the correctional quantity varies only by unity in the 7th place of decimals, the functions $L\,(sin^2\,\theta)$, $L\,(tan^2\,\theta)$ vary by $0\cdot0043214/5$.

The auxiliary tables which I constructed for the G. T. Survey of India were on the foregoing principles and consisted of

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1st Table No. 1.

Containing the values of $L$ ($sec^2\theta$) arranged in arithmetical progression from 0 to 0·0014400 ascending with a common difference 0·0000001, opposite to which were arranged the corresponding values of $L$ ($sin^2\theta$) and $L$ ($tan^2\theta$).

2nd Appendix No. 1 to Table No. 1.

Containing the values from $\bar{3}$·5190000 to $\bar{2}$·7180000 of $L$ ($sin^2\theta$) arranged in arithmetical series ascending with a common difference 0·0010000.

3rd Appendix No. 2 to Table No. 1.

Containing the values of $L$ ($tan^2\theta$) similarly arranged from $\bar{3}$·5210000 to $\bar{2}$·4200000, each of the latter having the corresponding values of $L$ ($sec^2\theta$) placed contiguously.

4th Table No. 2.

For finding $L$ ($sin\,\theta$) from $L$ ($tan\,\theta$) the values of the former being arranged in descending arithmetical series with a common difference 0·0000001 to $\bar{1}$·9985600 with the corresponding values of the latter function placed contiguously.

5th Appendix to Table No. 2.

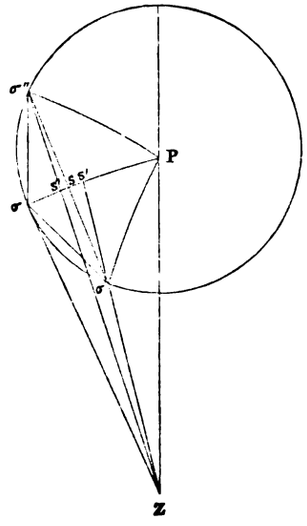
Containing the values of $L$ ($tan\,\theta$) arranged in arithmetical series descending with a common difference ·0010000 from 1·0890000 to 0·6400000 having the corresponding values of $L$ ($sin\,\theta$) placed contiguously.

6th Table No. 3.

Containing the values of the terms to be added to those of $L$ ($sin\,\theta$) in order to convert them into $L$ ($tan\,2\theta$) the former being arranged in arithmetical series increasing from 0·3010300 to 0·3012700.

Though the above tables were all rigorously computed and are still in manuscript, and have been found of essential service in facilitating azimuth computations, yet I have not deemed it desirable to encumber my present work with them because there is little probability that they would be sufficiently prized to warrant my putting the East-India Company to the expense of publishing them; most persons would indeed content themselves with a minor degree of accuracy in preference to going through such a wearisome mass of computation as this rigorous method requires, and in fact in the case of all stars very near the pole such as λ, α, 4 Bode, Ursæ Minoris, I have myself been satisfied with the following called the approximate method which needs no tables at all:—

*Fig. 3.*




Let $Z$ be the stereographic projection of the zenith; $P$ that of the pole; $\sigma$ that of a star at maximum; $\sigma'$, $\sigma''$ those of two positions at equal intervals before and after maximum: draw the projections of the declination circles $P\sigma'$, $P\sigma$, $P\sigma''$; those of the vertical circles $ZP$, $Z\sigma$, $Z\sigma'$, $Z\sigma''$; and those of the arcs of great circles $\sigma\sigma'$, $\sigma\sigma''$, $\sigma'\sigma''$: then the projections of the intersections of $\sigma''\sigma'$, $Z\sigma'$, $Z\sigma''$ with $P\sigma$ will be $s$, $s'$, $s''$;



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and as the stereographic projection of an angle differs in no wise from the angle itself, therefore each of the angles about $s$ is a right angle.

By our ordinary notation

$$Z\sigma=\underset{(i)}{a};\ P\sigma=\underset{(i)}{\varpi};\ PZ=\underset{(i)}{\lambda};\ \sigma PZ=P;\ \sigma P\sigma'=\sigma P\sigma''=\delta P;\ \sigma Z\sigma'=\delta Z;\ \sigma Z\sigma''=\dot{\delta}Z:$$

let us also put

$$s\sigma=x;\ s\sigma'=s\sigma''=y;\ ss'=\delta x;\ ss''=\dot{\delta}x;\ \angle Zs'\sigma=s';\ \angle Zs''\sigma=s''.$$

Then 1st. In the triangles $Z\sigma s'$, $Z\sigma s''$ right angled at $\sigma$ we have

$$tan\ (x+\delta x)=sin\ \underset{(i)}{a}.\ tan\ \delta Z;\ tan\ (x-\dot{\delta}x)=sin\ \underset{(i)}{a}.\ tan\ \dot{\delta}Z$$
$$cos\ s'=sin\ \delta Z.\ cos\ \underset{(i)}{a};\ cos\ s''=sin\ \dot{\delta}Z.\ cos\ \underset{(i)}{a}.$$

Whence as long as the conditions of the case will permit us to consider $\delta x=\dot{\delta}x$, and to substitute the arcs of $x$, $\delta x$, $\delta Z$, $(\frac{\pi}{2}-s')$, $(\frac{\pi}{2}-s'')$ for their functions we get.

$$\left.\begin{aligned} x\pm\delta x=sin\ \underset{(i)}{a}.\ \delta Z=sin\ P.\ cos\ \lambda.\ \delta Z \\ s'=\tfrac{\pi}{2}-cos\ \underset{(i)}{a}.\ \delta Z \end{aligned}\right\}\ldots\ldots\ldots\ldots(\varepsilon)$$

Wherein as the triangles $\sigma' ss'$, $\sigma'' ss''$ are assumed to be equal to each other, the same considerations which serve for the one will also serve for the other.

2nd. In the triangle $s\sigma' s'$ right angled at $s$ and considered as plain, if we put $\angle s\sigma' s'=\sigma'$ we have obviously

$$\left.\begin{aligned} \sigma'=\tfrac{\pi}{2}-s'=cos\ \underset{(i)}{a}.\ \delta Z \\ \delta x=y.\ tan\ \sigma'=y.\ cos\ \underset{(i)}{a}.\ \delta Z \end{aligned}\right\}\ldots\ldots\ldots(\zeta)$$

3rd. In the triangles $P\sigma' s$ right angled at $s$ we have

$$cos\ \delta P=cot\ \underset{(i)}{\varpi}.\ tan\ (\underset{(i)}{\varpi}-x);\ \text{or}\ \frac{tan\ \underset{(i)}{\varpi}-tan\ x}{1+tan\ \underset{(i)}{\varpi}.\ tan\ x}=tan\ \underset{(i)}{\varpi}.\ cos\ \delta P$$

which, omitting higher powers of $x$ than the first, is reduced to

$$x=sin\ 2\ \underset{(i)}{\varpi}.\ sin^2\tfrac{1}{2}\delta P$$

Also

$$tan\ y=sin\ (\underset{(i)}{\varpi}-x).\ tan\ \delta P$$

which, when $y$ is sufficiently minute, is reduced (by substituting for $x$ its value just found) to

$$y=sin\ \underset{(i)}{\varpi}.\ tan\ \delta P.\ (1-2\ cos^2\ \underset{(i)}{\varpi}.\ sin^2\tfrac{1}{2}\delta P).$$

$\left.\begin{aligned} \\ \\ \\ \end{aligned}\right\}\ldots\ldots(\eta)$

Hence 4th combining the values given in equations $(\zeta)$, $(\eta)$ and remembering that $cos\ \underset{(i)}{a}=\frac{cos\ \underset{(i)}{\lambda}}{cos\ \underset{(i)}{\varpi}}=\frac{sin\ \lambda}{cos\ \underset{(i)}{\varpi}}$, we get for the value of $ss'$ or $ss''$ supposed equal

$$\delta x=tan\ \underset{(i)}{\varpi}.\ sin\ \lambda.\ tan\ \delta P.\ \{1-2\ cos^2\ \underset{(i)}{\varpi}.\ sin^2\tfrac{1}{2}\delta P\}.\ \delta Z\ldots\ldots\ldots\ldots(\theta)$$

which value answers for both the upper and lower positions, being subtractive in the former and additive in the latter to the mean value of $\sigma s$ or $x$ as given in the first of equations $(\eta)$.

Hence 5th as the value of $(x\pm\delta x)$ given in the first of equations $(\varepsilon)$ is compounded of the values given in the first of equations $(\eta)$ and equation $(\theta)$ therefore

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$$\sin P.\cos\lambda.\delta Z=\sin 2\underset{(i)}{\alpha}.\sin^2\tfrac{1}{2}\delta P\pm\tan\underset{(i)}{\alpha}.\sin\lambda.\tan\delta P.\{1-2\cos^2\underset{(i)}{\alpha}.\sin^2\tfrac{1}{2}\delta P\}.\delta Z$$

$$\therefore\delta Z=\frac{\sin 2\underset{(i)}{\alpha}.\sin^2\tfrac{1}{2}\delta P}{\sin P.\cos\lambda.\{1\mp\cot P.\tan\delta P.(1-2.\cos^2\underset{(i)}{\alpha}.\sin^2\tfrac{1}{2}\delta P)\}}$$

which, omitting all powers of the functions of $\delta P$ higher than the 3rd, is reduced to

$$\delta Z=\frac{\sin 2\underset{(i)}{\alpha}.\sin^2\tfrac{1}{2}\delta P}{\sin 1''.\sin P.\cos\lambda}.(1\pm\cot P.\tan\delta P).....(E)$$

and consequently

$$L(\delta Z)=L(\sin 2\underset{(i)}{\alpha})+2.L(\sin\tfrac{1}{2}\delta P)+L(\operatorname{cosec} P)+L(\sec\lambda)+L(\operatorname{cosec} 1'')\pm M\cot P.\tan\delta P.$$

where $M$ is the inverse of the modulus 0·4342944819 &c. whose Log. is $\bar{1}$·6377843; the upper sign being used when the star is above maximum position and the lower when below.

In the observations of which I am treating, the telescope has been first brought up to intersect the lamp from the side of the horizon opposite the star, and next elevated to the proper altitude and moved in azimuth to the star; it has then been moved in the same direction through an arc of not less than 5 degrees, and thence brought back to intersect the star, after which it has been depressed and moved up to the lamp; whereby it has happened that the motion of the telescope in azimuth from either object to the other has always been continuous, and that the observations have been made by pairs, each pair with the divided face the opposite way to that of the preceding pair, the telescope having intermediately been turned over in altitude.

It will be manifest that great care is required in levelling the body of the instrument, and any residual error which may still exist prior to and at the conclusion of the observations, ought to be carefully noted in four positions, both ends of the level being always read off; it is necessary likewise to register the readings of the transit axis prior and subsequent to observing, as also the error of collimation, but these two tests need not be meddled with unless when they are serious in amount, and even then it is dangerous to attempt to rectify them near the time of observing, because they remain for a long time in a state of fluctuation, whilst a constant error in either will eliminate itself in reality though not in appearance by the principle inherent in the method and rules laid down.

Though it would be supererogatory to enter into any lengthened investigation of the nature of these errors which have been so often discussed as to have become quite familiar to astronomers each of whom has methods and formulæ of his own, yet in as far as they merely bear upon the question of azimuths observed in the way I am speaking of, perhaps it will not be deemed out of place to enter into a brief explanation illustrative of their effects.

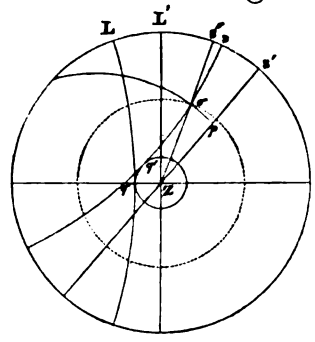
If fig. 4 be a stereographic projection of the sphere, the eye at $Z$, and $qZ$ be the error of collimation supposed to be all in the direction of the transit axis, then the small circle $Lq$ parallel to $L'Z$ will be the locus traced by the point $q$ in its passage from a lamp at $L$ in the horizon to the zenith, and the small circle of which $Zq$ is the radius,

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will be that traced by the same point when the telescope directed to the zenith rotates in azimuth.

If $\sigma$ be a star whose angle of azimuth with $L$ is sought, it must appear on the wires in the small circle $q'\sigma s$, parallel to which is the great circle $Zps'$; and $L's'$ is the arc through which the telescope will have rotated; but $s''$, being the point in the horizon determined by a great circle passing from $Z$ through $\sigma$, the true azimuthal arc between $L$ and $\sigma$ will be $Ls''$; the error therefore is $ss''$ which will always tend to make the apparent less or greater than the true angle, according as the more elevated of the two objects is on the same or contrary side of the observer with respect to $q$.

*Fig. 4.*




Let $\sigma p$ be part of a great circle equal to $\epsilon$, and put $ss''=\epsilon_{,}$ then in the triangle $Zp\sigma$;

$$sin\ \epsilon = sin\ \underset{(0)}{a}.\ sin\ (\epsilon+\epsilon_{,})$$

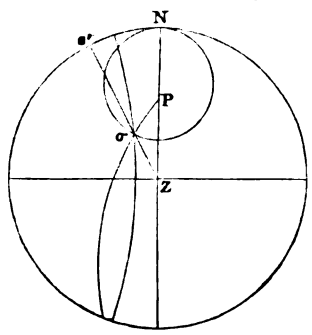
whence substituting the arc $\epsilon$ for its sine, there results

$$\epsilon_{,}=\epsilon\,.\,(sec\ a-1).....(\epsilon)$$

where $\epsilon$ is half the difference between the azimuths observed face right and face left of an object in the horizon.

To estimate the effect of $\epsilon$ on the time observed by transit we must remark that if the plane of the instrument coincide with that of the meridian, the star will come to transit at $\sigma$; $\sigma PZ=\delta P$ will be equivalent to the error in time and $\sigma ZP=(\epsilon+\epsilon_{,})=\epsilon.\ sec\ a$ will be the expression $\delta Z$ or the error in azimuth.

*Fig. 5.*




Now

$$sin\ \delta P=\frac{sin\ \delta Z}{sin\ \underset{(i)}{æ}}\cdot sin\ \underset{(i)}{a}=\frac{\epsilon.\ sec\ a}{sin\ \underset{(i)}{æ}}\cdot cos\ a=\frac{\epsilon}{sin\ \underset{(i)}{æ}}$$

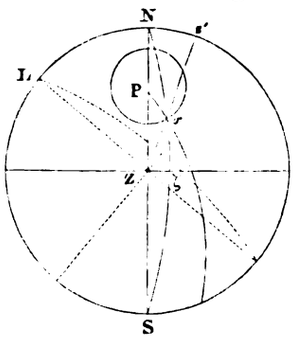
$$\therefore\ \delta P^{s}=\frac{\epsilon''}{15.\ sin\ \underset{(i)}{æ}}.....(\epsilon')$$

wherein $\delta P^{s}$ is in seconds of time and $\epsilon''$ in seconds of a great circle, the correction being in excess or defect of the true time of transit according as the locus of $q$ is to the west or east of the meridian.

We will next proceed to examine the effects of dislevelment of the transit axis to which end it will be remarked that if $Z$ be the true zenith, $\eta$ the error of level will all lie in a direction perpendicular to the plane of the instrument, and when the latter is in the meridian will be all in the prime vertical, so that if on the projection of a great circle drawn perpendicular to that of the plane of the instrument, the rectilinear part $Z\zeta$ be set off equal to $r.\ tan\ \frac{1}{2}\ \eta$, then $\zeta$ will be the stereographic projection of the point to which the telescope is directed when the reading of the vertical circle indicates the true zenith, and $N$, $S$, if in the horizon, will be the common to both circles $NZS$, $N\zeta S$.

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*Fig. 6.*




Let $L$ be a lamp situated in the horizon, and $\sigma$ a star; then as the position of $L$ is common to both $Z$ and $\zeta$, the azimuth reading of that point will not be affected by the deviation $\eta$, but when the telescope is elevated so that $\sigma$ may be on the wires, the corresponding horizontal point for the circle $\sigma\zeta$ will be $N$, whilst if there had been no error, $s'$ where the vertical circle $Z\sigma s'$ meets the horizon, would have been the horizontal point appertaining to $\sigma$, therefore $Ns'$ is the error which we will call $\gamma_{(i)}$.

In the spherical triangle $Z\zeta\sigma$;

$$sin\ \sigma = sin\ \eta\ .\ cosec\ a_{(i)}$$

In the spherical triangle $Ns'\sigma$;

$$tan\ \sigma = tan\ \gamma_{(i)}\ .\ cosec\ a$$

whence when $\sigma$ is so small that we are at liberty to consider its 3rd powers as rejectaneous we have

$$\gamma_{(i)} = \eta\ .\ tan\ a \ldots\ldots\ldots (\eta)$$

The false zenith $\zeta$ always lies on the side of that pivot which the level indicates to be the lower of the two, and the error $\gamma_{(i)}$ is always to be added to the observed azimuth reading when the more elevated object is on the same side of the observer with $\zeta$, or subtracted when on the contrary side.

If $N$ and $S$ be taken to represent the north and south points of the horizon, and $P$ the projection of the pole, then $NPZS$ will be a straight line, $\sigma$ will be the projection of a star at observed transit, $Z\sigma$ will be part of a vertical circle, and $P\sigma$ part of a declination circle drawn through it, also $\angle ZP\sigma$ will be the error in time or $\delta P$, and $\angle PS\sigma$ will be measured by $\eta$ of which $Z\zeta$ is the projection:

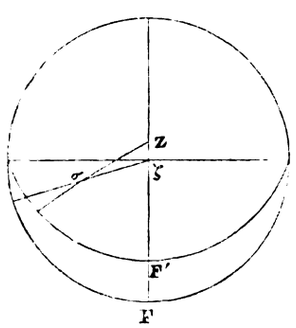
Therefore in the spherical triangle $PS\sigma$, if we put $S\sigma = \frac{\pi}{2} \pm a'_{(i)}$ we have

$$sin\ \delta P = sin\ \eta\ .\ \frac{cos\ a'_{(i)}}{sin\ æ_{(i)}}$$

But as $\eta$ is a small quantity we may put $a'_{(i)}$ for the correct meridional zenith distance of $\sigma$, in which case $cos\ a'_{(i)} = cos\ (\lambda \smile æ)$, and hence substituting the arcs for their functions and reducing to time we have

$$\delta P^{s} = \eta\ .\ \frac{cos\ (\lambda \smile æ)}{15\ .\ cos\ æ} \ldots\ldots\ldots\ldots\ldots\ldots (\eta')$$

*Fig. 7.*




The next error to be considered is that of dislevelment in the body of the instrument, to which end let $\zeta$ be the projection of the axis of the instrument on a great circle perpendicular to it or parallel to the azimuth circle, $Z$ that of the true zenith, and $\sigma$ that of a star; then $\zeta\sigma$ will be the observed zenith distance $a'_{(i)}$; $Z\sigma$ the true zenith distance $a_{(i)}$; $\sigma\zeta F = \zeta$, an observed arc of azimuth; $\sigma ZF = Z$ the corresponding true arc of azimuth of $\sigma$; and the deviation $\theta$, of which $Z\zeta$ is the stereographic projection, will represent the whole level error in the plane of $FZ$, $F$ being a point whose position is fixed by determinate but unknown co-ordinates.



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The spherical triangle $Z\zeta\sigma$, (because $\sigma\zeta Z=\pi-\zeta$), will give

$$tan\ Z=\frac{sin\ \zeta}{cot\ a'_{(i)}.\ sin\ \theta+cos\ \zeta.\ cos\ \theta}$$

Which on account of the minuteness of $\theta$ becomes

$$tan\ Z=\frac{tan\ \zeta}{1+\theta.\frac{cot\ a'_{(i)}}{cos\ \zeta}}$$

But

$$tan\ (\zeta-Z)=\frac{tan\ \zeta-tan\ Z}{1+tan\ Z.\ tan\ \zeta}$$

Wherein

$$tan\ \zeta-tan\ Z=tan\ \zeta.\left(1-\frac{1}{1+\theta.\frac{cot\ a'_{(i)}}{cos\ \zeta}}\right)=\frac{sin\ \zeta}{cos\ \zeta}.\theta.\frac{\frac{cot\ a'_{(i)}}{cos\ \zeta}}{1+\theta.\frac{cot\ a'_{(i)}}{cos\ \zeta}}=\theta.\frac{cot\ a'_{(i)}.\ sin\ \zeta}{cos^2\zeta+\theta.\ cot\ a'_{(i)}.\ cos\ \zeta}$$

And

$$1+tan\ Z.\ tan\ \zeta=1+\frac{sin^2\zeta}{cos^2\zeta+\theta.\ cot\ a'_{(i)}.\ cos\ \zeta}=\frac{1+\theta.\ cot\ a'_{(i)}.\ cos\ \zeta}{cos^2\zeta+\theta.\ cot\ a'_{(i)}.\ cos\ \zeta}$$

whence

$$tan\ (\zeta-Z)=\theta.\frac{cot\ a'_{(i)}.\ sin\ \zeta}{1+\theta.\ cot\ a'_{(i)}.\ cos\ \zeta}=\theta.\ tan\ a'.\ sin\ \zeta-\tfrac{1}{2}\ \theta^2.\ tan^2a'.\ sin\ 2\zeta.\ \&c.$$

or putting $tan\ (\zeta-Z)=\delta\zeta$; $\theta$ being in seconds;

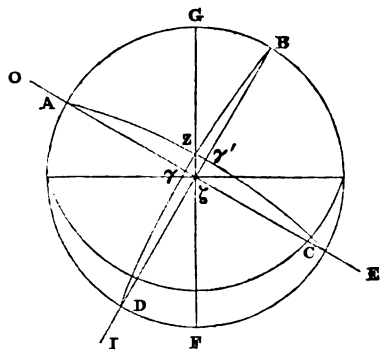
$$\delta\zeta=\theta.\ tan\ a'\ sin\ \zeta-\tfrac{1}{2}\ \theta^2.\ tan^2a'\ sin\ 2\zeta.\ sin\ 1''.$$

whence it would seem that when the observed object is in the plane of the azimuth circle no deviation in azimuth is caused by the level error, and as $\theta$ is exceedingly minute, the value may, except when $\sigma$ is very near the zenith, be expressed by

$$\delta\zeta=\theta.\ tan\ a'.\ sin\ \zeta.....(\delta)$$

The arc $\zeta$ which enters into the above formula, denotes an arc of azimuth supposed to be observed between an elevated object $\sigma$ and an imaginary point $F$ assumed as the origin, the position of which it is necessary to define: now it will have been concluded from what has preceded, that $\zeta$ is always on that side of $Z$ which the level indicates to be too low, and it is manifest that the plane $Z\zeta F$ will pass through that position, wherein the level error is at its maximum value.

*Fig. 8.*




The level being in the position $AC$ of which the reading is known, let the deviation of $\zeta$ be determined by the ordinary principle of turning half round in azimuth; then if $BZD$ be the projection of a great circle passing through $Z$ at right angles to $AC$, the part $\zeta\gamma$ intercepted between $\zeta$ and the point $\gamma$ where this circle cuts the plane of $AC$, will be the projection of the level error which we will call $x$.

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Similarly if the value of $\zeta\gamma'$ be determined, the level being in the position $BD$ at right angles to $AC$, and put equal to $y$, (the readings of those two positions being always taken which are in the two quadrants indicated as more elevated), then the point $Z$ will be in the quadrant between $\gamma$ and $\gamma'$, and the point $\zeta$ at 180° from $Z$.

To illustrate this let $AC$ be the 1st position, in which the index of the azimuth circle reads $n$ degrees and let the other positions read as follow:

$$\text{2nd position } \tfrac{\pi}{2}+n;\ \text{3rd position } \pi+n;\ \text{4th position } \tfrac{3\pi}{2}+n.$$

also let $O$ indicate the object end, $E$ the eye end, and $I$ the observer's position, the two lines $OE$ and $I\zeta$ which form a right angle $\zeta$, being supposed to be united and turn round together as the instrument revolves in azimuth in the order $A, B, C, D$, so that the observer will always look from $I$ perpendicularly to $O, E$.

Then at the reading $n$ if $l, r$, be the indications of the left and right ends of the level, and $l'', r''$ those at the reading of $\pi+n$, we have

$$\gamma\zeta=\tfrac{1}{2}\cdot\left\{\frac{r''-r}{2}+\frac{l-l''}{2}\right\}=\tfrac{1}{4}\cdot\left\{r''+l-(r+l'')\right\}=x$$

Similarly if at the reading $\frac{\pi}{2}+n$, $l'$, $r'$ be the indications, and at $\frac{3\pi}{2}+n$, $l'''$, $r'''$ denote them, then

$$\gamma'\zeta=\tfrac{1}{2}\cdot\left\{\frac{r'''-r'}{2}+\frac{l'-l'''}{2}\right\}=\tfrac{1}{4}\cdot\left\{r'''+l'-(r'+l''')\right\}=y$$

which expressions for $\gamma\zeta$, $\gamma'\zeta$ must be reduced to seconds of a great circle by the known values of the level.

Now in the triangles $\zeta Z\gamma$, $\zeta Z\gamma'$ right angled at $\gamma$, $\gamma'$, if we put $\varpi$ to denote the angle $Z\zeta\gamma$ and $Z\zeta=\theta$, we get

$$\cos\varpi=\tan x\,.\,\cot\theta$$

as also

$$\sin\varpi=\tan y\,.\,\cot\theta$$

whence

$$\frac{\tan y}{\tan x}=\tan\varpi;$$

$$\tan\theta=\begin{cases}\tan x\,.\,\sec\varpi\\ \tan y\,.\,\operatorname{cosec}\varpi\end{cases}$$

which for all practical purposes will be sufficiently determined by the equations

$$\tan\varpi=\frac{y}{x};$$

$$\theta=\begin{cases}x\,.\,\sec\varpi\\ y\,.\,\operatorname{cosec}\varpi\end{cases}$$

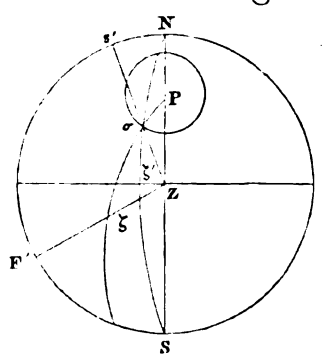
Hence $n+\varpi$ is the reading of the line $\zeta ZG$, and $\pi+n+\varpi$ that of the point $F$, which subtracted from that of the point $\sigma$ or any other observed point will give the angle $\zeta$ used in the formulæ.

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The effects of this error on observed transits may be investigated as follows:

If $NZS$ be the stereographic projection of the meridian on the horizon of $Z$, and $F'$ be the point on the horizon at which the great circle passing through $Z\zeta$ meets it, then in the spherical triangle $NZ\zeta$, the angle $NZ\zeta = N\zeta F - \delta\zeta$ will be known when the reading of $F'$ has been determined; but $\delta\zeta$ is evanescent when the point $F'$ is in the horizon of either $\zeta$ or $Z$, consequently we may substitute $NZF$ for $N\zeta F$, and assume that $Z\zeta' = Z\zeta . cos\, \zeta Z\zeta' = \theta . sin\, \zeta$, which expression will be exactly analogous to that previously given in the investigation for the error of the transit axis, if we write $\theta . sin\, \zeta$ instead of $\eta$ in formulæ $(\eta)$, $(\eta')$ and suppose $\zeta'$ to be the position $\zeta$.

*Fig. 9.*




From what has preceded it will be manifest that the terms which affect observed azimuths arising from errors of collimation and dislevelment of the transit axis, are of a nature to eliminate each other by reversion of the face of the instrument; for whilst the horizontal and elevated or lower and higher objects retain the same relative positions to the left or right of the observer, the line of collimation and dislevelled zenith point change their places with respect to the axis of the instrument by reason of that process, so that in truth only the small variations in altitude between two successive pairs of observations can have any effect, for if the point $\sigma$ were stationary, the correction which is positive with the face left would be negative with the face right.

But the deviation from level in the body of the instrument is of a totally different nature, and as it has no tendency to correct itself therefore no pains should be spared to eradicate every vestige of it in the first instance, and the readings of both ends of the level in four positions, both at the beginning and termination of every set of observations, should be carefully noted, so that the residual portion if any, both in amount and direction may be computed and applied where necessary.*

As it is of importance that the siderial time of maximum azimuth should be known with accuracy, and an astronomical clock cannot conveniently be carried or steadily put up in a tent, therefore a good chronometer has been used in all the operations of this description carried on in the series of the Great Arc of India, and it would doubtless be an advantage if the chronometer used on these occasions could be set to siderial time.

The time of each observation when the star is on the vertical wire has been rarely noted to the decimal of a second, for that would be an attempt at accuracy needless where the observer has the opportunity to select his own instant of intersection, and fruitless when the star is in that very position which is chosen for the smallness of its relative motion in azimuth.

It will also be remarked that provided the rule could be rigorously abided by of

* The corrections herein alluded to have not been applied in the series of operations now described, because the observations being numerous, it has been presumed that the errors with which they were burdened would correct each other.

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making each set consist of as many observations above maximum as below that position, a very considerable error of time might be admitted without affecting the resulting mean, for though each individual observation would be burdened with a discrepancy of its own, yet those discrepancies on either side of maximum must from the nature of the question cancel each other; a set of observations is always therefore considered more perfect as it approaches this condition, but as deviations must of necessity occur, therefore the more accurately the time of maximum or value of $\delta P$ and the rate of the chronometer can be determined, the greater will be the degree of confidence on the part of the observer in the result he arrives at.

It will be kept in mind however that the true siderial time is not the main end in view, but is merely used as an adjunct, and as celestial observations for azimuth of the nature herein spoken of, are conducted on the same occasions and under the same circumstances with those of the angles of principal triangles, therefore it becomes an object so to select the opportunities for each that they may interfere the least with each other.

Noon is the period generally speaking when the instrument and observers are most at liberty, and but for the effect of the sun's rays on the metals composing the former, the solar transit would be far preferable to any other method: the transit of a well-known star is free from the last evil, but liable to encroach on hours which it may be and often is desirable to occupy in other purposes; both these methods it will be remarked require that the deviation of the plane of the instrument from the meridian in azimuth should be known, but we may dispense with the term expressing that deviation by observing two well-known stars, though at the same time we increase the evil of encroachment on hours required for other business.

Though these subjects are sufficiently familiar to astronomers, yet it would not accord with the principle I have laid down for my guidance to abstain from considering their bearings on the present case, and to begin I will remark that prior to commencing any regular set of observations, the azimuth of the lamp is or ought to be known to within 10″ of the truth, and that after the first set of observations, the two nearest maximum position on opposite faces will certainly give that azimuth to within 3″ or probably much nearer without any correction.

It would seem superfluous to say more on a subject so well known; my manuscript instructions having been drawn up for the use of my subordinates whom I had to train to their duty, are of course essentially didactic; and so copious, and descend into such a world of minutiæ, that it is difficult for me to say when to stop in my extracts from them without either incurring the imputation of acting the pedagogue or leaving my methods unexplained, to both which charges I fear I must unavoidably be more or less open.

It is necessary to advert to some slight alterations which have been introduced into the computations of heights of stations and the forms in which the results are arranged



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in the present volume. It is sufficiently known that if $\gamma'$ be the right line drawn from $B$, the lower of two stations, to a point normally below $A$, the higher, at equal height with $B$; $\gamma$ be the corresponding chord at the level of the sea; $r$ the mean radius; $D, D'$ the two angles of depression in vacuo; $H$ the height of $B$; and $h$ the difference of height between $A$ and $B$; then

$$h=\gamma'\cdot\frac{\sin\frac{1}{2}\cdot(D-D')}{\cos D}$$

Now if $\gamma'=\gamma+\delta\gamma$; then

$$r : r+H :: \gamma : \gamma+\delta\gamma$$

Or

$$r : H :: \gamma : \delta\gamma=\gamma\cdot\frac{H}{r}$$

But $\gamma=\varpi-\frac{\varpi^3}{2^3.3.r^2}$ &c., $\varpi$ being the geodetic line given in the triangle sheets

$$\therefore h=\left(\varpi-\frac{\varpi^3}{2^3.3r^2}+\frac{\varpi}{r}\cdot H\right)\cdot\frac{\sin\frac{1}{2}(D-D')}{\cos D}=\varpi\cdot\left(1-\frac{\varpi^2}{2^3.3r^2}+\frac{H}{r}\right)\cdot\frac{\sin\frac{1}{2}(D-D')}{\cos D}$$

Whence

$$Lh=L\varpi+L\sin\tfrac{1}{2}(D-D')-L\cos D+M\cdot\left\{\frac{H}{r}-\frac{\varpi^2}{2^3.3r^2}\right\}$$

$M$ being the usual term 0·4342944819, &c.

Hence it appears that the terms which are most needed are not the natural numbers of the sides in feet but the common logarithms of those sides, and as the latter are quite as available as the former, they have been inserted in column 5th in lieu thereof, the next column being appropriated to the small logarithmic increments of the last-mentioned equation, in which particulars consist the alterations of form above spoken of.

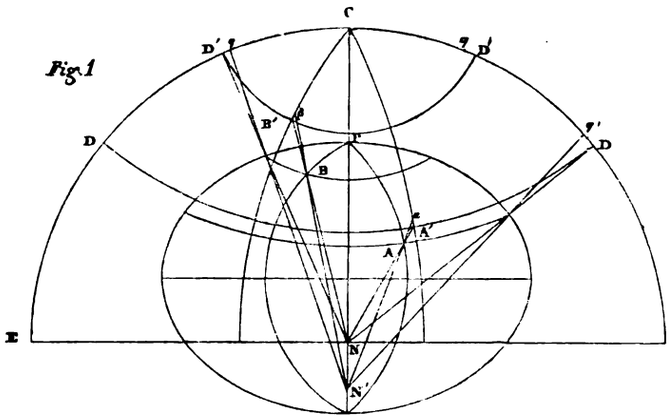
Of the formulæ used in deducing latitudes and longitudes in this series of operations it is not necessary that I should speak much at large, for the subject has been so ably discussed by M. De Lambre and other celebrated mathematicians, and latterly by M. Puissant, that little remains for me to say; as however it has necessarily devolved on me to investigate this question, in order to render it clearer by placing it in new points of view, it is but proper that I should explain the principles which have served as my guide.

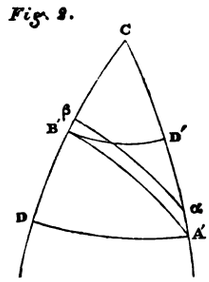
The triangles have all been computed on the theorem of M. Legendre, and each side in succession when employed in these deductions has been designated by the characteristic $\varpi$.

The fixed station of the side whose elements of position are supposed to be known, has been called $A$, and the opposite limit of the same side, or that of which the elements are sought, has been denominated $B$; the azimuths, in accordance with the system employed by continental geodists, have all been considered as originating in the

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south and proceeding round by the west, and each bears the characteristic letter of the station to which it is supposed to appertain.




If $A$, $B$, be two points on the surface of an ellipsoid of revolution, supposed to be mutually visible from each other, and the normals to the minor axis $AN$, $BN'$, be drawn, these lines if produced outwards will always be directed to the zeniths of those points; but if an observer at $A$ direct his telescope towards $B$, the two lines $AN$, $AB$,* will define the vertical plane of his instrument, and consequently if $B$ and $N$ be joined by a straight line $BN$, the telescope in the process of depression or elevation will always be directed to some point either in that line or its production; and similarly if an observer at $B$ direct his telescope to $A$, and the line $AN'$ be drawn, the telescope as it is depressed or raised will always have on its wires some point of that line or its production.

The zeniths of all places on the earth's surface being at an infinite distance, if an observer at $A$ desires to direct his telescope to the zenith of $B$, it is plain that he must make his instrument rotate in azimuth until the trace made by its vertical plane on the plane of the meridian of $B$ becomes parallel to the normal $N'B$; for though in that case, when the telescope is again depressed to the surface, the point $B$ will not be on the wires, but some other point as† $\beta'$ on the same meridian with it will be intersected, yet the small arc $B\beta'$ so intercepted will be evanescent when compared with the radius of the celestial sphere, and the parallelism will *de facto* amount to coincidence.

If about the point $N$ a sphere be described with any convenient finite radius, and the normal $NA$ be produced outwards, it will meet the surface of this sphere in a point $A'$, which may be taken to denote the zenith of $A$, and when the vertical plane of the instrument at $A$ coincides with $NA$, $NB$, if the telescope be elevated it will meet the said sphere in a point $B'$; but $B'$ will not represent the place on the sphere of the

* The line $AB$ is omitted in the diagram to avoid confusion.

† The point $\beta'$ is omitted to avoid confusion but will easily be conceived in the figure by supposing a line $N\beta'$ drawn parallel to $N'B$.

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zenith of the point $B$, which may be denoted by the point $\beta$ where the normal $N'B$ produced meets its surface.

Similar considerations shew that when the observer is at $B$, the point* $\alpha$ where the line $N'A$ produced meets the sphere, is that which would be indicated, if whilst the vertical plane coincides with $BN'$, $BA$, the telescope be elevated.

If $P$ be the pole of the earth, and the axis defined by $N'NP$ be produced outwards, it will meet the supposed sphere in $C$, which will denote the corresponding position of the celestial pole, and a diameter drawn through $N$ perpendicular to the axis, will intersect the sphere at $E$, which will be the zero point referred to as the origin of all latitudes by an observer at $A$.

Hence if parallels of latitude be drawn through $A'$, $B'$, meeting the generating circle of the sphere described about the centre $N$, in the points $D$, $D'$; the arcs $ED$, $ED'$, will express the latitudes of $A$ and $B$, as they would exist on a sphere, and consequently as they stand related to each other by the ordinary principles of spherical trigonometry; so that in fact the arc $DD'$ expresses the difference of latitude between those two stations, which would be given by spherical computation; but this would differ from the true value by the quantity $D'q$, the point $q$ being that where a normal drawn from $N'$ would meet the sphere.

It is obvious that the plane of $PBN'$ or the meridian of $B$ produced, will make on the sphere the corresponding trace $C\beta B'$, and the plane of $PAN$ or the meridian of $A$ produced, will make on the sphere the trace $C\alpha A'$; hence within the limits legitimate to the present assumption, it is evident that the azimuth of $B$ observed at $A$, which bears the designation $A$, will be equivalent to $\pi - CA'B'$, and the back azimuth deduced by spherical computation, or that of $A$ observed from $B$, which bears the designation $B$, will be $\pi + C\beta\alpha$.†

To render these results more intelligible fig. 2 has been drawn, wherein $CA'B'$ is the spherical triangle corresponding to that in fig. 1; $A'D$, $B'D'$, are parts of two parallels of latitude, the point $B'$ being the higher latitude of the two, and $\beta$, $\alpha$, the points above adverted to; whence it will be seen that the back azimuth of $A$ as it would be observed at $B$, will if computed spherically, need a correction, because the angle of the spherical triangle $CB'A'$ is not the same as the angle $C\beta\alpha$, but‡ is less than it by a quantity not sensibly different from half the spherical excess of the minute quadrilateral formed by the points $A'$, $B'$, $\beta$, $\alpha$.

* It will not be lost sight of that the point $\alpha$ in the diagram is liable to the objection of being on the surface of a sphere described about $N$ as a centre whereas it ought properly to be on the surface of a sphere described about $N'$, but the discrepancy is more imaginary than real.

† The arc $\beta\alpha$ is omitted in fig. 1, but both this and the arc $B'A'$ are inserted in fig. 2.

‡ Let the spherical excess of the triangle $A'B'C = E$; that of the triangle $\alpha\beta C = E'$, and the difference of the two or the spherical excess of the quadrilateral $A'B'\beta\alpha = \delta E$; then as $A'+B'+C = \pi+E$, and $\alpha+\beta+C = \pi+E'$ therefore $A'-\alpha+B'-\beta = \delta E$; in which, on account of the minuteness of the terms under consideration, we cannot sensibly err by putting $(A'-\alpha)$, $(B'-\beta)$ each equal to $\frac{1}{2}\delta E$, the truth of which may be otherwise shewn by a more elaborate process.

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Since the position of the pole $P$ of the earth must correspond with that of the point $C$ on the sphere, and the meridians $PA$, $C\alpha A'$, lie in the same plane, as also $PB$, $C\beta B'$, therefore the arc of longitude deduced spherically from the triangle $CB'A'$ will need no correction.

The following characteristics have been adopted as apparently most suitable and convenient.

$a$.....the semi-major axis.
$b$.....the semi-minor axis.
$e$.....the eccentricity.
$\lambda$.....the terrestrial latitude of the station given.
$\lambda'$.....the same term of the station sought.
$\Delta\lambda$.....the whole difference of latitude between $A$ and $B$.
$L$.....the longitude of the station given.
$L'$.....the same term of the station sought.
$\Delta L$.....the difference of longitude.
$r$.....the radius of curvature of the meridian
$\nu$.....the normal to the minor axis
} of the station given,

the two latter of which have the well known values

$$r=\frac{(1-e^2).a}{(1-e^2.\sin^2\lambda)^{\frac{3}{2}}};\quad \nu=\frac{a}{(1-e^2.\sin^2\lambda)^{\frac{1}{2}}}$$

$r'$.....the radius of curvature of the meridian
$\nu'$..... the normal to the minor axis
} of the station sought.

If the plane of the lines $AB$, $AN$, be conceived to pass through the ellipsoid, an elliptic section will thereby be made, whose normal to the minor axis is the line $AN$, which is thus in fact common to both the generating ellipse and the elliptic section at the point $A$; the radius of curvature of this oblique section at that point is denominated $\varrho$: similarly if a plane pass through $BA$, $BN'$, it will make an elliptic section whose radius of curvature at the point $B$ is designated $\varrho'$, and it can be shewn that the general expression for the value of this radius of curvature at $A$ is

$$\varrho=\frac{r.\nu}{r.\sin^2 A+\nu.\cos^2 A}$$

whence (as in the case of $A=90°$; $\varrho=\nu$) therefore the normal to the minor axis is also the radius of curvature to the arc perpendicular to the meridian at $A$.

It will not escape notice that from these considerations there are obviously two distinct elliptic traces on the ellipsoid between $A$ and $B$, the one formed by the plane defined by $AB$, $AN$; and the other by that defined by $BA$, $BN'$; of which the former (because $\lambda<\lambda'$ by construction) will in its whole course from $A$ to $B$ lie nearer the equator than the latter; whence it is evident that neither of these traces can be the shortest line that can be drawn from $A$ to $B$ on the surface of the ellipsoid, which may be thus defined. The celestial zeniths of $A$ and $B$ being supposed to be joined by a circular arc, from all points of that arc let lines be drawn which shall be perpendicular to the



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surface of the terrestrial ellipsoid of revolution, then the line drawn through the points where the said perpendiculars meet the surface will be the shortest line which can be drawn whether from $A$ to $B$ or from $B$ to $A$, and will obviously be a curve of double curvature lying in the small segment comprehended between the two oblique elliptic curves: of this nature are obviously all lines measured with compensation bars when the two limits are of equal height, for the position of the boning instrument, as has already been said, is wherever practicable advanced after each measurement of 126 feet, on all which occasions the normal of the spot is referred to for adjustment.

It is obvious that to determine the elements of the station $B$ from those of $A$ supposed to be given, there are required, besides the latitude of $A$ and the azimuth of $B$ observed from $A$, the corresponding angle which is measured by the arc between the zeniths of those two places: that angle is usually obtained by dividing the side $\varpi$ by the normal at $A$, a method which plainly gives only an approximate value* and cannot be used beyond certain limits without giving rise to larger errors than are admissible, but in the series of operations of which I am treating, the sides have in no case been of sufficient extent to cause such apprehension, and therefore I have adopted it without scruple in the manner which I will now proceed to describe.

In the triangle $A'B'C$ (vide fig. 2) the fundamental theorem of spherical trigonometry to radius unity is

$$cos\ a = cos\ b\ .\ cos\ c + cos\ A'.\ sin\ b\ .\ sin\ c$$

wherein
$$A' = (\pi - A);\ a = \left(\frac{\pi}{2} - \lambda'\right);\ b = \left(\frac{\pi}{2} - \lambda\right);\ c = \left(\frac{\varpi}{\nu}\right)$$

$$\therefore sin\ \lambda' = sin\ \lambda\ .\ cos\left(\frac{\varpi}{\nu}\right) - cos\ A\ .\ cos\ \lambda\ .\ sin\left(\frac{\varpi}{\nu}\right)$$

This if expanded and arranged according to the powers of $\lambda'$ and $\left(\frac{\varpi}{\nu}\right)$, will give

* The normal is as is well known the longest line which can be drawn from any point in the minor axis to the periphery of the ellipse, for $x$, $y$, being the co-ordinates of any point on the periphery referred to the major and minor axis, and to the centre as an origin, and $c$ the given distance $CN$ from the centre to the point $N$, it is plain that

$$1st\ (c+y)^2 + x^2 \text{ is a maximum; and } 2nd\ x^2 = \frac{a^2}{b^2} \cdot (b^2 - y^2)$$

whence by differentiating there results, $(c+y) : y :: a^2 : b^2$, which is the known property of the normal.

If $n$ be any other line drawn from $N$ to the surface, as $NB$ for example, it can be shewn that the difference is

$$\nu - n = e^2\,\nu \cdot \frac{\Delta\lambda^2}{2} \cdot \begin{cases} cos\ ^2\lambda - e^2.\ cos\ ^2\lambda\ .\ cos\ 2\lambda - \frac{e^4}{4}\ sin^2\ 2\lambda\ .\ (3\ .\ cos\ ^2\lambda - 1) \\ -sin\ 2\lambda\ .\ (1 - e^2.\ (5\ .\ cos\ ^2\lambda - 1)) \cdot \frac{\Delta\lambda}{2} \\ +(3 - 7\ .\ cos\ ^2\lambda) \cdot \frac{\Delta\lambda^2}{3.4} \\ \quad \&c. \qquad \&c. \qquad \&c. \end{cases}$$

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$$\lambda' - \frac{\lambda'^3}{2.3} + \frac{\lambda'^5}{2.3.4.5} - \frac{\lambda'^7}{2.3.4.5.6.7} \text{ \&c.} = \sin\lambda - \cos A \,.\, \cos\lambda \cdot \left(\frac{\varpi}{\nu}\right) - \frac{\sin\lambda}{2} \cdot \left(\frac{\varpi^2}{\nu^2}\right) + \frac{\cos A \,.\, \cos\lambda}{2.3} \cdot \left(\frac{\varpi^3}{\nu^3}\right) \text{ \&c.,}$$

and if we now assume

$$\lambda' = \alpha + \beta \cdot \left(\frac{\varpi}{\nu}\right) + \gamma \cdot \left(\frac{\varpi^2}{\nu^2}\right) + \varepsilon \cdot \left(\frac{\varpi^3}{\nu^3}\right) \text{ \&c.}$$

it will be seen that

$$\alpha - \frac{\alpha^3}{2.3} + \frac{\alpha^5}{2.3.4.5} - \frac{\alpha^7}{2.3.4.5.6.7} \text{ \&c.} = \sin\lambda, \text{ or } \lambda = \alpha;$$

and similarly the other co-efficients will be deduced in series as follows:

$$\beta = -\cos A$$

$$\gamma = -\tfrac{1}{2} \tan\lambda \,.\, \sin^2 A$$

$$\varepsilon = \frac{\sin A \,.\, \sin 2A}{4} \cdot \frac{1 + 3 \,.\, \tan^2\lambda}{3}$$

whence if $\Delta\lambda$ be put for the difference of latitude determined spherically, we shall obtain for the value on a sphere whose radius is unity

$$\Delta\lambda = \left\{ -\cos A \cdot \left(\frac{\varpi}{\nu}\right) - \frac{\tan\lambda \,.\, \sin^2 A}{2} \cdot \left(\frac{\varpi^2}{\nu^2}\right) + \frac{\sin A \,.\, \sin 2A \,.\, (1 + 3\tan^2\lambda)}{3.4} \cdot \left(\frac{\varpi^3}{\nu^3}\right) \text{ \&c.} \right\}$$

so that if $s$ be the corresponding length of this arc measured on a sphere whose radius is $\nu$, the said length will be

$$s = \left\{ -\cos A \,.\, \varpi - \frac{\tan\lambda \,.\, \sin^2 A}{2} \cdot \frac{\varpi^2}{\nu} + \frac{\sin A \,.\, \sin 2A \,.\, (1 + 3\tan^2\lambda)}{3.4} \cdot \frac{\varpi^3}{\nu^2} \text{ \&c.} \right\}$$

If it were admissible to consider the elliptic arc as part of a circle, the length $s$ so found would if divided by the radius of curvature at $D$ and reduced to seconds, give the corresponding value of $\Delta\lambda$, but this radius of curvature whose value is $r$ at $D$, is a function of $\lambda$, and therefore variable as $\lambda$ varies, whence that hypothesis cannot be allowed.

Suppose $S$ to represent the measure in feet, fathoms, or other linear denomination, of an arc of the meridian extending from the equator to the parallel of $\lambda$; then as $\lambda = f(S)$, if $S$ becomes $(S+s)$ and $\lambda$ becomes $\lambda'$, we have for the terrestrial arc of amplitude the expression

$$\lambda' = \lambda + \left(\frac{d\lambda}{dS}\right) \cdot s + \left(\frac{d^2\lambda}{dS^2}\right) \cdot \frac{s^2}{2} + \left(\frac{d^3\lambda}{dS^3}\right) \cdot \frac{s^3}{2.3} + \left(\frac{d^4\lambda}{dS^4}\right) \cdot \frac{s^4}{2.3.4} \text{ \&c.}$$

Now as $r \,.\, d\lambda = dS$

$$\therefore \left(\frac{d\lambda}{dS}\right) = \frac{1}{r}$$

And similarly we shall find by substituting the known values of $r$ and $\nu$, that the other differential co-efficients have the following expressions

$$\left(\frac{d^2\lambda}{dS^2}\right) = -\frac{3\,e^2 \,.\, \sin 2\lambda}{2\,(1-e^2) \,.\, \nu \,.\, r}$$

$$\left(\frac{d^3\lambda}{dS^3}\right) = -\frac{3\,e^2 \,.\, \cos 2\lambda}{(1-e^2) \,.\, \nu \,.\, r^2} + \frac{3\,e^4 \,.\, \sin^2 2\lambda}{(1-e^2)^2 \,.\, r \,.\, \nu^2}$$

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$$\left(\frac{d^4\lambda}{dS^4}\right)=\frac{2\,.\,3\,.\,e^2.\,sin\,2\lambda}{(1-e^2)\,.\,r^3.\,\nu}+\frac{3\,.\,3\,.\,5\,.\,e^4.\,sin\,4\lambda}{2\,.\,2\,.\,(1-e^2)^2.\,r^3.\,\nu^3}-\frac{3\,.\,5\,.\,e^6.\,sin^3\,2\lambda}{2\,.\,(1-e^2)^3.\,r\,.\,\nu^3}$$

&c. &c. &c.

but as it has been assumed as a rule in these operations to take as a limit the 3rd order of minute terms, therefore this will be reduced to

$$\lambda'=\lambda+\frac{1}{r}s-\frac{3\,e^2.\,sin\,2\lambda}{2\,.\,2\,(1-e^2)\,.\,\nu\,.\,r}\cdot s^2-\frac{3\,e^2.\,cos\,2\lambda}{2\,.\,3\,(1-e^2)\,r^2.\,\nu}\cdot s^3\ \&c.$$

in which series if we substitute for $s$ the value in linear dimensions of the deduced arc of latitude, we shall obtain the true terrestrial arc between $A$ and $B$ corresponding to the celestial arc of the meridian between the parallels of those places, so that omitting all terms more transcendental than the 3rd order, the true value of $\Delta\lambda$ or the difference of latitude in seconds of a great circle will be expressed by

$$\Delta\lambda=\left\{\begin{aligned}&-\left(\frac{\varpi}{r}\right)\cdot cos\,A\,.\,cosec\,1''\\&-\left(\frac{\varpi^2}{r.\,\nu}\right)\cdot\frac{tan\,\lambda\,.\,sin^2A}{2}\cdot cosec\,1''\\&-\left(\frac{\varpi^2}{r.\,\nu}\right)\cdot\frac{3\,.\,e^2.\,sin\,2\lambda\,.\,cos^2A}{4}\cdot cosec\,1''\\&+\left(\frac{\varpi^3}{r.\,\nu^2}\right)\cdot\frac{(1+3\,.\,tan^2\lambda)}{2.3}\cdot sin^2A\,.\,cos\,A\,.\,cosec\,1''\end{aligned}\right\}\text{No. 1.}$$

the difference between which and the term $\Delta\lambda$ above deduced by spherical computation, will be the small arc $D'q$ corresponding to the terrestrial meridional distance $B'\beta$, which difference let be called $\delta\lambda$; then $\delta\lambda$ will measure the angle at $B$ between the lines $BN$, $BN'$, and on the surface of a sphere in terms of radius unity, its value will have the following expression—

$$\delta\lambda=\left\{-cos\,A\cdot\left(\frac{\varpi}{r}-\frac{\varpi}{\nu}\right)-\frac{tan\,\lambda\,.\,sin^2A}{2}\cdot\left(\frac{\varpi}{\nu}\right)\cdot\left(\frac{\varpi}{r}-\frac{\varpi}{\nu}\right)\ \&c.\right\}$$

which if it be limited to the first term will be reduced to

$$\delta\lambda=-cos\,A\cdot\left(\frac{\varpi}{r}-\frac{\varpi}{\nu}\right)=-\frac{e^2.\,cos^2\lambda}{(1-e^2)}\cdot\left(\frac{\varpi}{\nu}\right)\cdot cos\,A$$

To deduce the back azimuth or the azimuth of $A$ as it would appear to an observer at $B$, which as has already been shewn, is equivalent to $\pi+C\beta\alpha$, we must employ the following well known fundamental theorem of the spherical triangle $A'B'C$

$$tan\,B'=\frac{sin\,A'}{cot\,b\,.\,sin\,c-cos\,A'.\,cos\,c}$$

which substituting therein the values

$$A'=\pi-A;\ b=\left(\frac{\pi}{2}-\lambda\right);\ c=\left(\frac{\varpi}{\nu}\right)$$

becomes transformed to

$$tan\,B'=tan\,A\cdot\left\{cos\left(\frac{\varpi}{\nu}\right)+\frac{tan\,\lambda}{cos\,A}\cdot sin\left(\frac{\varpi}{\nu}\right)\right\}^{-1}$$

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and if this be now expanded and arranged according to the powers of $B'$ and $\left(\frac{\varpi}{\nu}\right)$, there results the following equation for $B'$ in terms of radius unity:

$$B'+\frac{B'^3}{3}+\frac{2.B'^5}{3.5}\,\&c.=tan\,A-\frac{tan\,A\,.\,tan\,\lambda}{cos\,A}\cdot\left(\frac{\varpi}{\nu}\right)+\left\{\frac{tan\,A}{2}+\frac{tan\,A\,.\,tan^2\lambda}{cos^2A}\right\}\cdot\left(\frac{\varpi^2}{\nu^2}\right)-\left\{\frac{5\,tan\,A\,.\,tan\,\lambda}{2.3\,cos\,A}+\frac{tan\,A\,.\,tan^3\lambda}{cos^3A}\right\}\cdot\left(\frac{\varpi^3}{\nu^3}\right)\&c.$$

and if we now assume the value of $B'$ in a series of powers of $\left(\frac{\varpi}{\nu}\right)$ with unknown coefficients such as

$$B'=\alpha+\beta\cdot\left(\frac{\varpi}{\nu}\right)+\gamma\cdot\left(\frac{\varpi^2}{\nu^2}\right)+\varepsilon\cdot\left(\frac{\varpi^3}{\nu^3}\right)\,\&c.$$

there will result

$tan\,\alpha=tan\,A$, whence $\alpha=A=\pi+A$;

$\beta=-sin\,A\,.\,tan\,\lambda$;

$$\gamma=sin\,2A\cdot\frac{1+2\,.\,tan^2\lambda}{4}$$

$$\varepsilon=\left\{-\left(\frac{5}{2.3}+tan^2\lambda\right)\cdot\frac{tan\,\lambda}{2}\cdot sin\,2A\,.\,cos\,A+\frac{1+2\,.\,tan^2\lambda}{2}\cdot\frac{tan\,\lambda}{3}\cdot sin^3A\right\}$$

uniting which terms and keeping in mind that $B=\pi+B'$, there results for the back azimuth of $A$ observed from $B$ computed spherically, in seconds of a great circle

$$=+A+\left\{-tan\lambda\,.\,sin\,A\cdot\left(\frac{\varpi}{\nu}\right)+\frac{1+2\,.\,tan^2\lambda}{4}\cdot sin\,2A\cdot\left(\frac{\varpi^2}{\nu^2}\right)+\left[-\left(\frac{5}{6}+tan^2\lambda\right)\cdot\frac{tan\,\lambda}{2}\cdot sin\,2A\,.\,cos\,A+\frac{1+2\,.\,tan^2\lambda}{2}\cdot\frac{tan\,\lambda}{3}\cdot sin^3A\right]\cdot\left(\frac{\varpi^3}{\nu^3}\right)\right\}cosec\,1''$$

which value, when corrected by subtracting from it half the spherical excess of the quadrilateral $A'B'\beta\alpha$ as before mentioned, will be the true back azimuth $\pi+C\beta\alpha$ of the point $A$ as it would be observed at $B$.

The spherical excess of the quadrilateral in question, expressed in seconds of a great circle and limited to the 3rd order of transcendental terms is obviously

$$\left(\frac{\varpi}{\nu}\right)\cdot sin\,B'\,.\,\delta\lambda\,.\,cosec\,1''$$

which substituting for $\delta\lambda$ its value already given, will become

$$-\frac{e^2\,.\,cos^2\lambda}{(1-e^2)}\cdot sin\,B'\,.\,cos\,A\cdot\left(\frac{\varpi^2}{\nu^2}\right)\cdot cosec\,1''$$

but within the limits already adopted with regard to transcendental terms, $sin\,A$ may be further substituted for $sin\,B'$, and if we now put $\varepsilon$ for half the spherical excess of the quadrilateral, it will appear that the term to be applied to the value of the back azimuth spherically deduced is

$$-\varepsilon=\frac{e^2\,.\,cos^2\lambda}{4\,.\,(1-e^2)}\cdot sin\,2A\cdot\left(\frac{\varpi^2}{\nu^2}\right)\cdot cosec\,1''$$

which will combine conveniently with the second term of the series above deduced spherically, making that term

$$\frac{1}{4}\cdot\left\{1+2\,.\,tan^2\lambda+\frac{e^2\,.\,cos^2\lambda}{1-e^2}\right\}\cdot sin\,2A\cdot\left(\frac{\varpi^2}{\nu^2}\right)$$



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so that the formula for the azimuth of $A$ as it would appear to an observer at $B$, or the back azimuth as it is called, is as follows:—

$$B=\pi+A+\left\{\begin{array}{l} -tan\,\lambda\,.\,sin\,A\cdot\left(\frac{\varpi}{\nu}\right)\cdot cosec\,1'' \\ +\frac{1}{4}\left\{1+2\cdot tan^2\lambda+\frac{e^2.\,cos^2\lambda}{1-e^2}\right\}\cdot sin\,2A\cdot\left(\frac{\varpi^2}{\nu^2}\right)\cdot cosec\,1'' \\ -\left(\frac{5}{6}+tan^2\lambda\right)\cdot\frac{tan\,\lambda}{2}\cdot sin\,2A\,.\,cos\,A\cdot\left(\frac{\varpi^3}{\nu^3}\right)\cdot cosec\,1'' \\ +\left(\frac{1+2\,.\,tan^2\lambda}{2}\right)\cdot\frac{tan\,\lambda}{3}\cdot sin^3A\cdot\left(\frac{\varpi^3}{\nu^3}\right)\cdot cosec\,1'' \end{array}\right\}\text{No. 3.}$$

To determine the difference of longitude between $A$ and $B$ or $\Delta L$, represented by the angle at $C$ between the planes of the meridians of those two points, we must employ the fundamental formula of spherical trigonometry

$$tan\,C=\frac{sin\,A'}{cot\,c\,.\,sin\,b-cos\,A'.\,cos\,b}$$

which, substituting as before for $A'$ its value $(\pi-A)$, for $c$ its value $\left(\frac{\varpi}{\nu}\right)$, and for $b$ its value $\left(\frac{\pi}{2}-\lambda\right)$, becomes

$$tan\,C=\frac{sin\,A}{cos\,\lambda+cos\,A\,.\,sin\,\lambda\,.\,tan\left(\frac{\varpi}{\nu}\right)}\cdot tan\left(\frac{\varpi}{\nu}\right);$$

or which is the same thing

$$tan\,C=\frac{sin\,A}{cos\,\lambda}\cdot\left(1+cos\,A\,.\,tan\,\lambda\,.\,tan\left(\frac{\varpi}{\nu}\right)\right)^{-1}\cdot tan\left(\frac{\varpi}{\nu}\right)$$

expanding which and arranging the terms according to the powers of $C$ and $\left(\frac{\varpi}{\nu}\right)$, there results

$$C+\frac{C^3}{3}+\&c.=\frac{sin\,A}{cos\,\lambda}\cdot\left(\frac{\varpi}{\nu}\right)-\frac{sin\,A\,.\,cos\,A\,.\,tan\,\lambda}{cos\,\lambda}\cdot\left(\frac{\varpi^2}{\nu^2}\right)+\left\{\frac{sin\,A}{3\,.\,cos\,\lambda}+\frac{sin\,A\,.\,cos^2A\,.\,tan^2\lambda}{cos\,\lambda}\right\}\cdot\left(\frac{\varpi^3}{\nu^3}\right)\&c.$$

in which as before assuming $C$ in a series of powers of $\left(\frac{\varpi}{\nu}\right)$ such that

$$C=\beta\cdot\left(\frac{\varpi}{\nu}\right)+\gamma\cdot\left(\frac{\varpi^2}{\nu^2}\right)+\varepsilon\cdot\left(\frac{\varpi^3}{\nu^3}\right)\&c.$$

there results

$$\beta=\frac{sin\,A}{cos\,\lambda}$$

$$\gamma=-\frac{1}{2}\cdot\frac{tan\,\lambda}{cos\,\lambda}\cdot sin\,2A$$

$$\varepsilon=\frac{(1+3\,.\,tan^2\lambda)\,.\,sin\,A\,.\,cos^2A}{3\,.\,cos\,\lambda}-\frac{tan^2\lambda}{3\,.\,cos\,\lambda}\cdot sin^3A$$

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which values being by hypothesis positive for west longitude, will be negative for east longitude, and consequently the value of $\Delta L$ in east longitude in seconds of a great circle will be

$$\Delta L = \left\{ \begin{array}{l} -sec\,\lambda \,.\, sin\,A \cdot \left(\frac{\varpi}{\nu}\right) \cdot cosec\,1'' \\ +\frac{tan\,\lambda \,.\, sec\,\lambda}{2} \cdot sin\,2A \cdot \left(\frac{\varpi^2}{\nu^2}\right) \cdot cosec\,1'' \\ -\frac{(1+3\,tan^2\lambda) \,.\, sec\,\lambda}{2\,.\,3} \cdot sin\,2A \cdot cos\,A \cdot \left(\frac{\varpi^3}{\nu^3}\right) \cdot cosec\,1'' \\ +\frac{tan^2\lambda \,.\, sec\,\lambda}{3} \cdot sin^3 A \cdot \left(\frac{\varpi^3}{\nu^3}\right) \cdot cosec\,1'' \end{array} \right\} \text{No. 2.}$$

The stations $A$ and $B$ have hitherto been supposed to be both at, or equally elevated above, the surface of the aqueous ellipsoid, but as that rarely occurs in reality, therefore it is necessary to investigate the effects of a difference of height upon the formulæ above given.

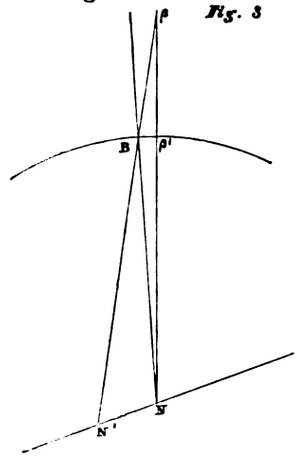


Fig. 3

To this end let the station $B$, which has the higher latitude, be more elevated than $A$ by the quantity $h$; then if $\beta$ (*vide* fig. 3) denote the elevated site, that point will be in the production of the normal $N'B$, and if $N\beta$, $NB$ be drawn, the former cutting the terrestrial meridian of $B$ or $\beta$ in $\beta'$, the line $N\beta'\beta$ will be the trace of the vertical plane of the instrument of an observer at $A$ on the plane thereof when directed to the former, and $NB$ the trace when directed to the latter point; the part $B\beta'$ intercepted between those two traces, which is the reduction to the surface, is therefore to be subtracted from the latitude of $B$ deduced spherically.

Because of the right angle at $B$ it is plain that $B\beta' = h \,.\, tan\,\beta$:
but in the triangle $\beta N N'$

$$\angle\, \beta N N' = \pi - (\beta N' N + \beta)$$

which because $\beta N' N = \left(\frac{\pi}{2} - \lambda'\right)$ becomes

$$\angle\, \beta N N' = \frac{\pi}{2} + (\lambda' - \beta)$$

The value of $NN'$ is known to be expressed by $e^2 \,.\, (\nu' \,.\, sin\,\lambda' - \nu \,.\, sin\,\lambda)$ and if this be designated by $m$, there will result

(because $N'\beta = (\nu' + h)$ and $sin\,\beta N N' = cos\,(\lambda' - \beta) = cos\,\lambda' \,.\, cos\,\beta + sin\,\lambda' \,.\, sin\,\beta$)

$$(\nu' + h) \,.\, sin\,\beta = m \,.\, cos\,\lambda' \,.\, cos\,\beta + m \,.\, sin\,\lambda' \,.\, sin\,\beta$$

$$\therefore tan\,\beta \cdot \left(1 - \frac{m \,.\, sin\,\lambda'}{\nu' + h}\right) = \frac{m}{\nu' + h} \cdot cos\,\lambda'$$

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whence

$$tan\,\beta=\frac{m}{\nu'+h}\cdot cos\,\lambda'+\frac{m^2}{2\,.\,(\nu'+h)^2}\cdot sin\,2\lambda'\ \&c.$$

$$\therefore B\,\beta'=h\cdot\left(\frac{m}{\nu'+h}\cdot cos\,\lambda'+\frac{m^2}{2.(\nu'+h)^2}\cdot sin\,2\lambda'\right)$$

and hence the value of this portion of the meridian in latitude in parts of radius unity will be

$$\frac{B\,\beta'}{r'}=\frac{h}{r'}\cdot\left(\frac{m}{\nu'+h}\cdot cos\,\lambda'+\frac{m^2}{2\,.\,(\nu'+h)^2}\cdot sin\,2\lambda'\right)$$

which omitting all transcendental terms of a higher order than the 3rd is reduced to

$$*\ \frac{B\,\beta'}{r'}=\frac{h}{r}e^2.\,cos^2\lambda\,.\,\Delta\lambda$$

which, substituting the 1st term of the series for $\Delta\lambda$, becomes

$$\frac{B\,\beta'}{r'}=-\frac{h}{r}\cdot e^2.\,cos^2\lambda\,.\,cos\,A\cdot\left(\frac{\varpi}{\nu}\right).$$

The effect of this element on the azimuth of $B$ observed at $A$ may be thus estimated.

* To shew the nature of the terms rejected in this conclusion, it may not be out of place to explain the progressive steps by which it is arrived at.

1st. Considering $(r)^{-1}$ as a function of $\lambda$ which becomes

$$(r')^{-1}\text{ when }\lambda\text{ becomes }\lambda'=\lambda+\Delta\lambda;$$

there results from expansion by the theorem of Dr. Brooke Taylor

1st. $$\frac{1}{r'}=\frac{1}{r}\cdot r\cdot(r')^{-1}=\frac{1}{r}\cdot\left\{1+r\cdot\left(\left(\frac{dr^{-1}}{d\lambda}\right)\cdot\Delta\lambda+\left(\frac{d^2r^{-1}}{d\lambda^2}\right)\cdot\frac{\Delta\lambda^2}{2}\ \&c.\right)\right\}=\frac{1}{r}\cdot\left(1-\frac{3\,e^2\,\nu^2}{2\,a^2}\cdot sin\,2\lambda\,.\,\Delta\lambda\ \&c.\right)$$

which within the prescribed limits obviously becomes $\frac{1}{r}$, because the rejected term being already of the 3rd order of transcendentals will be beyond that order when multiplied by $m$:

$$\therefore\frac{B\beta'}{r'}=\frac{h}{r}\cdot\left(\frac{m}{\nu'+h}\cdot cos\,\lambda'+\frac{m^2}{2\,.\,(\nu'+h)^2}\cdot sin\,2\lambda'\ \&c.\right)$$

2nd. $$m=e^2.\,\nu'.\,sin\,\lambda'\cdot\left\{1-\frac{\nu\,.\,sin\,\lambda}{\nu'.\,sin\,\lambda'}\right\}$$

which expanded, in like manner becomes

$$e^2\,\nu'.\,sin\,\lambda'\cdot\left\{1-\nu\,.\,sin\,\lambda\cdot\left[(\nu\,.\,sin\,\lambda)^{-1}+\frac{d\,(\nu\,.\,sin\,\lambda)^{-1}}{d\,\lambda}\cdot\Delta\lambda+\frac{d^2\,(\nu\,.\,sin\,\lambda)^{-1}}{d\lambda^2}\cdot\frac{\Delta\lambda^2}{2}\ \&c.\right]\right\}$$

$$\therefore m=e^2.\,\nu'.\,sin\,\lambda'\cdot\left\{cot\,\lambda\cdot\frac{\nu^2}{a^2}\cdot\Delta\lambda-\left(\frac{1+cos^2\lambda}{sin^2\lambda}+e^2\right)\cdot\frac{\Delta\lambda^2}{2}\&c.\right\}$$

and $$\frac{m}{\nu'+h}=e^2.\,sin\,\lambda'\cdot\left\{cot\,\lambda\cdot\frac{\nu^2}{a^2}\cdot\Delta\lambda\right\}\cdot\left(1-\frac{h}{\nu'}\right)$$

wherein as $\frac{m^2}{2\,.\,(\nu'+h)}$ is obviously rejectaneous, as well as the terms multiplied by $\frac{h}{\nu'}$.

$$\therefore\frac{B\beta'}{r'}=\frac{h}{r}e^2.\,cos^2\lambda\,.\,\Delta\lambda\text{ only.}$$

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In the fundamental theorem of spherical trigonometry (*vide* fig. 2)

$$\sin C \,.\, \cot A' = \cot a \,.\, \sin b - \cos C \,.\, \cos b$$

if for $A'$ be substituted the observed azimuth $A$ or its equivalent $(\pi - A')$ there will result

$$-\sin C \,.\, \cot A = \cot a \,.\, \sin b - \cos C \,.\, \cos b$$

which differentiated with respect to $A$ and $a$ ($C$ and $b$ constant), and divided by $\sin C$, will give

$$dA = -\frac{\sin b \,.\, \sin^2 A}{\sin C \,.\, \sin^2 a} \cdot da = -\frac{\sin B'}{\sin c} \cdot da$$

Now $da$ in terms of radius unity is in truth no other than the term $\frac{B\beta'}{r'}$ above given, therefore if for $C$ its equal $\left(\frac{\varpi}{\nu}\right)$ be substituted there results

$$dA = \frac{h}{r} \cdot e^2 \,.\, \cos^2 \lambda \,.\, \cos A \,.\, \sin B'$$

which as $B'$ is nearly equal to $A$ becomes in seconds of a great circle

$$dA = \frac{h}{2r} e^2 \,.\, \cos^2 \lambda \,.\, \sin 2A \,.\, \operatorname{cosec} 1''$$

which quantity called the reduction to the surface is additive to the azimuth of $B$ as it would appear to an observer at $A$ whenever $\sin 2A$ and $h$ are both positive; in all ordinary cases this term may be safely neglected, but when $h$ is of large amount as in the case of some of the loftier peaks of the Himalaya mountains, it may be of sufficient importance to deserve notice—if for example $\lambda = 30°$; $h = 4{,}000$ feet; $A = 45°$; then the correction will amount to nearly $\frac{1}{10}$ of a second.

It may doubtless be objected to the foregoing methods that the principle of obtaining the arc between the zeniths of $A$ and $B$, by making the normal of the place of observation the divisor of the terrestrial arc $\varpi$, involves a contradiction, because there must on that principle be two values for the said arc; one arising from using the normal at $A$, and another from the employment of the normal at $B$, but this objection is slight in comparison with others of a more serious nature, which it is hopeless to expect to overcome, the chief of which is that the dimensions and figure of the earth are not known to a degree of accuracy sufficient to correspond with the extreme minutiæ of which computation is susceptible, and there is very little reason to expect that if they were known, the divers portions of the globe would exhibit that extreme consistency of form which alone is adapted to answer the purpose of the rigorous analysis of the mathematician.

Hence in every given arc, whatever be the values assumed of $a$, $e^2$, we may be very well assured that the deduced latitudes of the limits will not agree to mathematical accuracy with those derived from observation, and as the latter if made with extreme



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care must after all be the test of truth, some method must be resorted to of dispersing the discrepancy which the comparison makes palpable. The plan which I have resorted to may be described as follows.

Let $\Delta\lambda$ be the whole observed arc of amplitude, $\Delta'\lambda=\Delta\lambda+\delta\lambda$ the analogous term derived from computation, and $\underset{(i)}{\Delta'}\lambda=\underset{(i)}{\Delta}\lambda+\underset{(i)}{\delta}\lambda$ that of any intermediate station deduced similarly with $\Delta'\lambda$; then the reduction for the intermediate station if calculated by direct proportion, is manifestly $\underset{(i)}{\delta}\lambda=\frac{\underset{(i)}{\Delta'}\lambda}{\Delta'\lambda}\cdot\delta\lambda$: this seems the simplest mode of dispersion, and in the imperfection of our knowledge perhaps leads to results as accurate as any more elaborate process could enable us to effect.

There are evidently no analogous data for correcting arcs of longitude, nor can any be hoped for until in the progress of science, means of measuring arcs of longitude, more susceptible of accuracy than any hitherto employed, shall be available; the principles of the electric telegraph seem to hold out the best hopes of realization of such a prospect; and when as knowledge advances, this principle becomes universally extended, there seems little reason to doubt that the difference of longitude between the limits of a chain of triangles running along a parallel of latitude may be determined to a small fraction of 1 second of time: with every precaution therefore we may perhaps hope eventually to measure such arcs to within $1\frac{1}{2}''$ of their true value, an error which dispersed over a space of 30° may be expected to give the value to within 50 feet of the truth, but I am wandering into dreams better suited to the rising than the setting generation.

Analogous to the foregoing method of dispersing the discrepancy between computed and observed terrestrial latitudes, is that employed in determining the correction to be applied to the whole meridional arc of any section on account of a similar discrepancy between the values derived from computation and measurement of a base of verification, such for example as the base of Dehra Dun, or the base near Beder in the Valley of the Manjera, each of which is in its own case verificatory of a series originating from the Seronj Base.

Let $S$ be the whole length in feet of the arc between the middle points of the base and its verificatory, and $\Sigma$ that of the arc between the corresponding stations at which observations to determine the celestial arc of amplitude were made; also let $B$ be the length of the verificatory from measurement, and $B-\eta$ that by computation; then $S\cdot\frac{B}{B-\eta}$ would be the length of the whole arc, if the verificatory had been used as the original element, and the mean value would be $S\cdot\frac{1}{2}\cdot\left(1+\frac{B}{B-\eta}\right)=S\cdot\left(1+\frac{\eta}{2B}\right)$ nearly, giving $\frac{S.\eta}{2B}$ for the correction additive to the smaller deduction or subtractive from the larger.

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Suppose that at each of the limits of the celestial arc of amplitude a base of the same length $B$ as the verificatory had been measured; then if $S'$ $S''$ be the meridional arcs intercepted between their middle points and that of the original base, and $B-\eta'$, $B-\eta''$, be the computed values of these bases, the errors if generated equably would be in like manner $\frac{S'\eta'}{2B}$, $\frac{S''\eta''}{2B}$, and the correction for $\Sigma$, which is the whole terrestrial arc corresponding to that given by celestial observation, would be expressed by

$$\frac{S''\eta''-S'\eta'}{2B} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

But by the hypothesis of the equable generation of errors

$$S : S' : S'' :: \eta : \eta' : \eta''$$

Whence

$$\eta'=\eta \cdot \frac{S'}{S} \text{ and } \eta''=\eta \cdot \frac{S''}{S}$$

which substituted in (1) will give for the correction

$$\frac{\eta}{2BS} \cdot (S''^2-S'^2)=\frac{\eta}{2BS} \cdot \Sigma \cdot (\Sigma+2S')=\frac{\eta.\Sigma^2}{2BS}+\frac{\eta.\Sigma S'}{BS}$$

a quantity which is additive to the terrestrial meridional value comprised between the limits of the celestial arc, when the measured base of verification exceeds that computed from the base used as the origin of computation.

In both the sections treated of in this volume the base measured at Seronj has been used as the original element of computation, and the base of Dehra Dun in one case, and that near Beder in the other have each in its turn been employed as verificatory, and as in both instances the measured value has exceeded that given by computation, therefore the corrections are both additive and as follows:

Correction to Arc Kalianpur—Kaliana..... + 13·080 feet
Ditto to Arc Kalianpur—Damargida..... + 9·296 feet

which are the corrections designated $\eta$.

The corrections +2·295 feet to the northern, and +2·578 feet to the southern of the two sections are due to the circumstance that as it was necessary to assume a determinate height above the sea level for the base at Seronj before the computations could be commenced on, the value thereof derived from the former operations of * Colonel Lambton and myself was employed by me for this purpose.

Those operations gave for the east end of the base at Seronj 1644·5 feet, but the

* Colonel Lambton's height of the station of Damargida above the sea, 2026·0 feet (*vide* General Report, vol. 6, p. 82) depends on a series of triangles brought from the sea coast near Cape Comorin, but the height of Damargida is also deducible from the Bombay Longitudinal Series, by Captain Jacob, (forming part 2nd, vol. 8 of the General Report), which likewise originates at the sea coast, but near Bombay, and is 1921·6 feet, shewing a difference of 104·4 feet, which would seem to indicate a further increase in the lengths of the terrestrial arcs.

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subsequent revision of 1838-9 which is probably more correct gives 1620 feet for the height of the same station, so that there is a difference of 24·5 feet between this and the former element of reduction, and as the computation was slightly affected thereby, it was thought better to differentiate for the proper correction, which though imperceptible in each individual side, becomes sensible when accumulated in the whole length of the arc, and amounts to the quantities above specified.

The principles upon which the latitudes and longitudes have been made to originate may be explained as follows:—The longitude of Damargida is derived by triangulation from the Madras Observatory as an origin, so that any error in the absolute geographical position of the latter will affect that of the former and all others depending on it.

The longitude of the Madras Observatory used in all prior operations of the Great Trigonometrical Survey of India by Lieutenant-Colonel Lambton is that given by the observations of Captain Warren, viz.:—

| | ° | ′ | ″ |
|---|---|---|---|
| East of Greenwich | 80 | 17 | 21 |
| But the subsequent observations by Mr. Taylor from a mean of the Greenwich and Cambridge observations compared with his own at Madras would give for the same element | 80 | 15 | 56·55 |
| Shewing a discrepancy between these two observers of | 0 | 1 | 24·45 |
| The longitude of Damargida west of the Madras Observatory given by Colonel Lambton is | 2 | 34 | 49·64 |
| And as Colonel Lambton has used Captain Warren's observations the longitude of Damargida east of Greenwich which he deduces is | 77 | 42 | 31·36* |
| But by the revised operations of the Great Arc Series, Kalianpur is to the west of Damargida | 0 | 0 | 46·61 |
| Whence the longitude of Kalianpur as depending on Captain Warren's observations would be | 77 | 41 | 44·75 |
| And the same if referred to Mr. Taylor's as an origin would be ... | 77 | 40 | 20·30 |
| Also the longitudinal arc of amplitude between Kalianpur and the observatory in Park Street, Chaoringi, No. 37, used as the Surveyor General's office is | 10 | 42 | 14·40 |

And as the same observatory was employed by Colonel Hodgson when Surveyor-General of India for the determination of the longitude of Calcutta by direct observation, we have hence three data bearing on the same point, which are as follows:—

| | | | |
|---|---|---|---|
| 1st, Longitude of the Observatory of Calcutta by Captain Warren's data as an origin | 88 | 23 | 59·15 |
| 2nd, By Mr. Taylor's data as an origin | 88 | 22 | 34·70 |
| 3rd, By Colonel Hodgson's direct observations | 88 | 21 | 33·40 |

* *Vide* 6th vol. General Report, p. 138.

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These data seem to me by no means sufficiently conclusive to warrant any alteration in the quantities employed by Colonel Lambton in all previous operations of the Great Trigonometrical Survey, for just in the same manner as Mr. Taylor has assigned a new value for the longitude of Madras, some future astronomer who may succeed him, or the astronomer perhaps at Trevandarum or other place may introduce an alteration which will affect the geographical position of the meridian of his observatory and all places connected with it.*

In fact the accurate determination of the terrestrial longitude of any place is too difficult and delicate a question to rest on a small number of observations, and if every new set of determinations were appealed to as a test, there would be no end to the shifting of the origin, wherefore it seems to me better, for the present at least, to use the same values for this element as those which were employed by Colonel Lambton, viz. :—

| | ° | ′ | ″ |
|---|---|---|---|
| That of the Madras observatory ..... | 80 | 17 | 21 |
| And that of Damargida ..... | 77 | 42 | 31·36 |

The latitude being a much more accessible element than the longitude, forms a totally different question.

There is perhaps no place in India of which there are so many good observations for determining the latitude as Kalianpur; for example, in 1825 observations to the number of 388 were taken by me with the zenith sector on 17 stars, whose positions are well laid down in the catalogues of Piazzi and others, and thence transferred by Mr. Baily into that of the Royal Astronomical Society, and the mean latitude thence deduced is 24° 7′ 11″·837.

In addition to this numerous set there are also 1,811 observations on 36 stars in 1839-40, and 1,529 observations on 32 stars in 1840-41, making, independent of the 388 of 1825 above alluded to, a total of 3,340 observations all taken with excellent instruments and with the greatest care, but as these latter † stars were selected more with

* By a memorandum received by me from Mr. Walker, Geographer to the H. E. I. Company, I perceive that the Admiralty and Royal Astronomical Society of London adopt 80° 14′ as the longitude of Madras.

† The places of all these stars having since been obtained from the recent catalogue of the Royal Observatory at Greenwich, the latitude of Kalianpur thence derived is as follows :—

| | ° | ′ | ″ |
|---|---|---|---|
| By 1811 observations in 1839-40 ..... | 24 | 7 | 11·0928 |
| By 1529 ditto in 1840-41 ..... | 24 | 7 | 11·3175 |
| Mean ..... | 24 | 7 | 11·196 |
| Result of 1825 ..... | 24 | 7 | 11·837 |
| Difference ..... | | | 0·641 |
| General Mean of all observations ..... | 24 | 7 | 11·262 |



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| Number in R.A.S.C. | Stars Observed. | Number of Observations. | Latitude of Kalianpur. |
|---|---|---|---|
| | | | ° ′ ″ |
| 2881 | α Andromedæ ... | 14 | 24 7 12·431 |
| 76 | ζ Andromedæ ... | 14 | .. .. 13·529 |
| 227 | α Arietis ..... | 24 | .. .. 11·683 |
| 304 | 41 Arietis ..... | 24 | .. .. 12·285 |
| 403 | 17 Tauri ..... | 24 | .. .. 12·114 |
| 414 | η Tauri ..... | 24 | .. .. 12·140 |
| 418 | 27 Tauri ..... | 24 | .. .. 11·623 |
| 642 | β Tauri ..... | 24 | .. .. 13·922 |
| 684 | ζ Tauri ..... | 24 | .. .. 11·647 |
| 775 | η Geminorum ... | 24 | .. .. 11·063 |
| 790 | μ Geminorum ... | 24 | .. .. 11·887 |
| 831 | ε Geminorum ... | 24 | .. .. 11·978 |
| 872 | ζ Geminorum ... | 24 | .. .. 10·097 |
| 900 | ὁ Geminorum ... | 24 | .. .. 11·231 |
| 1175 | ε Leonis ..... | 24 | .. .. 11·959 |
| 1187 | μ Leonis ..... | 24 | .. .. 11·134 |
| 1320 | ὁ Leonis ..... | 24 | .. .. 11·459 |
| Mean Latitude of Kalianpur | | | 24 7 11·837 |

reference to their localities with respect to the zeniths and times of culmination than for the sake of the accuracy of their catalogued places, which were not sufficiently known at the time these computations were commenced, the latitude of Kalianpur used herein is that derived from my former observations of the year 1825, which as already said are 388 in number and stand as shewn in the margin.

The latitudes and longitudes as well as the azimuths of all the principal stations in the sections of the Great Arc Series deduced geodetically have been computed with the following data, which will be found on reference to my printed book page 115 comparison No. 2, that being the comparison between the two measured arcs which of all those existing seemed to me most worthy of confidence, as they were then unquestionably the largest.

The equatorial radius $a$=.....20922931·8 feet... Log. 7·3206225

The square of the eccentricity $e^2$= ·006237846 ..... Log. $\bar{3}$·8220272

$1-e^2$=..... ·993362154 ..... Log. $\bar{1}$·9971076

which values have been employed in constructing the auxiliary tables used to facilitate the computations.

I will now proceed to explain the formulæ employed in deducing the various terms which define the figure and dimensions of the earth supposed to be an ellipsoid of revolution on the minor axis, premising that $a$, $b$, $e$, imply the same quantities as heretofore; that $c$ is employed to denote the difference of the two axes, so that $\frac{c}{a}=\frac{a-b}{a}$ is the compression; that $l$, $L$, denote the latitudes of the limits of an arc of the meridian whose length is $S$; that $\Sigma l$ implies the sum of the latitudes of the two limits or $L+l$, and $\Delta l$ their difference or $l-L$; also that with respect to any other arc whose limits are $L'$, $l'$, like terms have like significations.

The equation which defines the relation between any terrestrial measured arc and its corresponding celestial amplitude is well known to be

$$a\,.\,(1-e^2)\cdot\int_L^l (1-e^2.\,sin^{\,2}l)^{-\frac{3}{2}}.\,dl=S$$

and consequently when there are two such arcs there must exist the differential equation

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$$\frac{\int_L^l (1-e^2.\sin^2 l)^{-\frac{1}{2}}.dl}{\int_{L'}^{l'} (1-e^2.\sin^2 l')^{-\frac{1}{2}}.dl'} = \frac{S}{S'}$$

The integration of this equation will give an equation of the form

$$\frac{1+m\,e^2+n\,e^4+p\,e^6 \ldots\ldots\ldots\ldots +K\,e^{2k} \text{ \&c.}}{1+m'e^2+n'e^4+p'e^6 \ldots\ldots\ldots\ldots +K'e^{2k} \text{ \&c.}} = \frac{S.\,\Delta l'}{S'.\,\Delta l}$$

wherein

$$m=\frac{3}{4}-\frac{3}{4}\cdot\frac{\cos \Sigma l.\sin \Delta l}{\Delta l}$$

$$n=\frac{3^2.5}{2^6}-\frac{3.5}{2^4}\cdot\frac{\cos \Sigma l.\sin \Delta l}{\Delta l}+\frac{3.5}{2^7}\cdot\frac{\cos 2\Sigma l.\sin 2\Delta l}{\Delta l}$$

$$p=\frac{5^2.7}{2^8}-\frac{3.5^2.7}{2^9}\cdot\frac{\cos \Sigma l.\sin \Delta l}{\Delta l}+\frac{3.5.7}{2^9}\cdot\frac{\cos 2\Sigma l.\sin 2\Delta l}{\Delta l}-\frac{5.7}{2^9.3}\cdot\frac{\cos 3\Sigma l.\sin 3\Delta l}{\Delta l}$$

&c. &c. &c.

and similarly for $m'$, $n'$, $p'$, &c.

If we divide the numerator of the 1st member by its denominator, and transpose unity to the 2nd member, we obviously transmute this equation into one of the following form:

$$e^2+\alpha\,e^4+\beta\,e^6+\text{\&c.}=v$$

in which

$$\alpha=\frac{n-n'}{m-m'}-m';\ \beta=\frac{p-p'}{m-m'}-n'-m'\alpha;\ v=\left(\frac{S.\,\Delta l'-S'.\,\Delta l}{S'.\,\Delta l}\right)$$

and hence by reversion there results

1st. $$e^2=v-\alpha\,v^2+(2\alpha^2-\beta).v^3 \text{ \&c.}$$

2nd. $$a=\left\{\begin{array}{l}\text{either } \dfrac{S.\,cosec\ 1''}{\Delta l.\{1-(1-m).e^2-(m-n).e^4-(n-p).e^6 \text{ \&c.}\}} \\ \text{or } \dfrac{S'.\,cosec\ 1''}{\Delta l'.\{1-(1-m').e^2-(m'-n').e^4-(n'-p').e^6 \text{ \&c.}\}}\end{array}\right\}$$

3rd. $$\frac{c}{a}=\frac{1}{2}\cdot e^2+\frac{1}{8}\cdot e^4+\frac{1}{16}\cdot e^6 \text{ \&c.}$$

whence all other parts of the ellipsoid may be easily found.

From the different arcs measured at divers times in different parts of the globe, I have selected such as appear to me most worthy of confidence, and the results of the various comparisons made between them and the sections of the Indian arc, will be found detailed in their proper place in the body of the work.

It is obvious that every individual comparison thus instituted will furnish independent values of the terms $a$, and $c$, or $(a-b)$, and as the simplest mode of striking means between these, the rule subjoined has been adopted.

The values of $a$ and $c$ resulting from a comparison of each arc in turn with all

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others with which it is compared, will if arranged in order furnish a set of values of each of these terms, whereof let the arithmetical means be taken in the usual way, and let the probable errors be computed precisely as is done in the case of the observed angles of principal triangles; let the inverse of the probable error of the smallest mean of all, in each instance, be denominated $q$; and the rest $q'$, $q''$, $q'''$, &c., in the order of the magnitudes of the means to which they appertain.

Now in the case of either $a$, or $c$, if the least mean value of any such set of comparisons be subtracted from the mean value given by every other set in succession, and the differences arranged in the order of their magnitudes be denominated $d'$, $d''$, $d'''$, &c., whereby $q'$, $d'$; $q''$, $d''$; $q'''$, $d'''$; &c., will appertain to the same set: then putting $\varepsilon$ to denote the correction additive to the smallest mean, there results by the well-known principle of Cotes:

$$\varepsilon = \frac{d' . q' + d'' . q'' \ldots\ldots\ldots\ldots + d^{m} . q^{m}}{q + q' + q'' + q''' \ldots\ldots\ldots\ldots + q^{m}}$$

The smallest mean value of $a$ is 3486519·69 fathoms, or that derived from the set (7 in number) of comparisons of the arc Damargida to Punnæ, and the value of $\varepsilon$ is 297·39 fathoms, whence the resulting value of $a$ (supposed to be true) is 3486817·08 fathoms. The smallest value of $c$ is 11048·769 fathoms, or that derived from the set (9 in number) of comparisons of the arc Tarqui to Cotchesqui, and the value of $\varepsilon$ is 161·307 fathoms, whence the resulting value of $c$ is 11210·076 fathoms.

With these data

$$\frac{c}{a} = \cdot 0032149883 \text{ or } \frac{1}{311 \cdot 043} \text{ of the equatorial radius;}$$

$$\text{and } e^2 = 2 \cdot \frac{c}{a} - \frac{c^2}{a^2} = \cdot 006419641.$$

If in the case of any measured arc whatever, we retain the original values of $\Delta l$, $m$, $n$, $p$, and employ the new-found numerical values of $a$, $e^2$,

Then $\sigma = a . (1 - e^2) . \Delta l . \{1 + m . e^2 + n . e^4 + p . e^6 + \&c.\} . \sin 1''$ will be the value in fathoms of the hypothetical arc $\sigma$, whose value given by measurement is $S$; therefore if $S - \sigma = \delta S$, and $r$, $R$, be the hypothetical radii of curvature of the meridian in the parallels of $l$, $L$, respectively, which are represented by the expression $r = a . (1 - e^2) . (1 - e^2 . \sin^2 l)^{-\frac{1}{2}}$ or $R = a . (1 - e^2) . (1 - e^2 . \sin^2 L)^{-\frac{1}{2}}$; then at $l$, $\frac{\delta S}{r} \cdot \operatorname{cosec} 1''$; and at $L$, $\frac{\delta S}{R} \cdot \operatorname{cosec} 1''$ will be the corresponding variations of $\Delta l$, which must be applied to its observed value with an opposite sign to $\delta S$, in those cases where an alteration in the celestial amplitude is deemed more probable than in the terrestrial arc.

It will be remarked that any increment to $\Delta l$ is an increment to $l$, and a decrement to $L$, because $\Delta l = l - L$ and $d\,\Delta l = dl - dL$.

It may be desirable to alter both limits of a section, in which case the sum of the two increments of $\Delta l$ must be equal terrestrially to the whole increment $\delta S$: Let $\delta S = x + y$; then at $l$, $\frac{x}{r} \cdot \operatorname{cosec} 1''$, and at $L$, $\frac{y}{R} \cdot \operatorname{cosec} 1''$ will be variations of $\Delta l$.

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In illustration of this method of computation, let us take the arc Kalianpur to Kaliana, wherein

$$\Delta l.\{me^2+ne^4+pe^6 \&c.\}=38\cdot199;\ \{1+me^2+ne^4+pe^6 \&c.\}=1\cdot001967318$$
$$\therefore \sigma=326771\cdot37 \text{ fathoms};$$

and as

$$S=326859\cdot52 \text{ fathoms}$$
$$\therefore \delta S=88\cdot15 \text{ fathoms}$$

which value is equivalent at 29° 30′ 48″·895 to 5″·236 and at 24° 7′ 11″·837 to 5″·240.

The rest will no doubt be sufficiently evident, and I may now proceed to the results.

1st Section. Kalianpur—Kaliana.

$\sigma-S=-88\cdot15$ fathoms, which is equivalent to 5″·236 at $l$ or Kaliana, and 5″240 at $L$ or Kalianpur: if we take the latitude of Kalianpur as constant, and consider the measured terrestrial arc $S$ free from error, we must apply all this value as an increment to $l$, or the latitude of Kaliana:

Hence $l$ will become $l+5''\cdot236=29°\ 30'\ 54''\cdot131$
And $L$ will be as before $L=24°\ 7'\ 11''\cdot837$

2nd Section. Kalianpur—Damargida.

$\sigma-S'=63\cdot73$ fathoms, which is equivalent to 3″·788 at $l'$ or Kalianpur, and 3″·791 at $L'$ or Damargida, and if the latitude of Kalianpur be considered constant, and $S'$ be considered as free from error, we must apply all this value as a decrement to the celestial arc of amplitude, or what is the same thing, as an increment to the latitude of Damargida, because $d\Delta l'=dl'-dL'$:

Hence $l'$ will be as before 24° 7′ 11″·837
And $L'$ will become $L'+3''\cdot791=18°\ 3'\ 19''\cdot655$

3rd Section. Damargida—Punnæ.

$\sigma-S''=14\cdot44$ fathoms, which is equivalent to 0″·859 at $l''$ or Damargida, and 0″·860 at $L''$ or Punnæ; and if $S''$ were treated as invariable, would lead to the conclusion that $d\Delta l''$ is a negative quantity: now 63·73 fathoms has gone to increase the value of $l''$, therefore $63\cdot73+14\cdot44=78\cdot17$ fathoms, must be the quantity, by the equivalent of which $L''$ must be increased.

Hence $l''$ would become $l''+3''\cdot791=18°\ 3'\ 19''\cdot655$
And $L''$ would become $L''+3''\cdot794+0''\cdot860=8°\ 9'\ 36''\cdot952$

But this assumption with respect to the errorless value of $S''$ cannot be admitted with unbounded confidence in the present instance, because

1st. The unit of measure in all the operations prior to 1830 is uncertain;

2nd. Because the side Tadmanur to Topkonda appears by the revision of 1838-9 to have an error in defect of 10·75 in a distance of 113530·4 feet, which on the whole arc of 598629·84 fathoms, would give an error of 56·683 fathoms in defect, the half of which



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or 28·342 fathoms may legitimately be supposed to be the probable error by which the value of $S''$ as given by Colonel Lambton is in defect of the truth when referred to the same standard as the measurements of the sections Damargida—Kalianpur, Kalianpur—Kaliana.

Whilst applying these errors it must be considered that there is a shadow more reason to suppose the latitude of Damargida faulty than that of Kalianpur, because there is a discrepancy of 1″·777 between the computed and observed azimuths at Damargida, if the former be brought down from the contiguous station of Somtana (the former being in defect), which indicates a lateral attraction on the western side; whilst if the observed azimuth of Kalianpur be compared with that deduced from Ehmadpur, the station contiguous to it on the south side, the former would be 0″·664 in excess, indicating a westerly lateral attraction; and if again the observed azimuth of Kalianpur be compared with that computed from Pahargarh, the station contiguous to it on the north side, the former would be 0″·205 in defect, indicating easterly lateral attraction; so that not only on account of the comparative smallness of these latter errors, but on account of their having an opposite tendency, it seems a probable supposition, that at Kalianpur the irregularities of lateral attraction are nearly neutralized.

With the exception of these considerations, I see no other reason to suppose any liability to error in the latitude of Damargida, which I should pronounce *à priori* to be as free from lateral attraction as any spot on the globe. Kaliana is within 120 miles of one of the high peaks of the highest range of mountains in the earth, and on that account there is room to suspect the existence of lateral attraction at that locality, especially as the observed azimuths warrant the conclusion, and for this reason I see no objection to assigning the whole error 5″·236 to the latitude of Kaliana; though it must be remarked that if any portion of the error of the section Kalianpur—Damargida were applied to the latitude of Kalianpur, such portion would counteract an equal portion of the correction applied to the arc Kaliana to Kalianpur, and thereby render a less correction necessary at Kaliana.

The station of Punnæ is from its locality evidently liable to a disturbing force: situated at the southern extremity of the peninsula of India, and influenced by the whole mass of land on the north, with nothing but an open ocean to counterbalance it on the south, it is hardly possible to suppose its locality free from lateral attraction, and therefore I should feel no hesitation in applying the whole sum of the correction 4″·651 to its latitude; but here also it will be noticed, that whatever portion of correction is applied to the latitude of Kalianpur, will tend to diminish to an equal extent the correction to be applied to that of Punnæ.

On the whole I am disposed to prefer that application of the corrections, which interferes least with the original data, but still is consistent with a due regard to the peculiarities of locality of Kaliana and Punnæ, and I therefore am of opinion that the mode of dispersion given in the second of the two following hypotheses will be found most in accordance with the truth:

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| | 1st Hypothesis. | 2nd Hypothesis. |
|---|---|---|
| Kaliana..... | $l+5''\cdot236=29^\circ\ 30'\ 54''\cdot131$ | $l+3''\cdot343=29^\circ\ 30'\ 52''\cdot238$ |
| Kalianpur..... | $l'+0\quad=24\ 7\ 11\cdot837$ | $l'-1\cdot894=24\ 7\ 9\cdot943$ |
| Damargida ..... | $l''+3\cdot791=18\ 3\ 19\cdot655$ | $l''+1\cdot895=18\ 3\ 17\cdot759$ |
| Punnæ ..... | $L''+4\cdot651=\ 8\ 9\ 36\cdot949$ | $L''+2\cdot755=\ 8\ 9\ 35\cdot053$ |

I will now sum up by remarking that in consideration of what has been here advanced, and of the whole circumstances connected with the great arc of India, the following are the final elements which I should propose for the basis of the Indian atlas:

*a* the equatorial semidiameter ..... =3486817·08 fathoms
*b* the semi polar axis ..... =3475607·00 fathoms

| | |
|---|---|
| Latitude of Punnæ ..... | $8^\circ\ 9'\ 35''\cdot053$ |
| Latitude of Damargida..... | 18 3 17·759 |
| Latitude of Kalianpur ..... | 24 7 9·943 |
| Latitude of Kaliana ..... | 29 30 52·238 |

As frequent mention has been made of the new pattern barometer with an open cistern, which I designed for the use of my late department, it may not be inappropriate to give a more particular description of its construction, the manner of filling the tubes, and the mode of conveying the instrument from place to place with ease and safety.

It is and has for years been a subject of complaint with travellers that the barometers called portable perpetually become deranged from divers causes, but chiefly through the admission of air into the cistern attached to the tube, and the oozing out of the mercury from the action of the pressure screw at the bottom of the cistern; from the list of sufferers from these evils my name cannot plead exemption, and in 1835 I found that of all the numerous barometers at my disposal there were but two on which any reliance could be placed.

To repair these became an object of great moment, but all my attempts to expel the air by boiling the mercury in the tubes proved hopeless and ineffectual, and after breaking several tubes without in the least advancing my purpose, I eventually resorted to a method for the first conception of which I am mainly indebted to the writings of the late Mr. Daniel.

Most of the barometers at my disposal were constructed by the late Mr. Troughton, of the pattern which goes by his name; this is too familiarly known to need any description, wherefore it will suffice to mention that, in remodelling them to suit my new design, the cistern was entirely disengaged, and to compensate for its absence, a sphere of lead of equal weight with it and its contained mercury, was applied near the lower extremity of the tube of brass encasing the glass tube to which the graduations and index are attached.

The end of the glass tube, as is well known, projects beyond the sheathing tube of

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brass, and at the proper distance I attached to the former an ivory dipper, the lower point of which corresponded with the zero of the scale of inches; all the rest of the apparatus constructed by Mr. Troughton remained unaltered, and it is easy to see that the barometer so constructed may be made to hang on its gimbals, in such wise that the point of the dipper shall touch the surface of the mercury in a cistern supported at the requisite height below the point of suspension, the end of the glass tube being at the same time immersed in the fluid.

The cistern may be supported in many different modes, but I need only mention the two used by me, in one of which the instrument is a fixture and in the other portable.

In the former of these two instances brackets were fitted into a wall, the upper of which sustained the point of suspension and the lower the cistern. In the latter the point of suspension rested on a flat piece of wood at the summit of a small tripod, another similar and larger frame being placed parallel to it at the proper height below it for the cistern to rest on.

In both cases the cistern was of wood, and stood in a brass cup furnished with an elevating screw applied to it below, care being taken to counteract the rotatory motion of the screw, and confine its action to the vertical direction; also a slit of sufficient width was made in the upper bracket, so that whilst the lower end of the tube was still immersed in the mercury of the cistern, the tube itself might be made to pass through and obtain admission to the position adapted to receive it.

In travelling three spare tubes, all duly filled in vacuo, were usually carried with this instrument, besides that which was encased in the brass sheathing tube; all were carried in an inverted position, and as every body is familiar with Mr. Troughton's barometer, I need hardly mention that in case of accident it was easy to replace the injured tube by one of the others.

I now proceed to describe the apparatus* designed by me in April, 1836, shortly after my return to my head quarters at Hatipaon, for the purpose of filling tubes in vacuo, which I have designated by the name of a barometer pump: it consists of a simple exhausting cylinder, in which a piston is made to work up and down by means of a six-threaded screw of iron passing through a female screw of brass let into a wooden handle: the first cylinder used was a portion cut off from an old gun barrel, and after several experiments which were partially successful, I at length attained the end I had proposed to myself.

A brass bar 11 inches long, $\frac{1}{2}$ an inch thick, and $1\frac{3}{4}$ inches broad, is firmly screwed to two projecting pieces of wood which are united to a solid table or other such support; from the middle of the upper surface of this bar a small cylinder rises upwards to the height of 0·9 of an inch, in the centre of which is an aperture to admit a valve commu-

* To render this description more intelligible the reader is referred to Plates 27, 28, marked Series F1, F2, and those who desire more precise information are referred to Messrs. Troughton and Simms, in whose possession are one of the barometers of the new pattern and also one of the pumps herein described.

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nicating with a small canal running outwards from the table, whilst its external periphery is cut into the form of a male screw whereby the pump cylinder is united to it.

The cylinder has of course for this purpose at its lower extremity a female screw cut into its interior periphery, the outer surface being hexagonal that it may be more easily turned, and at its side runs a small canal which communicates with an external valve placed horizontally; the upper part of the cylinder is furnished with a collar of brass which catches into a groove formed in the outer surface of the female screw of the handle, and that this collar may be disconnected at pleasure from or connected with the top of the cylinder it is made in two halves which are kept united together by an outer collar with a milled circumference, the one collar screwing on to the other, and the inner of the two having a projection corresponding to a groove in the top of the cylinder, whereby the handle may turn round, but can never rise upwards.

The lower part of the bar is perforated vertically with a small canal into which is screwed a supplemental piece with a capstan head containing a reservoir for the oil and grease to descend into, and at the upper part of all is a clutch connected with the table of such form that the handle may revolve free of it, and the piston be prevented from turning round by the action of the latter.

Into that canal of the brass bar which runs outward from the table and at a slight angle of depression, a female screw is worked which admits of an iron cock to be connected with it; this cock has three arms, two of which are so contrived that when the cock is in position they may each lie at an angle of about 45° with the horizon, and as a canal which forms a continuation of that running outwards from the bar runs through this cock, and separates into two branches at the point where the axes of these arms meet, it will be clear that there is a free communication between the ends of these two arms, and the valve which opens into the bottom of the cylinder. The axis of the third arm of the cock lies in the same vertical plane with that which issues from the bar, but rises several inches above it, and the canal which it contains is much larger than the other, because as the object of it is to attach a bottle of sulphuric acid in such wise that it may tend to desiccate the canal and tubes, it is manifestly necessary to guard against the possibility of the acid and metal coming by any accident into contact with each other.

Now of the two canals of the cock which lie at 45° with the horizon, one is adapted to receive the tube to be filled, and the other to admit a thin tube, both of which are luted on so as to be perfectly air tight. The point where these two oblique canals meet is marked outside, and the lower end of the thin tube is immersed into a reservoir of mercury, and when all the packings and valves are in order, and all the different screws rendered air tight, the whole is in a condition to begin the work of filling.

It will be manifest that the up and down action of the piston will make the mercury immediately rise in the thin tube, and each successive stroke will increase this effect until at last, bating the effects of capillary attraction and the resistance of the



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valve, that fluid will remain stationary at the standard height of the place, beyond which no further benefit will be derived from the action of the piston. In this condition if we introduce a glass rod and press with it on the surface of the mercury in the reservoir, that fluid will pass over into the tube to be filled, and as each portion, in the course of repetition of this process, falls over, if heat be applied and the tube be agitated by tapping its outer surface with a pencil or other slight wooden rod, the air will be seen to ascend in groups of bubbles which successively rise to the top of the fluid to be pumped out in turn.

I can nowhere obtain any data to guide me satisfactorily as to the temperature at which mercury will boil in vacuo, but I am disposed to believe that the heat which converts water into steam under the pressure of the atmosphere would suffice; if that were the case the arrangement would be very easily brought about by a contrivance which I subsequently devised, though it has not yet been completed, but in the mean time the method resorted to has been by holding, each in a pair of tongs, several masses of ignited charcoal, the heat generated whereby has to all appearance been sufficient to vaporise the mercury, and though several tubes have been filled in this way, an instance of fracture has never yet occurred, nor do I think it need well be apprehended if proper care be taken.

In regard to the substance for the valves I have found the air bladders of fishes to be the most suitable and efficacious; this may be used in the uncured state, and to a traveller is perhaps generally speaking the most easily to be resorted to, but this is a subject too well known in Europe to need any further hints or suggestions of mine.

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# APPENDIX TO INTRODUCTION.

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## NOTE A.

### COMPARISONS of TROUGHTON and SIMMS' THERMOMETERS by the Makers.

| Standard. | No. 1. | Standard. | No. 3. | No. 4. | Standard. | No. 5. | Remarks |
|---|---|---|---|---|---|---|---|
| 31·9 | 32·3 | 31·9 | 32·3 | 32·3 | 31·9 | 32·2 | These Thermometers are of the new pattern bent bulb construction, and were used during the Celestial Observations at Kaliana in 1839–40. |
| 40·5 | 41·0 | 40·5 | 41·0 | 41·0 | 40·7 | 41·0 | |
| 49·5 | 49·8 | 49·3 | 49·5 | 49·4 | 49·3 | 49·1 | |
| 58·7 | 58·9 | 58·7 | 58·6 | 58·4 | 58·5 | 58·0 | |
| 67·1 | 67·3 | 67·2 | 67·2 | 67·2 | 67·2 | 67·0 | |
| 74·5 | 74·5 | 74·3 | 74·1 | 74·2 | 74·2 | 74·2 | |
| 81·5 | 81·8 | 81·5 | 81·4 | 81·6 | 81·5 | 81·5 | |
| 90·0 | 90·1 | 90·0 | 89·7 | 89·8 | 89·9 | 90·0 | |
| 96·5 | 96·5 | 96·2 | 96·3 | 96·2 | 96·2 | 96·3 | |
| 103·5 | 103·7 | 103·3 | 103·3 | 103·1 | 103·0 | 103·0 | |
| 108·0 | 108·1 | 107·9 | 107·5 | 107·5 | 107·0 | 107·2 | |
| 116·0 | 116·3 | 115·5 | 115·4 | 115·2 | 114·0 | 114·0 | |
| 122·0 | 121·9 | 121·0 | 120·8 | 120·8 | 120·2 | 120·0 | |
| 130·5 | 130·6 | 130·0 | 130·3 | 130·1 | 129·8 | 129·8 | |
| 137·0 | 136·5 | 136·5 | 136·8 | 136·8 | 136·2 | 136·0 | |
| 146·5 | 147·0 | 145·1 | 145·0 | 145·6 | 144·5 | 144·1 | |
| 154·4 | 154·5 | 152·2 | 152·1 | 152·3 | 151·5 | 151·2 | |
| 163·0 | 163·1 | 161·5 | 161·5 | 161·2 | 160·0 | 160·0 | |
| 174·5 | 174·5 | 173·0 | 173·0 | 172·9 | 170·5 | 171·0 | |
| 179·5 | 179·3 | 177·3 | 177·3 | 177·2 | 175·4 | 175·9 | |
| 193·8 | 193·7 | 190·8 | 190·1 | 190·4 | 188·2 | 188·0 | |
| 211·4 | 212·1 | 211·4 | 211·1 | 211·3 | 211·4 | 211·3 | |
| Means .. 115·014 | 115·159 | 114·323 | 114·286 | 114·295 | 113·686 | 113·673 | |

## NOTE B.

### COMPARISONS of THERMOMETERS used during the CELESTIAL OBSERVATIONS at KALIANA by Lieut. Renny at Hatipaon.

| Date, 1840. | Time. | Attached Thermometers. | | Internal and detached Thermometers.* | | Standard A.† Troughton and Simms. | Remarks. |
|---|---|---|---|---|---|---|---|
| | | To Barometer No. 1, Open Cistern. | To Barometer No. 2, Closed Cistern. | No. 1. | No. 3. | | |
| May 14 | 4 P.M. | 61·1 | 61·2 | 61·0 | 61·0 | 60·7 | |
| 15 | 6 A.M. | 61·9 | 62·0 | 61·8 | 61·7 | 61·5 | |
| 16 | 9 A.M. | 62·0 | 62·1 | 61·9 | 61·9 | 61·6 | |
| — | Noon. | 52·1 | 52·2 | 52·1 | 52·0 | 51·8 | In water cooled in Saltpetre. |
| — | h. m. 0 8 P.M. | 51·5 | 51·5 | 51·4 | 51·4 | 51·1 | |
| — | h. m. 0 15 P.M. | 51·4 | 51·5 | 51·3 | 51·3 | 51·0 | |
| — | 2 P.M. | 55·9 | 55·9 | 55·7 | 55·7 | 55·4 | |
| 17 | 10 A.M. | 63·0 | 63·2 | 63·0 | 63·1 | 62·7 | |
| 18 | 10 A.M. | 61·2 | 61·4 | 61·2 | 61·2 | 60·9 | |
| | Means ..... | 57·79 | 57·89 | 57·71 | 57·70 | 57·41 | |
| | Standard .... | 57·41 | 57·41 | 57·41 | 57·41 | | |
| | Corrections .. | —0·38 | —0·48 | —0·30 | —0·29 | | |

* Troughton and Simms' bent bulb pattern.
† Standard A belonging to the Surveyor General's Office Dehra.



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## NOTE C.

### COMPARISONS of THERMOMETERS used during the CELESTIAL OBSERVATIONS at KALIANPUR, 1839-40.

| Standard Thermometer $\sigma_{(1)}$ Troughton and Simms. | No. 6. Troughton and Simms. Used during the Observations as internal Thermometer. | No. 1½. Troughton and Simms. Used during the Observations as external Thermometer. | No. 4. Troughton, London. Used during the Observations as wet bulb Thermometer. | Attached Thermometer. Troughton and Simms' Barometer, No. 4. | Attached Thermometer. Open Cistern, Col. Everest's pattern, No. 3. | Remarks. |
|---|---|---|---|---|---|---|
| Fahrenheit. | Fahrenheit. | Fahrenheit. | Fahrenheit. | Fahrenheit. | Fahrenheit. | |
| 67·40 | 68·10 | 68·05 | 67·70 | 67·80 | 67·65 | Lieut. Waugh. |
| 68·25 | 68·85 | 68·80 | 68·50 | 68·50 | 68·45 | Mr. G. Logan. |
| 68·60 | 69·20 | 69·00 | 68·60 | 69·00 | 68·60 | Mr. T. Olliver. |
| 69·35 | 69·90 | 69·80 | 69·50 | 69·85 | 69·30 | Lieut. Waugh. |
| 69·40 | 69·95 | 69·80 | 69·55 | 69·85 | 69·40 | Mr. T. Olliver. |
| 68·60 | 69·20 | 69·09 | 68·77 | 69·00 | 68·68 | Means. |
| | 68·60 | 68·60 | 68·60 | 68·60 | 68·60 | Standard. |
| | —0·60 | —0·49 | —0·17 | —0·40 | —0·08 | Corrections. |

## NOTE D.

### COMPARISONS of Standard Bar B Thermometers with Troughton and Simms' Standard Thermometer A (by Lieut. Renny).

| Date, 1840. | Time. | Standard A. Troughton and Simms. | $\gamma$ Standard Bar B Thermometer. | $\delta$ Standard Bar B Thermometer. |
|---|---|---|---|---|
| May 27 | 10 A.M. | 61·4 | 61·9 | 61·7 |
| — | 1 P.M. | 61·7 | 62·2 | 62·0 |
| 28 | 10 A.M. | 61·3 | 61·9 | 61·6 |
| — | Noon | 96·3 | 97·3 | 97·3 |
| — | — | 90·1 | 91·2 | 91·2 |
| — | — | 88·0 | 89·1 | 89·0 |
| — | — | 85·4 | 86·5 | 86·4 |
| — | 1 P.M. | 83·0 | 84·1 | 84·0 |
| — | — | 79·5 | 80·4 | 80·4 |
| — | — | 79·0 | 79·8 | 79·8 |
| — | — | 78·5 | 79·3 | 79·3 |
| — | — | 78·0 | 78·7 | 78·7 |
| — | — | 77·5 | 78·2 | 78·1 |
| — | — | 77·0 | 77·7 | 77·7 |
| — | — | 76·5 | 77·3 | 77·2 |
| — | 2 P.M. | 76·0 | 76·7 | 76·7 |
| — | — | 75·1 | 75·8 | 75·7 |
| — | — | 74·5 | 75·2 | 75·1 |
| — | — | 74·0 | 74·8 | 74·7 |
| — | 3 P.M. | 72·5 | 73·3 | 73·1 |
| — | — | 70·7 | 71·4 | 71·3 |
| — | 4 P.M. | 68·5 | 69·3 | 69·1 |
| Mean..... | | 76·545 | 77·368 | 77·277 |

## NOTE E.

### COMPARISONS of Standard Bar B Thermometers with Troughton and Simms' Standard Thermometer $\sigma$ and $\sigma_{(1)}$

| Time. | Standard Thermometers, Troughton and Simms. $\sigma$ | Standard Thermometers, Troughton and Simms. $\sigma_{(1)}$ | Standard Bar B Thermometers. $\gamma$ | Standard Bar B Thermometers. $\delta$ | Remarks. |
|---|---|---|---|---|---|
| 8 0 | 73·0 | 72·8 | 73·4 | 73·1 | Made by Mr. G. Logan 10th April, 1835. |
| 8 15 | 73·1 | 72·9 | 73·6 | 73·2 | |
| 8 30 | 73·3 | 73·1 | 73·9 | 73·6 | |
| 8 45 | 73·5 | 73·4 | 74·0 | 73·9 | |
| 9 15 | 74·0 | 73·9 | 74·2 | 74·1 | |
| 9 37 | 74·4 | 74·3 | 74·7 | 74·6 | |
| 10 0 | 75·0 | 74·9 | 75·2 | 75·1 | |
| 10 20 | 75·4 | 75·4 | 75·6 | 75·5 | |
| 10 40 | 75·8 | 75·8 | 76·1 | 76·0 | |
| 11 0 | 76·4 | 76·3 | 76·6 | 76·5 | |
| 11 20 | 76·8 | 76·7 | 76·9 | 76·8 | |
| 11 40 | 77·2 | 77·2 | 77·4 | 77·3 | |
| 12 0 | 78·0 | 78·1 | 78·2 | 78·1 | |
| 12 20 | 78·1 | 78·0 | 78·2 | 78·1 | |
| 12 40 | 78·1 | 77·9 | 78·2 | 78·1 | |
| 1 0 | 78·0 | 77·7 | 78·0 | 78·0 | |
| 1 20 | 77·7 | 77·6 | 77·9 | 77·8 | |
| 1 40 | 77·6 | 77·6 | 77·8 | 77·8 | |
| 2 0 | 77·8 | 77·6 | 78·0 | 78·0 | |
| 2 30 | 77·9 | 77·8 | 78·2 | 78·1 | |
| 2 45 | 78·2 | 78·0 | 78·3 | 78·3 | |
| 3 0 | 78·4 | 78·2 | 78·5 | 78·6 | |
| 3 30 | 78·6 | 78·5 | 78·8 | 78·8 | |
| 3 45 | 78·9 | 78·8 | 78·8 | 79·0 | |
| 4 0 | 79·0 | 78·9 | 79·0 | 79·1 | |
| Mean.... | 76·568 | 76·456 | 76·780 | 76·700 | |
| Mean of each Pair .. | | 76·512 | | 76·740 | |
| | | | | +0·228 | |

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## NOTE F.

On the return of the party under Lieut. Waugh to my head quarters in 1842, I had the Thermometers used by him as standards compared with Standard A of the Surveyor General's Office, and the comparisons, 45 in number, are subjoined, shewing that $\sigma_{(i)}$ the Standard used at the Southern limits of the Sections reads higher than that employed at the Northern limits by 0·414 of Fahrenheit.

| $\sigma_{(i)}$ | A | $\sigma$ | $\sigma_{(i)}$ | A | $\sigma$ | $\sigma_{(i)}$ | A | $\sigma$ | $\sigma_{(i)}$ | A | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 96·05 | 95·6 | 96·0 | 85·05 | 84·6 | 85·0 | 74·0 | 73·45 | 73·95 | 63·0 | 62·70 | 62·95 |
| 95·0 | 94·65 | 95·05 | 84·0 | 83·5 | 83·9 | 73·0 | 72·55 | 72·95 | 62·0 | 61·65 | 61·9 |
| 94·05 | 93·65 | 93·95 | 83·0 | 82·5 | 82·95 | 72·0 | 71·6 | 71·95 | 61·0 | 60·8 | 60·95 |
| 92·9 | 92·5 | 93·0 | 82·0 | 81·6 | 81·95 | 71·0 | 70·55 | 70·95 | 60·0 | 59·65 | 59·95 |
| 92·0 | 91·6 | 92·0 | 81·0 | 80·55 | 80·95 | 70·0 | 69·6 | 70·0 | 59·0 | 58·6 | 58·85 |
| 91·0 | 90·55 | 90·95 | 80·0 | 79·6 | 80·0 | 69·0 | 68·55 | 68·95 | 58·0 | 57·5 | 57·8 |
| 90·0 | 89·60 | 90·0 | 79·0 | 78·55 | 78·95 | 68·0 | 67·55 | 67·95 | 57·0 | 56·55 | 56·8 |
| 89·0 | 88·55 | 89·0 | 78·0 | 77·5 | 77·95 | 67·0 | 66·7 | 66·9 | 56·0 | 55·65 | 55·85 |
| 88·0 | 87·55 | 88·0 | 77·0 | 76·55 | 76·95 | 66·0 | 65·6 | 65·9 | 55·0 | 54·7 | 54·95 |
| 87·0 | 86·65 | 87·05 | 76·0 | 75·55 | 76·0 | 65·0 | 64·55 | 64·9 | 54·1 | 53·65 | 53·85 |
| 86·05 | 85·6 | 86·05 | 75·0 | 74·5 | 75·0 | 64·0 | 63·7 | 63·95 | 53·0 | 52·6 | 52·8 |
| | | | | | | | | | 52·0 | 51·6 | 51·75 |
| | | | | | | | | Mean ..... | 74·004 | 73·590 | 73·942 |
| | | | | | | | | Difference .... | 0·414 | | 0·352 |

The Thermometers were suspended close together and immersed up to the 30° mark in water contained in a large iron vessel; owing to the quantity of water used the temperature varied very gradually, no change being perceptible in time of reading off.

Hatipaon, 21st May, 1842.

## NOTE G.

APPROXIMATE ZENITH DISTANCE. TIME OF TRANSIT.

OBSERVATIONS at with the Circle Face to the fixed Microscopes.

| Date. | Face. | Times of Transit. | Fixed Microscopes. | | | Revolving Microscopes. | | | Character. | General Mean. | Level of the body of Instrument. | | Barometer. | Thermometer attached. | Thermometer detached. | Observer's Initials. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | Mean. | A | B | Mean. | | | Left. | Right. | | | | | |
| | | | | | | | | | | | | | | | | | |



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# OBSERVED ANGLES

OF THE

# SECTION KALIANPUR—DAMARGIDA.

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SERIES B. and C.

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# OBSERVED ANGLES OF THE SECTION

No. 1.—At the STATION of GARGAJA.—November and December 1838.

| Zero. | Bhaorasa and Kamkhera. | Kamkhera and Ehmadpur. | Ehmadpur and Ander. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 43 51 8·173 (3) | 61 11 29·953 (3) | 48 2 33·667 (3) |
| 180 | 10·313 (3) | 30·293 (3) | 34·180 (3) |
| 9 | 9·240 (3) | 26·373 (3) | 36·113 (3) |
| 189 | 10·380 (3) | 28·867 (3) | 33·480 (3) |
| 18 | 8·453 (3) | 28·500 (3) | 37·787 (3) |
| 198 | 10·407 (3) | 27·540 (3) | 36·260 (3) |
| 27 | 11·593 (3) | 27·380 (3) | 34·233 (3) |
| 207 | 9·660 (3) | 27·947 (3) | 35·033 (3) |
| Means | 43 51 9·777 | 61 11 28·357 | 48 2 35·094 |
| | Prob. = 0·374 | Prob. = 0·438 | Prob. = 0·498 |

No. 2.—At the STATION of EHMADPUR.—December 1838.

| Zero. | Kamkhera and Gargaja. | Gargaja and Ander. | Ander and Gidgarh. |
|---|---|---|---|
| | (68·11)° ′ − (3·31)° ′ = (64·40)° ′ | (131·47)° ′ − (68·12)° ′ = (63·35)° ′ | (207·10)° ′ − (131·48)° ′ = (75·22)° ′ |
| 0 | 106·873 (3) − 57·300 (3) = 49″·573 | 80·587 (3) − 46·873 (3) = 33″·713 | 23·140 (3) − 20·587 (3) = 2″·553 |
| 180 | 108·760 (3) − 58·947 (3) = 49·813 | 81·433 (3) − 48·760 (3) = 32·673 | 24·020 (3) − 21·433 (3) = 2·587 |
| 9 | 107·327 (3) − 60·513 (3) = 46·813 | 81·273 (3) − 47·327 (3) = 33·947 | 24·180 (3) − 21·273 (3) = 2·907 |
| 189 | 107·680 (3) − 59·673 (3) = 48·007 | 80·113 (3) − 47·680 (3) = 32·433 | 21·673 (3) − 20·113 (3) = 1·560 |
| 18 | 107·933 (3) − 57·647 (3) = 50·287 | 80·947 (3) − 47·933 (3) = 33·013 | 21·173 (3) − 20·947 (3) = 0·227 |
| 198 | 107·993 (3) − 60·440 (3) = 47·553 | 81·307 (3) − 47·993 (3) = 33·313 | 24·340 (3) − 21·307 (3) = 3·033 |
| 27 | 107·960 (3) − 58·953 (3) = 49·007 | 79·020 (3) − 47·960 (3) = 31·060 | 20·873 (3) − 19·020 (3) = 1·853 |
| 207 | 108·813 (3) − 60·073 (3) = 48·740 | 81·220 (3) − 48·813 (3) = 32·407 | 22·647 (3) − 21·220 (3) = 1·427 |
| Means | 64 40 48·724 | 63 35 32·820 | 75 22 2·018 |
| | Prob. = 0·395 | Prob. = 0·301 | Prob. = 0·312 |

| Zero. | Referring Lamp and Kamkhera. |
|---|---|
| | ° ′ ″ |
| 0 | 3 31 57·300 (3) |
| 180 | 58·947 (3) |
| 9 | 60·513 (3) |
| 189 | 59·673 (3) |
| 18 | 57·647 (3) |
| 198 | 60·440 (3) |
| 27 | 58·953 (3) |
| 207 | 60·073 (3) |
| Means | 3 31 59·193 |

Azimuth of Lamp ..... = 181° 38′ 55″·541

Lamp and Kamkhera ..... = +3 31 59·193

Azimuth of Kamkhera..... = 185 10 54·734

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No. 3.—At the STATION of ANDER.—December 1838.

| Zero. | Gargaja and Ehmadpur. | Ehmadpur and Gidgarh. | Gidgarh and Ladi. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ″ (3) |
| 0 | 68 21 57·320 | 47 6 11·813 | 51 9 47·567 |
| 180 | 56·700 | 13·933 | 47·640 |
| 9 | 56·887 | 12·260 | 44·900 |
| 189 | 56·287 | 14·307 | 46·887 |
| 18 | 57·700 | 14·533 | 45·253 |
| 198 | 56·207 | 14·447 | 46·500 |
| 27 | 55·740 | 13·980 | 46·533 |
| 207 | 57·113 | 14·640 | 45·520 |
| Means | 68 21 56·744 | 47 6 13·739 | 51 9 46·350 |
| Prob. | = 0·213 | = 0·359 | = 0·342 |

| Zero. | Ladi and Ranipur. | | |
|---|---|---|---|
| | ° ′ ″ (3) | | |
| 0 | 54 3 26·440 | | |
| 180 | 25·113 | | |
| 9 | 28·673 | | |
| 189 | 27·253 | | |
| 18 | 26·053 | | |
| 198 | 26·220 | | |
| 27 | 25·420 | | |
| 207 | 25·567 | | |
| Means | 54 3 26·342 | | |
| Prob. | = 0·382 | | |

No. 4.—At the STATION of GIDGARH.—December 1838 and January 1839.

| Zero. | Ehmadpur and Ander. | Ander and Ladi. | Ladi and Samasgarh. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ″ (3) |
| 0 | 57 31 46·240 | 62 1 30·473 | 63 57 10·713 |
| 180 | 44·813 | 31·380 | 10·853 |
| 9 | 47·687 | 31·807 | 10·047 |
| 189 | 46·687 | 28·993 | 11·560 |
| 18 | 46·247 | 33·133 | 11·640 |
| 198 | 46·167 | 32·067 | 10·333 |
| 27 | 46·020 | 30·920 | 14·253 |
| 207 | 46·800 | 29·960 | 12·687 |
| Means | 57 31 46·333 | 62 1 31·092 | 63 57 11·511 |
| Prob. | = 0·269 | = 0·430 | = 0·460 |

No. 5.—At the STATION of SAMASGARH.—January 1839.

| Zero. | Gidgarh and Ladi. | Ladi and Bhimbet. | |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | |
| 0 | 50 30 9·673 | 55 7 29·927 | |
| 180 | 9·673 | 29·973 | |
| 9 | 13·433 | 26·987 | |
| 189 | 12·167 | 28·027 | |
| 18 | 11·930 | 28·107 | |
| 198 | 12·233 | 27·767 | |
| 27 | 11·760 | 29·093 | |
| 207 | 10·460 | 29·413 | |
| Means | 50 30 11·416 | 55 7 28·662 | |
| Prob. | = 0·445 | = 0·362 | |



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No. 6.—At the STATION of LADI.—January 1839.

| Zero. | Ander and Ranipur. | Ranipur and Bhimbet. | Bhimbet and Samasgarh. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 80 53 21·967 (3) | 78 30 39·620 (3) | 68 14 32·633 (3) |
| 180 | 23·373 (3) | 39·160 (3) | 32·373 (3) |
| 9 | 23·893 (3) | 39·480 (3) | 32·307 (3) |
| 189 | 23·593 (3) | 40·573 (3) | 30·260 (3) |
| 18 | 23·287 (3) | 41·407 (3) | 30·673 (3) |
| 198 | 25·533 (3) | 38·573 (3) | 32·760 (3) |
| 27 | 23·927 (3) | 39·987 (3) | 32·160 (3) |
| 207 | 24·587 (3) | 38·400 (3) | 31·873 (3) |
| Means | 80 53 23·770 | 78 30 39·650 | 68 14 31·880 |
| Prob. | = 0·342 | = 0·333 | = 0·304 |

| Zero. | Samasgarh and Gidgarh. | Gidgarh and Ander. | |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | |
| 0 | 65 32 40·153 (3) | 66 48 46·007 (3) | |
| 180 | 40·520 (3) | 44·040 (3) | |
| 9 | 38·740 (3) | 45·080 (3) | |
| 189 | 40·287 (3) | 44·840 (3) | |
| 18 | 38·007 (3) | 46·427 (3) | |
| 198 | 38·920 (3) | 44·467 (3) | |
| 27 | 39·507 (3) | 45·480 (3) | |
| 207 | 41·120 (3) | 43·620 (3) | |
| Means | 65 32 39·657 | 66 48 44·995 | |
| Prob. | = 0·346 | = 0·317 | |

No. 7.—At the STATION of RANIPUR.—January 1839.

| Zero. | Ander and Ladi. | Ladi and Bhimbet. | Bhimbet and Tek. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 45 3 13·433 (3) | 46 21 5·647 (3) | 75 18 16·893 (3) |
| 180 | 13·220 (3) | 5·040 (3) | 16·833 (3) |
| 9 | 12·813 (3) | 7·807 (3) | 19·047 (3) |
| 189 | 14·440 (3) | 5·040 (3) | 18·340 (3) |
| 18 | 12·507 (3) | 6·540 (3) | 16·487 (3) |
| 198 | 13·853 (3) | 4·193 (3) | 19·607 (3) |
| 27 | 13·340 (3) | 4·547 (3) | 17·260 (3) |
| 207 | 13·153 (3) | 3·867 (3) | 18·420 (3) |
| Means | 45 3 13·345 | 46 21 5·335 | 75 18 17·861 |
| Prob. | = 0·198 | = 0·431 | = 0·380 |

| Zero. | Bhimbet and Morpani. | Morpani and Tek. | |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | |
| 0 | 52 18 38·327 (3) | 22 59 38·567 (3) | |
| 180 | 37·327 (3) | 39·507 (3) | |
| 9 | 38·073 (3) | 40·973 (3) | |
| 189 | 38·127 (3) | 40·213 (3) | |
| 18 | 37·000 (3) | 39·487 (3) | |
| 198 | 40·667 (3) | 38·940 (3) | |
| 27 | 38·867 (3) | 38·393 (3) | |
| 207 | 40·320 (3) | 38·100 (3) | |
| Means | 52 18 38·589 | 22 59 39·273 | |
| Prob. | = 0·434 | = 0·322 | |

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No. 8.—At the STATION of BHIMBET.—December 1838.

| Zero. | Samasgarh and Ladi. | | Ladi and Ranipur. | | Ranipur and Tek. | |
|---|---|---|---|---|---|---|
| | (25° 56′) + (30° 41′) = (56° 37′) | | (85° 49′) − (30° 41′) = (55° 8′) | | (141° 17′) − (85° 49′) = (55° 28′) | |
| 0 | 24″·527 (3) + 38″·373 (3) = 62″·900 | | 55″·687 (3) − 38″·373 (3) = 17″·313 | | 100″·733 (3) − 55″·687 (3) = 45″·047 | |
| 180 | 24·640 (3) + 38·793 (3) = 63·433 | | 57·220 (3) − 38·793 (3) = 18·427 | | 100·500 (3) − 57·220 (3) = 43·280 | |
| 9 | 23·300 (3) + 38·073 (3) = 61·373 | | 57·767 (3) − 38·073 (3) = 19·693 | | 99·093 (3) − 57·767 (3) = 41·327 | |
| 189 | 24·100 (3) + 36·340 (3) = 60·440 | | 58·007 (3) − 36·340 (3) = 21·667 | | 100·720 (3) − 58·007 (3) = 42·713 | |
| 18 | 24·127 (3) + 37·260 (3) = 61·387 | | 55·993 (3) − 37·260 (3) = 18·733 | | 98·573 (3) − 55·993 (3) = 42·580 | |
| 198 | 23·913 (3) + 36·640 (3) = 60·553 | | 56·613 (3) − 36·640 (3) = 19·973 | | 99·853 (3) − 56·613 (3) = 43·240 | |
| 27 | 25·540 (3) + 37·847 (3) = 63·387 | | 55·620 (3) − 37·847 (3) = 17·773 | | 98·740 (3) − 55·620 (3) = 43·120 | |
| 207 | 24·800 (3) + 37·620 (3) = 62·420 | Prob. = 0·400 | 55·133 (3) − 37·620 (3) = 17·513 | Prob. = 0·491 | 100·827 (3) − 55·133 (3) = 45·693 | Prob. = 0·460 |
| Means | 56 38 1·987 | | 55 8 18·887 | | 55 28 43·375 | |

| Zero. | Ranipur and Morpani. | | Tek and Narwargarh. | | Morpani and Narwargarh. | |
|---|---|---|---|---|---|---|
| | (159° 8′) − (85° 49′) = (73° 19′) | | (197° 47′) − (141° 18′) = (56° 29′) | | (197° 47′) − (159° 9′) = (38° 38′) | |
| 0 | 107″·380 (3) − 55″·687 (3) = 51″·693 | | 90″·293 (3) − 40″·733 (3) = 49″·560 | | 90″·293 (3) − 47″·380 (3) = 42″·913 | |
| 180 | 108·980 (3) − 57·220 (3) = 51·760 | | 90·567 (3) − 40·500 (3) = 50·067 | | 90·567 (3) − 48·980 (3) = 41·587 | |
| 9 | 108·233 (3) − 57·767 (3) = 50·467 | | 91·680 (3) − 39·093 (3) = 52·587 | | 91·680 (3) − 48·233 (3) = 43·447 | |
| 189 | 110·200 (3) − 58·007 (3) = 52·193 | | 92·267 (3) − 40·720 (3) = 51·547 | | 92·267 (3) − 50·200 (3) = 42·067 | |
| 18 | 108·693 (3) − 55·993 (3) = 52·700 | | 91·393 (3) − 38·573 (3) = 52·820 | | 91·393 (3) − 48·693 (3) = 42·700 | |
| 198 | 108·727 (3) − 56·613 (3) = 52·113 | | 91·487 (3) − 39·853 (3) = 51·633 | | 91·487 (3) − 48·727 (3) = 42·760 | |
| 27 | 107·887 (3) − 55·620 (3) = 52·267 | | 90·020 (3) − 38·740 (3) = 51·280 | | 90·020 (3) − 47·887 (3) = 42·133 | |
| 207 | 108·040 (3) − 55·133 (3) = 52·907 | Prob. = 0·248 | 90·480 (3) − 40·827 (3) = 49·653 | Prob. = 0·418 | 90·480 (3) − 48·040 (3) = 42·440 | Prob. = 0·190 |
| Means | 73 19 52·013 | | 56 29 51·143 | | 38 38 42·506 | |

| Zero. | Morpani and Tek. | | Referring Lamp and Ladi. | |
|---|---|---|---|---|
| | (159° 9′) − (141° 18′) = (17° 51′) | | | |
| 0 | 47″·380 (3) − 40″·733 (3) = 6″·647 | | 30° 41′ 38″·373 (3) | |
| 180 | 48·980 (3) − 40·500 (3) = 8·480 | | 38·793 (3) | Azimuth of Lamp = 163° 52′ 22″·745 |
| 9 | 48·233 (3) − 39·093 (3) = 9·140 | | 38·073 (3) | Lamp and Ladi ... = +30 41 37·618 |
| 189 | 50·200 (3) − 40·720 (3) = 9·480 | | 36·340 (3) | |
| 18 | 48·693 (3) − 38·573 (3) = 10·120 | | 37·260 (3) | Azimuth of Ladi = 194 34 0·363 |
| 198 | 48·727 (3) − 39·853 (3) = 8·873 | | 36·640 (3) | |
| 27 | 47·887 (3) − 38·740 (3) = 9·147 | | 37·847 (3) | |
| 207 | 48·040 (3) − 40·827 (3) = 7·213 | Prob. = 0·385 | 37·620 (3) | |
| Means | 17 51 8·638 | | 30 41 37·618 | |



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No. 9.—At the STATION of TEK.—February 1839.

| Zero. | Ranipur and Bhimbet. | | Ranipur and Morpani. | | Bhimbet and Morpani. | |
|---|---|---|---|---|---|---|
| | (89° 37′) − (40° 24′) = (49° 13′) | | | | | |
| 0 | 41″·053 (3) − 37″·053 (3) = 4″·000 | Prob. = 0·262 | 89° 37′ 41″·053 (3) | Prob. = 0·283 | 40° 24′ 37″·053 (3) | Prob. = 0·283 |
| 180 | 41·107 (3) − 38·227 (3) = 2·880 | | 41·107 (3) | | 38·227 (3) | |
| 9 | 40·293 (3) − 36·753 (3) = 3·540 | | 40·293 (3) | | 36·753 (3) | |
| 189 | 39·887 (3) − 35·280 (3) = 4·607 | | 39·887 (3) | | 35·280 (3) | |
| 18 | 41·173 (3) − 37·093 (3) = 4·080 | | 41·173 (3) | | 37·093 (3) | |
| 198 | 41·873 (3) − 36·553 (3) = 5·320 | | 41·873 (3) | | 36·553 (3) | |
| 27 | 42·120 (3) − 37·513 (3) = 4·607 | | 42·120 (3) | | 37·513 (3) | |
| 207 | 42·327 (3) − 37·353 (3) = 4·973 | | 42·327 (3) | | 37·353 (3) | |
| Means | 49° 13′ 4″·251 | | 89° 37′ 41″·229 | | 40° 24′ 36″·978 | |

| Zero. | Bhimbet and Narwargarh. | | Morpani and Narwargarh. | | Morpani and Dhabadeo. | |
|---|---|---|---|---|---|---|
| | (25° 35′) + (40° 24′) = (65° 59′) | | | | | |
| 0 | 20″·193 (3) + 37″·053 (3) = 57″·247 | Prob. = 0·235 | 25° 35′ 20″·193 (3) | Prob. = 0·347 | 61° 53′ 35″·033 (3) | Prob. = 0·304 |
| 180 | 20·307 (3) + 38·227 (3) = 58·533 | | 20·307 (3) | | 33·220 (3) | |
| 9 | 19·780 (3) + 36·753 (3) = 56·533 | | 19·780 (3) | | 34·593 (3) | |
| 189 | 22·747 (3) + 35·280 (3) = 58·027 | | 22·747 (3) | | 35·080 (3) | |
| 18 | 20·633 (3) + 37·093 (3) = 57·727 | | 20·633 (3) | | 35·940 (3) | |
| 198 | 20·307 (3) + 36·553 (3) = 56·860 | | 20·307 (3) | | 34·240 (3) | |
| 27 | 19·867 (3) + 37·513 (3) = 57·380 | | 19·867 (3) | | 34·147 (3) | |
| 207 | 19·213 (3) + 37·353 (3) = 56·567 | | 19·213 (3) | | 33·313 (3) | |
| Means | 65° 59′ 57″·359 | | 25° 35′ 20″·381 | | 61° 53′ 34″·446 | |

| Zero. | Narwargarh and Dhabadeo. | | | |
|---|---|---|---|---|
| | (61° 53′) − (25° 35′) = (36° 18′) | | | |
| 0 | 35″·033 (3) − 20″·193 (3) = 14″·840 | Prob. = 0·333 | | |
| 180 | 33·220 (3) − 20·307 (3) = 12·913 | | | |
| 9 | 34·593 (3) − 19·780 (3) = 14·813 | | | |
| 189 | 35·080 (3) − 22·747 (3) = 12·333 | | | |
| 18 | 35·940 (3) − 20·633 (3) = 15·307 | | | |
| 198 | 34·240 (3) − 20·307 (3) = 13·933 | | | |
| 27 | 34·147 (3) − 19·867 (3) = 14·280 | | | |
| 207 | 33·313 (3) − 19·213 (3) = 14·100 | | | |
| Means | 36° 18′ 14″·065 | | | |

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No. 10.—At the STATION of MORPANI.—January 1839.

| Zero. | Tek and Ranipur. | Tek and Bhimbet. | Ranipur and Bhimbet. |
|---|---|---|---|
| | $\overline{67\ 22\ 42\cdot500}^{(3)}$ | $\overline{(67\cdot22)}^{\circ\ '} + \overline{(54\cdot21)}^{\circ\ '} = \overline{(121\cdot43)}^{\circ\ '}$ | $\overline{54\ 21\ 34\cdot473}^{(3)}$ |
| 0 | | $\overline{42\cdot500}^{(3)} + \overline{34\cdot473}^{(3)} = 76''\cdot973$ | |
| 180 | $\overline{43\cdot173}^{(3)}$ | $\overline{43\cdot173}^{(3)} + \overline{33\cdot253}^{(3)} = 76\cdot427$ | $\overline{33\cdot253}^{(3)}$ |
| 9 | $\overline{41\cdot413}^{(3)}$ | $\overline{41\cdot413}^{(3)} + \overline{34\cdot533}^{(3)} = 75\cdot947$ | $\overline{34\cdot533}^{(3)}$ |
| 189 | $\overline{42\cdot967}^{(3)}$ | $\overline{42\cdot967}^{(3)} + \overline{33\cdot873}^{(3)} = 76\cdot840$ | $\overline{33\cdot873}^{(3)}$ |
| 18 | $\overline{42\cdot053}^{(3)}$ | $\overline{42\cdot053}^{(3)} + \overline{34\cdot673}^{(3)} = 76\cdot727$ | $\overline{34\cdot673}^{(3)}$ |
| 198 | $\overline{42\cdot553}^{(3)}$ | $\overline{42\cdot553}^{(3)} + \overline{34\cdot713}^{(3)} = 77\cdot267$ | $\overline{34\cdot713}^{(3)}$ |
| 27 | $\overline{41\cdot773}^{(3)}$ | $\overline{41\cdot773}^{(3)} + \overline{35\cdot893}^{(3)} = 77\cdot667$ | $\overline{35\cdot893}^{(3)}$ |
| 207 | $\overline{43\cdot560}^{(3)}$ | $\overline{43\cdot560}^{(3)} + \overline{34\cdot807}^{(3)} = 78\cdot367$ | $\overline{34\cdot807}^{(3)}$ |
| Means | 67 22 42·499 | 121 44 17·027 | 54 21 34·527 |
| Prob. | = 0·241 | = 0·247 | = 0·252 |

| Zero. | Bhimbet and Narwargarh. | Narwargarh and Tek. | Narwargarh and Dhabadeo. |
|---|---|---|---|
| | $\overline{97\ 3\ 19\cdot213}^{(3)}$ | $\overline{(92\cdot13)}^{\circ\ '} + \overline{(48\cdot58)}^{\circ\ '} = \overline{(141\cdot11)}^{\circ\ '}$ | $\overline{48\ 58\ 29\cdot387}^{(3)}$ |
| 0 | | $\overline{54\cdot267}^{(3)} + \overline{29\cdot387}^{(3)} = 83''\cdot653$ | |
| 180 | $\overline{19\cdot500}^{(3)}$ | $\overline{55\cdot033}^{(3)} + \overline{28\cdot587}^{(3)} = 83\cdot620$ | $\overline{28\cdot587}^{(3)}$ |
| 9 | $\overline{21\cdot147}^{(3)}$ | $\overline{54\cdot840}^{(3)} + \overline{28\cdot360}^{(3)} = 83\cdot200$ | $\overline{28\cdot360}^{(3)}$ |
| 189 | $\overline{19\cdot613}^{(3)}$ | $\overline{55\cdot940}^{(3)} + \overline{27\cdot647}^{(3)} = 83\cdot587$ | $\overline{27\cdot647}^{(3)}$ |
| 18 | $\overline{20\cdot447}^{(3)}$ | $\overline{55\cdot100}^{(3)} + \overline{27\cdot593}^{(3)} = 82\cdot693$ | $\overline{27\cdot593}^{(3)}$ |
| 198 | $\overline{19\cdot660}^{(3)}$ | $\overline{54\cdot747}^{(3)} + \overline{28\cdot067}^{(3)} = 82\cdot813$ | $\overline{28\cdot067}^{(3)}$ |
| 27 | $\overline{20\cdot360}^{(3)}$ | $\overline{53\cdot867}^{(3)} + \overline{29\cdot180}^{(3)} = 83\cdot047$ | $\overline{29\cdot180}^{(3)}$ |
| 207 | $\overline{17\cdot493}^{(3)}$ | $\overline{54\cdot220}^{(3)} + \overline{30\cdot607}^{(3)} = 84\cdot827$ | $\overline{30\cdot607}^{(3)}$ |
| Means | 97 3 19·679 | 141 12 23·430 | 48 58 28·679 |
| Prob. | = 0·359 | = 0·223 | = 0·335 |

| Zero. | Dhabadeo and Tek. |
|---|---|
| | $\overline{92\ 13\ 54\cdot267}^{(3)}$ |
| 0 | |
| 180 | $\overline{55\cdot033}^{(3)}$ |
| 9 | $\overline{54\cdot840}^{(3)}$ |
| 189 | $\overline{55\cdot940}^{(3)}$ |
| 18 | $\overline{55\cdot100}^{(3)}$ |
| 198 | $\overline{54\cdot747}^{(3)}$ |
| 27 | $\overline{53\cdot867}^{(3)}$ |
| 207 | $\overline{54\cdot220}^{(3)}$ |
| Means | 92 13 54·752 |
| Prob. | = 0·214 |

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No. 11.—At the STATION of NARWARGARH.—March 1839.

| Zero. | Bhimbet and Tek. | | Bhimbet and Morpani. | | Morpani and Tek. | |
|---|---|---|---|---|---|---|
| | (185° 52′) — (128° 22′) = (57° 30′) | | (185° 53′) — (141° 35′) = (44° 18′) | | (141° 34′) — (128° 22′) = (13° 12′) | |
| 0 | 64″·867 (3) — 44″·280 (3) = 20″·587 | Prob. = 0·278 | 4″·867 (3) — 2″·820 (3) = 2″·047 | Prob. = 0·143 | 62″·820 (3) — 44″·280 (3) = 18″·540 | Prob. = 0·233 |
| 180 | 64·687 (3) — 45·280 (3) = 19·407 | | 4·687 (3) — 2·133 (3) = 2·553 | | 62·133 (3) — 45·280 (3) = 16·853 | |
| 9 | 65·660 (3) — 44·780 (3) = 20·880 | | 5·660 (3) — 3·480 (3) = 2·180 | | 63·480 (3) — 44·780 (3) = 18·700 | |
| 189 | 65·153 (3) — 43·827 (3) = 21·327 | | 5·153 (3) — 2·100 (3) = 3·053 | | 62·100 (3) — 43·827 (3) = 18·273 | |
| 18 | 65·587 (3) — 46·380 (3) = 19·207 | | 5·587 (3) — 3·460 (3) = 2·127 | | 63·460 (3) — 46·380 (3) = 17·080 | |
| 198 | 65·127 (3) — 44·873 (3) = 20·253 | | 5·127 (3) — 2·420 (3) = 2·707 | | 62·420 (3) — 44·873 (3) = 17·547 | |
| 27 | 63·720 (3) — 44·633 (3) = 19·087 | | 3·720 (3) — 2·067 (3) = 1·653 | | 62·067 (3) — 44·633 (3) = 17·433 | |
| 207 | 64·980 (3) — 45·433 (3) = 19·547 | | 4·980 (3) — 2·653 (3) = 2·327 | | 62·653 (3) — 45·433 (3) = 17·220 | |
| Means | 57 30 20·037 | | 44 18 2·331 | | 13 12 17·706 | |

| Zero. | Morpani and Dhabadeo. | | Tek and Dhabadeo. | | Dhabadeo and Alampur. | |
|---|---|---|---|---|---|---|
| | (141° 34′) — (71° 53′) = (69° 41′) | | (128° 22′) — (71° 53′) = (56° 29′) | | | |
| 0 | 62″·820 (3) — 8″·293 (3) = 54″·527 | Prob. = 0·119 | 44″·280 (3) — 8″·293 (3) = 35″·987 | Prob. = 0·236 | 71° 53′ 8″·293 (3) | Prob. = 0·103 |
| 180 | 62·133 (3) — 7·933 (3) = 54·200 | | 45·280 (3) — 7·933 (3) = 37·347 | | 7·933 (3) | |
| 9 | 63·480 (3) — 8·840 (3) = 54·640 | | 44·780 (3) — 8·840 (3) = 35·940 | | 8·840 (3) | |
| 189 | 62·100 (3) — 8·227 (3) = 53·873 | | 43·827 (3) — 8·227 (3) = 35·600 | | 8·227 (3) | |
| 18 | 63·460 (3) — 8·860 (3) = 54·600 | | 46·380 (3) — 8·860 (3) = 37·520 | | 8·860 (3) | |
| 198 | 62·420 (3) — 8·273 (3) = 54·147 | | 44·873 (3) — 8·273 (3) = 36·600 | | 8·273 (3) | |
| 27 | 62·067 (3) — 8·447 (3) = 53·620 | | 44·633 (3) — 8·447 (3) = 36·187 | | 8·447 (3) | |
| 207 | 62·653 (3) — 8·367 (3) = 54·287 | | 45·433 (3) — 8·367 (3) = 37·067 | | 8·367 (3) | |
| Means | 69 41 54·237 | | 56 29 36·531 | | 71 53 8·405 | |

| Zero. | Dhabadeo and Nilgarh. | | Nilgarh and Alampur. | | |
|---|---|---|---|---|---|
| | (71° 52′) — (13° 38′) = (58° 14′) | | | | |
| 0 | 68″·293 (3) — 39″·787 (3) = 28″·507 | Prob. = 0·199 | 13° 38′ 39″·787 (3) | Prob. = 0·187 | |
| 180 | 67·933 (3) — 39·827 (3) = 28·107 | | 39·827 (3) | | |
| 9 | 68·840 (3) — 39·387 (3) = 29·453 | | 39·387 (3) | | |
| 189 | 68·227 (3) — 40·087 (3) = 28·140 | | 40·087 (3) | | |
| 18 | 68·860 (3) — 41·053 (3) = 27·807 | | 41·053 (3) | | |
| 198 | 68·273 (3) — 40·780 (3) = 27·493 | | 40·780 (3) | | |
| 27 | 68·447 (3) — 40·347 (3) = 28·100 | | 40·347 (3) | | |
| 207 | 68·367 (3) — 40·613 (3) = 27·753 | | 40·613 (3) | | |
| Means | 58 14 28·170 | | 13 38 40·235 | | |

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No. 12.—At the STATION of DHABADEO.—March 1839.

| Zero. | Tek and Morpani. | | | | Morpani and Narwargarh. | | | | Tek and Narwargarh. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (214·36) | (188·44) | (25·52) | | (188·43) | (127·24) | (61·19) | | (214·36) | (127·24) | (87·12) | |
| 0 | 64·393 (3) | 31·027 (3) | 33″·367 | Prob. = 0·283 | 91·027 (3) | 51·500 (3) | 39″·527 | Prob. = 0·294 | 64·393 (3) | 51·500 (3) | 12″·893 | Prob. = 0·246 |
| 180 | 62·960 (3) | 28·727 (3) | 34·233 | | 88·727 (3) | 49·047 (3) | 39·680 | | 62·960 (3) | 49·047 (3) | 13·913 | |
| 9 | 64·153 (3) | 31·447 (3) | 32·707 | | 91·447 (3) | 51·420 (3) | 40·027 | | 64·153 (3) | 51·420 (3) | 12·733 | |
| 189 | 64·200 (3) | 30·093 (3) | 34·107 | | 90·093 (3) | 50·833 (3) | 39·260 | | 64·200 (3) | 50·833 (3) | 13·367 | |
| 18 | 63·287 (3) | 31·660 (3) | 31·627 | | 91·660 (3) | 50·020 (3) | 41·640 | | 63·287 (3) | 50·020 (3) | 13·267 | |
| 198 | 64·307 (3) | 30·413 (3) | 33·893 | | 90·413 (3) | 50·633 (3) | 39·780 | | 64·307 (3) | 50·633 (3) | 13·673 | |
| 27 | 64·707 (3) | 31·053 (3) | 33·653 | | 91·053 (3) | 49·780 (3) | 41·273 | | 64·707 (3) | 49·780 (3) | 14·927 | |
| 207 | 63·933 (3) | 30·467 (3) | 33·467 | | 90·467 (3) | 49·553 (3) | 40·913 | | 63·933 (3) | 49·553 (3) | 14·380 | |
| Means | 25 | 52 | 33·382 | | 61 | 19 | 40·263 | | 87 | 12 | 13·644 | |

| Zero. | Narwargarh and Alampur. | | | | Alampur and Nilgarh. | | | | Nilgarh and Narwargarh. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (127·24) | (96·36) | (30·48) | | (96·35) | (48·41) | (47·54) | | (127·24) | (48·41) | (78·43) | |
| 0 | 51·500 (3) | 2·933 (3) | 48″·567 | Prob. = 0·304 | 62·933 (3) | 11·720 (3) | 51″·213 | Prob. = 0·163 | 51·500 (3) | 11·720 (3) | 39″·780 | Prob. = 0·223 |
| 180 | 49·047 (3) | 3·167 (3) | 45·880 | | 63·167 (3) | 10·740 (3) | 52·427 | | 49·047 (3) | 10·740 (3) | 38·307 | |
| 9 | 51·420 (3) | 3·933 (3) | 47·487 | | 63·933 (3) | 12·467 (3) | 51·467 | | 51·420 (3) | 12·467 (3) | 38·953 | |
| 189 | 50·833 (3) | 2·793 (3) | 48·040 | | 62·793 (3) | 11·473 (3) | 51·320 | | 50·833 (3) | 11·473 (3) | 39·360 | |
| 18 | 50·020 (3) | 3·447 (3) | 46·573 | | 63·447 (3) | 12·400 (3) | 51·047 | | 50·020 (3) | 12·400 (3) | 37·620 | |
| 198 | 50·633 (3) | 2·347 (3) | 48·287 | | 62·347 (3) | 11·627 (3) | 50·720 | | 50·633 (3) | 11·627 (3) | 39·007 | |
| 27 | 49·780 (3) | 2·880 (3) | 46·900 | | 62·880 (3) | 11·340 (3) | 51·540 | | 49·780 (3) | 11·340 (3) | 38·440 | |
| 207 | 49·553 (3) | 2·527 (3) | 47·027 | | 62·527 (3) | 11·073 (3) | 51·453 | | 49·553 (3) | 11·073 (3) | 38·480 | |
| Means | 30 | 48 | 47·345 | | 47 | 54 | 51·398 | | 78 | 43 | 38·743 | |

| Zero. | Nilgarh and Jagdhar. | | | | Jagdhar and Alampur. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| 0 | 48 | 41 | 11·720 (3) | Prob. = 0·198 | 96 | 36 | 2·933 (3) | Prob. = 0·168 | | | | |
| 180 | | | 10·740 (3) | | | | 3·167 (3) | | | | | |
| 9 | | | 12·467 (3) | | | | 3·933 (3) | | | | | |
| 189 | | | 11·473 (3) | | | | 2·793 (3) | | | | | |
| 18 | | | 12·400 (3) | | | | 3·447 (3) | | | | | |
| 198 | | | 11·627 (3) | | | | 2·347 (3) | | | | | |
| 27 | | | 11·340 (3) | | | | 2·880 (3) | | | | | |
| 207 | | | 11·073 (3) | | | | 2·527 (3) | | | | | |
| Means | 48 | 41 | 11·605 | | 96 | 36 | 3·003 | | | | | |



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No. 13.—At the STATION of ALAMPUR.—February 1839.

| Zero. | Narwargarh and Dhabadeo. | Narwargarh and Nilgarh. | Dhabadeo and Jagdhar. |
|---|---|---|---|
| | $\overline{77\ 18\ 5\cdot500}^{(3)}$ | $\overline{158\ 44\ 37\cdot907}^{(3)}$ | $(\overline{114\cdot30}) - (\overline{77\cdot18}) = (\overline{37\cdot12})$ |
| 0 | $\overline{5\cdot207}^{(3)}$ | $\overline{36\cdot427}^{(3)}$ | $\overline{56\cdot747}^{(3)} - \overline{5\cdot500}^{(3)} = 51''\cdot247$ |
| 180 | $\overline{5\cdot967}^{(3)}$ | $\overline{38\cdot000}^{(3)}$ | $\overline{56\cdot513}^{(3)} - \overline{5\cdot207}^{(3)} = 51\cdot307$ |
| 9 | $\overline{5\cdot793}^{(3)}$ | $\overline{37\cdot773}^{(3)}$ | $\overline{56\cdot300}^{(3)} - \overline{5\cdot967}^{(3)} = 50\cdot333$ |
| 189 | $\overline{4\cdot847}^{(3)}$ | $\overline{37\cdot567}^{(3)}$ | $\overline{56\cdot067}^{(3)} - \overline{5\cdot793}^{(3)} = 50\cdot273$ |
| 18 | $\overline{6\cdot687}^{(3)}$ | $\overline{36\cdot920}^{(3)}$ | $\overline{57\cdot233}^{(3)} - \overline{4\cdot847}^{(3)} = 52\cdot387$ |
| 198 | $\overline{5\cdot893}^{(3)}$ | $\overline{37\cdot653}^{(3)}$ | $\overline{55\cdot760}^{(3)} - \overline{6\cdot687}^{(3)} = 49\cdot073$ |
| 27 | $\overline{4\cdot880}^{(3)}$ | $\overline{36\cdot507}^{(3)}$ | $\overline{57\cdot367}^{(3)} - \overline{5\cdot893}^{(3)} = 51\cdot473$ |
| 207 | | | $\overline{56\cdot133}^{(3)} - \overline{4\cdot880}^{(3)} = 51\cdot253$ |
| Means | 77 18 5·597 | 158 44 37·344 | 37 12 50·918 |
| Prob. | = 0·205 | = 0·209 | = 0·331 |

| Zero. | Jagdhar and Nilgarh. | Dhabadeo and Nilgarh. |
|---|---|---|
| | $(\overline{158\cdot43}) - (\overline{114\cdot30}) = (\overline{44\cdot13})$ | $(\overline{158\cdot44}) - (\overline{77\cdot18}) = (\overline{81\cdot26})$ |
| 0 | $\overline{97\cdot907}^{(3)} - \overline{56\cdot747}^{(3)} = 41''\cdot160$ | $\overline{37\cdot907}^{(3)} - \overline{5\cdot500}^{(3)} = 32''\cdot407$ |
| 180 | $\overline{96\cdot427}^{(3)} - \overline{56\cdot513}^{(3)} = 39\cdot913$ | $\overline{36\cdot427}^{(3)} - \overline{5\cdot207}^{(3)} = 31\cdot220$ |
| 9 | $\overline{98\cdot000}^{(3)} - \overline{56\cdot300}^{(3)} = 41\cdot700$ | $\overline{38\cdot000}^{(3)} - \overline{5\cdot967}^{(3)} = 32\cdot033$ |
| 189 | $\overline{97\cdot773}^{(3)} - \overline{56\cdot067}^{(3)} = 41\cdot707$ | $\overline{37\cdot773}^{(3)} - \overline{5\cdot793}^{(3)} = 31\cdot980$ |
| 18 | $\overline{97\cdot567}^{(3)} - \overline{57\cdot233}^{(3)} = 40\cdot333$ | $\overline{37\cdot567}^{(3)} - \overline{4\cdot847}^{(3)} = 32\cdot720$ |
| 198 | $\overline{96\cdot920}^{(3)} - \overline{55\cdot760}^{(3)} = 41\cdot160$ | $\overline{36\cdot920}^{(3)} - \overline{6\cdot687}^{(3)} = 30\cdot233$ |
| 27 | $\overline{97\cdot653}^{(3)} - \overline{57\cdot367}^{(3)} = 40\cdot287$ | $\overline{37\cdot653}^{(3)} - \overline{5\cdot893}^{(3)} = 31\cdot760$ |
| 207 | $\overline{96\cdot507}^{(3)} - \overline{56\cdot133}^{(3)} = 40\cdot373$ | $\overline{36\cdot507}^{(3)} - \overline{4\cdot880}^{(3)} = 31\cdot627$ |
| Means | 44 13 40·829 | 81 26 31·748 |
| Prob. | = 0·228 | = 0·253 |

No. 14.—At the STATION of JAGDHAR.—March 1839.

| Zero. | Dhabadeo and Alampur. | Alampur and Nilgarh. | Dhabadeo and Nilgarh. |
|---|---|---|---|
| | $(\overline{90\cdot21}) - (\overline{44\cdot10}) = (\overline{46\cdot11})$ | $\overline{44\ 10\ 54\cdot773}^{(3)}$ | $\overline{90\ 22\ 3\cdot120}^{(3)}$ |
| 0 | $\overline{63\cdot120}^{(3)} - \overline{54\cdot773}^{(3)} = 8''\cdot347$ | $\overline{54\cdot133}^{(3)}$ | $\overline{3\cdot560}^{(3)}$ |
| 180 | $\overline{63\cdot560}^{(3)} - \overline{54\cdot133}^{(3)} = 9\cdot427$ | $\overline{54\cdot960}^{(3)}$ | $\overline{3\cdot540}^{(3)}$ |
| 9 | $\overline{63\cdot540}^{(3)} - \overline{54\cdot960}^{(3)} = 8\cdot580$ | $\overline{53\cdot680}^{(3)}$ | $\overline{3\cdot787}^{(3)}$ |
| 189 | $\overline{63\cdot787}^{(3)} - \overline{53\cdot680}^{(3)} = 10\cdot107$ | $\overline{55\cdot393}^{(3)}$ | $\overline{3\cdot680}^{(3)}$ |
| 18 | $\overline{63\cdot680}^{(3)} - \overline{55\cdot393}^{(3)} = 8\cdot287$ | $\overline{53\cdot653}^{(3)}$ | $\overline{2\cdot433}^{(3)}$ |
| 198 | $\overline{62\cdot433}^{(3)} - \overline{53\cdot653}^{(3)} = 8\cdot780$ | $\overline{54\cdot013}^{(3)}$ | $\overline{2\cdot393}^{(3)}$ |
| 27 | $\overline{62\cdot393}^{(3)} - \overline{54\cdot013}^{(3)} = 8\cdot380$ | $\overline{54\cdot460}^{(3)}$ | $\overline{2\cdot353}^{(3)}$ |
| 207 | $\overline{62\cdot353}^{(3)} - \overline{54\cdot460}^{(3)} = 7\cdot893$ | | |
| Means | 46 11 8·725 | 44 10 54·383 | 90 22 3·108 |
| Prob. | = 0·236 | = 0·207 | = 0·206 |

| Zero. | Nilgarh and Salbaldi. | Nilgarh and Dhar. | Salbaldi and Dhar. |
|---|---|---|---|
| | $\overline{73\ 40\ 5\cdot553}^{(3)}$ | $\overline{30\ 17\ 11\cdot093}^{(3)}$ | $(\overline{73\cdot39}) - (\overline{30\cdot17}) = (\overline{43\cdot22})$ |
| 0 | $\overline{6\cdot333}^{(3)}$ | $\overline{12\cdot133}^{(3)}$ | $\overline{65\cdot553}^{(3)} - \overline{11\cdot093}^{(3)} = 54''\cdot460$ |
| 180 | $\overline{6\cdot280}^{(3)}$ | $\overline{11\cdot807}^{(3)}$ | $\overline{66\cdot333}^{(3)} - \overline{12\cdot133}^{(3)} = 54\cdot200$ |
| 9 | $\overline{5\cdot307}^{(3)}$ | $\overline{11\cdot780}^{(3)}$ | $\overline{66\cdot280}^{(3)} - \overline{11\cdot807}^{(3)} = 54\cdot473$ |
| 189 | $\overline{6\cdot047}^{(3)}$ | $\overline{10\cdot800}^{(3)}$ | $\overline{65\cdot307}^{(3)} - \overline{11\cdot780}^{(3)} = 53\cdot527$ |
| 18 | $\overline{6\cdot567}^{(3)}$ | $\overline{12\cdot067}^{(3)}$ | $\overline{66\cdot047}^{(3)} - \overline{10\cdot800}^{(3)} = 55\cdot247$ |
| 198 | $\overline{6\cdot133}^{(3)}$ | $\overline{11\cdot553}^{(3)}$ | $\overline{66\cdot567}^{(3)} - \overline{12\cdot067}^{(3)} = 54\cdot500$ |
| 27 | $\overline{6\cdot020}^{(3)}$ | $\overline{10\cdot787}^{(3)}$ | $\overline{66\cdot133}^{(3)} - \overline{11\cdot553}^{(3)} = 54\cdot580$ |
| 207 | | | $\overline{66\cdot020}^{(3)} - \overline{10\cdot787}^{(3)} = 55\cdot233$ |
| Means | 73 40 6·030 | 30 17 11·503 | 43 22 54·528 |
| Prob. | = 0·137 | = 0·179 | = 0·183 |

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No. 15.—At the STATION OF NILGARH.—February 1839.

| Zero. | Alampur and Narwargarh. | Alampur and Dhabadeo. | Alampur and Jagdhar. |
|---|---|---|---|
| | (146° 12′) — (138° 36′) = (7° 36′) | (146° 12′) — (95° 34′) = (50° 38′) | (146° 13′) — (54° 38′) = (91° 35′) |
| 0 | 90″·260 (3) — 47″·347 (3) = 42″·913 | 90″·260 (3) — 50″·300 (3) = 39″·960 | 30″·260 (3) — 3″·547 (3) = 26″·713 |
| 180 | 87″·753 (3) — 46″·860 (3) = 40″·893 | 87″·753 (3) — 50″·447 (3) = 37″·307 | 27″·753 (3) — 2″·293 (3) = 25″·460 |
| 9 | 89″·280 (3) — 46″·487 (3) = 42″·793 | 89″·280 (3) — 48″·753 (3) = 40″·527 | 29″·280 (3) — 1″·013 (3) = 28″·267 |
| 189 | 89″·113 (3) — 46″·533 (3) = 42″·580 | 89″·113 (3) — 51″·507 (3) = 37″·607 | 29″·113 (3) — 1″·527 (3) = 27″·587 |
| 18 | 88″·927 (3) — 46″·560 (3) = 42″·367 | 88″·927 (3) — 49″·293 (3) = 39″·633 | 28″·927 (3) — 1″·307 (3) = 27″·620 |
| 198 | 90″·120 (3) — 45″·187 (3) = 44″·933 | 90″·120 (3) — 49″·667 (3) = 40″·453 | 30″·120 (3) — 1″·547 (3) = 28″·573 |
| 27 | 90″·700 (3) — 46″·433 (3) = 44″·267 | 90″·700 (3) — 50″·920 (3) = 39″·780 | 30″·700 (3) — 2″·827 (3) = 27″·873 |
| 207 | 88″·673 (3) — 46″·653 (3) = 42″·020 | 88″·673 (3) — 51″·087 (3) = 37″·587 | 28″·673 (3) — 3″·647 (3) = 25″·027 |
| Means | 7° 36′ 42″·846 | 50° 38′ 39″·107 | 91° 35′ 27″·140 |
| Prob. | = 0″·418 | = 0″·452 | = 0″·429 |

| Zero. | Narwargarh and Dhabadeo. | Dhabadeo and Jagdhar. | Jagdhar and Salbaldi. |
|---|---|---|---|
| | (138° 35′) — (95° 34′) = (43° 1′) | (95° 34′) — (54° 38′) = (40° 56′) | (54° 38′) + (8° 31′) = (63° 9′) |
| 0 | 107″·347 (3) — 50″·300 (3) = 57″·047 | 50″·300 (3) — 3″·547 (3) = 46″·753 | 3″·547 (3) + 53″·487 (3) = 57″·033 |
| 180 | 106″·860 (3) — 50″·447 (3) = 56″·413 | 50″·447 (3) — 2″·293 (3) = 48″·153 | 2″·293 (3) + 53″·787 (3) = 56″·080 |
| 9 | 106″·487 (3) — 48″·753 (3) = 57″·733 | 48″·753 (3) — 1″·013 (3) = 47″·740 | 1″·013 (3) + 54″·647 (3) = 55″·660 |
| 189 | 106″·533 (3) — 51″·507 (3) = 55″·027 | 51″·507 (3) — 1″·527 (3) = 49″·980 | 1″·527 (3) + 54″·133 (3) = 55″·660 |
| 18 | 106″·560 (3) — 49″·293 (3) = 57″·267 | 49″·293 (3) — 1″·307 (3) = 47″·987 | 1″·307 (3) + 54″·400 (3) = 55″·707 |
| 198 | 105″·187 (3) — 49″·667 (3) = 55″·520 | 49″·667 (3) — 1″·547 (3) = 48″·120 | 1″·547 (3) + 54″·913 (3) = 56″·460 |
| 27 | 106″·433 (3) — 50″·920 (3) = 55″·513 | 50″·920 (3) — 2″·827 (3) = 48″·093 | 2″·827 (3) + 53″·747 (3) = 56″·573 |
| 207 | 106″·653 (3) — 51″·087 (3) = 55″·567 | 51″·087 (3) — 3″·647 (3) = 47″·440 | 3″·647 (3) + 53″·387 (3) = 57″·033 |
| Means | 43° 1′ 56″·261 | 40° 56′ 48″·033 | 63° 9′ 56″·276 |
| Prob. | = 0″·329 | = 0″·303 | = 0″·193 |

| Zero. | Jagdhar and Dhar. | Dhar and Salbaldi. | Referring Lamp and Narwargarh. |
|---|---|---|---|
| | (54° 38′) + (64° 10′) = (118° 48′) | (64° 9′) — (8° 31′) = (55° 38′) | |
| 0 | 3″·547 (3) + 20″·753 (3) = 24″·300 | 80″·753 (3) — 53″·487 (3) = 27″·267 | 138° 36′ 47″·347 (3) |
| 180 | 2″·293 (3) + 22″·593 (3) = 24″·887 | 82″·593 (3) — 53″·787 (3) = 28″·807 | 46″·860 (3) |
| 9 | 1″·013 (3) + 21″·980 (3) = 22″·993 | 81″·980 (3) — 54″·647 (3) = 27″·333 | 46″·487 (3) |
| 189 | 1″·527 (3) + 22″·607 (3) = 24″·133 | 82″·607 (3) — 54″·133 (3) = 28″·473 | 46″·533 (3) |
| 18 | 1″·307 (3) + 20″·853 (3) = 22″·160 | 80″·853 (3) — 54″·400 (3) = 26″·453 | 46″·560 (3) |
| 198 | 1″·547 (3) + 21″·873 (3) = 23″·420 | 81″·873 (3) — 54″·913 (3) = 26″·960 | 45″·187 (3) |
| 27 | 2″·827 (3) + 20″·920 (3) = 23″·747 | 80″·920 (3) — 53″·747 (3) = 27″·173 | 46″·433 (3) |
| 207 | 3″·647 (3) + 22″·060 (3) = 25″·707 | 82″·060 (3) — 53″·387 (3) = 28″·673 | 46″·653 (3) |
| Means | 118° 48′ 23″·918 | 55° 38′ 27″·642 | 138° 36′ 46″·508 |
| Prob. | = 0″·366 | = 0″·392 | |

Azimuth of Lamp ..... = 312° 32′ 49″·333

Lamp and Narwargarh ..... = —138° 36′ 46″·508

Azimuth of Narwargarh ..... = 173° 56′ 2″·825

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No. 16.—At the STATION of DHAR.—March 1839.

| Zero. | Nilgarh and Jagdhar. | Jagdhar and Salbaldi. | Nilgarh and Salbaldi. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | (°′) + (°′) = (°′) |
| 0 | 30 54 27·633 (3) | 49 46 2·300 (3) | 27·633 (3) + 2·300 (3) = 29·933 |
| 180 | 26·853 (3) | 2·200 (3) | 26·853 (3) + 2·200 (3) = 29·053 |
| 9 | 27·227 (3) | 2·200 (3) | 27·227 (3) + 2·200 (3) = 29·427 |
| 189 | 28·093 (3) | 2·687 (3) | 28·093 (3) + 2·687 (3) = 30·780 |
| 18 | 26·740 (3) | 2·480 (3) | 26·740 (3) + 2·480 (3) = 29·220 |
| 198 | 27·653 (3) | 2·780 (3) | 27·653 (3) + 2·780 (3) = 30·433 |
| 27 | 27·867 (3) | 2·247 (3) | 27·867 (3) + 2·247 (3) = 30·114 |
| 207 | 26·640 (3) | 2·027 (3) | 26·640 (3) + 2·027 (3) = 28·667 |
| Means | 30 54 27·338 | 49 46 2·365 | 80 40 29·703 |
| Prob. | = 0·182 | = 0·086 | = 0·241 |

| Zero. | Salbaldi and Ner. | Ner and Ashti. | Salbaldi and Ashti. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | (°′) + (°′) = (°′) |
| 0 | 34 36 22·567 (3) | 40 5 47·440 (3) | 22·567 (3) + 47·440 (3) = 10″·007 |
| 180 | 22·413 (3) | 46·713 (3) | 22·413 (3) + 46·713 (3) = 9·126 |
| 9 | 22·220 (3) | 47·493 (3) | 22·220 (3) + 47·493 (3) = 9·713 |
| 189 | 22·400 (3) | 45·993 (3) | 22·400 (3) + 45·993 (3) = 8·393 |
| 18 | 23·147 (3) | 47·673 (3) | 23·147 (3) + 47·673 (3) = 10·820 |
| 198 | 21·733 (3) | 47·487 (3) | 21·733 (3) + 47·487 (3) = 9·220 |
| 27 | 21·820 (3) | 48·080 (3) | 21·820 (3) + 48·080 (3) = 9·900 |
| 207 | 23·140 (3) | 46·080 (3) | 23·140 (3) + 46·080 (3) = 9·220 |
| Means | 34 36 22·430 | 40 5 47·120 | 74 42 9·550 |
| Prob. | = 0·174 | = 0·254 | = 0·241 |

No. 17.—At the STATION of SALBALDI.—March 1839.

| Zero. | Jagdhar and Nilgarh. | Nilgarh and Dhar. | Jagdhar and Dhar. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | (°′) + (°′) = (°′) |
| 0 | 43 10 1·620 (3) | 43 41 7·110 (4) | 7·110 (4) + 1·620 (3) = 8″·730 |
| 180 | 0·960 (3) | 6·447 (3) | 6·447 (3) + 0·960 (3) = 7·407 |
| 9 | 0·955 (4) | 6·535 (4) | 6·535 (4) + 0·955 (4) = 7·490 |
| 189 | 2·740 (3) | 6·680 (3) | 6·680 (3) + 2·740 (3) = 9·420 |
| 18 | 1·213 (3) | 6·867 (3) | 6·867 (3) + 1·213 (3) = 8·080 |
| 198 | 1·647 (3) | 5·560 (3) | 5·560 (3) + 1·647 (3) = 7·207 |
| 27 | 1·700 (3) | 6·133 (3) | 6·133 (3) + 1·700 (3) = 7·833 |
| 207 | 1·360 (3) | 7·387 (3) | 7·387 (3) + 1·360 (3) = 8·747 |
| Means | 43 10 1·524 | 43 41 6·590 | 86 51 8·114 |
| Prob. | = 0·190 | = 0·189 | = 0·259 |

| Zero. | Dhar and Ashti. | Ashti and Ner. | Dhar and Ner. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | (°′) + (°′) = (°′) |
| 0 | 59 44 43·750 (4) | 37 59 51·385 (4) | 51·385 (4) + 43·750 (4) = 35″·135 |
| 180 | 44·587 (3) | 51·213 (3) | 51·213 (3) + 44·587 (3) = 35·800 |
| 9 | 44·590 (4) | 51·400 (4) | 51·400 (4) + 44·590 (4) = 35·990 |
| 189 | 44·980 (3) | 51·827 (3) | 51·827 (3) + 44·980 (3) = 36·807 |
| 18 | 44·073 (3) | 51·680 (3) | 51·680 (3) + 44·073 (3) = 35·753 |
| 198 | 46·460 (3) | 51·120 (3) | 51·120 (3) + 46·460 (3) = 37·580 |
| 27 | 45·113 (3) | 52·427 (3) | 52·427 (3) + 45·113 (3) = 37·540 |
| 207 | 44·127 (3) | 52·080 (3) | 52·080 (3) + 44·127 (3) = 36·207 |
| Means | 59 44 44·710 | 37 59 51·642 | 97 44 36·352 |
| Prob. | = 0·279 | = 0·149 | = 0·291 |

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No. 18.—At the STATION of NER.—March 1839.

| Zero. | Salbaldi and Dhar. | Salbaldi and Ashti. | Dhar and Ashti. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | (° ′) − (° ′) = (° ′) |
| 0 | 47 39 3·320 (3) | 109 36 24·055 (4) | ″ ″ ″ |
| 180 | 3·140 (3) | 22·920 (3) | 24·055 (4) − 3·320 (3) = 20·735 |
| 9 | 4·110 (4) | 22·900 (3) | 22·920 (3) − 3·140 (3) = 19·780 |
| 189 | 4·053 (3) | 22·380 (3) | 22·900 (3) − 4·110 (4) = 18·790 |
| 18 | 1·927 (3) | 22·040 (3) | 22·380 (3) − 4·053 (3) = 18·327 |
| 198 | 3·727 (3) | 23·260 (4) | 22·040 (3) − 1·927 (3) = 20·113 |
| 27 | 2·373 (3) | 22·553 (3) | 23·260 (4) − 3·727 (3) = 19·533 |
| 207 | 4·260 (4) | 23·055 (4) | 22·553 (3) − 2·373 (3) = 20·180 |
| | | | 23·055 (4) − 4·260 (4) = 18·795 |
| Means | 47 39 3·364 | 109 36 22·895 | 61 57 19·532 |
| Prob. | = 0·281 | = 0·202 | = 0·274 |

| Zero. | Ashti and Badali. | Badali and Wirur. | |
|---|---|---|---|
| | (° ′) − (° ′) = (° ′) | | |
| 0 | ″ ″ ″ | ° ′ ″ | |
| 180 | 79·405 (4) − 24·055 (4) = 55·350 | 49 30 39·513 (3) | |
| 9 | 77·133 (3) − 22·920 (3) = 54·213 | 40·105 (4) | |
| 189 | 77·113 (3) − 22·900 (3) = 54·213 | 39·380 (3) | |
| 18 | 76·907 (3) − 22·380 (3) = 54·527 | 39·420 (3) | |
| 198 | 77·153 (3) − 22·040 (3) = 55·113 | 39·375 (4) | |
| 27 | 76·555 (4) − 23·260 (4) = 53·295 | 39·564 (5) | |
| 207 | 77·507 (3) − 22·553 (3) = 54·954 | 38·947 (3) | |
| | 77·150 (5) − 23·055 (4) = 54·095 | 39·247 (3) | |
| Means | 42 26 54·470 | 49 30 39·444 | |
| Prob. | = 0·219 | = 0·108 | |

No. 19.—At the STATION of ASHTI.—February and March 1839.

| Zero. | Dhar and Salbaldi. | Dhar and Ner. | Salbaldi and Ner. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | (° ′) − (° ′) = (° ′) |
| 0 | 45 33 9·768 (5) | 77 56 57·628 (5) | ″ ″ ″ |
| 180 | 10·260 (3) | 56·540 (3) | 57·628 (5) − 9·768 (5) = 47·860 |
| 9 | 9·360 (5) | 58·065 (4) | 56·540 (3) − 10·260 (3) = 46·280 |
| 189 | 9·660 (3) | 57·767 (3) | 58·065 (4) − 9·360 (5) = 48·705 |
| 18 | 9·425 (4) | 58·160 (4) | 57·767 (3) − 9·660 (3) = 48·107 |
| 198 | 9·987 (3) | 56·960 (4) | 58·160 (4) − 9·425 (4) = 48·735 |
| 27 | 9·553 (3) | 57·633 (3) | 56·960 (4) − 9·987 (3) = 46·973 |
| 207 | 9·025 (4) | 56·705 (4) | 57·633 (3) − 9·553 (3) = 48·080 |
| | | | 56·705 (4) − 9·025 (4) = 47·680 |
| Means | 45 33 9·630 | 77 56 57·432 | 32 23 47·803 |
| Prob. | = 0·127 | = 0·204 | = 0·276 |

| Zero. | Ner and Badali. | Badali and Badgaon. | |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | |
| 0 | 59 46 48·660 (3) | 53 20 23·613 (3) | |
| 180 | 49·347 (3) | 24·780 (3) | |
| 9 | 47·815 (4) | 25·180 (4) | |
| 189 | 49·933 (3) | 23·907 (3) | |
| 18 | 48·030 (4) | 25·685 (4) | |
| 198 | 48·575 (4) | 24·807 (3) | |
| 27 | 49·795 (4) | 22·945 (4) | |
| 207 | 48·220 (4) | 25·730 (4) | |
| Means | 59 46 48·797 | 53 20 24·581 | |
| Prob. | = 0·266 | = 0·332 | |



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No. 20.—At the STATION of BADALI.—February 1839

| Zero. | Ashti and Ner. | Ner and Wirur. | Wirur and Ikjhera. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 77 46 18·165 (4) | 80 2 30·933 (3) | 49 20 34·233 (3) |
| 180 | 16·293 (3) | 30·827 (3) | 34·053 (3) |
| 9 | 17·740 (4) | 30·600 (4) | 32·365 (4) |
| 189 | 17·400 (5) | 30·692 (5) | 33·050 (4) |
| 18 | 17·780 (3) | 31·447 (3) | 32·625 (4) |
| 198 | 17·773 (3) | 31·040 (4) | 32·730 (4) |
| 27 | 18·293 (3) | 30·327 (3) | 33·607 (3) |
| 207 | 17·180 (3) | 30·207 (3) | 32·960 (3) |
| Prob. | = 0·209 | = 0·132 | = 0·227 |
| Means | 77 46 17·578 | 80 2 30·759 | 49 20 33·203 |

| Zero. | Ikjhera and Badgaon. | Badgaon and Ashti. | |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | |
| 0 | 70 58 40·530 (4) | 81 51 56·780 (3) | |
| 180 | 40·667 (3) | 58·050 (4) | |
| 9 | 41·485 (4) | 57·465 (4) | |
| 189 | 42·015 (4) | 56·405 (4) | |
| 18 | 41·515 (4) | 56·430 (4) | |
| 198 | 41·720 (5) | 56·696 (5) | |
| 27 | 41·647 (3) | 56·440 (3) | |
| 207 | 42·027 (3) | 57·627 (3) | |
| Prob. | = 0·187 | = 0·211 | |
| Means | 70 58 41·451 | 81 51 56·987 | |

No. 21.—At the STATION of WIRUR.—February 1839.

| Zero. | Ikjhera and Badali. | Badali and Ner. | |
|---|---|---|---|
| | | (° ′) − (° ′) = (° ′) | |
| | ° ′ ″ | ″ ″ ″ | |
| 0 | 93 38 18·987 (3) | 95·000 (4) − 41·540 (5) = 53·460 | |
| 180 | 18·754 (7) | 94·880 (5) − 41·100 (5) = 53·780 | |
| 9 | 19·273 (3) | 94·907 (3) − 40·193 (3) = 54·714 | |
| 189 | 18·660 (4) | 96·100 (5) − 40·575 (4) = 55·525 | |
| 18 | 19·784 (5) | 94·135 (4) − 41·095 (4) = 53·040 | |
| 198 | 19·127 (3) | 94·920 (4) − 40·620 (3) = 54·300 | |
| 27 | 19·550 (4) | 95·180 (5) − 40·910 (4) = 54·270 | |
| 207 | 19·230 (4) | 94·205 (4) − 40·755 (4) = 53·450 | |
| Prob. | = 0·125 | = 0·266 | |
| Means | 93 38 19·171 | 50 26 54·067 | |

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No. 22.—At the STATION of IKJHERA.—February 1839.

| Zero. | Bam and Kopdi. | Kopdi and Pilkher. | Pilkher and Badgaon. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ″ (3) |
| 0 | 67 22 8·207 | 22 56 20·360 | 37 1 21·467 |
| 180 | 8·087 | 20·033 | 21·067 |
| 9 | 6·953 | 22·007 | 20·853 |
| 189 | 9·113 | 20·860 | 20·873 |
| 18 | 9·327 | 20·840 | 20·273 |
| 198 | 8·680 | 20·267 | 21·253 |
| 27 | 8·213 | 21·200 | 20·820 |
| 207 | 8·373 | 20·533 | 19·893 |
| | Prob. = 0·241 | Prob. = 0·207 | Prob. = 0·169 |
| Means | 67 22 8·369 | 22 56 20·763 | 37 1 20·812 |

| Zero. | Badgaon and Badali. | Badali and Wirur. |
|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) |
| 0 | 32 0 27·373 | 37 1 8·953 |
| 180 | 27·900 | 9·047 |
| 9 | 27·513 | 9·860 |
| 189 | 27·627 | 9·140 |
| 18 | 27·627 | 8·827 |
| 198 | 26·507 | 9·887 |
| 27 | 27·100 | 10·167 |
| 207 | 27·480 | 9·480 |
| | Prob. = 0·140 | Prob. = 0·166 |
| Means | 32 0 27·391 | 37 1 9·420 |

No. 23.—At the STATION of BADGAON.—January 1839.

| Zero. | Ashti and Badali. | Badali and Ikjhera. | Ikjhera and Pilkher. |
|---|---|---|---|
| | (47·55) — (3·8) = (44·47) | (124·56) — (47·56) = (77·0) | (177·59) — (124·57) = (53·2) |
| 0 | 100·710 (4) — 60·735 (4) = 39″·975 | 95·833 (3) — 40·710 (4) = 55″·123 | 38·667 (3) — 35·833 (3) = 2″·834 |
| 180 | 99·905 (4) — 59·827 (3) = 40·078 | 94·647 (3) — 39·905 (4) = 54·742 | 36·890 (4) — 34·647 (3) = 2·243 |
| 9 | 100·333 (3) — 60·165 (4) = 40·168 | 95·893 (3) — 40·333 (3) = 55·560 | 37·620 (3) — 35·893 (3) = 1·727 |
| 189 | 101·324 (5) — 60·687 (3) = 40·637 | 95·470 (4) — 41·324 (5) = 54·146 | 38·210 (4) — 35·470 (4) = 2·740 |
| 18 | 101·570 (4) — 60·395 (4) = 41·175 | 96·036 (5) — 41·570 (4) = 54·466 | 37·607 (3) — 36·036 (5) = 1·571 |
| 198 | 101·020 (3) — 59·900 (3) = 41·120 | 95·733 (3) — 41·020 (3) = 54·713 | 37·633 (3) — 35·733 (3) = 1·900 |
| 27 | 100·287 (3) — 59·933 (3) = 40·354 | 95·767 (3) — 40·287 (3) = 55·480 | 38·453 (3) — 35·767 (3) = 2·686 |
| 207 | 100·672 (5) — 59·940 (4) = 40·732 | 95·075 (4) — 40·672 (5) = 54·403 | 37·412 (5) — 35·075 (4) = 2·337 |
| | Prob. = 0·153 | Prob. = 0·170 | Prob. = 0·160 |
| Means | 44 47 40·530 | 77 0 54·829 | 53 2 2·255 |

| Zero. | Referring Lamp and Ashti. |
|---|---|
| | ° ′ ″ (4) |
| 0 | 3 8 60·735 |
| 180 | 59·827 (3) |
| 9 | 60·165 (4) |
| 189 | 60·687 (3) |
| 18 | 60·395 (4) |
| 198 | 59·900 (3) |
| 27 | 59·933 (3) |
| 207 | 59·940 (4) |
| Means | 3 9 0·198 |

Azimuth of Lamp ..... = 180° 0′ 0″·483

Lamp and Ashti..... = +3 9 0·198

Azimuth of Ashti ..... = 183 9 0·681

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No. 24.—At the STATION of PILKHER.—January 1839.

| Zero. | Kopdi and Ikjhera. | Ikjhera and Badgaon. | |
|---|---|---|---|
| | ° ′ ″ | (° ′) − (° ′) = (° ′) | |
| 0 | 70 21 2·863 (6) | 43·090 (4) − 2·863 (6) = 40″·227 | |
| 180 | 3·845 (4) | 43·984 (5) − 3·845 (4) = 40·139 | |
| 9 | 4·512 (5) | 44·128 (5) − 4·512 (5) = 39·616 | |
| 189 | 2·890 (4) | 45·706 (7) − 2·890 (4) = 42·816 | |
| 18 | 3·004 (5) | 45·360 (5) − 3·004 (5) = 42·356 | |
| 198 | 2·924 (5) | 42·828 (5) − 2·924 (5) = 39·904 | |
| 27 | 2·580 (4) | 43·350 (4) − 2·580 (4) = 40·770 | |
| 207 | 3·010 (4) | 43·404 (5) − 3·010 (4) = 40·394 | |
| Means | 70 21 3·204 | 89 56 40·778 | |
| | Prob. = 0·212 | Prob. = 0·388 | |

No. 25.—At the STATION of KOPDI.—January 1839.

| Zero. | Pilkher and Ikjhera. | Ikjhera and Bam. | Bam and Sakri. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 86 42 38·045 (4) | 42 2 40·000 (4) | 68 20 0·500 (6) |
| 180 | 35·753 (3) | 40·667 (3) | 1·647 (3) |
| 9 | 37·740 (3) | 39·707 (3) | 0·500 (3) |
| 189 | 37·133 (3) | 39·505 (4) | 0·993 (3) |
| 18 | 37·420 (4) | 39·340 (4) | 0·935 (4) |
| 198 | 36·633 (3) | 40·793 (3) | 1·380 (3) |
| 27 | 38·007 (3) | 39·973 (3) | 1·520 (3) |
| 207 | 36·433 (3) | 39·660 (3) | 1·893 (3) |
| Means | 86 42 37·146 | 42 2 39·956 | 68 20 1·171 |
| | Prob. = 0·271 | Prob. = 0·174 | Prob. = 0·172 |

No. 26.—At the STATION of BAM.—January 1839.

| Zero. | Mahur and Sakri. | Sakri and Kopdi. | Kopdi and Ikjhera. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 41 0 20·807 (3) | 57 29 37·700 (3) | 70 35 14·700 (2) |
| 180 | 19·865 (4) | 38·367 (3) | 14·467 (3) |
| 9 | 21·000 (3) | 38·200 (3) | 14·047 (3) |
| 189 | 22·253 (3) | 37·493 (3) | 13·555 (4) |
| 18 | 20·220 (3) | 38·400 (3) | 13·800 (4) |
| 198 | 21·000 (4) | 38·310 (4) | 13·010 (4) |
| 27 | 21·120 (3) | 38·453 (3) | 14·287 (3) |
| 207 | 20·320 (3) | 38·267 (3) | 14·493 (3) |
| Means | 41 0 20·823 | 57 29 38·149 | 70 35 14·045 |
| | Prob. = 0·241 | Prob. = 0·117 | Prob. = 0·187 |

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No. 27.—At the STATION of SAKRI.—December 1838.

| Zero. | Referring Lamp and Kopdi. | Kopdi and Bam. | Bam and Mahur. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 4 35 22·633 (3) | 54 10 24·085 (4) | 78 22 51·795 (4) |
| 180 | 22·400 (3) | 23·753 (3) | 49·780 (3) |
| 9 | 22·233 (3) | 24·053 (3) | 50·360 (3) |
| 189 | 20·880 (3) | 23·320 (3) | 50·707 (3) |
| 18 | 21·167 (3) | 22·607 (3) | 50·333 (3) |
| 198 | 21·487 (3) | 23·413 (3) | 50·630 (4) |
| 27 | 20·973 (3) | 22·253 (3) | 50·780 (3) |
| 207 | 22·407 (3) | 23·153 (3) | 50·687 (3) |
| Means | 4 35 21·773 | 54 10 23·330 | 78 22 50·634 |
| Prob. | | = 0·216 | = 0·188 |

| Zero. | Mahur and Sukli. |
|---|---|
| | ° ′ ″ |
| 0 | 52 30 3·607 (3) |
| 180 | 3·453 (3) |
| 9 | 3·435 (4) |
| 189 | 2·973 (3) |
| 18 | 3·453 (3) |
| 198 | 2·600 (4) |
| 27 | 3·367 (3) |
| 207 | 3·480 (3) |
| Means | 52 30 3·296 |
| Prob. | = 0·111 |

Azimuth of Lamp ..... = 179° 59′ 59″·146
Lamp and Kopdi ..... = −4 35 21·773
Azimuth of Kopdi ..... = 175 24 37·373

No. 28.—At the STATION of MAHUR.—December 1838.

| Zero. | Bitergaon and Sukli. | Sukli and Sakri. | Sakri and Bam. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 60 56 60·433 (3) | 70 19 48·673 (3) | 60 36 51·380 (3) |
| 180 | 59·673 (3) | 49·047 (3) | 51·133 (3) |
| 9 | 57·473 (3) | 51·233 (3) | 51·247 (3) |
| 189 | 60·967 (3) | 47·980 (3) | 52·173 (3) |
| 18 | 60·493 (3) | 47·353 (3) | 52·887 (3) |
| 198 | 60·600 (3) | 48·100 (3) | 52·067 (3) |
| 27 | 59·773 (3) | 49·947 (3) | 49·713 (3) |
| 207 | 60·090 (4) | 47·510 (4) | 53·175 (4) |
| Means | 60 56 59·938 | 70 19 48·730 | 60 36 51·722 |
| Prob. | = 0·359 | = 0·437 | = 0·365 |

No. 29.—At the STATION of SUKLI.—December 1838.

| Zero. | Sakri and Mahur. | Mahur and Bitergaon. | Bitergaon and Terban. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| | 57 10 8·667 (3) | 57 31 20·813 (3) | 67 22 25·200 (3) |
| 180 | 7·693 (3) | 20·387 (3) | 24·580 (4) |
| 9 | 8·007 (3) | 20·273 (3) | 23·627 (3) |
| 189 | 9·387 (3) | 21·060 (3) | 24·267 (3) |
| 18 | 8·280 (3) | 20·893 (3) | 25·020 (3) |
| 198 | 9·215 (4) | 20·840 (3) | 24·220 (3) |
| 27 | 8·000 (4) | 20·673 (3) | 24·833 (3) |
| 207 | 7·255 (4) | 21·107 (3) | 24·753 (3) |
| Means | 57 10 8·313 | 57 31 20·756 | 67 22 24·563 |
| Prob. | = 0·243 | = 0·099 | = 0·168 |



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No. 30.—At the STATION of BITERGAON.—December 1838.

| Zero. | Shevni and Terban. | Terban and Sukli. | Sukli and Mahur. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 81 27 49·787 (3) | 72 44 35·733 (3) | 61 31 42·473 (3) |
| 180 | 48·313 (3) | 35·353 (3) | 44·007 (3) |
| 9 | 48·740 (3) | 35·093 (3) | 42·740 (3) |
| 189 | 49·727 (3) | 35·967 (3) | 42·347 (3) |
| 18 | 49·293 (3) | 36·980 (3) | 42·327 (3) |
| 198 | 49·987 (3) | 36·193 (3) | 42·433 (3) |
| 27 | 49·693 (3) | 36·407 (3) | 42·227 (3) |
| 207 | 49·220 (3) | 36·233 (3) | 41·473 (3) |
| Means | 81 27 49·345 | 72 44 35·995 | 61 31 42·503 |
| | Prob. = 0·191 | Prob. = 0·199 | Prob. = 0·234 |

No. 31.—At the STATION of SHEVNI.—December 1838.

| Zero. | Bhesa and Terban. | Terban and Bitergaon. | |
|---|---|---|---|
| | | (° ′) − (° ′) = (° ′) | |
| | ° ′ ″ | ″ ″ | |
| 0 | 50 35 60·936 (5) | 112·773 (3) − 60·936 (5) = 51″·837 | |
| 180 | 60·965 (4) | 111·527 (3) − 60·965 (4) = 50·562 | |
| 9 | 61·020 (3) | 112·747 (3) − 61·020 (3) = 51·727 | |
| 189 | 61·420 (3) | 113·725 (4) − 61·420 (3) = 52·305 | |
| 18 | 59·000 (3) | 112·727 (3) − 59·000 (3) = 53·727 | |
| 198 | 61·540 (3) | 113·373 (3) − 61·540 (3) = 51·833 | |
| 27 | 60·660 (3) | 112·820 (3) − 60·660 (3) = 52·160 | |
| 207 | 60·300 (3) | 112·193 (3) − 60·300 (3) = 51·893 | |
| Means | 50 35 60·730 | 60 56 52·006 | |
| | Prob. = 0·265 | Prob. = 0·288 | |

No. 32.—At the STATION of TERBAN.—November 1838.

| Zero. | Somtana and Bhesa. | Bhesa and Shevni. | Shevni and Bitergaon. |
|---|---|---|---|
| | | (° ′) − (° ′) = (° ′) | (° ′) − (° ′) = (° ′) |
| | ° ′ ″ | ″ ″ | ″ ″ |
| 0 | 63 35 25·667 (3) | 36·713 (3) − 25·667 (3) = 11″·046 | 56·520 (3) − 36·713 (3) = 19″·807 |
| 180 | 24·360 (3) | 35·787 (3) − 24·360 (3) = 11·427 | 56·653 (3) − 35·787 (3) = 20·866 |
| 9 | 25·260 (3) | 34·753 (3) − 25·260 (3) = 9·493 | 56·500 (3) − 34·753 (3) = 21·747 |
| 189 | 26·087 (3) | 36·267 (3) − 26·087 (3) = 10·180 | 57·640 (3) − 36·267 (3) = 21·373 |
| 18 | 27·293 (3) | 35·427 (3) − 27·293 (3) = 8·134 | 57·027 (3) − 35·427 (3) = 21·600 |
| 198 | 26·240 (3) | 36·167 (3) − 26·240 (3) = 9·927 | 56·280 (3) − 36·167 (3) = 20·113 |
| 27 | 27·340 (3) | 36·413 (3) − 27·340 (3) = 9·073 | 57·693 (3) − 36·413 (3) = 21·280 |
| 207 | 23·500 (3) | 33·300 (3) − 23·500 (3) = 9·800 | 55·680 (3) − 33·300 (3) = 22·380 |
| Means | 63 35 25·718 | 43 17 9·885 | 37 35 21·146 |
| | Prob. = 0·442 | Prob. = 0·347 | Prob. = 0·282 |

| Zero. | Bitergaon and Sukli. |
|---|---|
| | (° ′) − (° ′) = (° ′) |
| | ″ ″ |
| 0 | 117·247 (3) − 56·520 (3) = 60″·727 |
| 180 | 115·460 (3) − 56·653 (3) = 58·807 |
| 9 | 116·093 (3) − 56·500 (3) = 59·593 |
| 189 | 118·060 (3) − 57·640 (3) = 60·420 |
| 18 | 117·773 (3) − 57·027 (3) = 60·746 |
| 198 | 117·133 (3) − 56·280 (3) = 60·853 |
| 27 | 117·960 (3) − 57·693 (3) = 60·267 |
| 207 | 115·853 (3) − 55·680 (3) = 60·173 |
| Means | 39 53 0·198 |
| | Prob. = 0·229 |

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No. 33.—At the STATION of BHESA.—December 1838.

| Zero. | Yemsha and Somtana. | Somtana and Terban. | Terban and Shevni. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 85 37 18·427 (3) | 37 52 8·907 (3) | 86 6 55·107 (3) |
| 180 | 16·825 (4) | 9·930 (4) | 54·093 (3) |
| 9 | 17·587 (3) | 8·447 (3) | 55·073 (3) |
| 189 | 17·247 (3) | 10·267 (3) | 54·273 (3) |
| 18 | 18·100 (3) | 9·467 (3) | 54·487 (3) |
| 198 | 17·933 (3) | 10·607 (3) | 53·173 (3) |
| 27 | 16·953 (3) | 10·060 (3) | 54·780 (3) |
| 207 | 16·395 (4) | 11·480 (4) | 53·587 (3) |
| Means | 85 37 17·433 | 37 52 9·896 | 86 6 54·322 |
| | Prob. = 0·231 | Prob. = 0·317 | Prob. = 0·228 |

No. 34.—At the STATION of SOMTANA.—November 1838.

| Zero. | Terban and Bhesa. | Bhesa and Yemsha. | Yemsha and Shevalingapa. |
|---|---|---|---|
| | (° ′ − ° ′ = °) | (° ′ − ° ′ = °) | (° ′ − ° ′ = °) |
| | (85 23) − (6 51) = (78 32) | (126 13) − (85 24) = (40 49) | (188 58) − (126 13) = (62 45) |
| 0 | ″ ″ ″ | ″ ″ ″ | ″ ″ ″ |
| | 68·187 (3) − 41·988 (5) = 26·199 | 29·733 (3) − 8·187 (3) = 21·546 | 78·373 (3) − 29·733 (3) = 48·640 |
| 180 | 67·595 (4) − 40·470 (4) = 27·125 | 30·450 (4) − 7·595 (4) = 22·855 | 76·993 (3) − 30·450 (4) = 46·543 |
| 9 | 67·153 (3) − 41·080 (3) = 26·073 | 29·160 (3) − 7·153 (3) = 22·007 | 77·107 (3) − 29·160 (3) = 47·947 |
| 189 | 67·447 (3) − 41·380 (4) = 26·067 | 30·330 (4) − 7·447 (3) = 22·883 | 76·880 (4) − 30·330 (4) = 46·550 |
| 18 | 67·400 (3) − 42·212 (5) = 25·188 | 29·260 (3) − 7·400 (3) = 21·860 | 78·220 (3) − 29·260 (3) = 48·960 |
| 198 | 67·747 (3) − 42·265 (4) = 25·482 | 30·745 (4) − 7·747 (3) = 22·998 | 77·800 (4) − 30·745 (4) = 47·055 |
| 27 | 68·253 (3) − 41·933 (3) = 26·320 | 30·607 (3) − 8·253 (3) = 22·354 | 77·680 (3) − 30·607 (3) = 47·073 |
| 207 | 66·695 (4) − 39·910 (4) = 26·785 | 29·930 (4) − 6·695 (4) = 23·235 | 77·555 (4) − 29·930 (4) = 47·625 |
| Means | 78 32 26·155 | 40 49 22·467 | 62 45 47·549 |
| | Prob. = 0·208 | Prob. = 0·203 | Prob. = 0·311 |

| Zero. | Referring Lamp and Terban. | Referring Lamp and Terban. |
|---|---|---|
| | ° ′ ″ | ° ′ ″ |
| 0 | 6 51 41·267 (3) | 6 51 41·988 (5) |
| 180 | 40·307 (3) | 40·470 (4) |
| 9 | 41·973 (3) | 41·080 (3) |
| 189 | 42·073 (3) | 41·380 (4) |
| 18 | 42·727 (3) | 42·212 (5) |
| 198 | 41·747 (3) | 42·265 (4) |
| 27 | 41·667 (3) | 41·933 (3) |
| 207 | 41·767 (3) | 39·910 (4) |
| Means | 6 51 41·691 | 6 51 41·405 |

April 1838.

Azimuth of Lamp = 180° 0′ 4″·938

Lamp and Terban = + 6 51 41·691

Azimuth of Terban = 186 51 46·629

November 1838.

Azimuth of Lamp ..... = 180° 0′ 5″·109

Lamp and Terban ..... = +6 51 41·405

Azimuth of Terban ..... = 186 51 46·514

Mean Azimuth ..... = 186 51 46·572

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No. 35.—At the STATION of YEMSHA.—November 1838.

| Zero. | Bhesa and Somtana. | Somtana and Shevalingapa. | Shevalingapa and Yenagapali. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 53 33 23·360 (3) | 53 18 5·047 (3) | 70 56 44·165 (4) |
| 180 | 21·820 (3) | 3·507 (3) | 45·584 (5) |
| 9 | 22·120 (3) | 4·433 (3) | 43·850 (4) |
| 189 | 22·147 (3) | 4·747 (3) | 44·330 (4) |
| 18 | 23·733 (3) | 3·293 (3) | 44·760 (3) |
| 198 | 22·053 (3) | 4·353 (3) | 45·227 (6) |
| 27 | 23·305 (4) | 4·867 (3) | 43·933 (3) |
| 207 | 22·265 (4) | 4·007 (3) | 44·407 (3) |
| Means | 53 33 22·600 | 53 18 4·282 | 70 56 44·532 |
| Prob. = | 0·244 | 0·210 | 0·204 |

| Zero. | Yenagapali and Baktapur. | Shevalingapa and Baktapur. |
|---|---|---|
| | ° ′ ″ | (70° 56′) − (43° 44′) = (27° 12′) |
| 0 | 43 44 24·500 (4) | 44·165 (4) − 24·500 (4) = 19·665 |
| 180 | 25·207 (3) | 45·584 (5) − 25·207 (3) = 20·377 |
| 9 | 24·744 (5) | 43·850 (4) − 24·744 (5) = 19·106 |
| 189 | 26·064 (5) | 44·330 (4) − 26·064 (5) = 18·266 |
| 18 | 25·320 (3) | 44·760 (3) − 25·320 (3) = 19·440 |
| 198 | 26·593 (6) | 45·227 (6) − 26·593 (6) = 18·634 |
| 27 | 24·173 (3) | 43·933 (3) − 24·173 (3) = 19·760 |
| 207 | 25·460 (3) | 44·407 (3) − 25·460 (3) = 18·947 |
| Means | 43 44 25·258 | 27 12 19·274 |
| Prob. = | 0·265 | 0·223 |

No. 36.—At the STATION of SHEVALINGAPA.—November 1838.

| Zero. | Somtana and Yemsha. | Yemsha and Yenagapali. | Yenagapali and Baktapur. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 63 56 11·220 (3) | 59 4 3·693 (3) | 51 30 38·747 (3) |
| 180 | 11·573 (3) | 2·787 (3) | 38·240 (4) |
| 9 | 11·273 (3) | 3·953 (3) | 38·173 (3) |
| 189 | 12·353 (3) | 3·033 (3) | 37·833 (3) |
| 18 | 11·867 (3) | 3·467 (3) | 38·173 (3) |
| 198 | 11·880 (3) | 3·687 (3) | 38·230 (4) |
| 27 | 12·307 (3) | 3·647 (3) | 39·040 (3) |
| 207 | 11·020 (3) | 3·313 (3) | 38·773 (3) |
| Means | 63 56 11·687 | 59 4 3·448 | 51 30 38·401 |
| Prob. = | 0·165 | 0·127 | 0·134 |

| Zero. | Baktapur and Yemsha. |
|---|---|
| | (59° 4′) + (51° 30′) = (110° 34′) |
| 0 | 3·693 (3) + 38·747 (3) = 42·440 |
| 180 | 2·787 (3) + 38·240 (4) = 41·027 |
| 9 | 3·953 (3) + 38·173 (3) = 42·126 |
| 189 | 3·033 (3) + 37·833 (3) = 40·886 |
| 18 | 3·467 (3) + 38·173 (3) = 41·640 |
| 198 | 3·687 (3) + 38·230 (4) = 41·917 |
| 27 | 3·647 (3) + 39·040 (3) = 42·687 |
| 207 | 3·313 (3) + 38·773 (3) = 42·086 |
| Means | 110 34 41·849 |
| Prob. = | 0·212 |

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No. 37.—At the STATION of BAKTAPUR.—October 1838 and March 1841.

| Zero. | Shevalingapa and Yemsha. | Shevalingapa and Yenagapali. | Yenagapali and Burgapali. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 42 12 62·160 (3) | 95 11 16·227 (3) | 53 51 35·747 (3) |
| 180 | 60·447 (3) | 13·567 (3) | 36·707 (3) |
| 9 | 59·880 (3) | 12·767 (3) | 37·173 (3) |
| 189 | 62·153 (3) | 13·747 (3) | 38·113 (3) |
| 18 | 62·373 (3) | 15·393 (3) | 34·900 (3) |
| 198 | 61·833 (3) | 13·907 (3) | 37·933 (3) |
| 27 | 60·470 (4) | 14·520 (4) | 36·000 (5) |
| 207 | 61·260 (3) | 13·253 (3) | 36·767 (3) |
| Prob. = 0·315 | | Prob. = 0·381 | Prob. = 0·362 |
| Means | 42 13 1·322 | 95 11 14·173 | 53 51 36·668 |

| Zero. | Yenagapali and Yemsha. | Burgapali and Munganal. |
|---|---|---|
| | (° ′) − (° ′) = (° ′) | |
| | (95 10) − (42 12) = (52 58) | |
| 0 | 76·227 (3) − 62·160 (3) = 14″·067 | ° ′ ″ |
| 180 | 73·567 (3) − 60·447 (3) = 13·120 | 63 55 41·513 (3) |
| 9 | 72·767 (3) − 59·880 (3) = 12·887 | 41·260 (3) |
| 189 | 73·747 (3) − 62·153 (3) = 11·594 | 40·127 (3) |
| 18 | 75·393 (3) − 62·373 (3) = 13·020 | 41·387 (3) |
| 198 | 73·907 (3) − 61·833 (3) = 12·074 | 40·827 (3) |
| 27 | 74·520 (4) − 60·470 (4) = 14·050 | 41·027 (3) |
| 207 | 73·253 (3) − 61·260 (3) = 11·993 | 40·727 (3) |
| Prob. = 0·305 | | 40·800 (3) |
| | | Prob. = 0·147 |
| Means | 52 58 12·851 | 63 55 40·959 |

No. 38.—At the STATION of YENAGAPALI.—October 1838.

| Zero. | Bachapali and Burgapali. | Burgapali and Baktapur. | Baktapur and Shevalingapa. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 41 33 22·873 (3) | 42 6 4·520 (3) | 33 18 9·760 (3) |
| 180 | 21·973 (3) | 5·560 (3) | 9·873 (3) |
| 9 | 22·227 (3) | 5·907 (3) | 9·340 (3) |
| 189 | 23·420 (3) | 5·640 (3) | 8·713 (3) |
| 18 | 23·747 (3) | 5·820 (3) | 9·360 (3) |
| 198 | 23·560 (3) | 4·633 (3) | 9·280 (3) |
| 27 | 22·507 (3) | 6·380 (3) | 9·587 (3) |
| 207 | 22·893 (3) | 4·207 (3) | 10·173 (3) |
| Prob. = 0·213 | | Prob. = 0·257 | Prob. = 0·147 |
| Means | 41 33 22·900 | 42 6 5·333 | 33 18 9·511 |

| Zero. | Shevalingapa and Yemsha. | Baktapur and Yemsha. |
|---|---|---|
| | ° ′ ″ | (° ′) + (° ′) = (° ′) |
| | | (33 18) + (49 59) = (83 17) |
| 0 | 49 59 17·260 (3) | 9·760 (3) + 17·260 (3) = 27″·020 |
| 180 | 19·327 (3) | 9·873 (3) + 19·327 (3) = 29·200 |
| 9 | 19·107 (3) | 9·340 (3) + 19·107 (3) = 28·447 |
| 189 | 19·547 (3) | 8·713 (3) + 19·547 (3) = 28·260 |
| 18 | 18·753 (3) | 9·360 (3) + 18·753 (3) = 28·113 |
| 198 | 18·293 (3) | 9·280 (3) + 18·293 (3) = 27·573 |
| 27 | 17·933 (3) | 9·587 (3) + 17·933 (3) = 27·520 |
| 207 | 19·753 (3) | 10·173 (3) + 19·753 (3) = 29·926 |
| Prob. = 0·285 | | Prob. = 0·313 |
| Means | 49 59 18·747 | 83 17 28·257 |



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No. 39.—At the STATION of BURGAPALI.—August 1838 and March 1841.

| Zero. | Damargida and Bachapali. | Bachapali and Yenagapali. | Yenagapali and Baktapur. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 64 11 32·487 (3) | 67 24 43·067 (3) | 84 2 19·640 (3) |
| 180 | 32·840 (3) | 43·160 (3) | 18·793 (3) |
| 9 | 32·525 (4) | 42·393 (3) | 19·340 (3) |
| 189 | 32·767 (3) | 42·560 (3) | 20·080 (3) |
| 18 | 33·025 (4) | 42·547 (3) | 19·327 (3) |
| 198 | 32·160 (3) | 42·907 (3) | 19·367 (3) |
| 27 | 31·767 (3) | 42·893 (3) | 19·980 (3) |
| 207 | 33·947 (3) | 42·300 (3) | 18·847 (3) |
| Means | 64 11 32·690 | 67 24 42·728 | 84 2 19·422 |
| Prob. | = 0·214 | = 0·106 | = 0·155 |

| Zero. | Baktapur and Munganal. | Munganal and Damargida. |
|---|---|---|
| | ° ′ ″ | ° ′ ″ |
| 0 | 71 17 51·040 (3) | 73 3 33·553 (3) |
| 180 | 50·320 (3) | 33·707 (3) |
| 9 | 51·580 (3) | 32·947 (3) |
| 189 | 51·520 (3) | 33·353 (3) |
| 18 | 52·107 (3) | 32·920 (3) |
| 198 | 51·593 (3) | 33·360 (3) |
| 27 | 50·813 (3) | 33·160 (3) |
| 207 | 51·233 (3) | 34·180 (3) |
| Means | 71 17 51·276 | 73 3 33·398 |
| Prob. | = 0·182 | = 0·138 |

No. 40.—At the STATION of MUNGANAL.—March 1841.

| Zero. | Baktapur and Burgapali. | Burgapali and Damargida. | Damargida and W. End Base. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 44 46 29·393 (3) | 40 44 55·560 (3) | 31 9 52·247 (2) |
| 180 | 28·167 (3) | 53·200 (2) | 54·060 (3) |
| 9 | 29·513 (2) | 54·120 (3) | 53·187 (3) |
| 189 | 30·047 (3) | 54·447 (2) | 52·947 (3) |
| 18 | 29·050 (4) | 54·727 (3) | 53·200 (3) |
| 198 | 29·380 (2) | 54·793 (2) | 53·347 (2) |
| 27 | 29·400 (3) | 54·847 (2) | 52·840 (3) |
| 207 | 28·987 (3) | 53·760 (3) | 54·240 (3) |
| Means | 44 46 29·242 | 40 44 54·432 | 31 9 53·259 |
| Prob. | = 0·179 | = 0·241 | = 0·214 |

No. 41.—At the STATION of BACHAPALI.—August 1838.

| Zero. | Damargida and Dudala. | Damargida and Burgapali. | Burgapali and Yenagapali. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 61 35 45·687 (3) | 61 16 51·147 (3) | 71 1 55·687 (3) |
| 180 | 45·313 (3) | 51·167 (2) | 56·060 (3) |
| 9 | 45·220 (4) | 51·367 (3) | 55·487 (3) |
| 189 | 46·567 (3) | 50·680 (3) | 55·367 (3) |
| 18 | 45·890 (4) | 51·387 (3) | 55·467 (3) |
| 198 | 46·007 (3) | 51·787 (3) | 54·633 (2) |
| 27 | 46·207 (3) | 50·360 (2) | 55·380 (2) |
| 207 | 45·780 (3) | 50·980 (3) | 55·667 (3) |
| Means | 61 35 45·834 | 61 16 51·109 | 71 1 55·469 |
| Prob. | = 0·147 | = 0·146 | = 0·134 |

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No. 42.—At the STATION of DAMARGIDA.—July 1838, November 1840 and February 1841.

| Zero. | Burgapali and Bachapali. | | Bachapali and Dudala. | | Dudala and Malgi. | |
|---|---|---|---|---|---|---|
| | (62 42) — (8 11) = (54 31) | | (120 40) — (62 43) = (57 57) | | (199 2) — (120 41) = (78 21) | |
| 0 | 97·673 (3) — 60·140 (3) = 37″·533 | | 82·213 (3) — 37·673 (3) = 44″·540 | | 39·993 (3) — 22·213 (3) = 17″·780 | |
| 180 | 98·193 (3) — 58·973 (3) = 39·220 | | 81·607 (3) — 38·193 (3) = 43·414 | | 39·200 (3) — 21·607 (3) = 17·593 | |
| 9 | 96·607 (3) — 59·400 (3) = 37·207 | | 82·460 (3) — 36·607 (3) = 45·853 | | 39·387 (3) — 22·460 (3) = 16·927 | |
| 189 | 98·120 (3) — 59·580 (3) = 38·540 | | 82·380 (3) — 38·120 (3) = 44·260 | | 39·453 (3) — 22·380 (3) = 17·073 | |
| 18 | 97·073 (3) — 59·487 (3) = 37·586 | | 82·180 (3) — 37·073 (3) = 45·107 | | 38·893 (3) — 22·180 (3) = 16·713 | |
| 198 | 97·725 (4) — 60·060 (4) = 37·665 | | 83·207 (3) — 37·725 (4) = 45·482 | | 40·747 (3) — 23·207 (3) = 17·540 | |
| 27 | 96·600 (3) — 59·780 (3) = 36·820 | | 81·167 (3) — 36·600 (3) = 44·567 | | 40·207 (3) — 21·167 (3) = 19·040 | |
| 207 | 97·907 (3) — 59·065 (4) = 38·842 | | 82·733 (3) — 37·907 (3) = 44·826 | | 39·973 (3) — 22·733 (3) = 17·240 | |
| Means | 54 31 37·927 | Prob. = 0·279 | 57 57 44·756 | Prob. = 0·250 | 78 21 17·488 | Prob. = 0·239 |

| Zero. | North Referring Lamp and Burgapali. | | Dudala and Shilapali. | | Dudala and E. End Base. | |
|---|---|---|---|---|---|---|
| | | | (78 20) — (19 0) = (59 20) | | (78 20) — (2 14) = (76 6) | |
| 0 | 8 11 60·140 (3) | | 77·780 (3) — 33·307 (3) = 44″·473 | | 77·780 (3) — 46·947 (3) = 30″·833 | |
| 180 | 58·973 (3) | | 77·593 (3) — 34·833 (3) = 42·760 | | 77·593 (3) — 47·427 (3) = 30·166 | |
| 9 | 59·400 (3) | | 76·927 (3) — 34·587 (3) = 42·340 | | 76·927 (3) — 47·980 (3) = 28·947 | |
| 189 | 59·580 (3) | | 77·073 (3) — 34·740 (3) = 42·333 | | 77·073 (3) — 48·020 (3) = 29·053 | |
| 18 | 59·487 (3) | | 76·713 (3) — 34·967 (3) = 41·746 | | 76·713 (3) — 47·160 (3) = 29·553 | |
| 198 | 60·060 (4) | | 77·540 (3) — 35·427 (3) = 42·113 | | 77·540 (3) — 47·820 (3) = 29·720 | |
| 27 | 59·780 (3) | | 79·040 (3) — 35·240 (3) = 43·800 | | 79·040 (3) — 47·827 (3) = 31·213 | |
| 207 | 59·065 (4) | | 77·240 (3) — 35·393 (3) = 41·847 | | 77·240 (3) — 47·200 (3) = 30·040 | |
| Means | 8 11 59·561 | Prob. = 0·321 | 59 20 42·677 | Prob. = 0·264 | 76 6 29·941 | |

| Zero. | E. End Base and W. End Base. | | Shilapali and Malgi. | | Malgi and W. End Base. | |
|---|---|---|---|---|---|---|
| | (2 14) + (37 4) = (39 19) | | | | | |
| 0 | 46·947 (3) + 51·093 (3) = 38″·040 | | 19 0 33·307 (2) | | 37 4 51·093 (3) | |
| 180 | 47·427 (3) + 50·765 (4) = 38·192 | | 34·833 (3) | | 50·765 (4) | |
| 9 | 47·980 (3) + 48·387 (3) = 36·367 | | 34·587 (3) | | 48·387 (3) | |
| 189 | 48·020 (3) + 50·140 (3) = 38·160 | | 34·740 (3) | | 50·140 (3) | |
| 18 | 47·160 (3) + 50·180 (3) = 37·340 | | 34·967 (3) | | 50·180 (3) | |
| 198 | 47·820 (3) + 48·813 (3) = 36·633 | | 35·427 (3) | | 48·813 (3) | |
| 27 | 47·827 (3) + 48·033 (3) = 35·860 | | 35·240 (3) | | 48·033 (3) | |
| 207 | 47·200 (3) + 49·093 (3) = 36·293 | | 35·393 (3) | | 49·093 (3) | |
| Means | 39 19 37·111 | Prob. = 0·311 | 19 0 34·812 | Prob. = 0·225 | 37 4 49·563 | Prob. = 0·375 |

| Zero. | Burgapali and Munganal. | | Munganal and W. End Base. | |
|---|---|---|---|---|
| 0 | 66 11 33·573 (3) | | 65 52 56·453 (3) | |
| 180 | 33·213 (3) | | 55·100 (4) | |
| 9 | 33·860 (3) | | 55·380 (3) | |
| 189 | 34·347 (3) | | 55·387 (3) | |
| 18 | 33·440 (3) | | 55·567 (3) | |
| 198 | 34·127 (3) | | 55·493 (3) | |
| 27 | 35·707 (3) | | 55·393 (3) | |
| 207 | 34·753 (3) | | 55·533 (3) | |
| Means | 66 11 34·128 | Prob. = 0·269 | 65 52 55·538 | Prob. = 0·131 |

| | ° ′ ″ |
|---|---|
| Azimuth of Lamp .. | = 179 59 59·243 |
| Lamp and Burgapali | = +8 11 59·561 |
| Azimuth of Burgapali | = 188 11 58·804 |

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No. 43.—At the STATION of DUDALA.—August 1838 and November 1840.

| Zero. | Malgi and Damargida. | Damargida and Bachapali. | Malgi and Shilapali. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 41 51 43·940 (3) | 60 26 28·587 (3) | 28 34 9·133 (3) |
| 180 | 42·720 (3) | 29·280 (3) | 10·373 (3) |
| 9 | 42·630 (4) | 29·015 (4) | 9·920 (3) |
| 189 | 43·933 (3) | 28·347 (3) | 9·960 (3) |
| 18 | 42·887 (3) | 29·707 (3) | 10·660 (3) |
| 198 | 43·807 (3) | 28·727 (3) | 10·720 (3) |
| 27 | 42·560 (3) | 30·007 (3) | 10·773 (3) |
| 207 | 43·740 (4) | 28·795 (4) | 9·633 (3) |
| Prob. | = 0·208 | = 0·189 | = 0·194 |
| Means | 41 51 43·277 | 60 26 29·058 | 28 34 10·147 |

| Zero. | Shilapali and Damargida. | Damargida and E. End Base. |
|---|---|---|
| | (° ′ 28 34) + (° ′ 1 8) + (° ′ 40 42) = (° ′ 70 25) | (° ′ 41 50) − (° ′ 1 8) = (° ′ 40 42) |
| 0 | ″ ″ ″ 9·133 (3) + 52·360 (3) + 51·580 = 53·073 | ″ ″ 103·940 (3) − 52·360 (3) = 51·580 |
| 180 | 10·373 (3) + 52·873 (3) + 49·847 = 53·093 | 102·720 (3) − 52·873 (3) = 49·847 |
| 9 | 9·920 (3) + 52·900 (3) + 49·730 = 52·550 | 102·630 (4) − 52·900 (3) = 49·730 |
| 189 | 9·960 (3) + 52·960 (3) + 50·973 = 53·893 | 103·933 (3) − 52·960 (3) = 50·973 |
| 18 | 10·660 (3) + 51·620 (3) + 51·267 = 53·547 | 102·887 (3) − 51·620 (3) = 51·267 |
| 198 | 10·720 (3) + 53·193 (3) + 50·614 = 54·527 | 103·807 (3) − 53·193 (3) = 50·614 |
| 27 | 10·773 (3) + 53·180 (3) + 49·380 = 53·333 | 102·560 (3) − 53·180 (3) = 49·380 |
| 207 | 9·633 (3) + 53·033 (3) + 50·707 = 53·373 | 103·740 (4) − 53·033 (3) = 50·707 |
| Prob. | = 0·196 | = 0·259 |
| Means | 70 25 53·424 | 40 42 50·512 |

| Zero. | Tadmanur and Shilapali. | Tadmanur and Goraegat. | Goraegat and Shilapali. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 83 49 22·533 (3) | 41 8 33·280 (3) | 42 40 49·253 (3) |
| 180 | 22·707 (3) | 35·240 (3) | 47·467 (3) |
| 9 | 24·413 (3) | 34·353 (3) | 50·060 (3) |
| 189 | 24·607 (3) | 34·820 (3) | 49·787 (3) |
| 18 | 24·267 (3) | 35·000 (3) | 49·267 (3) |
| 198 | 22·427 (3) | 33·107 (3) | 49·320 (3) |
| 27 | 21·607 (3) | 33·667 (3) | 48·167 (3) |
| 207 | 23·507 (3) | 34·007 (3) | 49·500 (3) |
| Prob. | = 0·364 | = 0·265 | = 0·285 |
| Means | 83 49 23·259 | 41 8 34·184 | 42 40 49·103 |

| Zero. | Goraegat and Topkonda. | Topkonda and Tadmanur. | East End Base and Malgi. |
|---|---|---|---|
| | ° ′ ″ | (° ′ 41 8) − (° ′ 31 23) = (° ′ 9 45) | ° ′ ″ |
| 0 | 31 23 1·867 (3) | ″ ″ 33·280 (3) − 1·867 (3) = 31·413 | 1 8 52·360 (3) |
| 180 | 3·547 (3) | 35·240 (3) − 3·547 (3) = 31·693 | 52·873 (3) |
| 9 | 3·640 (3) | 34·353 (3) − 3·640 (3) = 30·713 | 52·900 (3) |
| 189 | 2·840 (3) | 34·820 (3) − 2·840 (3) = 31·980 | 52·960 (3) |
| 18 | 4·420 (3) | 35·000 (3) − 4·420 (3) = 30·580 | 51·620 (3) |
| 198 | 2·453 (3) | 33·107 (3) − 2·453 (3) = 30·654 | 53·193 (3) |
| 27 | 3·233 (3) | 33·667 (3) − 3·233 (3) = 30·434 | 53·180 (3) |
| 207 | 2·927 (3) | 34·007 (3) − 2·927 (3) = 31·080 | 53·033 (3) |
| Prob. | = 0·259 | = 0·189 | = 0·175 |
| Means | 31 23 3·116 | 9 45 31·068 | 1 8 52·765 |

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No. 44.—At the STATION of MALGI.—October 1840.

| Zero. | W. End Base and Damargida. | Damargida and Dudala. | Dudala and Shilapali. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ″ (3) |
| 0 | 67 22 40·333 | 59 46 59·867 | 74 18 27·840 |
| 180 | 41·433 | 59·860 | 26·513 |
| 9 | 41·100 | 60·407 | 26·840 |
| 189 | 41·627 | 60·353 | 27·613 |
| 18 | 41·433 | 59·293 | 28·487 |
| 198 | 41·420 | 60·353 | 26·540 |
| 27 | 40·753 | 60·287 | 27·900 |
| 207 | 41·540 | 59·800 | 28·127 |
| | Prob. = 0·149 | Prob. = 0·129 | Prob. = 0·250 |
| Means | 67 22 41·205 | 59 47 0·028 | 74 18 27·483 |

| Zero. | Damargida and Shilapali. |
|---|---|
| | ° ′ ″ (3) |
| 0 | 134 5 27·707 |
| 180 | 26·373 |
| 9 | 27·247 |
| 189 | 27·967 |
| 18 | 27·780 |
| 198 | 26·893 |
| 27 | 28·187 |
| 207 | 27·927 |
| | Prob. = 0·205 |
| Means | 134 5 27·510 |

No. 45.—At the EAST END BASE.—October 1840.

| Zero. | W. End Base and Damargida. | Damargida and Dudala. | |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | |
| 0 | 70 54 37·173 | 63 10 43·933 | |
| 180 | 36·980 | 42·280 | |
| 9 | 36·100 | 43·193 | |
| 189 | 36·800 | 43·493 | |
| 18 | 37·120 | 43·140 | |
| 198 | 36·173 | 42·660 | |
| 27 | 36·813 | 43·767 | |
| 207 | 37·613 | 42·287 | |
| | Prob. = 0·168 | Prob. = 0·210 | |
| Means | 70 54 36·847 | 63 10 43·094 | |

No. 46.—At the WEST END BASE.—October 1840 and March 1841.

| Zero. | Damargida and E. End Base. | Damargida and Malgi. | Munganal and Damargida. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ″ (3) |
| 0 | 69 45 46·347 | 75 32 29·220 | 82 57 11·893 |
| 180 | 45·567 | 28·407 | 14·513 |
| 9 | 45·293 | 29·087 | 13·233 |
| 189 | 46·127 | 28·780 | 11·513 |
| 18 | 45·840 (4) | 28·840 (4) | 13·653 |
| 198 | 46·660 (4) | 30·080 (4) | 13·060 |
| 27 | 46·613 | 29·833 | 13·053 |
| 207 | 45·087 | 27·740 | 13·187 |
| | Prob. = 0·196 | Prob. = 0·248 | Prob. = 0·312 |
| Means | 69 45 45·942 | 75 32 28·998 | 82 57 13·013 |



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No. 47.—At the STATION of SHILAPALI.—October and November 1840.

| Zero. | Malgi and Damargida. | Malgi and Dudala. | Damargida and Dudala. |
|---|---|---|---|
| | $\overline{26\ 53\ 56{\cdot}327}^{(3)}$ | $\overline{77\ 7\ 22{\cdot}587}^{(3)}$ | $(\overline{77\ 6}) - (\overline{26\ 53}) = (\overline{50\ 13})$ |
| 0 | $\overline{55{\cdot}667}^{(3)}$ | $\overline{22{\cdot}415}^{(4)}$ | $\overline{82{\cdot}587}^{(3)} - \overline{56{\cdot}327}^{(3)} = 26''{\cdot}260$ |
| 180 | $\overline{56{\cdot}373}^{(3)}$ | $\overline{22{\cdot}175}^{(4)}$ | $\overline{82{\cdot}415}^{(4)} - \overline{55{\cdot}667}^{(3)} = 26{\cdot}748$ |
| 9 | $\overline{56{\cdot}127}^{(3)}$ | $\overline{22{\cdot}385}^{(4)}$ | $\overline{82{\cdot}175}^{(4)} - \overline{56{\cdot}373}^{(3)} = 25{\cdot}802$ |
| 189 | $\overline{55{\cdot}580}^{(3)}$ | $\overline{21{\cdot}840}^{(3)}$ | $\overline{82{\cdot}385}^{(4)} - \overline{56{\cdot}127}^{(3)} = 26{\cdot}258$ |
| 18 | $\overline{56{\cdot}893}^{(3)}$ | $\overline{23{\cdot}273}^{(3)}$ | $\overline{81{\cdot}840}^{(1)} - \overline{55{\cdot}580}^{(3)} = 26{\cdot}260$ |
| 198 | $\overline{56{\cdot}720}^{(3)}$ | $\overline{22{\cdot}387}^{(3)}$ | $\overline{83{\cdot}273}^{(3)} - \overline{56{\cdot}893}^{(3)} = 26{\cdot}380$ |
| 27 | $\overline{56{\cdot}793}^{(3)}$ | $\overline{22{\cdot}827}^{(3)}$ | $\overline{82{\cdot}387}^{(3)} - \overline{56{\cdot}720}^{(3)} = 25{\cdot}667$ |
| 207 | | | $\overline{82{\cdot}827}^{(3)} - \overline{56{\cdot}793}^{(3)} = 26{\cdot}034$ |
| Prob. | = 0·164 | = 0·142 | = 0·113 |
| Means | 26 53 56·310 | 77 7 22·486 | 50 13 26·176 |

| Zero. | Dudala and Tadmanur. | Dudala and Goraegat. | Tadmanur and Goraegat. |
|---|---|---|---|
| | $(\overline{109\ 42}) - (\overline{77\ 7}) = (\overline{32\ 35})$ | $(\overline{150\ 56}) - (\overline{77\ 7}) = (\overline{73\ 49})$ | $(\overline{150\ 56}) - (\overline{109\ 42}) = (\overline{41\ 14})$ |
| 0 | $\overline{35{\cdot}180}^{(3)} - \overline{22{\cdot}587}^{(3)} = 12''{\cdot}593$ | $\overline{43{\cdot}900}^{(3)} - \overline{22{\cdot}587}^{(3)} = 21''{\cdot}313$ | $\overline{43{\cdot}900}^{(3)} - \overline{35{\cdot}180}^{(3)} = 8''{\cdot}720$ |
| 180 | $\overline{34{\cdot}347}^{(3)} - \overline{22{\cdot}415}^{(4)} = 11{\cdot}932$ | $\overline{41{\cdot}675}^{(4)} - \overline{22{\cdot}415}^{(4)} = 19{\cdot}260$ | $\overline{41{\cdot}675}^{(4)} - \overline{34{\cdot}347}^{(3)} = 7{\cdot}328$ |
| 9 | $\overline{34{\cdot}293}^{(3)} - \overline{22{\cdot}175}^{(4)} = 12{\cdot}118$ | $\overline{43{\cdot}233}^{(3)} - \overline{22{\cdot}175}^{(4)} = 21{\cdot}058$ | $\overline{43{\cdot}233}^{(3)} - \overline{34{\cdot}293}^{(3)} = 8{\cdot}940$ |
| 189 | $\overline{35{\cdot}133}^{(3)} - \overline{22{\cdot}385}^{(4)} = 12{\cdot}748$ | $\overline{43{\cdot}027}^{(3)} - \overline{22{\cdot}385}^{(4)} = 20{\cdot}642$ | $\overline{43{\cdot}027}^{(3)} - \overline{35{\cdot}133}^{(3)} = 7{\cdot}894$ |
| 18 | $\overline{34{\cdot}433}^{(3)} - \overline{21{\cdot}840}^{(3)} = 12{\cdot}593$ | $\overline{43{\cdot}080}^{(3)} - \overline{21{\cdot}840}^{(3)} = 21{\cdot}240$ | $\overline{43{\cdot}080}^{(3)} - \overline{34{\cdot}433}^{(3)} = 8{\cdot}647$ |
| 198 | $\overline{35{\cdot}087}^{(3)} - \overline{23{\cdot}273}^{(3)} = 11{\cdot}814$ | $\overline{44{\cdot}013}^{(3)} - \overline{23{\cdot}273}^{(3)} = 20{\cdot}740$ | $\overline{44{\cdot}013}^{(3)} - \overline{35{\cdot}087}^{(3)} = 8{\cdot}926$ |
| 27 | $\overline{34{\cdot}760}^{(3)} - \overline{22{\cdot}387}^{(3)} = 12{\cdot}373$ | $\overline{43{\cdot}280}^{(3)} - \overline{22{\cdot}387}^{(3)} = 20{\cdot}893$ | $\overline{43{\cdot}280}^{(3)} - \overline{34{\cdot}760}^{(3)} = 8{\cdot}520$ |
| 207 | $\overline{34{\cdot}887}^{(3)} - \overline{22{\cdot}827}^{(3)} = 12{\cdot}060$ | $\overline{42{\cdot}767}^{(3)} - \overline{22{\cdot}827}^{(3)} = 19{\cdot}940$ | $\overline{42{\cdot}767}^{(3)} - \overline{34{\cdot}887}^{(3)} = 7{\cdot}880$ |
| Prob. | = 0·114 | = 0·232 | = 0·194 |
| Means | 32 35 12·279 | 73 49 20·636 | 41 14 8·357 |

No. 48.—At the STATION of TADMANUR.—February 1841.

| Zero. | Topkonda and Goraegat. | Goraegat and Shilapali. | Shilapali and Dudala. |
|---|---|---|---|
| | $\overline{59\ 3\ 32{\cdot}920}^{(3)}$ | $\overline{42\ 44\ 15{\cdot}253}^{(3)}$ | $(\overline{106\ 19}) - (\overline{42\ 44}) = (\overline{63\ 35})$ |
| 0 | $\overline{31{\cdot}807}^{(3)}$ | $\overline{15{\cdot}020}^{(3)}$ | $\overline{39{\cdot}900}^{(3)} - \overline{15{\cdot}253}^{(3)} = 24''{\cdot}647$ |
| 180 | $\overline{30{\cdot}647}^{(3)}$ | $\overline{16{\cdot}633}^{(3)}$ | $\overline{40{\cdot}267}^{(3)} - \overline{15{\cdot}020}^{(3)} = 25{\cdot}247$ |
| 9 | $\overline{32{\cdot}067}^{(3)}$ | $\overline{15{\cdot}100}^{(3)}$ | $\overline{41{\cdot}373}^{(3)} - \overline{16{\cdot}633}^{(3)} = 24{\cdot}740$ |
| 189 | $\overline{31{\cdot}093}^{(3)}$ | $\overline{15{\cdot}800}^{(3)}$ | $\overline{40{\cdot}207}^{(3)} - \overline{15{\cdot}100}^{(3)} = 25{\cdot}107$ |
| 18 | $\overline{32{\cdot}400}^{(3)}$ | $\overline{14{\cdot}933}^{(3)}$ | $\overline{40{\cdot}527}^{(3)} - \overline{15{\cdot}800}^{(3)} = 24{\cdot}727$ |
| 198 | $\overline{33{\cdot}293}^{(3)}$ | $\overline{14{\cdot}607}^{(3)}$ | $\overline{40{\cdot}320}^{(3)} - \overline{14{\cdot}933}^{(3)} = 25{\cdot}387$ |
| 27 | $\overline{31{\cdot}300}^{(3)}$ | $\overline{15{\cdot}993}^{(3)}$ | $\overline{39{\cdot}733}^{(3)} - \overline{14{\cdot}607}^{(3)} = 25{\cdot}126$ |
| 207 | | | $\overline{40{\cdot}027}^{(3)} - \overline{15{\cdot}993}^{(3)} = 24{\cdot}034$ |
| Prob. | = 0·302 | = 0·221 | = 0·143 |
| Means | 59 3 31·941 | 42 44 15·417 | 63 35 24·877 |

| Zero. | Goraegat and Dudala. | Topkonda and Dudala. | |
|---|---|---|---|
| | $\overline{106\ 19\ 39{\cdot}900}^{(3)}$ | $(\overline{106\ 19}) + (\overline{59\ 3}) = (\overline{165\ 22})$ | |
| 0 | $\overline{40{\cdot}267}^{(3)}$ | $\overline{39{\cdot}900}^{(3)} + \overline{32{\cdot}920}^{(3)} = 72''{\cdot}820$ | |
| 180 | $\overline{41{\cdot}373}^{(3)}$ | $\overline{40{\cdot}267}^{(3)} + \overline{31{\cdot}807}^{(3)} = 72{\cdot}074$ | |
| 9 | $\overline{40{\cdot}207}^{(3)}$ | $\overline{41{\cdot}373}^{(3)} + \overline{30{\cdot}647}^{(3)} = 72{\cdot}020$ | |
| 189 | $\overline{40{\cdot}527}^{(3)}$ | $\overline{40{\cdot}207}^{(3)} + \overline{32{\cdot}067}^{(3)} = 72{\cdot}274$ | |
| 18 | $\overline{40{\cdot}320}^{(3)}$ | $\overline{40{\cdot}527}^{(3)} + \overline{31{\cdot}093}^{(3)} = 71{\cdot}620$ | |
| 198 | $\overline{39{\cdot}733}^{(3)}$ | $\overline{40{\cdot}320}^{(3)} + \overline{32{\cdot}400}^{(3)} = 72{\cdot}720$ | |
| 27 | $\overline{40{\cdot}027}^{(3)}$ | $\overline{39{\cdot}733}^{(3)} + \overline{33{\cdot}293}^{(3)} = 73{\cdot}026$ | |
| 207 | | $\overline{40{\cdot}027}^{(3)} + \overline{31{\cdot}300}^{(3)} = 71{\cdot}327$ | |
| Prob. | = 0·166 | = 0·197 | |
| Means | 106 19 40·294 | 165 23 12·235 | |

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No. 49.—At the STATION of GORAEGAT.—February 1841.

| Zero. | Shilapali and Dudala. | Dudala and Tadmanur. | Shilapali and Tadmanur. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ + ° ′ = ° ′ |
| 0 | 63 29 51·833 | 32 31 46·013 | ″ (3) + ″ (3) = ″ |
| 180 | 52·100 | 44·607 | 51·833 + 46·013 = 97·846 |
| 9 | 51·307 | 46·127 | 52·100 + 44·607 = 96·707 |
| 189 | 51·553 | 45·213 | 51·307 + 46·127 = 97·434 |
| 18 | 51·887 | 45·053 | 51·553 + 45·213 = 96·766 |
| 198 | 51·653 | 45·227 | 51·887 + 45·053 = 96·940 |
| 27 | 53·513 | 45·073 | 51·653 + 45·227 = 96·880 |
| 207 | 50·747 | 45·560 | 53·513 + 45·073 = 98·586 |
| | | | 50·747 + 45·560 = 96·307 |
| Means | 63 29 51·824 | 32 31 45·359 | 96 1 37·183 |
| Prob. | = 0·264 | = 0·169 | = 0·243 |

| Zero. | Dudala and Topkonda. | Tadmanur and Topkonda. | |
|---|---|---|---|
| | ° ′ + ° ′ = ° ′ | | |
| 0 | ″ (3) + ″ (3) = ″ | ° ′ ″ (3) | |
| 180 | 46·013 + 59·307 = 105·320 | 83 33 59·307 | |
| 9 | 44·607 + 58·833 = 103·440 | 58·833 | |
| 189 | 46·127 + 59·727 = 105·854 | 59·727 | |
| 18 | 45·213 + 60·273 = 105·486 | 60·273 | |
| 198 | 45·053 + 59·407 = 104·460 | 59·407 | |
| 27 | 45·227 + 60·193 = 105·420 | 60·193 | |
| 207 | 45·073 + 59·713 = 104·786 | 59·713 | |
| | 45·560 + 59·273 = 104·833 | 59·273 | |
| Means | 116 5 44·950 | 83 33 59·591 | |
| Prob. | = 0·251 | = 0·161 | |

No. 50.—At the STATION of TOPKONDA.—February 1841.

| Zero. | Goraegat and Dudala. | Goraegat and Tadmanur. | Dudala and Tadmanur. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ~ ° ′ = ° ′ |
| 0 | 32 31 13·047 | 37 22 29·693 | ″ (3) − ″ (3) = ″ |
| 180 | 11·900 | 28·360 | 29·693 − 13·047 = 16·646 |
| 9 | 11·847 | 27·193 | 28·360 − 11·900 = 16·460 |
| 189 | 13·027 | 29·113 | 27·193 − 11·847 = 15·346 |
| 18 | 13·080 | 28·953 | 29·113 − 13·027 = 16·086 |
| 198 | 13·367 | 29·020 | 28·953 − 13·080 = 15·873 |
| 27 | 12·873 | 29·073 | 29·020 − 13·367 = 15·653 |
| 207 | 12·813 | 28·907 | 29·073 − 12·873 = 16·200 |
| | | | 28·907 − 12·813 = 16·094 |
| Means | 32 31 12·744 | 37 22 28·789 | 4 51 16·045 |
| Prob. | = 0·186 | = 0·245 | = 0·139 |

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# PRINCIPAL TRIANGLES

OF THE

# SECTION KALIANPUR—DAMARGIDA.

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## SERIES B. & C.



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# MEMORANDUM.

THE correction for reducing the base line at Seronj to the sea-level was originally made on the assumed height of 1644·5 feet of the south end, but subsequent observations shew that the real height of the south end is 1620·0 feet, which will diminish that correction by 0·0449557 parts of a foot, and consequently increase the length of the base by the same quantity.

This will induce a constant correction of +0·0000006 to the logarithm of each side derived from the Seronj base as an origin, and the numerical value of each side will need to be increased by a term of the form $a \times 0 \cdot 0000011703$, wherein $a$ is the value originally brought out in feet.

For the same cause the whole length of the arc between Kalianpur and Damargida will, as previously explained in the introductory pages, be increased by the quantity 2·57780 feet, and the value of the Beder base, as computed from that of Seronj as an origin, will be increased by 0·04866 of a foot.

The small series C is supposed to emanate directly from the base measured near Beder, in the valley of the Manjera, and will need no correction of the above kind.

Seronj base in terms of the Dehra Dun base (=38413·323+0·633) =38413·956 feet.

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 1.—Kamkhera to Bhaorasa = 109876·261 Feet...Log 5·0409039; Miles 20·8099.

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·375 | Kamkhera.... | 68 23 52·057 | — 1·177 | — 0·108 | — 1·285 | 68 23 50·772 | 9·9683709 | 146788·000 | 27·8008 | 0·172 |
| 0·284 | Bhaorasa .... | 67 45 1·992 | — 1·176 | — 0·082 | — 1·258 | 67 45 0·734 | 9·9663961 | 147457·000 | 27·9275 | 0·173 |
| 0·374 | Gargaja ..... | 43 51 9·777 | — 1·176 | — 0·107 | — 1·283 | 43 51 8·494 | 9·8406094 | Logs. 5·1666906 | | |
| | | 180 0 3·826 | — 3·529 | — 0·297 | — 3·826 | 180 0 0·000 | | 5·1686654 | | |

No. 2.—Kamkhera to Gargaja = 146788·000 Feet...Log 5·1666906; Miles 27·8008. (Δ 1)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·447 | Kamkhera.... | 54 7 43·797 | — 1·327 | + 1·084 | — 0·243 | 54 7 43·554 | 9·9086651 | 142289·523 | 26·9488 | 0·167 |
| 0·438 | Gargaja ..... | 61 11 28·357 | — 1·328 | + 1·063 | — 0·265 | 61 11 28·092 | 9·9426192 | 131588·788 | 24·9221 | 0·154 |
| 0·395 | Ehmadpur.... | 64 40 48·724 | — 1·328 | + 0·958 | — 0·370 | 64 40 48·354 | 9·9561368 | Logs. 5·1531730 | | |
| | | 180 0 0·878 | — 3·983 | + 3·105 | — 0·878 | 180 0 0·000 | | 5·1192189 | | |

No. 3.—Gargaja to Ehmadpur = 131588·788 Feet...Log 5·1192189; Miles 24·9221. (Δ 2)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·498 | Gargaja ..... | 48 2 35·094 | — 0·973 | — 0·855 | — 1·828 | 48 2 33·266 | 9·8713638 | 126789·290 | 24·0131 | 0·148 |
| 0·301 | Ehmadpur.... | 63 35 32·820 | — 0·973 | — 0·517 | — 1·490 | 63 35 31·330 | 9·9521383 | 105270·848 | 19·9377 | 0·123 |
| 0·213 | Ander ..... | 68 21 56·744 | — 0·974 | — 0·366 | — 1·340 | 68 21 55·404 | 9·9682746 | Logs. 5·1030826 | | |
| | | 180 0 4·658 | — 2·920 | — 1·738 | — 4·658 | 180 0 0·000 | | 5·0223081 | | |

No. 4.—Ehmadpur to Ander = 105270·848 Feet...Log 5·0223081; Miles 19·9377. (Δ 3)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·312 | Ehmadpur.... | 75 22 2·018 | — 0·731 | + 0·033 | — 0·698 | 75 22 1·320 | 9·9856797 | 91410·462 | 17·3126 | 0·107 |
| 0·359 | Ander ..... | 47 6 13·739 | — 0·730 | + 0·039 | — 0·691 | 47 6 13·048 | 9·8648586 | 120730.500 | 22·8656 | 0·141 |
| 0·269 | Gidgarh..... | 57 31 46·333 | — 0·730 | + 0·029 | — 0·701 | 57 31 45·632 | 9·9261708 | Logs. 4·9609959 | | |
| | | 180 0 2·090 | — 2·191 | + 0·101 | — 2·090 | 180 0 0·000 | | 5·0818170 | | |

No. 5.—Ander to Gidgarh = 120730·500 Feet...Log 5.0818170; Miles 22·8656. (Δ 4)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·342 | Ander ..... | 51 9 46·350 | — 0·855 | + 0·219 | — 0·636 | 51 9 45·714 | 9·8914983 | 115993·427 | 21·9685 | 0·136 |
| 0·430 | Gidgarh..... | 62 1 31·092 | — 0·856 | — 0·110 | — 0·966 | 62 1 30·126 | 9·9460357 | 102304·800 | 19·3759 | 0·120 |
| 0·317 | Ladi ..... | 66 48 44·995 | — 0·856 | + 0·021 | — 0·835 | 66 48 44·160 | 9·9634193 | Logs. 5·0644334 | | |
| | | 180 0 2·437 | — 2·567 | + 0·130 | — 2·437 | 180 0 0·000 | | 5·0098960 | | |

No. 6.—Gidgarh to Ladi = 102304·800 Feet...Log 5·0098960; Miles 19·3759. (Δ 5)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·460 | Gidgarh..... | 63 57 11·511 | — 0·870 | + 0·233 | — 0·637 | 63 57 10·874 | 9·9534864 | 120683·278 | 22·8567 | 0·141 |
| 0·346 | Ladi ..... | 65 32 39·657 | — 0·871 | — 0·029 | — 0·900 | 65 32 38·757 | 9·9591751 | 119112·793 | 22·5592 | 0·139 |
| 0·445 | Samasgarh.... | 50 30 11·416 | — 0·870 | — 0·177 | — 1·047 | 50 30 10·369 | 9·8874240 | Logs. 5·0816471 | | |
| | | 180 0 2·584 | — 2·611 | + 0·027 | — 2·584 | 180 0 0·000 | | 5·0759584 | | |

*Note.*—Correction ·0000006 to be added to all the logarithms throughout the Series.

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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 7.—Ladi to Samasgarh = 119112·793 Feet...Log 5·0759584; Miles 22·5952. (Δ 6)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·304 | Ladi ..... | 68° 14′ 31″·880 | — 1·016 | + 0·124 | — 0·892 | 68° 14′ 30″·988 | 9·9679023 | 117005·592 | 22·1602 | + 0·137 |
| 0·362 | Samasgarh .. | 55 7 28·662 | — 1·015 | + 0·357 | — 0·658 | 55 7 28·004 | 9·9140235 | 132460·215 | 25·0872 | 0·155 |
| 0·400 | Bhimbet .... | 56 38 1·987 | — 1·015 | + 0·036 | — 0·979 | 56 38 1·008 | 9·9217752 | Logs. 5·0682067 | | |
| | | 180 0 2·529 | — 3·046 | + 0·517 | — 2·529 | 180 0 0·000 | | 5·1220855 | | |

**No. 8.—Ladi to Bhimbet = 117005·592 Feet...Log 5·0682067; Miles 22·1602. (Δ 7)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·332 | Ladi ..... | 78 30 39·650 | — 1·194 | — 0·116 | — 1·310 | 78 30 38·340 | 9·9912091 | 132682·918 | 25·1293 | 0·155 |
| 0·491 | Bhimbet .... | 55 8 18·887 | — 1·193 | + 0·115 | — 1·078 | 55 8 17·809 | 9·9140965 | 158462·877 | 30·0119 | 0·185 |
| 0·431 | Ranipur .... | 46 21 5·335 | — 1·193 | — 0·291 | — 1·484 | 46 21 3·851 | 9·8594882 | Logs. 5·1228150 | | |
| | | 180 0 3·872 | — 3·580 | — 0·292 | — 3·872 | 180 0 0·000 | | 5·1999276 | | |

**No. 9.—Ander to Ladi=115993·427 Feet...Log 5·0644334; Miles 21·9685. (Δ 5)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·382 | Ander ..... | 54 3 26·342 | — 1·192 | — 0·071 | — 1·263 | 54 3 25·079 | 9·9082710 | 161819·374 | 30·6476 | 0·189 |
| 0·342 | Ladi ..... | 80 53 23·770 | — 1·192 | + 0·048 | — 1·144 | 80 53 22·626 | 9·9944866 | 132682·885 | 25·1293 | 0·155 |
| 0·198 | Ranipur .... | 45 3 13·345 | — 1·192 | + 0·142 | — 1·050 | 45 3 12·295 | 9·8498895 | Logs. 5·2090305 | | |
| | | 180 0 3·457 | — 3·576 | + 0·119 | — 3·457 | 180 0 0·000 | | 5·1228149 | | |

**No. 10.—Ladi to Ranipur = 132682·902 Feet...Log 5·1228150; Miles 25·1293. (Δs 8 & 9)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·332 | Ladi ..... | 78 30 39·650 | — 1·194 | — 0·116 | — 1·310 | 78 30 38·340 | 9·9912091 | 117005·592 | 22·1602 | 0·137 |
| 0·431 | Ranipur..... | 46 21 5·335 | — 1·193 | — 0·291 | — 1·484 | 46 21 3·851 | 9·8594882 | 158462·877 | 30·0119 | 0·185 |
| 0·491 | Bhimbet .... | 55 8 18·887 | — 1·193 | + 0·115 | — 1·078 | 55 8 17·809 | 9·9140965 | Logs. 5·0682067 | | |
| | | 180 0 3·872 | — 3·580 | — 0·292 | — 3·872 | 180 0 0·000 | | 5·1999276 | | |

**No. 11.—Ranipur to Bhimbet = 158462·877 Feet...Log 5·1999276; Miles 30·0119. (Δs 8 & 10)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·434 | Ranipur..... | 52 18 38·589 | — 1·837 | + 0·468 | — 1·369 | 52 18 37·220 | 9·8983598 | 186792·860 | 35·3774 | 0·219 |
| 0·248 | Bhimbet .... | 73 19 52·013 | — 1·838 | + 0·044 | — 1·794 | 73 19 50·219 | 9·9813546 | 154299·853 | 29·2235 | 0·181 |
| 0·252 | Morpani .... | 54 21 34·527 | — 1·838 | — 0·128 | — 1·966 | 54 21 32·561 | 9·9099219 | Logs. 5·2713603 | | |
| | | 180 0 5·129 | — 5·513 | + 0·384 | — 5·129 | 180 0 0·000 | | 5·1883655 | | |

**No. 12.—Bhimbet to Morpani = 154299·853 Feet...Log 5·1883655; Miles 29·2235. (Δ 11)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·190 | Bhimbet .... | 38 38 42·506 | — 1·657 | + 0·301 | — 1·356 | 38 38 41·150 | 9·7955255 | 219254·961 | 41·5256 | 0·257 |
| 0·359 | Morpani .... | 97 3 19·679 | — 1·658 | + 0·048 | — 1·610 | 97 3 18·069 | 9·9966993 | 137967·095 | 26·1301 | 0·161 |
| 0·143 | Narwargarh .. | 44 18 2·331 | — 1·657 | + 0·107 | — 1·550 | 44 18 0·781 | 9·8441154 | Logs. 5·3409494 | | |
| | | 180 0 4·516 | — 4·972 | + 0·456 | — 4·516 | 180 0 0·000 | | 5·1397756 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 13.—Morpani to Narwargarh = 137967·095 Feet...Log 5·1397756; Miles 26·1301. (Δ 12)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·335 | Morpani .... | 48° 58′ 28″·679 | — 1·204 | + 0·134 | — 1·070 | 48° 58′ 27″·609 | 9·8776107 | 147480·813 | 27·9320 | 0·173 |
| 0·119 | Narwargarh .. | 69 41 54·237 | — 1·205 | + 0·170 | — 1·035 | 69 41 53·202 | 9·9721461 | 118631·519 | 22·4681 | 0·139 |
| 0·294 | Dhaba Deo .. | 61 19 40·263 | — 1·204 | + 0·130 | — 1·074 | 61 19 39·189 | 9·9431862 | Logs. 5·1687355 | | |
| | | 180 0 3·179 | — 3·613 | + 0·434 | — 3·179 | 180 0 0·000 | | 5·0742001 | | |

**No. 14.—Ranipur to Bhimbet = 158462·877 Feet...Log 5·1999276; Miles 30·0119. (Δs 8 & 10)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·380 | Ranipur..... | 75 18 17·861 | — 2·074 | + 0·376 | — 1·698 | 75 18 16·163 | 9·9855556 | 172425·356 | 32·6563 | 0·202 |
| 0·460 | Bhimbet .... | 55 28 43·375 | — 2·073 | + 0·121 | — 1·952 | 55 28 41·423 | 9·9158799 | 202430·889 | 38·3392 | 0·237 |
| 0·262 | Tek ..... | 49 13 4·251 | — 2·073 | + 0·236 | — 1·837 | 49 13 2·414 | 9·8792064 | Logs. 5·2366011 | | |
| | | 180 0 5·487 | — 6·220 | + 0·733 | — 5·487 | 180 0 0·000 | | 5·3062768 | | |

**No. 15.—Bhimbet to Tek = 202430·889 Feet...Log 5·3062768; Miles 38·3392. (Δ 14)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·418 | Bhimbet .... | 56 29 51·143 | — 2·903 | + 0·224 | — 2·679 | 56 29 48·464 | 9·9210905 | 219254·910 | 41·5255 | 0·257 |
| 0·235 | Tek ..... | 65 59 57·359 | — 2·904 | — 0·165 | — 3·069 | 65 59 54·290 | 9·9607248 | 200131·278 | 37·9037 | 0·234 |
| 0·278 | Narwargarh .. | 57 30 20·037 | — 2·903 | + 0·112 | — 2·791 | 57 30 17·246 | 9·9260523 | Logs. 5·3409493 | | |
| | | 180 0 8·539 | — 8·710 | + 0·171 | — 8·539 | 180 0 0·000 | | 5·3013150 | | |

**No. 16.—Tek to Narwargarh = 200131·278 Feet...Log 5·3013150; Miles 37·9037. (Δ 15)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·333 | Tek ..... | 36 18 14·065 | — 1·553 | + 0·050 | — 1·503 | 36 18 12·562 | 9·7723674 | 167072·308 | 31·6424 | 0·196 |
| 0·236 | Narwargarh .. | 56 29 36·531 | — 1·553 | + 0·165 | — 1·388 | 56 29 35·143 | 9·9210719 | 118631·493 | 22·4681 | 0·139 |
| 0·246 | Dhaba Deo .. | 87 12 13·644 | — 1·553 | + 0·204 | — 1·349 | 87 12 12·295 | 9·9994824 | Logs. 5·2229045 | | |
| | | 180 0 4·240 | — 4·659 | + 0·419 | — 4.240 | 180 0 0·000 | | 5·0742000 | | |

**No. 17.—Ranipur to Morpani = 186792·860 Feet...Log 5·2713603; Miles 35·3774. (Δ 11)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·322 | Ranipur..... | 22 59 39·273 | — 0·987 | — 0·093 | — 1·080 | 22 59 38·193 | 9·5917698 | 172425·395 | 32·6563 | 0·202 |
| 0·241 | Morpani .... | 67 22 42·499 | — 0·987 | — 0·050 | — 1·037 | 67 22 41·462 | 9·9652317 | 72969·150 | 13·8199 | 0·854 |
| 0·283 | Tek ..... | 89 37 41·229 | — 0·987 | + 0·103 | — 0·884 | 89 37 40·345 | 9·9999908 | Logs. 5·2366012 | | |
| | | 180 0 3·001 | — 2·961 | — 0·040 | — 3·001 | 180 0 0.000 | | 4·8631393 | | |

**No. 18.—Morpani to Tek = 72969·150 Feet...Log 4·8631393; Miles 13·8199. (Δ 17)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·214 | Morpani .... | 92 13 54·752 | — 0·844 | — 0·139 | — 0·983 | 92 13 53·769 | 9·9996705 | 147480·778 | 27·9320 | 0·173 |
| 0·304 | Tek ..... | 61 53 34·446 | — 0·844 | + 0·017 | — 0·827 | 61 53 33·619 | 9·9455014 | 167072·308 | 31·6424 | 0·196 |
| 0·283 | Dhaba Deo .. | 25 52 33·382 | — 0·843 | + 0·073 | — 0·770 | 25 52 32·612 | 9·6399053 | Logs. 5·1687354 | | |
| | | 180 0 2·580 | — 2·531 | — 0·049 | — 2·580 | 180 0 0·000 | | 5·2229045 | | |



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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 19.—Bhimbet to Tek = 202430·889 Feet...Log 5·3062768; Miles 38·3392. (Δ 14)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·385 | Bhimbet .... | 17° 51′ 8″·638 | — 0·751 | — 0·078 | — 0·829 | 17° 51′ 7″·809 | 9·4865185 | 154299·782 | 29·2234 | 0·181 |
| 0·283 | Tek ..... | 40 24 36·978 | — 0·751 | — 0·132 | — 0·883 | 40 24 36·095 | 9·8117446 | 72969·133 | 13·8199 | 0·085 |
| 0·247 | Morpani .... | 121 44 17·027 | — 0·752 | — 0·179 | — 0·931 | 121 44 16·096 | 9·9296561 | Logs. | | |
| | | 180 0 2·643 | — 2·254 | — 0·389 | — 2·643 | 180 0 0·000 | | 5·1883653 | | |
| | | | | | | | | 4·8631392 | | |

No. 20.—Tek to Morpani = 72969·142 Feet...Log 4·8631393; Miles 13·8199. (Δs 17 & 19)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·347 | Tek ..... | 25 35 20·381 | — 0·495 | — 0·033 | — 0·528 | 25 35 19·853 | 9·6353935 | 200131·323 | 37·9037 | 0·234 |
| 0.223 | Morpani .... | 141 12 23·430 | — 0·495 | — 0·004 | — 0·499 | 141 12 22·931 | 9·7969330 | 137967·095 | 26·1301 | 0·161 |
| 0·233 | Narwargarh .. | 13 12 17·706 | — 0·494 | + 0·004 | — 0·490 | 13 12 17·216 | 9·3587572 | Logs. | | |
| | | 180 0 1·517 | — 1·484 | — 0·003 | — 1·517 | 180 0 0·000 | | 5·3013151 | | |
| | | | | | | | | 5·1397756 | | |

No. 21.—Narwargarh to Dhaba Deo = 118631·506 Feet...Log 5·0742001; Miles 22·4681. (Δs 13 & 16)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·199 | Narwargarh .. | 58 14 28·170 | — 1·349 | + 0·076 | — 1·273 | 58 14 26·897 | 9·9295557 | 170488·900 | 32·2896 | 0·200 |
| 0·223 | Dhaba Deo .. | 78 43 38·743 | — 1·350 | + 0·395 | — 0·955 | 78 43 37·788 | 9·9915395 | 147812·885 | 27·9949 | 0·173 |
| 0·329 | Nilgarh ..... | 43 1 56·261 | — 1·349 | + 0·403 | — 0·946 | 43 1 55·315 | 9·8340435 | Logs. | | |
| | | 180 0 3·174 | — 4·048 | + 0·874 | — 3·174 | 180 0 0·000 | | 5·2316961 | | |
| | | | | | | | | 5·1697123 | | |

No. 22.—Narwargarh to Nilgarh = 170488·900 Feet...Log 5·2316961; Miles 32·2896. (Δ 21)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·187 | Narwargarh .. | 13 38 40·235 | — 0·197 | + 0·057 | — 0·140 | 13 38 40·095 | 9·3727214 | 62291·300 | 11·7976 | 0·073 |
| 0·418 | Nilgarh ..... | 7 36 42·846 | — 0·196 | — 0·096 | — 0·292 | 7 36 42·554 | 9·1220877 | 110933·077 | 21·0101 | 0·130 |
| 0·209 | Alampur .... | 158 44 37·344 | — 0·197 | + 0·204 | + 0·007 | 158 44 37·351 | 9·5593564 | Logs. | | |
| | | 180 0 0·425 | — 0·590 | + 0·165 | — 0·425 | 180 0 0·000 | | 4·7944274 | | |
| | | | | | | | | 5·0450611 | | |

No. 23.—Narwargarh to Dhaba Deo = 118631·506 Feet...Log 5·0742001; Miles 22·4681. (Δs 13 & 16)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·103 | Narwargarh .. | 71 53 8·405 | — 0·551 | + 0·133 | — 0·418 | 71 53 7·987 | 9·9779235 | 62291·286 | 11·7976 | 0·073 |
| 0·304 | Dhaba Deo .. | 30 48 47·345 | — 0·551 | + 0·188 | — 0·363 | 30 48 46·982 | 9·7094722 | 115578·905 | 21·8899 | 0·135 |
| 0·205 | Alampur .... | 77 18 5·597 | — 0·551 | — 0·015 | — 0·566 | 77 18 5·031 | 9·9892450 | Logs. | | |
| | | 180 0 1·347 | — 1·653 | + 0·306 | — 1·347 | 180 0 0·000 | | 4·7944273 | | |
| | | | | | | | | 5·0628786 | | |

No. 24.—Dhaba Deo to Alampur = 115578·905 Feet...Log 5·0628786; Miles 21·8899. (Δ 23)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·163 | Dhaba Deo .. | 47 54 51·398 | — 0·995 | + 0·206 | — 0·789 | 47 54 50·609 | 9·8704861 | 147812·885 | 27·9949 | 0·173 |
| 0·253 | Alampur .... | 81 26 31·748 | — 0·995 | + 0·218 | — 0·777 | 81 26 30·971 | 9·9951373 | 110933·077 | 21·0101 | 0·130 |
| 0·452 | Nilgarh ..... | 50 38 39·107 | — 0·994 | + 0·307 | — 0·687 | 50 38 38·420 | 9·8883036 | Logs. | | |
| | | 180 0 2·253 | — 2·984 | + 0·731 | — 2·253 | 180 0 0·000 | | 5·1697123 | | |
| | | | | | | | | 5·0450611 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | **No. 25.—Dhaba Deo to Nilgarh = 147812·885 Feet...Log 5·1697123; Miles 27·9949. (Δs 21 & 24)** | | | | | | | | | |
| 0·198 | Dhaba Deo .. | 48° 41′ 11″·605 | — 0·844 | — 0·211 | — 1·055 | 48° 41′ 10″·550 | 9·8757011 | 96871·644 | 18·3469 | + 0·113 |
| 0·303 | Nilgarh ..... | 40 56 48·033 | — 0·843 | + 0·014 | — 0·829 | 40 56 47·204 | 9·8164755 | 111025·384 | 21·0275 | 0·130 |
| 0·206 | Jagdhar..... | 90 22 3·108 | — 0·844 | — 0·018 | — 0·862 | 90 22 2·246 | 9·9999911 | Logs. 4·9861967 | | |
| | | 180 0 2·746 | — 2·531 | — 0·215 | — 2·746 | 180 0 0·000 | | 5·0454223 | | |
| | **No. 26.—Dhaba Deo to Alampur = 115578·905 Feet...Log 5·0628786; Miles 21·8899. (Δ 23)** | | | | | | | | | |
| 0·168 | Dhaba Deo .. | 96 36 3·003 | — 0·873 | — 0·004 | — 0·877 | 96 36 2·126 | 9·9971118 | 96871·667 | 18·3469 | 0·113 |
| 0·331 | Alampur .... | 37 12 50·918 | — 0·872 | — 0·128 | — 1·000 | 37 12 49·918 | 9·7816060 | 159111·881 | 30·1348 | 0·186 |
| 0·236 | Jagdhar..... | 46 11 8·725 | — 0·873 | + 0·104 | — 0·769 | 46 11 7·956 | 9·8582878 | Logs. 4·9861968 | | |
| | | 180 0 2·646 | — 2·618 | — 0·028 | — 2·646 | 180 0 0·000 | | 5·2017026 | | |
| | **No. 27.—Alampur to Jagdhar = 159111·881 Feet...Log 5·2017026; Miles 30·1348. (Δ 26)** | | | | | | | | | |
| 0·228 | Alampur .... | 44 13 40·829 | — 0·966 | + 0·347 | — 0·619 | 44 13 40·210 | 9·8435525 | 110933·077 | 21·0101 | 0·130 |
| 0·207 | Jagdhar..... | 44 10 54·383 | — 0·966 | — 0·122 | — 1·088 | 44 10 53·295 | 9·8431911 | 111025·436 | 21·0275 | 0·130 |
| 0·429 | Nilgarh ..... | 91 35 27·140 | — 0·966 | + 0·321 | — 0·645 | 91 35 26·495 | 9·9998326 | Logs. 5·0450611 | | |
| | | 180 0 2·352 | — 2·898 | + 0·546 | — 2·352 | 180 0 0·000 | | 5·0454225 | | |
| | **No. 28.—Jagdhar to Nilgarh = 111025·410 Feet...Log 5·0454224; Miles 21·0275. (Δs 25 & 27)** | | | | | | | | | |
| 0·137 | Jagdhar..... | 73 40 6·030 | — 1·211 | — 0·110 | — 1·321 | 73 40 4·709 | 9·9821121 | 144812·067 | 27·4265 | 0·169 |
| 0·193 | Nilgarh ..... | 63 9 56·276 | — 1·210 | + 0·006 | — 1·204 | 63 9 55·072 | 9·9505170 | 155739·897 | 29·4962 | 0·182 |
| 0·190 | Salbaldi..... | 43 10 1·524 | — 1·210 | — 0·095 | — 1·305 | 43 10 0·219 | 9·8351346 | Logs. 5·1608048 | | |
| | | 180 0 3·830 | — 3·631 | — 0·199 | — 3·830 | 180 0 0·000 | | 5·1923999 | | |
| | **No. 29.—Nilgarh to Salbaldi = 155739·897 Feet...Log 5·1923999; Miles 29·4962. (Δ 28)** | | | | | | | | | |
| 0·292 | Nilgarh ..... | 55 38 27·642 | — 1·100 | — 0·222 | — 1·322 | 55 38 26·320 | 9·9167245 | 109008·778 | 20·6456 | 0·128 |
| 0·189 | Salbaldi..... | 43 41 6·590 | — 1·099 | — 0·208 | — 1·307 | 43 41 5·283 | 9·8392835 | 130287·390 | 24·6756 | 0·152 |
| 0·241 | Dhar ..... | 80 40 29·703 | — 1·100 | — 0·206 | — 1·306 | 80 40 28·397 | 9·9942220 | Logs. 5·0374614 | | |
| | | 180 0 3·935 | — 3·299 | — 0·636 | — 3·935 | 180 0 0·000 | | 5·1149024 | | |
| | **No. 30.—Jagdhar to Nilgarh = 111025·410 Feet...Log 5·0454224; Miles 21·0275. (Δs 25 & 27)** | | | | | | | | | |
| 0·179 | Jagdhar..... | 30 17 11·503 | — 0·832 | + 0·029 | — 0·803 | 30 17 10·700 | 9·7027072 | 189401·657 | 35·8715 | 0·222 |
| 0·366 | Nilgarh ..... | 118 48 23·918 | — 0·832 | — 0·216 | — 1·048 | 118 48 22·870 | 9·9426297 | 109008·753 | 20·6456 | 0·128 |
| 0·182 | Dhar ..... | 30 54 27·338 | — 0·832 | — 0·076 | — 0·908 | 30 54 26·430 | 9·7106683 | Logs. 5·2773838 | | |
| | | 180 0 2·759 | — 2·496 | — 0·263 | — 2·759 | 180 0 0·000 | | 5·0374613 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 31.—Jagdhar to Dhar = 189401·657 Feet...Log 5·2773838; Miles 35·8715. (Δ 30)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·183 | Jagdhar..... | 43° 22′ 54″·528 | — 1·478 | — 0·140 | — 1·618 | 43° 22′ 52″·910 | 9·8368626 | 144812·100 | 27·4265 | 0·169 |
| 0·086 | Dhar..... | 49 46 2·365 | — 1·478 | — 0·130 | — 1·608 | 49 46 0·757 | 9·8827651 | 130287·390 | 24·6756 | 0·152 |
| 0·259 | Salbaldi..... | 86 51 8·114 | — 1·478 | — 0·303 | — 1·781 | 86 51 6·333 | 9·9993440 | Logs. | | |
| | | 180 0 5·007 | — 4·434 | — 0·573 | — 5·007 | 180 0 0·000 | | 5·1608049 | | |
| | | | | | | | | 5·1149024 | | |

No. 32.—Salbaldi to Dhar = 130287·390 Feet...Log 5·1149024; Miles 24·6756. (Δs 29 & 31)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·291 | Salbaldi..... | 97 44 36·352 | — 1·014 | + 0·409 | — 0·605 | 97 44 35·747 | 9·9960219 | 100120·646 | 18·9622 | 0·117 |
| 0·174 | Dhar..... | 34 36 22·430 | — 1·014 | + 0·482 | — 0·532 | 34 36 21·898 | 9·7542957 | 174682·644 | 33·0838 | 0·204 |
| 0·281 | Ner ..... | 47 39 3·364 | — 1·014 | + 0·005 | — 1·009 | 47 39 2·355 | 9·8686745 | Logs. | | |
| | | 180 0 2·146 | — 3·042 | + 0·896 | — 2·146 | 180 0 0·000 | | 5·0005236 | | |
| | | | | | | | | 5·2422498 | | |

No. 33.—Dhar to Ner = 174682·644 Feet...Log 5·2422498; Miles 33·0838. (Δ 32)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·254 | Dhar..... | 40 5 47·120 | — 1·391 | — 0·171 | — 1·562 | 40 5 45·558 | 9·8089331 | 157645·544 | 29·8571 | 0·184 |
| 0·274 | Ner ..... | 61 57 19·532 | — 1·392 | + 0·186 | — 1·206 | 61 57 18·326 | 9·9457538 | 115043·213 | 21·7885 | 0·135 |
| 0·204 | Ashti..... | 77 56 57·432 | — 1·392 | + 0·076 | — 1·316 | 77 56 56·116 | 9·9903219 | Logs. | | |
| | | 180 0 4·084 | — 4·175 | + 0·091 | — 4·084 | 180 0 0·000 | | 5·1976817 | | |
| | | | | | | | | 5·0608610 | | |

No. 34.—Salbaldi to Dhar = 130287·390 Feet...Log 5·1149024; Miles 24·6756. (Δs 29 & 31)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·279 | Salbaldi..... | 59 44 44·710 | — 1·554 | + 0·169 | — 1·385 | 59 44 43·325 | 9·9364106 | 176036·932 | 33·3403 | 0·206 |
| 0·241 | Dhar..... | 74 42 9·550 | — 1·555 | + 0·311 | — 1·244 | 74 42 8·306 | 9·9843329 | 157645·473 | 29·8571 | 0·184 |
| 0·127 | Ashti..... | 45 33 9·630 | — 1·554 | + 0·293 | — 1·261 | 45 33 8·369 | 9·8536315 | Logs. | | |
| | | 180 0 3·890 | — 4·663 | + 0·773 | — 3·890 | 180 0 0·000 | | 5·2456038 | | |
| | | | | | | | | 5·1976815 | | |

No. 35.—Salbaldi to Ashti = 176036·932 Feet...Log 5·2456038; Miles 33·3403. (Δ 34)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·149 | Salbaldi..... | 37 59 51·642 | — 0·851 | + 0·240 | — 0·611 | 37 59 51·031 | 9·7893178 | 100120·623 | 18·9622 | 0·117 |
| 0·276 | Ashti..... | 32 23 47·803 | — 0·851 | — 0·218 | — 1·069 | 32 23 46·734 | 9·7289804 | 115043·185 | 21·7885 | 0·135 |
| 0·202 | Ner ..... | 109 36 22·895 | — 0·852 | + 0·192 | — 0·660 | 109 36 22·235 | 9·9740607 | Logs. | | |
| | | 180 0 2·340 | — 2·554 | + 0·214 | — 2·340 | 180 0 0·000 | | 5·0005235 | | |
| | | | | | | | | 5·0608609 | | |

No. 36.—Ner to Ashti = 115043·199 Feet...Log 5·0608610; Miles 21·7885. (Δs 33 & 35)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·219 | Ner ..... | 42 26 54·470 | — 0·619 | + 0·445 | — 0·174 | 42 26 54·296 | 9·8292563 | 101716·749 | 19·2645 | 0·119 |
| 0·266 | Ashti..... | 59 46 48·797 | — 0·620 | + 0·238 | — 0·382 | 59 46 48·415 | 9·9365641 | 79448·319 | 15·0470 | 0·093 |
| 0·209 | Badali ..... | 77 46 17·578 | — 0·620 | + 0·331 | — 0·289 | 77 46 17·289 | 9·9900326 | Logs. | | |
| | | 180 0 0·845 | — 1·859 | + 1·014 | — 0·845 | 180 0 0·000 | | 5·0073925 | | |
| | | | | | | | | 4·9000847 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 37.—Ner to Badali = 101716·749 Feet...Log 5·0073925; Miles 19·2645. (Δ 36)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·108 | Ner ..... | 49 30 39·444 | — 0·788 | — 0·487 | — 1·275 | 49 30 38·169 | 9·8811141 | 129932·924 | 24·6085 | 0·152 |
| 0·132 | Badali ..... | 80 2 30·759 | — 0·789 | — 0·511 | — 1·300 | 80 2 29·459 | 9·9934068 | 100329·000 | 19·0017 | 0·117 |
| 0·266 | Wirur ..... | 50 26 54·067 | — 0·789 | — 0·906 | — 1·695 | 50 26 52·372 | 9·8870801 | Logs. | | |
| | | 180 0 4·270 | — 2·366 | — 1·904 | — 4·270 | 180 0 0·000 | | 5·1137192 | | |
| | | | | | | | | 5·0014265 | | |

No. 38.—Badali to Wirur = 100329·000 Feet...Log 5·0014265; Miles 19·0017. (Δ 37)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·227 | Badali ..... | 49 20 33·203 | — 0·993 | + 0·462 | — 0·531 | 49 20 32·672 | 9·8800224 | 166301·076 | 31·4964 | 0·195 |
| 0·125 | Wirur ..... | 93 38 19·171 | — 0·993 | + 0·312 | — 0·681 | 93 38 18·490 | 9·9991238 | 126413·552 | 23·9420 | 0·148 |
| 0·166 | Ikjhera ..... | 37 1 9·420 | — 0·993 | + 0·411 | — 0·582 | 37 1 8·838 | 9·7796553 | Logs. | | |
| | | 180 0 1·794 | — 2·979 | + 1·185 | — 1·794 | 180 0 0·000 | | 5·2208950 | | |
| | | | | | | | | 5·1017936 | | |

No. 39.—Badali to Ikjhera = 166301·076 Feet...Log 5·2208950; Miles 31·4964. (Δ 38)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·187 | Badali ..... | 70 58 41·451 | — 1·116 | — 0·118 | — 1·234 | 70 58 40·217 | 9·9756122 | 90457·084 | 17·1320 | 0·106 |
| 0·140 | Ikjhera ..... | 32 0 27·391 | — 1·116 | — 0·179 | — 1·295 | 32 0 26·096 | 9·7242976 | 161345·593 | 30·5579 | 0·189 |
| 0·170 | Badgaon .... | 77 0 54·829 | — 1·116 | — 0·026 | — 1·142 | 77 0 53·687 | 9·9887500 | Logs. | | |
| | | 180 0 3·671 | — 3·348 | — 0·323 | — 3·671 | 180 0 0·000 | | 4·9564426 | | |
| | | | | | | | | 5·2077572 | | |

No. 40.—Ashti to Badali = 79448·319 Feet...Log 4·9000847; Miles 15·0470. (Δ 36)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·332 | Ashti..... | 53 20 24·581 | — 0·558 | — 0·073 | — 0·631 | 53 20 23·950 | 9·9042786 | 111627·798 | 21·1416 | 0·131 |
| 0·211 | Badali ..... | 81 51 56·987 | — 0·559 | — 0·142 | — 0·701 | 81 51 56·286 | 9·9956084 | 90457·062 | 17·1320 | 0·106 |
| 0·153 | Badgaon .... | 44 47 40·530 | — 0·558 | — 0·208 | — 0·766 | 44 47 39·764 | 9·8479208 | Logs. | | |
| | | 180 0 2·098 | — 1·675 | — 0·423 | — 2·098 | 180 0 0·000 | | 5·0477723 | | |
| | | | | | | | | 4·9564425 | | |

No. 41.—Badali to Badgaon = 90457·073 Feet...Log 4·9564426; Miles 17·1320. (Δs 39 & 40)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·187 | Badali ..... | 70 58 41·451 | — 1·116 | — 0·118 | — 1·234 | 70 58 40·217 | 9·9756122 | 166301·076 | 31·4964 | 0·195 |
| 0·170 | Badgaon .... | 77 0 54·829 | — 1·116 | — 0·026 | — 1·142 | 77 0 53·687 | 9·9887500 | 161345·593 | 30·5579 | 0·189 |
| 0·140 | Ikjhera ..... | 32 0 27·391 | — 1·116 | — 0·179 | — 1·295 | 32 0 26·096 | 9·7242976 | Logs. | | |
| | | 180 0 3·671 | — 3·348 | — 0·323 | — 3·671 | 180 0 0·000 | | 5·2208950 | | |
| | | | | | | | | 5·2077572 | | |

No. 42.—Badgaon to Ikjhera = 161345·593 Feet...Log 5·2077572; Miles 30·5579. (Δs 39 & 41)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·160 | Badgaon .... | 53 2 2·255 | — 0·983 | — 0·200 | — 1·183 | 53 2 1·072 | 9·9025406 | 97150·000 | 18·3996 | 0·114 |
| 0·169 | Ikjhera ..... | 37 1 20·812 | — 0·982 | — 0·212 | — 1·194 | 37 1 19·618 | 9·7796854 | 128913·386 | 24·4154 | 0·151 |
| 0·388 | Pilkher..... | 89 56 40·778 | — 0·983 | — 0·485 | — 1·468 | 89 56 39·310 | 9·9999998 | Logs. | | |
| | | 180 0 3·845 | — 2·948 | — 0·897 | — 3·845 | 180 0 0·000 | | 4·9874428 | | |
| | | | | | | | | 5·1102980 | | |



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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 43.—Ikjhera to Pilkher = 128913·386 Feet...Log 5·1102980; Miles 24·4154. (Δ 42)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·207 | Ikjhera ..... | 22 56 20·763 | — 0·479 | + 0·097 | — 0·382 | 22 56 20·381 | 9·5907870 | 121607·028 | 23·0316 | 0·142 |
| 0·212 | Pilkher..... | 70 21 3·204 | — 0·479 | + 0·100 | — 0·379 | 70 21 2·825 | 9·9739444 | 50327·035 | 9·5316 | 0·059 |
| 0·271 | Kopdi ..... | 86 42 37·146 | — 0·480 | + 0·128 | — 0·352 | 86 42 36·794 | 9·9992837 | Logs. | | |
| | | 180 0 1·113 | — 1·438 | + 0·325 | — 1·113 | 180 0 0·000 | | 5·0849587 | | |
| | | | | | | | | 4·7018013 | | |

**No. 44.—Ikjhera to Kopdi = 121607·028 Feet...Log 5·0849587; Miles 23·0316. (Δ 43)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·241 | Ikjhera ..... | 67 22 8·369 | — 0·760 | — 0·035 | — 0·795 | 67 22 7·574 | 9·9652020 | 86349·920 | 16·3541 | 0·101 |
| 0·174 | Kopdi ..... | 42 2 39·956 | — 0·760 | — 0·026 | — 0·786 | 42 2 39·170 | 9·8258828 | 119009·327 | 22·5397 | 0·139 |
| 0·187 | Bam ..... | 70 35 14·045 | — 0·761 | — 0·028 | — 0·789 | 70 35 13·256 | 9·9745796 | Logs. | | |
| | | 180 0 2·370 | — 2·281 | — 0·089 | — 2·370 | 180 0 0·000 | | 4·9362619 | | |
| | | | | | | | | 5·0755811 | | |

**No. 45.—Kopdi to Bam = 119009·327 Feet...Log 5·0755811; Miles 22·5397. (Δ 44)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·172 | Kopdi ..... | 68 20 1·171 | — 1·074 | + 0·195 | — 0·879 | 68 20 0·292 | 9·9681784 | 123786·343 | 23·4444 | 0·145 |
| 0·117 | Bam ..... | 57 29 38·149 | — 1·074 | + 0·133 | — 0·941 | 57 29 37·208 | 9·9259986 | 136412·000 | 25·8356 | 0·160 |
| 0·216 | Sakri..... | 54 10 23·330 | — 1·075 | + 0·245 | — 0·830 | 54 10 22·500 | 9·9089069 | Logs. | | |
| | | 180 0 2·650 | — 3·223 | + 0·573 | — 2·650 | 180 0 0·000 | | 5·0926728 | | |
| | | | | | | | | 5·1348526 | | |

**No. 46.—Bam to Sakri = 136412·000 Feet...Log 5·1348526; Miles 25·8356. (Δ 45)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·241 | Bam ..... | 41 0 20·823 | — 1·077 | + 0·016 | — 1·061 | 41 0 19·762 | 9·8169908 | 153346·918 | 29·0430 | 0·179 |
| 0·188 | Sakri..... | 78 22 50·634 | — 1·077 | + 0·012 | — 1·065 | 78 22 49·569 | 9·9910073 | 102720·852 | 19·4547 | 0·120 |
| 0·365 | Mahur ..... | 60 36 51·722 | — 1·077 | + 0·024 | — 1·053 | 60 36 50·669 | 9·9401848 | Logs. | | |
| | | 180 0 3·179 | — 3·231 | + 0·052 | — 3·179 | 180 0 0·000 | | 5·1856751 | | |
| | | | | | | | | 5·0116586 | | |

**No. 47.—Sakri to Mahur = 102720·852 Feet...Log 5·0116586; Miles 19·4547. (Δ 46)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·111 | Sakri..... | 52 30 3·296 | — 0·736 | + 0·262 | — 0·474 | 52 30 2·822 | 9·8994712 | 115113·716 | 21·8018 | 0·135 |
| 0·437 | Mahur ..... | 70 19 48·730 | — 0·736 | + 1·033 | + 0·297 | 70 19 49·027 | 9·9738888 | 96986·100 | 18·3686 | 0·114 |
| 0·243 | Sukli..... | 57 10 8·313 | — 0·736 | + 0·574 | — 0·162 | 57 10 8·151 | 9·9244203 | Logs. | | |
| | | 180 0 0·339 | — 2·208 | + 1·869 | — 0·339 | 180 0 0·000 | | 5·0611271 | | |
| | | | | | | | | 4·9867095 | | |

**No. 48.—Mahur to Sukli = 96986·100 Feet...Log 4·9867095; Miles 18·3686. (Δ 47)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·359 | Mahur ..... | 60 56 59·938 | — 0·619 | — 0·695 | — 1·314 | 60 56 58·624 | 9·9416073 | 93074·664 | 17·6278 | 0·109 |
| 0·099 | Sukli..... | 57 31 20·756 | — 0·620 | — 0·191 | — 0·811 | 57 31 19·945 | 9·9261364 | 96450·044 | 18·2671 | 0·113 |
| 0·234 | Bitergaon .... | 61 31 42·503 | — 0·619 | — 0·453 | — 1·072 | 61 31 41·431 | 9·9440144 | Logs. | | |
| | | 180 0 3·197 | — 1·858 | — 1·339 | — 3·197 | 180 0 0·000 | | 4·9688315 | | |
| | | | | | | | | 4·9843024 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | **No. 49.—Sukli to Bitergaon = 96450·044 Feet...Log 4·9843024; Miles 18·2671.** | | | | | | | | | (Δ 48) |
| 0·168 | Sukli ..... | 67° 22′ 24″·563 | — 1·003 | + 0·635 | — 0·368 | 67° 22′ 24″·195 | 9·9652166 | 143643·927 | 27·2053 | + 0·168 |
| 0·199 | Bitergaon .... | 72 44 35·995 | — 1·004 | + 0·753 | — 0·251 | 72 44 35·744 | 9·9799965 | 138837·703 | 26·2950 | 0·162 |
| 0·229 | Terban ..... | 39 53 0·198 | — 1·003 | + 0·866 | — 0·137 | 39 53 0·061 | 9·8070116 | Logs. 5·1572873 | | |
| | | 180 0 0·756 | — 3·010 | + 2·254 | — 0·756 | 180 0 0·000 | | 5·1425074 | | |
| | **No. 50.—Bitergaon to Terban = 138837·703 Feet...Log 5·1425074; Miles 26·2950.** | | | | | | | | | (Δ 49) |
| 0·191 | Bitergaon .... | 81 27 49·345 | — 1·043 | + 0·159 | — 0·884 | 81 27 48·461 | 9·9951617 | 96879·867 | 18·3485 | 0·113 |
| 0·282 | Terban ..... | 37 35 21·146 | — 1·044 | + 0·235 | — 0·809 | 37 35 20·337 | 9·7853247 | 157061·761 | 29·7465 | 0·184 |
| 0·288 | Shivni ..... | 60 56 52·006 | — 1·044 | + 0·240 | — 0·804 | 60 56 51·202 | 9·9415986 | Logs. 4·9862335 | | |
| | | 180 0 2·497 | — 3·131 | + 0·634 | — 2·497 | 180 0 0·000 | | 5·1960705 | | |
| | **No. 51.—Terban to Shivni = 157061·761 Feet...Log 5·1960705; Miles 29·7465.** | | | | | | | | | (Δ 50) |
| 0·347 | Terban ..... | 43 17 9·885 | — 1·028 | — 0·765 | — 1·793 | 43 17 8·092 | 9·8360931 | 121646·084 | 23·0390 | 0·142 |
| 0·265 | Shivni ..... | 50 36 0·730 | — 1·028 | — 0·584 | — 1·612 | 50 35 59·118 | 9·8880283 | 107935·150 | 20·4423 | 0·126 |
| 0·228 | Bhesa ..... | 86 6 54·322 | — 1·028 | — 0·504 | — 1·532 | 86 6 52·790 | 9·9990007 | Logs. 5·0850981 | | |
| | | 180 0 4·937 | — 3·084 | — 1·853 | — 4·937 | 180 0 0·000 | | 5·0331629 | | |
| | **No. 52.—Terban to Bhesa = 121646·084 Feet...Log 5·0850981; Miles 23·0390.** | | | | | | | | | (Δ 51) |
| 0·442 | Terban ..... | 63 35 25·718 | — 0·651 | + 0·084 | — 0·567 | 63 35 25·151 | 9·9521319 | 76192·752 | 14·4304 | 0·089 |
| 0·317 | Bhesa ..... | 37 52 9·896 | — 0·651 | + 0·061 | — 0·590 | 37 52 9·306 | 9·7880705 | 111166·792 | 21·0543 | 0·130 |
| 0·208 | Somtana .... | 78 32 26·155 | — 0·652 | + 0·040 | — 0·612 | 78 32 25·543 | 9·9912549 | Logs. 4·8819137 | | |
| | | 180 0 1·769 | — 1·954 | + 0·185 | — 1·769 | 180 0 0·000 | | 5·0459751 | | |
| | **No. 53.—Bhesa to Somtana = 111166·792 Feet...Log 5·0459751; Miles 21·0543.** | | | | | | | | | (Δ 52) |
| 0·231 | Bhesa ..... | 85 37 17·433 | — 0·786 | — 0·049 | — 0·835 | 85 37 16·598 | 9·9987305 | 90338·800 | 17·1096 | 0·106 |
| 0·203 | Somtana .... | 40 49 22·467 | — 0·785 | — 0·043 | — 0·828 | 40 49 21·639 | 9·8153919 | 137788·476 | 26·0963 | 0·161 |
| 0·244 | Yemsha .... | 53 33 22·600 | — 0·786 | — 0·051 | — 0·837 | 53 33 21·763 | 9·9054927 | Logs. 4·9558743 | | |
| | | 180 0 2·500 | — 2·357 | — 0·143 | — 2·500 | 180 0 0·000 | | 5·1392129 | | |
| | **No. 54.—Somtana to Yemsha = 137788·476 Feet...Log 5·1392129; Miles 26·0963.** | | | | | | | | | (Δ 53) |
| 0·311 | Somtana .... | 62 45 47·549 | — 1·182 | + 0·013 | — 1·169 | 62 45 46·380 | 9·9489604 | 122983·396 | 23·2923 | 0·144 |
| 0·210 | Yemsha .... | 53 18 4·282 | — 1·182 | + 0·009 | — 1·173 | 53 18 3·109 | 9·9040578 | 136379·500 | 25·8295 | 0·160 |
| 0·165 | Shevalingapa.. | 63 56 11·687 | — 1·183 | + 0·007 | — 1·176 | 63 56 10·511 | 9·9534242 | Logs. 5·0898465 | | |
| | | 180 0 3·518 | — 3·547 | + 0·029 | — 3·518 | 180 0 0·000 | | 5·1347491 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 55.—Yemsha to Shevalingapa = 136379·500 Feet...Log 5·1347491; Miles 25·8295. (Δ 54)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·204 | Yemsha..... | 70° 56′ 44″·532 | — 1·545 | — 0·631 | — 2·176 | 70° 56′ 42″·356 | 9·9755265 | 152736·881 | 28·9274 | 0·179 |
| 0·127 | Shevalingapa.. | 59 4 3·448 | — 1·545 | — 0·198 | — 1·743 | 59 4 1·705 | 9·9333709 | 168305·970 | 31·8761 | 0·197 |
| 0·285 | Yenagapali .. | 49 59 18·747 | — 1·545 | — 1·263 | — 2·808 | 49 59 15·939 | 9·8841761 | Logs. 5·1839439 5·2260995 | | |
| | | 180 0 6·727 | — 4·635 | — 2·092 | — 6·727 | 108 0 0·000 | | | | |

No. 56.—Shevalingapa to Yenagapali = 168305·970 Feet...Log 5·2260995; Miles 31·8761. (Δ 55)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·134 | Shevalingapa.. | 51 30 38·401 | — 0·959 | + 0·101 | — 0·858 | 51 30 37·543 | 9·8936072 | 92789·984 | 17·5739 | 0·109 |
| 0·147 | Yenagapali .. | 33 18 9·511 | — 0·959 | + 0·517 | — 0·442 | 33 18 9·069 | 9·7396194 | 132278·398 | 25·0527 | 0·155 |
| 0·381 | Baktapur .... | 95 11 14·173 | — 0·960 | + 0·175 | — 0·785 | 95 11 13·388 | 9·9982178 | Logs. 4·9675011 5·1214889 | | |
| | | 180 0 2·085 | — 2·878 | + 0·793 | — 2·085 | 180 0 0·000 | | | | |

No. 57.—Yemsha to Shevalingapa = 136379·500 Feet...Log 5·1347491; Miles 25·8295. (Δ 54)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·223 | Yemsha..... | 27 12 19·274 | — 0·929 | — 0·390 | — 1·319 | 27 12 17·955 | 9·6600828 | 190013·440 | 35·9874 | 0·222 |
| 0·212 | Shevalingapa.. | 110 34 41·849 | — 0·930 | — 0·097 | — 1·027 | 110 34 40·822 | 9·9713660 | 92789·984 | 17·5739 | 0·109 |
| 0·315 | Baktapur .... | 42 13 1·322 | — 0·930 | + 0·831 | — 0·099 | 42 13 1·223 | 9·8273308 | Logs. 5·2787843 4·9675011 | | |
| | | 180 0 2·445 | — 2·789 | + 0·344 | — 2·445 | 180 0 0·000 | | | | |

No. 58.—Yemsha to Baktapur = 190013·440 Feet...Log 5·2787843; Miles 35·9874. (Δ 57)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·265 | Yemsha..... | 43 44 25·258 | — 1·574 | — 0·241 | — 1·815 | 43 44 23·443 | 9·8397200 | 152736·846 | 28·9274 | 0·179 |
| 0·305 | Baktapur .... | 52 58 12·851 | — 1·575 | — 0·656 | — 2·231 | 52 58 10·620 | 9·9021750 | 132278·367 | 25·0527 | 0·155 |
| 0·313 | Yenagapali .. | 83 17 28·257 | — 1·575 | — 0·745 | — 2·320 | 83 17 25·937 | 9·9970155 | Logs. 5·1839438 5·1214888 | | |
| | | 180 0 6·366 | — 4·724 | — 1·642 | — 6·366 | 180 0 0·000 | | | | |

No. 59.—Baktapur to Yenagapali = 132278·383 Feet...Log 5·1214889; Miles 25·0527. (Δs 56 & 58)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·362 | Baktapur .... | 53 51 36·668 | — 0·748 | + 1·127 | + 0·379 | 53 51 37·047 | 9·9071863 | 89167·142 | 16·8877 | 0·104 |
| 0·257 | Yenagapali .. | 42 6 5·333 | — 0·747 | — 0·421 | — 1·168 | 42 6 4·165 | 9·8263610 | 107406·420 | 20·3421 | 0·126 |
| 0·155 | Burgapali .... | 84 2 19·422 | — 0·748 | + 0·114 | — 0·634 | 84 2 18·788 | 9·9976450 | Logs. 4·9502049 5·0310302 | | |
| | | 180 0 1·423 | — 2·243 | + 0·820 | — 1·423 | 180 0 0·000 | | | | |

No. 60.—Burgapali to Baktapur = 89167·142 Feet...Log 4·9502049; Miles 16·8877. (Δ 59)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·147 | Baktapur .... | 63 55 40·959 | — 0·754 | — 0·145 | — 0·899 | 63 55 40·060 | 9·9533929 | 119915·055 | 22·7112 | 0·140 |
| 0·182 | Burgapali .... | 71 17 51·276 | — 0·754 | + 0·255 | — 0·499 | 71 17 50·777 | 9·9764398 | 113717·365 | 21·5374 | 0·133 |
| 0·179 | Munganal .... | 44 46 29·242 | — 0·753 | + 0·674 | — 0·079 | 44 46 29·163 | 9·8477710 | Logs. 5·0788737 5·0558268 | | |
| | | 180 0 1·477 | — 2·261 | + 0·784 | — 1·477 | 180 0 0·000 | | | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 61.—Burgapali to Munganal = 113717·365 Feet...Log 5·0558268; Miles 21·5374. (Δ 60)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·138 | Burgapali .... | 73 3 33·398 | — 0·693 | + 0·060 | — 0·633 | 73 3 32·765 | 9·9807330 | 81130·776 | 15·3657 | 0·095 |
| 0·241 | Munganal .... | 40 44 54·432 | — 0·692 | — 0·564 | — 1·256 | 40 44 53·176 | 9·8147367 | 118900·000 | 22·5189 | 0·139 |
| 0·269 | Damargida.... | 66 11 34·128 | — 0·693 | + 0·624 | — 0·069 | 66 11 34·059 | 9·9613779 | Logs. | | |
| | | 180 0 1·958 | — 2·078 | + 0·120 | — 1·958 | 180 0 0·000 | | 4·9091856 | | |
| | | | | | | | | 5·0751819 | | |

**No. 62.—Munganal to Damargida = 118900·000 Feet...Log 5·0751819; Miles 22·5189. (Δ 61)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·214 | Munganal .... | 31 9 53·259 | — 0·528 | — 0·007 | — 0·535 | 31 9 52·724 | 9·7139096 | 109346·578 | 20·7096 | 0·128 |
| 0·131 | Damargida.... | 65 52 55·538 | — 0·528 | — 0·075 | — 0·603 | 65 52 54·935 | 9·9603305 | 61998·943 | 11·7422 | 0·073 |
| 0·312 | West End Base | 82 57 13·013 | — 0·528 | — 0·144 | — 0·672 | 82 57 12·341 | 9·9967072 | Logs. | | |
| | | 180 0 1·810 | — 1·584 | — 0·226 | — 1·810 | 180 0 0·000 | | 5·0388052 | | |
| | | | | | | | | 4·7923843 | | |

**No. 63.—Yenagapali to Burgapali = 107406·420 Feet...Log 5·0310302; Miles 20·3421. (Δ 59)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·213 | Yenagapali .. | 41 33 22·900 | — 0·586 | + 0·726 | + 0·140 | 41 33 23·040 | 9·8217473 | 104861·146 | 19·8601 | 0·123 |
| 0·106 | Burgapali .... | 67 24 42·728 | — 0·586 | + 0·112 | — 0·474 | 67 24 42·254 | 9·9653376 | 75339·770 | 14·2689 | 0·088 |
| 0·134 | Bachapali .... | 71 1 55·469 | — 0·587 | — 0·176 | — 0·763 | 71 1 54·706 | 9·9757532 | Logs. | | |
| | | 180 0 1·097 | — 1·759 | + 0·662 | — 1·097 | 180 0 0·000 | | 5·0206146 | | |
| | | | | | | | | 4·8770243 | | |

**No. 64.—Burgapali to Bachapali = 75339·770 Feet...Log 4·8770243; Miles 14·2689. (Δ 63)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·214 | Burgapali .... | 64 11 32·690 | — 0·432 | — 0·055 | — 0·487 | 64 11 32·203 | 9·9543680 | 81130·776 | 15·3657 | 0·095 |
| 0·146 | Bachapali .... | 61 16 51·109 | — 0·432 | + 0·373 | — 0·059 | 61 16 51·050 | 9·9429925 | 83283·900 | 15·7735 | 0·097 |
| 0·279 | Damargida.... | 54 31 37·927 | — 0·432 | — 0·748 | — 1·180 | 54 31 36·747 | 9·9108312 | Logs. | | |
| | | 180 0 1·726 | — 1·296 | — 0·430 | — 1·726 | 180 0 0·000 | | 4·9091856 | | |
| | | | | | | | | 4·9205611 | | |

**No. 65.—Bachapali to Damargida = 83283·900 Feet...Log 4·9205611; Miles 15·7735. (Δ 64)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·147 | Bachapali .... | 61 35 45·834 | — 0·467 | + 0·426 | — 0·041 | 61 35 45·793 | 9·9442931 | 81163·056 | 15·3718 | 0·095 |
| 0·250 | Damargida.... | 57 57 44·756 | — 0·466 | + 0·701 | + 0·235 | 57 57 44·991 | 9·9282427 | 84218·758 | 15·9505 | 0·099 |
| 0·189 | Dudala ..... | 60 26 29·058 | — 0·467 | + 0·625 | + 0·158 | 60 26 29·216 | 9·9394454 | Logs. | | |
| | | 179 59 59·648 | — 1·400 | + 1·752 | + 0·352 | 180 0 0·000 | | 4·9093584 | | |
| | | | | | | | | 4·9254088 | | |

**No. 66.—Damargida to Dudala = 84218·758 Feet...Log 4·9254088; Miles 15·9505. (Δ 65)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·321 | Damargida.... | 59 20 42·677 | — 0·587 | — 0·401 | — 0·988 | 59 20 41·689 | 9·9346258 | 103252·214 | 19·5553 | 0·121 |
| 0·196 | Dudala ..... | 70 25 53·424 | — 0·587 | + 0·067 | — 0·520 | 70 25 52·904 | 9·9741619 | 94267·786 | 17·8537 | 0·110 |
| 0·112 | Shilapali..... | 50 13 26·176 | — 0·587 | — 0·182 | — 0·769 | 50 13 25·407 | 9·8856713 | Logs. | | |
| | | 180 0 2·277 | — 1·761 | — 0·516 | — 2·277 | 180 0 0·000 | | 5·0138994 | | |
| | | | | | | | | 4·9743633 | | |



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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 67.—Damargida to Shilapali = 103252·214 Feet...Log 5·0138994; Miles 19·5553. (Δ 66)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. s | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·225 | Damargida .. | 19 0 34·812 | — 1·171 | + 0·578 | + 0·407 | 19 0 35·219 | 9·5128572 | 65039·276 | 12·3180 | 0·076 |
| 0·164 | Shilapali .... | 26 53 56·310 | — 0·172 | + 0·545 | + 0·373 | 26 53 56·683 | 9·6555422 | 46826·387 | 8·8686 | 0·055 |
| 0·205 | Malgi..... | 134 5 27·510 | — 0·172 | + 0·760 | + 0·588 | 134 5 28·098 | 9·8562659 | Logs. | | |
| | | 179 59 58·632 | — 0·515 | + 1·883 | + 1·368 | 180 0 0·000 | | 4·8131757 | | |
| | | | | | | | | 4·6704907 | | |

**No. 68.—Damargida to Dudala = 84218·758 Feet...Log 4·9254088; Miles 15·9505. (Δ 65)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·239 | Damargida .. | 78 21 17·488 | — 0·421 | + 0·178 | — 0·243 | 78 21 17·245 | 9·9909673 | 65039·291 | 12·3180 | 0·076 |
| 0·208 | Dudala ..... | 41 51 43·277 | — 0·421 | — 0·119 | — 0·540 | 41 51 42·737 | 9·8243453 | 95454·800 | 18·0786 | 0·112 |
| 0·129 | Malgi..... | 59 47 0·028 | — 0·421 | + 0·411 | — 0·010 | 59 47 0·018 | 9·9365783 | Logs. | | |
| | | 180 0 0·793 | — 1·263 | + 0·470 | — 0·793 | 180 0 0·000 | | 4·8131758 | | |
| | | | | | | | | 4·9797978 | | |

**No. 69.—Damargida to Malgi = 65039·284 Feet...Log 4·8131758; Miles 12·3180. (Δs 67 & 68)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·375 | Damargida .. | 37 4 49·563 | — 0·190 | — 0·079 | — 0·269 | 37 4 49·294 | 9·7802701 | 61998·943 | 11·7422 | 0·073 |
| 0·149 | Malgi..... | 67 22 41·205 | — 0·191 | + 0·135 | — 0·056 | 67 22 41·149 | 9·9652314 | 40497·009 | 7·6699 | 0·047 |
| 0·248 | West End Base | 75 32 28·998 | — 0·191 | + 0·750 | + 0·559 | 75 32 29·557 | 9·9860229 | Logs. | | |
| | | 179 59 59·766 | — 0·572 | + 0·806 | + 0·234 | 180 0 0·000 | | 4·7923843 | | |
| | | | | | | | | 4·6074230 | | |

**No. 70.—Damargida to Dudali = 84218·758 Feet...Log 4·9254088; Miles 15·9505. (Δ 65)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·264 | Damargida .. | 76 6 29·941 | — 0·395 | — 0·545 | — 0·940 | 76 6 29·001 | 9·9871075 | 61556·786 | 11·6585 | 0·072 |
| 0·259 | Dudala ..... | 40 42 50·512 | — 0·395 | — 0·807 | — 1·202 | 40 42 49·310 | 9·8144338 | 91611·420 | 17·3506 | 0·107 |
| 0·210 | East End Base | 63 10 43·094 | — 0·395 | — 1·010 | — 1·405 | 63 10 41·689 | 9·9505667 | Logs. | | |
| | | 180 0 3·547 | — 1·185 | — 2·362 | — 3·547 | 180 0 0·000 | | 4·7892759 | | |
| | | | | | | | | 4·9619496 | | |

**No. 71.—Damargida to West End Base = 61998·943 Feet...Log 4·7923843; Miles 11·7422. (Δs 62 & 69)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·311 | Damargida .. | 39 19 37·111 | — 0·189 | + 0·641 | + 0·452 | 39 19 37·563 | 9·8019158 | 61556·786 | 11·6585 | 0·072 |
| 0·196 | West End Base | 69 45 45·942 | — 0·190 | — 0·139 | — 0·329 | 69 45 45·613 | 9·9723268 | 41578·129 | 7·8746 | 0·049 |
| 0·168 | East End Base | 70 54 36·847 | — 0·190 | + 0·167 | — 0·023 | 70 54 36·824 | 9·9754352 | Logs. | | |
| | | 179 59 59·900 | — 0·569 | + 0·669 | + 0·100 | 180 0 0·000 | | 4·7892759 | | |
| | | | | | | | | 4·6188649 | | |

**No. 72.—Dudali to Malgi = 95454·800 Feet...Log 4·9797978; Miles 18·0786. (Δ 68)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·194 | Dudala ..... | 28 34 10·147 | — 0·337 | + 0·186 | — 0·151 | 28 34 9·996 | 9·6796310 | 94267·786 | 17·8537 | 0·110 |
| 0·250 | Malgi..... | 74 18 27·483 | — 0·338 | + 0·348 | + 0·010 | 74 18 27·493 | 9·9835035 | 46826·400 | 8·8686 | 0·055 |
| 0·142 | Shilapali .... | 77 7 22·486 | — 0·338 | + 0·363 | + 0·025 | 77 7 22·511 | 9·9889380 | Logs. | | |
| | | 180 0 0·116 | — 1·013 | + 0·897 | — 0·116 | 180 0 0·000 | | 4·9743633 | | |
| | | | | | | | | 4·6704908 | | |

| | Feet. | |
|---|---|---|
| Beder Base by Measurement | = 41578·5361086 | Log 4·6188692 |
| Triangulation | = 41578·178 | Log 4·6188655 |
| Diff. in parts of a foot | = 0·358= | 0·0000037 |

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## FROM THE MEASURED BASE AT BEDER.

### COMPUTATION OF PRINCIPAL TRIANGLES.

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | **No. 1.—West End Beder Base to East End Base = 41578·5361086 Feet...Log 4·6188692; Miles 7·8746.** | | | | | | | | | + |
| 0·196 | W. End .... | 69° 45′ 45″·942 | — 0·190 | — 0·139 | — 0·329 | 69° 45′ 45″·613 | 9·9723268 | 61999·557 | 11·7423 | |
| 0·168 | E. End..... | 70 54 36·847 | — 0·190 | + 0·167 | — 0·023 | 70 54 36·824 | 9·9754352 | 61557·400 | 11·6586 | |
| 0·311 | Damargida .. | 39 19 37·111 | — 0·189 | + 0·641 | + 0·452 | 39 19 37·563 | 9·8019158 | Logs. 4·7923886 | | |
| | | 179 59 59·900 | — 0·569 | + 0·669 | + 0·100 | 180 0 0·000 | | 4·7892802 | | |
| | **No. 2.—W. End Base to Damargida = 61999·557 Feet...Log 4·7923886; Miles 11·7423.** | | | | | | | | | (Δ 1) |
| 0·248 | W. End .... | 75 32 28·998 | — 0·191 | + 0·750 | + 0·559 | 75 32 29·557 | 9·9860229 | 40497·409 | 7·6700 | |
| 0·375 | Dama rgid a.. | 37 4 49·563 | — 0·190 | — 0·079 | — 0·269 | 37 4 49·294 | 9·7802701 | 45039·946 | 12·3182 | |
| 0·149 | Malgi ..... | 67 22 41·205 | — 0·191 | + 0·135 | — 0·056 | 67 22 41·149 | 9·9652314 | Logs. 4·6074273 | | |
| | | 179 59 59·766 | — 0·572 | + 0·806 | + 0·234 | 180 0 0·000 | | 4·8131801 | | |
| | **No. 3.—Damargida to Malgi = 65039·946 Feet...Log 4·8131801; Miles 12·3182.** | | | | | | | | | (Δ 2) |
| 0·239 | Damargida .. | 78 21 17·488 | — 0·421 | + 0·178 | — 0·243 | 78 21 17·245 | 9·9909673 | 84219·578 | 15·9507 | |
| 0·129 | Malgi ..... | 59 47 0·028 | — 0·421 | + 0·411 | — 0·010 | 59 47 0·018 | 9·9365783 | 95455·744 | 18·0787 | |
| 0·208 | Dudala ..... | 41 51 43·277 | — 0·421 | — 0·119 | — 0·540 | 41 51 42·737 | 9·8243453 | Logs. 4·9254131 | | |
| | | 180 0 0·793 | — 1·263 | + 0·470 | — 0·793 | 180 0 0·000 | | 4·9798021 | | |
| | **No. 4.—Damargida to Malgi = 65039·946 Feet...Log 4·8131801; Miles 12·3182.** | | | | | | | | | (Δ 2) |
| 0·225 | Damargida .. | 19 0 34·812 | — 0·171 | + 0·578 | + 0·407 | 19 0 35·219 | 9·5128572 | 103253·262 | 19·5555 | |
| 0·205 | Malgi..... | 134 5 27·510 | — 0·172 | + 0·760 | + 0·588 | 134 5 28·098 | 9·8562659 | 46826·865 | 8·8687 | |
| 0·164 | Shilapali .... | 26 53 56·310 | — 0·172 | + 0·545 | + 0·373 | 26 53 56·683 | 9·6555422 | Logs. 5·0139038 | | |
| | | 179 59 58·632 | — 0·515 | + 1·883 | + 1·368 | 180 0 0·000 | | 4·6704951 | | |
| | **No. 5.—E. End Base to Damargida = 61557·400 Feet...Log 4·7892802; Miles 11·6586.** | | | | | | | | | (Δ 1) |
| 0·210 | E. End..... | 63 10 43·094 | — 0·395 | — 1·010 | — 1·405 | 63 10 41·689 | 9·9505667 | 91612·322 | 17·3508 | |
| 0·264 | Damargida .. | 76 6 29·941 | — 0·395 | — 0·545 | — 0·940 | 76 6 29·001 | 9·9871075 | 84219·578 | 15·9507 | |
| 0·259 | Dudala ..... | 40 42 50·512 | — 0·395 | — 0·807 | — 1·202 | 40 42 49·310 | 9·8144338 | Logs. 4·9619539 | | |
| | | 180 0 3·547 | — 1·185 | — 2·362 | — 3·547 | 180 0 0·000 | | 4·9254131 | | |
| | **No. 6.—Damargida to Shilapali = 103253·262 Feet...Log 5·0139038; Miles 19·5555.** | | | | | | | | | (Δ 4) |
| 0·321 | Damargida .. | 59 20 42·677 | — 0·587 | — 0·401 | — 0·988 | 59 20 41·689 | 9·9346258 | 84219·600 | 15·9507 | |
| 0·112 | Shilapali .... | 50 13 26·176 | — 0·587 | — 0·182 | — 0·769 | 50 13 25·407 | 9·8856713 | 94268·744 | 17·8539 | |
| 0·196 | Dudala ..... | 70 25 53·424 | — 0·587 | + 0·067 | — 0·520 | 70 25 52·904 | 9·9741619 | Logs. 4·9254132 | | |
| | | 180 0 2·277 | — 1·761 | — 0·516 | — 2·277 | 180 0 0·000 | | 4·9743677 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 7.—Dudala to Shilapali = 94268·744 Feet...Log 4·9743677; Miles 17·8539. (Δ 6)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·364 | Dudala ..... | 83° 49′ 23″·259 | — 0·417 | + 0·554 | + 0·137 | 83° 49′ 23″·396 | 9·9974714 | 56686·839 | 10·7361 | + |
| 0·114 | Shilapali .... | 32 35 12·279 | — 0·417 | + 0·101 | — 0·316 | 32 35 11·963 | 9·7312459 | 104642·434 | 19·8186 | |
| 0·143 | Tadmanur.... | 63 35 24·877 | — 0·417 | + 0·181 | — 0·236 | 63 35 24·641 | 9·9521313 | Logs. 4·7534823 5·0197078 | | |
| | | 180 0 0·415 | — 1·251 | + 0·836 | — 0·415 | 180 0 0·000 | | | | |

**No. 8.—Dudala to Shilapali = 94268·744 Feet...Log 4·9743677; Miles 17·8539. (Δ 6)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·285 | Dudala ..... | 42 40 49·103 | — 0·507 | + 0·007 | — 0·500 | 42 40 48·603 | 9·8311690 | 101167·023 | 19·1604 | |
| 0·232 | Shilapali .... | 73 49 20·636 | — 0·508 | + 0·103 | — 0·405 | 73 49 20·231 | 9·9824531 | 71409·300 | 13·5245 | |
| 0·264 | Goraegat .... | 63 29 51·824 | — 0·507 | — 0·151 | — 0·658 | 63 29 51·166 | 9·9517819 | Logs. 5·0050389 4·8537548 | | |
| | | 180 0 1·563 | — 1·522 | — 0·041 | — 1·563 | 180 0 0·000 | | | | |

**No. 9.—Shilapali to Tadmanur = 104642·434 Feet...Log 5·0197078; Miles 19·8186. (Δ 7)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·194 | Shilapali .... | 41 14 8·357 | — 0·386 | + 0·002 | — 0·384 | 41 14 7·973 | 9·8189883 | 71409·317 | 13·5245 | |
| 0·221 | Tadmanur.... | 42 44 15·417 | — 0·387 | — 0·002 | — 0·389 | 42 44 15·028 | 9·8316399 | 69359·080 | 13·1362 | |
| 0·243 | Goraegat .... | 96 1 37·183 | — 0·387 | + 0·203 | — 0·184 | 96 1 36·999 | 9·9975928 | Logs. 4·8537549 4·8411033 | | |
| | | 180 0 0·957 | — 1·160 | + 0·203 | — 0·957 | 180 0 0·000 | | | | |

**No. 10.—Dudala to Goraegat = 101167·023 Feet...Log 5·0050389; Miles 19·1604. (Δ 8)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·265 | Dudala ..... | 41 8 34·184 | — 0·296 | + 0·519 | + 0·223 | 41 8 34·407 | 9·8181858 | 56686·839 | 10·7361 | |
| 0·169 | Goraegat .... | 32 31 45·359 | — 0·296 | + 0·354 | + 0·058 | 32 31 45·417 | 9·7305648 | 69359·080 | 13·1362 | |
| 0·166 | Tadmanur.... | 106 19 40·294 | — 0·296 | + 0·178 | — 0·118 | 106 19 40·176 | 9·9821214 | Logs. 4·7534823 4·8411033 | | |
| | | 179 59 59·837 | — 0·888 | + 1·051 | + 0·163 | 180 0 0·000 | | | | |

**No. 11.—Dudala to Goraegat = 101167·023 Feet...Log 5·0050389; Miles 19·1604. (Δ 8)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·259 | Dudala ..... | 31 23 3·116 | — 0·698 | + 0·166 | — 0·532 | 31 23 2·584 | 9·7166476 | 169000·427 | 32·0077 | |
| 0·251 | Goraegat .... | 116 5 44·950 | — 0·699 | + 0·562 | — 0·137 | 116 5 44·813 | 9·9533053 | 98000·900 | 18·5608 | |
| 0·186 | Topkonda.... | 32 31 12·744 | — 0·699 | + 0·558 | — 0·141 | 32 31 12·603 | 9·7304564 | Logs. 5·2278878 4·9912301 | | |
| | | 180 0 0·810 | — 2·096 | + 1·286 | — 0·810 | 180 0 0·000 | | | | |

**No. 12.—Goraegat to Tadmanur = 69359·080 Feet...Log 4·8411033; Miles 13·1362. (Δs 9 & 10)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·161 | Goraegat .... | 83 33 59·591 | — 0·530 | + 0·208 | — 0·322 | 83 33 59·269 | 9·9972564 | 98000·922 | 18·5608 | |
| 0·302 | Tadmanur.... | 59 3 31·941 | — 0·530 | + 0·457 | — 0·073 | 59 3 31·868 | 9·9333333 | 113541·158 | 21·5040 | |
| 0·245 | Topkonda.... | 37 22 28·789 | — 0·530 | + 0·604 | + 0·074 | 37 22 28·863 | 9·7832064 | Logs. 4·9912302 5·0551533 | | |
| | | 180 0 0·321 | — 1·590 | + 1·269 | — 0·321 | 180 0 0·000 | | | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 13.—Dudala to Tadmanur = 56686·839 Feet...Log 4·7534823; Miles 10·7361. (As 7 & 10)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·189 | Dudala ..... | 9 45 31·068 | — 0·127 | + 0·354 | + 0·227 | 9 45 31·295 | 9·2291672 | 169000·466 | 32·0077 | |
| 0·197 | Tadmanur.... | 165 23 12·235 | — 0·128 | + 0·635 | + 0·507 | 165 23 12·742 | 9·4019019 | 113541·131 | 21·5040 | |
| 0·139 | Topkonda.... | 4 51 16·045 | — 0·127 | + 0·045 | — 0·082 | 4 51 15·963 | 8·9274963 | Logs. | | |
| | | 179 59 59·348 | — 0·382 | + 1·034 | — 0·652 | 180 0 0·000 | | 5·2278879 | | |
| | | | | | | | | 5·0551532 | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | Logs. | | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

**No. 1.—Kalianpur to Bhaorasa = 118972·752 Feet...Log 5·0754476; Miles 22·5327.**

| Stations. | Angles Observed. | Corrections. e | Corrections. s | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| Kalianpur..... | 92° 37′ 24″·884 | — 0·523 | | | 92° 37′ 24″·361 | 9·9995446 | + 56041·939 | 10·6140 |
| Bhaorasa ..... | 24 43 55·370 | — 0·522 | | | 24 43 54·848 | 9·6215635 | 133811·740 | 25·3431 |
| $m^{I}$ ..... | 62 38 41·313 | — 0·522 | | | 62 38 40·791 | 9·9484980 | Logs. 4·7485131 | |
| | 180 0 1·567 | — 1·567 | | | 180 0 0·000 | | 5·1264942 | |

**No. 2.—Kamkhera to $m^{I}$ = (133811·740 — 109876·261) = 23935·479 Feet...Log 4·3790421; Miles 4·5332.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{I}$ ..... | 62 38 41·313 | — 0·049 | | | 62 38 41·264 | 9·9484985 | — 29506·288 | 5·5883 |
| Kamkhera..... | 68 23 51·949 | — 0·050 | | | 68 23 51·899 | 9·9683718 | 28186·506 | 5·3384 |
| $m^{II}$..... | 48 57 26·886 | — 0·049 | | | 48 57 26·837 | 9·8774993 | Logs. 4·4699146 | |
| | 180 0 0·148 | — ·0148 | | | 180 0 0·000 | | 4·4500413 | |

**No. 3.—Gargaja to $m^{II}$ = (28186·506 + 146788·000) = 174974·506 Feet...Log 5·2429748; Miles 33·1391.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{II}$..... | 48 57 26·886 | — 1·690 | | | 48 57 25·196 | 9·8774964 | + 163311·864 | 30·9303 |
| Gargaja..... | 61 11 29·420 | — 1·691 | | | 61 11 27·729 | 9·9426188 | 140570·906 | 26·6233 |
| $m^{III}$ ..... | 69 51 8·766 | — 1·691 | | | 69 51 7·075 | 9·9725758 | Logs. 5·2130178 | |
| | 180 0 5·072 | — 5·072 | | | 180 0 0·000 | | 5·1478954 | |

**No. 4.—Ehmadpur to $m^{III}$ = (140570·906 — 131588·788) = 8982·118 Feet...Log 3·9533788; Miles 1·7012.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{III}$ ..... | 69 51 8·766 | — 0·008 | | | 69 51 8·758 | 9·9725771 | — 11080·484 | 2·0986 |
| Ehmadpur ..... | 63 35 32·303 | — 0·007 | | | 63 35 32·296 | 9·9521393 | 11614·396 | 2·1997 |
| $m^{IV}$ ..... | 46 33 18·953 | — 0·007 | | | 46 33 18·946 | 9·8609593 | Logs. 4·0445588 | |
| | 180 0 0·022 | — 0·022 | | | 180 0 0·000 | | 4·0649966 | |

**No. 5.—Ander to $m^{IV}$ = (11614·396 + 105270·848) = 116885·244 Feet...Log 5·0677597; Miles 22·1374.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{IV}$ ..... | 46 33 18·953 | — 0·571 | | | 46 33 18·382 | 9·8609582 | + 85803·440 | 16·2507 |
| Ander ..... | 47 6 13·778 | — 0·571 | | | 47 6 13·207 | 9·8648589 | 85036·240 | 16·1053 |
| $m^{V}$..... | 86 20 28·983 | — 0·572 | | | 86 20 28·411 | 9·9991139 | Logs. 4·9335047 | |
| | 180 0 1·714 | — 1·714 | | | 180 0 0·000 | | 4·9296040 | |

**No. 6.—Gidgarh to $m^{V}$ = (120730·500 — 85036·240) = 35694·260 Feet...Log 4·5525983; Miles 6·7603.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{V}$..... | 86 20 28·983 | — 0·168 | | | 86 20 28·815 | 9·9991140 | + 60104·014 | 11·3833 |
| Gidgarh..... | 62 1 30·982 | — 0·168 | | | 62 1 30·814 | 9·9460365 | 67917·393 | 12·8631 |
| $m^{VI}$ ..... | 31 38 0·539 | — 0·168 | | | 31 38 0·371 | 9·7197313 | Logs. 4·7789035 | |
| | 180 0 0·504 | — 0·504 | | | 180 0 0·000 | | 4·8319810 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 7.—Ladi to $m^{VI}$ = (102304·800 — 67917·393) = 34387·407 Feet...Log 4·5363994; Miles 6·5128.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $m^{VI}$ ..... | 31° 38′ 0″·539 | — 0·044 | | | 31° 38′ 0″·495 | 9·7197317 | + 31549·480 | 5·9753 |
| Ladi ..... | 65 32 39·628 | — 0·045 | | | 65 32 39·583 | 9·9591759 | 18178·080 | 3·4428 |
| $m^{VII}$ ..... | 82 49 19·967 | — 0·045 | | | 82 49 19·922 | 9·9965831 | Logs. 4·4989922 | |
| | 180 0 0·134 | — 0·134 | | | 180 0 0·000 | | 4·2595480 | |

No. 8.—Samasgarh to $m^{VII}$ = (119112·793 — 18178·080) = 100934·713 Feet...Log 5·0040406; Miles 19·1164.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{VII}$ ..... | 82 49 19·967 | — 0·972 | | | 82 49 18·995 | 9·9965829 | + 123623·909 | 23·4136 |
| Samasgarh..... | 55 7 29·019 | — 0·971 | | | 55 7 28·048 | 9·9140236 | 149507·103 | 28·3157 |
| $m^{VIII}$ ..... | 42 3 13·928 | — 0·971 | | | 42 3 12·957 | 9·8259617 | Logs. 5·0921025 | |
| | 180 0 2·914 | — 2·914 | | | 180 0 0·000 | | 5·1746618 | |

No. 9.—Bhimbet to $m^{VIII}$ = (149507·103 — 132460·215) = 17046·888 Feet...Log 4·2316451; Miles 3·2286.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{VIII}$ ..... | 42 3 13·928 | — 0·011 | | | 42 3 13·917 | 9·8259639 | — 12657·576 | 2·3973 |
| Bhimbet ..... | 47 56 46·106 | — 0·011 | | | 47 56 46·095 | 9·8707055 | 11418·500 | 2·1626 |
| $p^{I}$ ..... | 90 0 0·000 | — 0·012 | | | 89 59 59·988 | 10·0000000 | Logs. 4·1023506 | |
| | 180 0 0·034 | — 0·034 | | | 180 0 0·000 | | 4·0576090 | |

No. 10.—Bhimbet to $p^{I}$ = 11418·500 Feet...Log 4·0576090; Miles 2·1626.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $p^{I}$ ..... | 90 0 0·000 | — 0·008 | | | 89 59 59·992 | 10·0000000 | + 8054·089 | 1·5254 |
| Bhimbet ..... | 35 11 50·627 | — 0·007 | | | 35 11 50·620 | 9·7607204 | 13973·203 | 2·6464 |
| $m^{IX}$ ..... | 54 48 9·395 | — 0·007 | | | 54 48 9·388 | 9·9123130 | Logs. 3·9060164 | |
| | 180 0 0·022 | — 0·022 | | | 180 0 0·000 | | 4·1452960 | |

No. 11.—Tek to $m^{IX}$ = (202430·889 — 13973·203) = 188457·686 Feet...Log 5·2752139; Miles 35·6927.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{IX}$ ..... | 54 48 9·395 | — 2·421 | | | 54 48 6·974 | 9·9123095 | + 200432·692 | 37·9607 |
| Tek ..... | 65 59 57·194 | — 2·422 | | | 65 59 54·772 | 9·9607253 | 179288·617 | 33·9562 |
| $m^{X}$ ..... | 59 12 0·676 | — 2·422 | | | 59 11 58·254 | 9·9339707 | Logs. 5·3019685 | |
| | 180 0 7·265 | — 7·265 | | | 180 0 0·000 | | 5·2535527 | |

No. 12.—Narwargarh to $m^{X}$ = (200131·278 — 179288·617) = 20842·661 Feet...Log 4·3189532; Miles 3·9474.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{X}$ ..... | 59 12 0·676 | — 0·027 | | | 59 12 0·649 | 9·9339737 | + 19286·004 | 3·6527 |
| Narwargarh ..... | 56 29 36·696 | — 0·027 | | | 56 29 36·669 | 9·9210740 | 19867·441 | 3·7628 |
| $m^{XI}$ ..... | 64 18 22·709 | — 0·027 | | | 64 18 22·682 | 9·9547849 | Logs. 4·2852423 | |
| | 180 0 0·081 | — 0·081 | | | 180 0 0·000 | | 4·2981420 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 13.—Dhaba Deo to $m^{xi}$ = (118631·506 — 19867·441) = 98764·065 Feet...Log 4·9945990; Miles 18·7053.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $m^{xi}$ ..... | 64° 18′ 22″·709 | — 1·125 | | | 64° 18′ 21″·584 | 9·9547838 | + 161068·259 | 30·5054 |
| Dhaba Deo ..... | 78 43 39·138 | — 1·125 | | | 78 43 38·013 | 9·9915396 | 147997·444 | 28·0298 |
| $m^{xii}$ ..... | 36 58 1·527 | — 1·124 | | | 36 58 0·403 | 9·7791286 | Logs. 5·2070100 | |
| | 180 0 3·374 | — 3·374 | | | 180 0 0·000 | | 5·1702542 | |

No. 14.—Nilgarh to $m^{xii}$ = (147997·444 — 147812·885) = 184·559 Feet...Log 2·2661352; Miles 0·0350.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xii}$ ..... | 36 58 1·527 | 0·000 | | | 36 58 1·527 | 9·7791318 | — 284·904 | 0·0540 |
| Nilgarh ..... | 104 6 44·329 | 0·000 | | | 104 6 44·329 | 9·9866909 | 176·661 | 0·0335 |
| $m^{xiii}$ ..... | 38 55 14·144 | 0·000 | | | 38 55 14·144 | 9·7981275 | Logs. 2·4546986 | |
| | 180 0 0·000 | 0·000 | | | 180 0 0·000 | | 2·2471395 | |

No. 15.—Salbaldi to $m^{xiii}$ = (155739·897 + 176·661) = 155916·558 Feet...Log 5·1928923; Miles 29·5297.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xiii}$ ..... | 38 55 14·144 | — 0·834 | | | 38 55 13·310 | 9·7981253 | + 108593·425 | 20·5669 |
| Salbaldi..... | 43 41 6·382 | — 0·835 | | | 43 41 5·547 | 9·8392841 | 98774·469 | 18·7073 |
| $m^{xiv}$ ..... | 97 23 41·978 | — 0·835 | | | 97 23 41·143 | 9·9963729 | Logs. 5·0358035 | |
| | 180 0 2·504 | — 2·504 | | | 180 0 0·000 | | 4·9946447 | |

No. 16.—Dhar to $m^{xiv}$ = (130287·390 — 98774·469) = 31512·921 Feet...Log 4·4984886; Miles 5·9684.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xiv}$ ..... | 97 23 41·978 | — 0·059 | | | 97 23 41·919 | 9·9963726 | + 24083·678 | 4·5613 |
| Dhar..... | 34 36 22·912 | — 0·059 | | | 34 36 22·853 | 9·7542986 | 42052·978 | 7·9646 |
| $m^{xv}$ ..... | 47 59 55·287 | — 0·059 | | | 47 59 55·228 | 9·8710644 | Logs. 4·3817228 | |
| | 180 0 0·177 | — 0·177 | | | 180 0 0·000 | | 4·6237968 | |

No. 17.—Ner to $m^{xv}$ = (174682·644 — 42052·978) = 132629·666 Feet...Log 5·1226407; Miles 25·1193.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xv}$ ..... | 47 59 55·287 | — 0·963 | | | 47 59 54·324 | 9·8710627 | + 124532·114 | 23·5856 |
| Ner ..... | 61 57 19·718 | — 0·963 | | | 61 57 18·755 | 9·9457542 | 104855·167 | 19·8589 |
| $m^{xvi}$ ..... | 70 2 47·884 | — 0·963 | | | 70 2 46·921 | 9·9731135 | Logs. 5·0952814 | |
| | 180 0 2·889 | — 2·889 | | | 180 0 0·000 | | 5·0205899 | |

No. 18.—Ashti to $m^{xvi}$ = (115043·199 — 104855·167) = 10188·032 Feet...Log 4·0080903; Miles 1·9296.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xvi}$ ..... | 70 2 47·884 | — 0·009 | | | 70 2 47·875 | 9·9731143 | + 11463·140 | 2·1710 |
| Ashti..... | 59 46 49·035 | — 0·009 | | | 59 46 49·026 | 9·9365648 | 12469·617 | 2·3617 |
| $m^{xvii}$ ..... | 50 10 23·107 | — 0·008 | | | 50 10 23·099 | 9·8853515 | Logs. 4·0593036 | |
| | 180 0 0·026 | — 0·026 | | | 180 0 0·000 | | 4·0958531 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

**No. 19.—Badali to $m^{XVII}$ = (79448·300 — 12469·617) = 66978·683 Feet...Log 4·8259366; Miles 12·6854.**

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $m^{XVII}$ ..... | 50° 10′ 23″·107 | — 0·360 | | | 50° 10′ 22″·747 | 9·8853508 | + 89276·182 | 16·9084 |
| Badali ..... | 81 51 56·845 | — 0·361 | | | 81 51 56·484 | 9·9956084 | 69259·280 | 13·1173 |
| $m^{XVIII}$ ..... | 47 57 41·129 | — 0·360 | | | 47 57 40·769 | 9·8708094 | Logs. 4·9507356 | |
| | 180 0 1·081 | — 1·081 | | | 180 0 0·000 | | 4·8404780 | |

**No. 20.—Badgaon to $m^{XVIII}$ = (90457·073 — 69259·280) = 21197·793 Feet...Log 4·3262907; Miles 4·0147.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XVIII}$ ..... | 47 57 41·129 | — 0·031 | | | 47 57 41·098 | 9·8708100 | + 25208·835 | 4·7744 |
| Badgaon ..... | 77 0 54·803 | — 0·031 | | | 77 0 54·772 | 9·9887506 | 19213·753 | 3·6390 |
| $m^{XIX}$ ..... | 55 1 24·161 | — 0·031 | | | 55 1 24·130 | 9·9134885 | Logs. 4·4015528 | |
| | 180 0 0·093 | — 0·093 | | | 180 0 0·000 | | 4·2836122 | |

**No. 21.—Ikjhera to $m^{XIX}$ = (161345·593 — 19213·753) = 142131·840 Feet...Log 5·1526915; Miles 26·9189.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XIX}$ ..... | 55 1 24·161 | — 1·240 | | | 55 1 22·921 | 9·9134867 | + 135743·969 | 25·7091 |
| Ikjhera ..... | 59 57 41·460 | — 1·240 | | | 59 57 40·220 | 9·9373606 | 128483·295 | 24·3340 |
| $m^{XX}$ ..... | 65 0 58·100 | — 1·241 | | | 65 0 56·859 | 9·9573316 | Logs. 5·1327205 | |
| | 180 0 3·721 | — 3·721 | | | 180 0 0·000 | | 5·1088466 | |

**No. 22.—Kopdi to $m^{XX}$ = (128483·295 — 121607·028) = 6876·267 Feet...Log 3·8373527; Miles 1·3023.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XX}$ ..... | 65 0 58·100 | — 0·002 | | | 65 0 58·098 | 9·9573327 | — 4817·054 | 0·9123 |
| Kopdi ..... | 42 2 39·930 | — 0·002 | | | 42 2 39·928 | 9·8258846 | 6519·731 | 1·2348 |
| $m^{XXI}$ ..... | 72 56 21·977 | — 0·003 | | | 72 56 21·974 | 9·9804557 | Logs. 3·6827816 | |
| | 180 0 0·007 | — 0·007 | | | 180 0 0·000 | | 3·8142297 | |

**No. 23.—Bam to $m^{XXI}$ = (119009·327 + 6519·731) = 125529·058 Feet...Log 5·0987442; Miles 23·7744.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXI}$ ..... | 72 56 21·977 | — 1·310 | | | 72 56 20·667 | 9·9804549 | + 139079·032 | 26·3407 |
| Bam ..... | 57 29 38·282 | — 1·310 | | | 57 29 36·972 | 9·9259983 | 157658·836 | 29·8596 |
| $m^{XXII}$ ..... | 49 34 3·670 | — 1·309 | | | 49 34 2·361 | 9·8814808 | Logs. 5·1432617 | |
| | 180 0 3·929 | — 3·929 | | | 180 0 0·000 | | 5·1977183 | |

**No. 24.—Sakri to $m^{XXII}$ = (157658·836 — 136412·000) = 21246·836 Feet...Log 4·3272942; Miles 4·0240.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXII}$ ..... | 49 34 3·670 | — 0·033 | | | 49 34 3·637 | 9·8814831 | — 26391·530 | 4·9984 |
| Sakri ..... | 78 22 50·646 | — 0·034 | | | 78 22 50·612 | 9·9910078 | 20508·785 | 3·8842 |
| $m^{XXIII}$ ..... | 52 3 5·784 | — 0·033 | | | 52 3 5·751 | 9·8968374 | Logs. 4·4214646 | |
| | 180 0 0·100 | — 0·100 | | | 180 0 0·000 | | 4·3119399 | |



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## COMPUTATION OF MERIDIONAL TRIANGLES.

**No. 25.—Mahur to $m^{XXIII}$ = (20508·785 + 102720·852) = 123229·637 Feet...Log 5·0907151; Miles 23·3389.**

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $m^{XXIII}$ ..... | 52° 3′ 5″·784 | — 1·047 | | | 52° 3′ 4″·737 | 9·8968358 | + 137405·379 | 26·0237 |
| Mahur ..... | 70 19 49·763 | — 1·048 | | | 70 19 48·715 | 9·9738886 | 115067·027 | 21·7930 |
| $m^{XXIV}$ ..... | 57 37 7·596 | — 1·048 | | | 57 37 6·548 | 9·9266000 | Logs. 5·1380037 | |
| | 180 0 3·143 | — 3·143 | | | 180 0 0·000 | | 5·0609509 | |

**No. 26.—Sukli to $m^{XXIV}$ = (115067·027 — 96986·100) = 18080·927 Feet...Log 4·2572206; Miles 3·4244.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXIV}$ ..... | 57 37 7·596 | — 0·020 | | | 57 37 7·576 | 9·9266014 | — 16849·331 | 3·1912 |
| Sukli ..... | 57 31 20·565 | — 0·020 | | | 57 31 20·545 | 9·9261372 | 16867·350 | 3·1946 |
| $m^{XXV}$ ..... | 64 51 31·900 | — 0·021 | | | 64 51 31·879 | 9·9567752 | Logs. 4·2265826 | |
| | 180 0 0·061 | — 0·061 | | | 180 0 0·000 | | 4·2270468 | |

**No. 27.—Bitergaon to $m^{XXV}$ = (16867·350 + 96450·044) = 113317·394 Feet...Log 5·0542966; Miles 21·4616.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXV}$ ..... | 64 51 31·900 | — 1·292 | | | 64 51 30·608 | 9·9567740 | + 160491·556 | 30·3961 |
| Bitergaon ..... | 72 44 36·748 | — 1·292 | | | 72 44 35·456 | 9·9799964 | 152135·210 | 28·8135 |
| $m^{XXVI}$ ..... | 42 23 55·228 | — 1·292 | | | 42 23 53·936 | 9·8288408 | Logs. 5·2054522 | |
| | 180 0 3·876 | — 3·876 | | | 180 0 0·000 | | 5·1822298 | |

**No. 28.—Terban to $m^{XXVI}$ = (152135·210 — 138837·703) = 13297·507 Feet...Log 4·1237702; Miles 2·5185.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXVI}$ ..... | 42 23 55·228 | — 0·011 | | | 42 23 55·217 | 9·8288437 | — 15703·722 | 2·9742 |
| Terban ..... | 80 52 30·501 | — 0·011 | | | 80 52 30·490 | 9·9944689 | 10724·507 | 2·0312 |
| $m^{XXVII}$ ..... | 56 43 34·304 | — 0·011 | | | 56 43 34·293 | 9·9222365 | Logs. 4·1960026 | |
| | 180 0 0·033 | — 0·033 | | | 180 0 0·000 | | 4·0303774 | |

**No. 29.—Bhesa to $m^{XXVII}$ = (121646·084 + 10724·507) = 132370·591 Feet...Log 5·1217915; Miles 25·0702.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXVII}$ ..... | 56 43 34·304 | — 0·708 | | | 56 43 33·596 | 9·9222356 | + 81519·256 | 15·4393 |
| Bhesa ..... | 37 52 9·957 | — 0·708 | | | 37 52 9·249 | 9·7880704 | 111026·179 | 21·0277 |
| $m^{XXVIII}$ ..... | 85 24 17·863 | — 0·708 | | | 85 24 17·155 | 9·9986017 | Logs. 4·9112602 | |
| | 180 0 2·124 | — 2·124 | | | 180 0 0·000 | | 5·0454254 | |

**No. 30.—Somtana to $m^{XXVIII}$ = (111166·792 — 111026·179) = 140·613 Feet...Log 2·1480255; Miles 0·0266.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{XXVIII}$ ..... | 85 24 17·863 | 0·000 | | | 85 24 17·863 | 9·9986019 | + 113·952 | 0·0216 |
| Somtana ..... | 40 49 22·424 | 0·000 | | | 40 49 22·424 | 9·8153938 | 173·752 | 0·0329 |
| $m^{XXIX}$ ..... | 53 46 19·713 | 0·000 | | | 53 46 19·713 | 9·9066975 | Logs. 2·0567218 | |
| | 180 0 0·000 | 0·000 | | | 180 0 0·000 | | 2·2399299 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 31.—Yemsha to $m^{xxix}$ = (137788·476 — 173·752) = 137614·724 Feet...Log 5·1386649; Miles 26·0634.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $m^{xxix}$ ..... | 53° 46′ 19″·713 | — 1·006 | | | 53° 46′ 18″·707 | 9·9066960 | + 115423·851 | 21·8606 |
| Yemsha..... | 53 18 4·291 | — 1·005 | | | 53 18 3·286 | 9·9040580 | 116127·108 | 21·9938 |
| $m^{xxx}$..... | 72 55 39·013 | — 1·006 | | | 72 55 38·007 | 9·9804273 | Logs. 5·0622956 | |
| | 180 0 3·017 | — 3·017 | | | 180 0 0·000 | | 5·0649336 | |

No. 32.—Shivalingapa to $m^{xxx}$ = (136379·500 — 116127·108) = 20252·392 Feet...Log 4·3064764; Miles 3·8357.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xxx}$..... | 72 55 39·013 | — 0·036 | | | 72 55 38·977 | 9·9804279 | + 23374·492 | 4·4270 |
| Shivalingapa..... | 59 4 3·250 | — 0·036 | | | 59 4 3·214 | 9·9333729 | 26049·360 | 4·9336 |
| $m^{xxxi}$ ..... | 48 0 17·844 | — 0·035 | | | 48 0 17·809 | 9·8711072 | Logs. 4·3687421 | |
| | 180 0 0·107 | — 0·107 | | | 180 0 0·000 | | 4·4157971 | |

No. 33.—Yenagapali to $m^{xxxi}$ = (168305·970 — 26049·360) = 142256·610 Feet...Log 5·1530725; Miles 26·9425.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xxxi}$ ..... | 48 0 17·844 | — 1·368 | | | 48 0 16·476 | 9·8711047 | + 164915·115 | 31·2339 |
| Yenagapali ..... | 75 24 15·633 | — 1·369 | | | 75 24 14·264 | 9·9857527 | 126652·118 | 23·9871 |
| $m^{xxxii}$ ..... | 56 35 30·628 | — 1·368 | | | 56 35 29·260 | 9·9215647 | Logs. 5·2172605 | |
| | 180 0 4·105 | — 4·105 | | | 180 0 0·000 | | 5·1026125 | |

No. 34.—Burgapali to $m^{xxxii}$ = (126652·118 — 107406·420) = 19245·698 Feet...Log 4·2843337; Miles 3·6450.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xxxii}$ ..... | 56 35 30·628 | — 0·027 | | | 56 35 30·601 | 9·9215665 | — 21434·664 | 4·0596 |
| Burgapali ..... | 67 24 42·840 | — 0·027 | | | 67 24 42·813 | 9·9653381 | 19379·614 | 3·6704 |
| $m^{xxxiii}$ ..... | 55 59 46·613 | — 0·027 | | | 55 59 46·586 | 9·9185551 | Logs. 4·3311167 | |
| | 180 0 0·081 | — 0·081 | | | 180 0 0·000 | | 4·2873451 | |

No. 35.—Bachapali to $m^{xxxiii}$ = (19379·614 + 75339·770) = 94719·384 Feet...Log 4·9764389; Miles 17·9393.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xxxiii}$ ..... | 55 59 46·613 | — 0·576 | | | 55 59 46·037 | 9·9185544 | + 93460·086 | 17·7008 |
| Bachapali ..... | 61 16 51·482 | — 0·576 | | | 61 16 50·906 | 9·9429923 | 88346·282 | 16·7323 |
| $m^{xxxiv}$ ..... | 62 43 23·633 | — 0·576 | | | 62 43 23·057 | 9·9488050 | Logs. 4·9706262 | |
| | 180 0 1·728 | — 1·728 | | | 180 0 0·000 | | 4·9461883 | |

No. 36.—Damargida to $m^{xxxiv}$ = (88346·282 — 83283·900) = 5062·382 Feet...Log 3·7043550; Miles 0.9588.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xxxiv}$ ..... | 62 43 23·633 | — 0·001 | | | 62 43 23·632 | 9·9488056 | — 2320·035 | 0·4394 |
| Damargida ..... | 27 16 36·369 | — 0·000 | | | 27 16 36·369 | 9·6611396 | 4499·462 | 0·8522 |
| $p^{II}$ ..... | 90 0 0·000 | — 0·001 | | | 89 59 59·999 | 10·0000000 | Logs. 3·3654946 | |
| | 180 0 0·002 | — 0·002 | | | 180 0 0·000 | | 3·6531606 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 37.—Damargida to $m^{xxxiv}$ = (88346·282 — 83283·900) = 5062·382 Feet...Log 3·7043550; Miles 0·9588.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $m^{xxxiv}$ ..... | 62° 43′ 23″·633 | — 0·002 | | | 62° 43′ 23″·631 | 9·9488056 | — 4990·118 | 0·9451 |
| Damargida ..... | 57 57 45·457 | — 0·001 | | | 57 57 45·456 | 9·9282433 | 5232·065 | 0·9909 |
| $m^{xxxv}$ ..... | 59 18 50·915 | — 0·002 | | | 59 18 50·913 | 9·9344875 | Logs. | |
| | 180 0 0·005 | — 0·005 | | | 180 0 0·000 | | 3·6981108 | |
| | | | | | | | 3·7186731 | |

No. 38.—Dudala to $m^{xxxv}$ = (5232·065 + 84218·758) = 89450·823 Feet...Log 4·9515843; Miles 16·9414.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $m^{xxxv}$ ..... | 59 18 50·915 | — 0·367 | | | 59 18 50·548 | 9·9344870 | — 60847·728 | 11·5242 |
| Dudala ..... | 41 51 43·158 | — 0·367 | | | 41 51 42·791 | 9·8243454 | 78412·617 | 14·8509 |
| $m^{xxxvi}$ ..... | 78 49 27·029 | — 0·368 | | | 78 49 26·661 | 9·9916853 | Logs. | |
| | 180 0 1·102 | — 1·102 | | | 180 0 0·000 | | 4·7842444 | |
| | | | | | | | 4·8943860 | |

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| | | | | | | | Logs. | |

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| | | | | | | | Logs. | |

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| | | | | | | | | |
| | | | | | | | Logs. | |

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| | | | | | | | | |
| | | | | | | | Logs. | |

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## Series B. SYNOPSIS

Shewing the length of the Terrestrial Arc in feet comprised between the parallels of Kalianpur and Damargida.

| No. | Points of Intersection. | Positive Distances. | Negative Distances. | Results. |
|---|---|---|---|---|
| | | + | − | |
| 1 | Kalianpur to $m^{I}$ ..... | 56041·939 | | |
| 2 | $m^{I}$ ... $m^{II}$ ..... | | 29506·288 | |
| 3 | $m^{II}$ ... $m^{III}$ ..... | 163311·864 | | 178767·031 |
| 4 | $m^{III}$ ... $m^{IV}$ ..... | | 11080·484 | |
| 5 | $m^{IV}$ ... $m^{V}$ ..... | 85803·440 | | |
| 6 | $m^{V}$ ... $m^{VI}$ ..... | 60104·014 | | |
| 7 | $m^{VI}$ ... $m^{VII}$ ..... | 31549·480 | | 288423·267 |
| 8 | $m^{VII}$ ... $m^{VIII}$ ..... | 123623·909 | | |
| 9 | $m^{VIII}$ ... $p^{I}$ ..... | | 12657·576 | |
| 10 | $p^{I}$ ... $m^{IX}$ ..... | 8054·089 | | |
| 11 | $m^{IX}$ ... $m^{X}$ ..... | 200432·692 | | |
| 12 | $m^{X}$ ... $m^{XI}$ ..... | 19286·004 | | 388556·140 |
| 13 | $m^{XI}$ ... $m^{XII}$ ..... | 161068·259 | | |
| 14 | $m^{XII}$ ... $m^{XIII}$ ..... | | 284·904 | |
| 15 | $m^{XIII}$ ... $m^{XIV}$ ..... | 108593·425 | | |
| 16 | $m^{XIV}$ ... $m^{XV}$ ..... | 24083·678 | | |
| 17 | $m^{XV}$ ... $m^{XVI}$ ..... | 124532·114 | | |
| 18 | $m^{XVI}$ ... $m^{XVII}$ ..... | 11463·140 | | 514084·289 |
| 19 | $m^{XVII}$ ... $m^{XVIII}$ ..... | 89276·182 | | |
| 20 | $m^{XVIII}$ ... $m^{XIX}$ ..... | 25208·835 | | |
| 21 | $m^{XIX}$ ... $m^{XX}$ ..... | 135743·969 | | |
| 22 | $m^{XX}$ ... $m^{XXI}$ ..... | | 4817·054 | |
| 23 | $m^{XXI}$ ... $m^{XXII}$ ..... | 139079·032 | | |
| 24 | $m^{XXII}$ ... $m^{XXIII}$ ..... | | 26391·530 | |
| 25 | $m^{XXIII}$ ... $m^{XXIV}$ ..... | 137405·379 | | |
| 26 | $m^{XXIV}$ ... $m^{XXV}$ ..... | | 16849·331 | 378031·384 |
| 27 | $m^{XXV}$ ... $m^{XXVI}$ ..... | 160491·556 | | |
| 28 | $m^{XXVI}$ ... $m^{XXVII}$ ..... | | 15703·722 | |
| 29 | $m^{XXVII}$ ... $m^{XXVIII}$ ..... | 81519·256 | | |
| 30 | $m^{XXVIII}$ ... $m^{XXIX}$ ..... | 113·952 | | |
| 31 | $m^{XXIX}$ ... $m^{XXX}$ ..... | 115423·851 | | |
| 32 | $m^{XXX}$ ... $m^{XXXI}$ ..... | 23374·492 | | |
| 33 | $m^{XXXI}$ ... $m^{XXXII}$ ..... | 164915·115 | | 455052·211 |
| 34 | $m^{XXXII}$ ... $m^{XXXIII}$ ..... | | 21434·664 | |
| 35 | $m^{XXXIII}$ ... $m^{XXXIV}$ ..... | 93460·086 | | |
| 36 | $m^{XXXIV}$ ... $p^{II}$ ..... | | 2320·035 | |
| 37 | $p^{II}$ ... $p^{II}_{(0)}$ ..... | 0·158 | | |

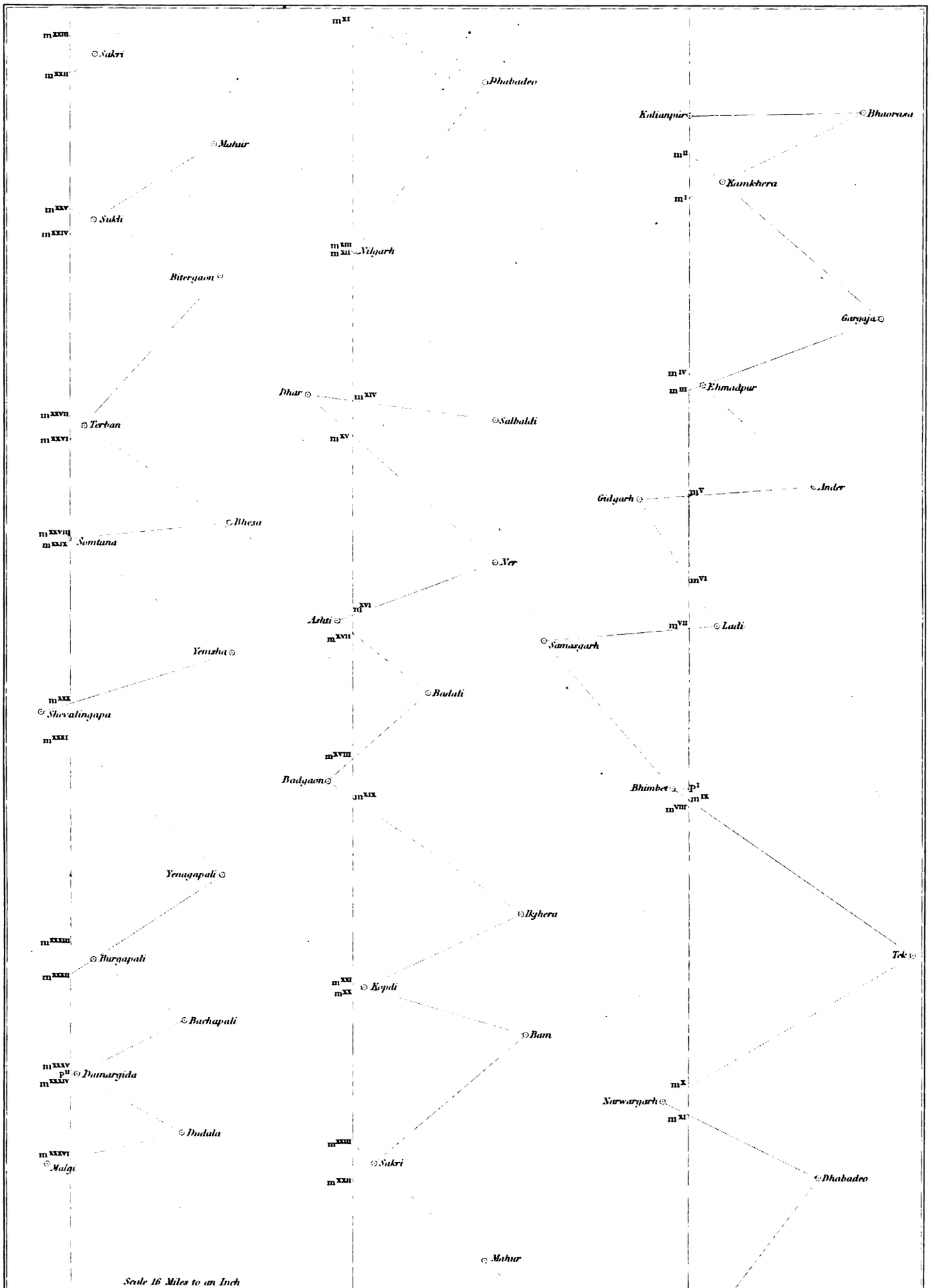
| | |
|---|---|
| Length of the Arc deduced from Seronj Base ..... | 2202914·322 |
| Add correction for 24·5 feet difference of height ..... | 2·578 |
| Add correction $\eta$ as explained in Introduction page clxxi ..... | 9·296 |
| Total Terrestrial Arc from a mean of the two Bases in feet ..... | 2202926·196 |



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*Sketch illustrative of the Projections on the Meridian of Kaliunpur of the principal triangles of the Section Kaliunpur to Damargida and the points to its South in continuation of the course of the Great Arc Series.*




*Drawn in the Field Office of the Surveyor General of India, at Hatipaon.*

*Engraved by A. Stockler.*

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# DESCRIPTION

OF

# PRINCIPAL STATIONS

OF

## SERIES B & C.

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# DESCRIPTION OF PRINCIPAL STATIONS.

## SERIES B.

### GARGAJA.

This station is fixed on the N.W. peak of a small isolated range, extending about 2 miles from N.E. to S.W., and called Gargaja in honour of a Hindu deity. The range is of sandstone; at the foot are a few huts on the eastern and southern sides; the former composing the hamlet of Kargaoli, and the latter of Maser. This station is situated in the Bhilsa district of the Gualior territory, and about 6 miles direct distance N.W. of Garaspur, a large village on the high road from Sagar to Mhao. The old platform was circular, and apparently in good order. Digging down to the lower mark, it was found to differ one-tenth of an inch from the upper one: this error being corrected on the lower mark, a pillar was constructed for the instrument, and the upper mark carefully replaced as before, both in regard to lateral and horizontal positions. A central mark-stone was fixed in the pillar, which therefore contains three mark-stones; and the distance between the upper and lower ones is 5 feet 6½ inches. The platform has also been built up of the same height as the original one, but square, and isolated by 3 inches from the instrument pillar.

### EHMADPUR.

This station is situated near the small village of Ehmadpur, in the Bhilsa district of the Gualior country, and about 10 miles N.W. of the large town of Bhilsa. The station mark is fixed on the peak of an isolated hill, and on an artificial mound of very ancient date, on the east side of a small Hindu temple, standing also on the mound. The former platform was, to outward appearance, uninjured: on digging down, a mark-stone was found at 30·6 inches below the upper one, but no other, although the excavation was continued for 9 feet further. A mark-stone has been now inserted on a level with the surface of the mound, and fixed with reference to the former upper mark, which is itself replaced in exactly the same position it previously occupied. The upper mark is 64·6 inches above the lower one; and these marks, together with the instrument feet stones, are contained within a pillar 3 feet 9 inches in diameter, built of flat stones laid in mud, and isolated by 3 inches from the surrounding platform, which is 17 feet square.



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## ANDER.

This station is fixed on the highest point of an isolated hill on the Raisen district of the Bhopal state, on the northern side of the small village of Ander, about 11 miles S.E. of Bhilsa and 8 miles N.E. of Raisen. The old platform was found apparently in good order: the lower mark differed from the upper one 3·1 inches to the south: this lower mark-stone was removed, and a mark corresponding to the upper one was cut in the rock itself; the upper stone was replaced as before, and stands 26½ inches above the mark on the rock. The platform is 17 feet square, containing an isolated pillar for the support of the instrument.

## GIDGARH.

This station is situated in the Bhopal territory, about 14 miles N.E. of Bhopal, and 2 miles west of the small village of Gidgarh, from which the station derives its name. The station is fixed on the highest point of a hill, forming part of a range running north and south. The only practicable access to the station is by a cart-track, branching off the high road between Bhilsa and Bhopal, at the head of the hill-pass, about 1 mile W.N.W. of the station. The original platform was found standing, but with the centre injured and the mark-stones removed: a mark has now been cut on the rock, nearly corresponding with the centre of the original platform, 11·6 inches below the soil, and the platform has been reconstructed: a circular pillar, isolated by 3 inches from the surrounding platform, is built up over the mark for the instrument, and contains two mark-stones, the lower at 11·6 inches, and the upper at 56·6 inches above the mark on the rock.

## SAMASGARH.

This station is situated in the Bhopal state, about 12 miles south of the capital, 4 miles S.E. of Samasgarh, and 3 miles S.W. of Bhorda; the two latter being the nearest villages that lie in the plains extending east and west from the base of the narrow range of hills on which the station is fixed. This range commences near Bhopal, and is called Samasgarh in the environs of the station. It is of sandstone, and well wooded up to the crest, which is studded with elevated platforms of bare rock. The mark is cut on one of these platforms, and surmounted with a circular pillar, built of flat stones and earth, for the support of the theodolite: around the pillar, at a distance of 3 inches, the observer's platform is constructed of similar materials, and 18 feet square. The pillar contains two mark-stones; the upper at 57 inches, and the lower at 36 inches above the mark engraved on the rock.

## LADI.

This station is situated in the Bhopal territory, about 2 miles north of the village of Chiklaod. The station is fixed on the crest of a hill, which derives the name of Ladi from a high piece of rock forming a conspicuous object on the west side of the hill.

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The platform originally constructed at this station had been injured, and the upper mark-stone removed; but the lower mark cut on the rock being found in good order, a circular pillar was built over it for the support of the theodolite, and surrounded at an interval of 3 inches with a platform 17 feet square. The pillar contains a mark-stone level with its surface 32½ inches above the mark on the rock, and both platform and pillar are constructed of flat stones disposed in layers, with a sprinkling of earth between each layer.

## RANIPUR.

This station is situated in the Bhopal territory on the crest of a hill rising nearly perpendicularly above the small villages of Ranipur and Patni, the former on the south, and the latter on the north side of the hill. The town of Bari also lies to the north within 3 miles of the station. The original platform and mark were found in good order, and surmounted with the flag of a Fakir, who has taken up his abode in a neighbouring cavern. The platform, which is circular and constructed of stone and mud with a retaining wall of masonry, is raised on the top of a large rock rising about 16 feet perpendicularly above the crest of the hill and thence shelving upwards towards the north at an angle of 15 degrees; so as to present a surface of about 30 feet square overhanging the base by 14 or 15 feet. The mark is fixed at 9 feet from the upper edge of this shelving surface, on a large stone 15 inches high, firmly cemented to the rock with mortar. The only alteration made in the original platform has been to surround the theodolite feet-stones with a circular trench, cut down to the rock, so as to isolate that portion of the platform from the remainder. The original ramp up the platform having been destroyed or fallen to pieces, a new one, 8½ feet broad, has been constructed, on the north side: it is formed of flat stones secured with mortar for the space of a foot on either edge.

## BHIMBET.

This station is about 10 miles N.W. of Husangabad, but situated within the Bhopal territory, on a high swell of a hill forming part of a broad sandstone range which extends nearly east and west along the north bank of the Narbada. The only access to the station, practicable for cattle and men carrying loads, is by an ascent commencing about 5½ miles S.E. of the station, near the small village of Talpura, as in all other directions the hill is bound round with perpendicular belts of rock. The old platform was found in good order, and the upper mark differed only 0·7 inch from the lower one; a new platform has been constructed with flat stones and earth, 17 feet square, and containing an isolated pillar for the theodolite: the lower mark, having been originally cut on the rock, was retained, and the distance between it and the present upper mark is 47·7 inches.

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## TEK.

This station is situated in the Betul pargana of the Husangabad zilla, about 30 miles direct distance S.S.E. of Husangabad, and 15 miles S.W. of Sohagpur, the nearest village from which supplies are obtainable. The station is fixed on a peak of the Mahadeo range of hills, and was named after the small Gond village of Tek, which formerly existed near the foot of the hill, but has now for some years past been deserted by its inhabitants. At the foot of the hill, and about 3 miles from the station, there is a very old-looking temple, similar in shape to the Suraj Mandils near Sherghati and Gya; small streams flow in either side of the temple; at about 100 yards to its east there is also an artificial tank. The place is called Dehra, and is said to have been formerly a retreat for Dakoits. A tolerable track is cut from Dehra to the station, and good water is obtained from a rivulet that crosses this track about half-way up the hill. The old platform was found in good order: removing the upper mark-stone, and digging down, a second was found whose mark differed 0·6 inch from the normal of the upper one. The rock lay immediately under the second mark-stone, but unmarked, having probably been rejected as too soft and friable for permanency: a mark has now been cut on the rock, and the lower mark-stone replaced — both in reference to the normal of the mark originally on the surface of the platform: above these marks a circular pillar has been constructed, containing the theodolite feet-stones and the upper mark-stone; the latter being replaced on the surface in the same position it previously occupied, and at a distance of 35·8 inches from the mark on the lower stone. A platform 17 feet square surrounds the pillar at an interval of 3 inches. Both pillar and platform are built with flat stones and earth.

## MORPANI.

This station is fixed on a peak near the western extremity of the Mahadeo range of hills, and is situated in the Husangabad district, about 21 miles direct distance S.E. of Husangabad, 2 miles N.E. of the hamlet of Morpani, and 4 miles east of Kesla, a tolerable-sized village on the high road from Husangabad to Betul. The old mark and platform were found in good order: the former is fixed on a portion of rock rising above the surface, and has been surrounded with a pillar, for the support of the theodolite, built of mud and stone to the level of the mark: around this pillar, at an interval of 3 inches, the platform is constructed of earth and stone, and 17 feet square in exterior dimensions.

## NARWARGARH.

This station is situated on the summit of a high hill of that name in the Betul pargana of the Husangabad district, about 3 miles north of the hamlet of Belhor, and 15 miles direct distance S.W. of Bhorda, a large village on the high road and about half-way between Husangabad and Betul. The old platform and mark were in good order; the former only a few inches high, and the latter imbedded to a level with the surface

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of the hill. The only alteration made on the platform has been to isolate, by a narrow trench, the central portion containing the mark and theodolite feet-stones.

## ALAMPUR.

This station is situated in the Betul pargana, of the Husangabad zilla, about 1 mile north of the small village of Alampur, and 6 miles N.W. of Chenchuli, a large village, in which the Tahsildar of this neighbourhood resides. A road to the station is cut up the south face of the hill, and near the foot of this road water is obtained from some small wells dug in the bed of a water-course. The old platform was found in good order, and contained a mark-stone at its surface only. A mark-stone, fixed in reference to the normal of the original one, has now been embedded to a level with the surface of the hill, and a pillar, built of stone and earth, has been erected over it for the support of the theodolite. The pillar contains a mark on its surface, 32·4 inches above the lower one, and is isolated by 3 inches from the surrounding platform, which is 17 feet in exterior dimensions, and constructed of the same materials as the pillar.

## DHABADEO.

This station is situated on a hill of that name in the Betul pargana, of the Husangabad district, about 16 miles north of Betul and 4 miles east of Nimpani, a small village on the high road between Husangabad and Betul. Dhabadeo is an isolated hill of basaltic formation, with steep sides, and a very narrow, undulating ridge at top. A road had to be cut for the theodolite up the west side of the hill. Nimpani is the nearest place at which water is procurable, and from that village a cart-track leads through the jungle to the foot of the hill. The old platform and lower mark were found in good order, but the upper mark was effaced apparently by an exfoliation from the surface of the mark-stone. The platform has been rebuilt with stone and earth 17 feet square in exterior dimensions, and containing an isolated pillar for the support of the theodolite. There are two mark-stones in the pillar, 23 inches perpendicular distance apart, of which the original or lower mark is on a level with the surface of the hill.

## JAGDHAR.

Jagdhar station is situated in the Betul pargana, of the Husangabad district, about 3 miles S.E. of Betul, and a mile south of the hamlet of Jagdhar. The station is fixed on the highest point of a hill, forming the south-east boundary of the valley in which Betul is situated. Water is obtained near the village of Jagdhar, from whence also a good road leads to the station up the north side of the hill. The old platform and upper mark were found apparently in good order, though the latter differed 2 inches from the normal of the lower mark. A pillar for the support of the theodolite has now been constructed of stone and mortar, with an isolating well also of masonry. There are two mark-stones in the pillar, 68·9 inches perpendicular distance apart; the lower one is embedded to a



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level with the surface of the hill, and both are fixed with reference to the normal of the original lower one.

## NILGARH.

This station is situated in the Betul pargana, of the Husangabad district, about 19 miles direct distance west of Betul, 1 mile east of the hamlet of Badugaon, and 6 miles S.E. of Chandri, a large Gond village. The station is fixed on a high swell of a range of hills, bordering the south bank of the Tapti, and is called Nilgarh, after a neighbouring place of Hindu worship. Water is obtained from a well at about $\frac{1}{2}$ a mile from the station near the foot of the east side of the hill, whence also a tolerable road has been cut to the station. The old platform was found in good order; on removing the upper mark-stone and digging down, a second was found on a level with the surface of the ground, and correctly placed with reference to the normal of the upper one. A pillar has now been constructed over the lower mark, for the support of the theodolite, and the upper mark-stone replaced at a distance of 35·6 inches above the lower one. The platform is 17 feet square in exterior dimensions, and surrounds the pillar at an interval of 3 inches. Both platform and pillar are constructed of flat stones.

## DHAR.

This station is on a very high table-topped hill, in the Gawilgarh range, or Satpurda hills. It is named from a Gond village, situated in a transverse mountain valley, about 1 mile S.W. of the station, and included in the Naib Tahsildari of Atner, district Betul. The village of Derpani is on a table land 3 miles north, and Kamla, a comparatively large village, is 5 miles N.W. The only practicable ascent to the station is from the north through Derpani. The former platform at Dhar was found in good order, and 4 feet 11·5 inches high. The new platform is constructed of flat stones, and the centre pier for the instrument is well insulated from the observers. The distance between upper and lower marks is 4 feet 11·5 inches, and the foundation is 18 inches deep.

## SALBALDI.

This station is on the top of a lofty hill, in the well-known basaltic range of mountains, called by the natives the Satpurda hills, and by Europeans the Gawilgarh range. This range bounds the province of Berar on the north, and is the southern limit of the rugged and desolate tract comprised in the ancient province Gundwana. The village of Salbaldi is 4 miles east of the station, and belongs to the Atner pargana of the Betul district, British territory. The village of Bikundi is 4 miles south, Pala (a kasba) is 7 miles S.E., Murchi (a kasba) is 10 miles S.E.; the two latter are in the Nizam's dominions. The only practicable ascent to the station is from Bikundi, on the south side of the hill, which is abrupt. The old platform was found undisturbed and in good order. The new station has a pillar of picked stones, duly isolated from the platform. The distance between the upper and lower marks is 4 feet 0·3 inches.

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## NER.

This station is upon a small isolated hill, about 4 miles W.S.W. of the town called Pinglai Ner, to distinguish it from other places bearing the same name. The station is upon a small building, at the S.E. angle of the enclosure surrounding the Temple of Pinglai Bowani. The village of Sawalkhera is 2 miles north of the station. The old lower mark was found in the floor of the building, apparently undisturbed, and therefore taken for the centre of the new platform. The floor has been excavated down to the rocky part of the hill, upon which foundation a pillar has been erected to the height of 21 feet 3·1 inches. The distance between the upper and lower marks is 19 feet 9·1 inches. The pillar is surrounded by a scaffolding, upon which the observers stood perfectly isolated from the instrument.

## ASHTI.

This station is 1½ miles west of the village of that name, in pargana Tugaon, about 16 miles S.E. of Ellichpur. Tugaon is a kasba, about 5 miles north. Takalkhera (on the high road) is a large village, about 4 miles N.E. The old station was found in good order, consisting of an internal pillar of brick-work surrounded by an earthen mound. The diameter of this column being nearly 6 feet, it was necessary to adopt the following arrangements to isolate the instrument from the observers: — The pillar was raised 18 inches by a cylinder of brick-work 4 feet in diameter, and a scaffolding resting upon poles was erected round the pillar, leaving a space of 3 inches in breadth between the masonry and the stage.

## BADALI.

This station is on an eminent height towards the western edge of a group of basaltic hills, lying east of the well-known town of Omraoti, which is 3 miles from the station. The village of Badali is at the foot of the hill, and about 1 mile N.W. of the station. The old mark at this station was found utterly destroyed, the mark-stones having been rooted out, and the rock itself excavated to a depth of 5 feet. The new station coincides with the old one as nearly as could be estimated; it is composed of a pillar and isolating annulus of good stone masonry, founded on the solid rock and remarkably steady. The upper mark is 18 inches above the surface of the hill, and the lower mark (which is engraved on a large block of basalt), is 30·4 inches below the same level; therefore, the distance between those marks is 48·4 inches. There is also an intermediate mark 23·5 inches below the upper mark.

## WIRUR.

This station, or Birul, is upon the higher of two isolated little trap hills situated in the plains south of the village of Birul. This is a Jagirdari or Mafi village, in the pargana of Talegaon, sirkar Gawil. Damangaon lies east 3 miles, Badgaon south 4 miles, Sendurjana 7 miles south, Dipora west 8 miles, Mandua N.W. 2 miles, Terora

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(pargana Mangrul) N.E. two miles. The kasba of Talegaon is S.S.E. 11 miles, the kasba Mangrul is 12 miles east, the kasba Kura 10 miles north, and the kasba Majarkhera N.W. 14 miles. The old platform was in good order, and 11 feet 6 inches high, but the upper mark differed 4 inches from the lower. The new station consists of a pillar of strong masonry 13 feet 8·6 inches high, exclusive of 2½ feet foundation. In consequence of the difficulty experienced in procuring stones and material for making a regular platform, it was found expedient to use a stage or scaffolding round the pillar, and the instrument accordingly stood perfectly isolated from the observers. The material of the old platform has been banked up round the pillar to within 8 feet of the top. Distance between upper and lower marks 13 feet 8·6 inches.

## BADGAON.

This station is situated on a swelling ridge of land, about 300 yards south of the village of Badgaon, pargana Kurm, taluka Murtazapur, sirkar Gawil, suba Berar. The kasba Kurm is 3 miles west; Mana, 9 miles west; Murtazapur, about 16 miles west. The high road between Omraoti and Karinja passes about 4 miles east of the station. No lower mark was found at this station, and a new platform has therefore been centered with respect to the old upper mark. The pier for the instrument is constructed of good masonry, and is isolated from the platform by an annulus of stones cemented with mud. The soil being firm, the pier was found steady, and supported the instrument free from vibration. The distance between the upper and lower marks is 13 feet 2 inches, and there is also a mark in the centre of the pier. The lamp at this station was raised upon a strong well-braced trestle, 10 feet high, for the ray to Pilkher. These lights were mutually visible immediately after sunset.

## IKJHERA.

This station is on a steep knife-edged or prismatic-shaped hill, rising considerably higher than the basaltic range of which it forms a part. This hill is locally known by the name of Daga. The hill Chaosala, about 5 miles E.S.E., is about 200 feet higher, and is the most eminent point of the range. The village of Ikjhera, half a mile west of the station, is now deserted; but the village of Asola, about 1½ west, is large and well known. Both these villages belong to the pargana of Talegaon, sirkar Gawil. Talegaon is about 17 miles N.N.E. No lower mark was found at this station; therefore the old upper mark has been used for the centre of the new platform. The pillar and isolating annulus of the new platform are built of masonry, and the foundation is upon the rock *in situ* about 9 inches below the surface of the hill. The lower mark is engraved on the rock, and the distance between it and the upper mark is 4 feet 5·6 inches: the old platform was 4 feet 3·5 inches high, and in good order.

## PILKHER.

This station is about a mile from the southern edge of the table land called Paia

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Ghat, which bounds the valley of Berar on the south. The station is in the fields, one mile south of Pilkhera, taluka Karinja, suba Berar. The well-known ancient town of Karinja, situated on the high road between Ellichpur and Hydrabad, is 6 miles west; Omalda, a kasba village, with a large chaoburja, is 2 miles west; Manba is a large village, 2 miles N.E.; Sukli, 1¼ S.E.; Lohi, a kasba, 4 miles south. The old platform was found in ruins, its site being indicated by a mound of earth 8 feet high. The upper mark was found about 8 or 10 yards west of the mound. Both the pillar and annulus of the new station are built of good masonry, with a foundation of 2 feet 6 inches; but the instrument was not quite free from vibration, owing to the height of the column and the peculiar character of the black soil in which it is built. The lower mark is at the level of the ground, and the distance between it and the upper mark is 123·4 inches. The lamp and heliotrope, directed from this station to Badgaon, were placed upon a strong well-braced trestle, 16 feet high.

## KOPDI.

This station, or Chor Kopri, is on an isolated eminence rising above the general level of the trap plateau. The station is named from a ruined village about 2 miles south, in the kasba of Darwar, pargana Karinja. Borgaon is east of the station 2 miles, and Bandegaon about 1½ miles N.N.E. The old platform at this station was found in good order, and 7 feet high. This new station has a pillar of masonry and isolating annulus of stone and mud, both having a foundation of 2 feet 2 inches. The lower mark is engraved on a large stone, and the distance between it and the upper mark is 72·1 inches.

## BAM.

This station, or Kanuba ki Tekri, taluka Korhar, sirkar Mahur, suba Berar, is on a peaked eminence rising a little above the flat trap range. It is called after the deserted village of Bam (2 miles S.E.), the ruins of which indicate the once flourishing condition of the place. This part of the country, however, suffers greatly from scarcity of water. An old baoli was fortunately discovered in the ravine half a mile north of the station, which being cleared out afforded a supply for the camp. There was a difference of 11 inches between the upper and lower marks of the old platform: it was therefore necessary to build an annulus of the new platform, of good masonry, with a foundation of 2 feet. The lower mark is engraved on a large stone, and the distance between it and the upper mark is 64·4 inches: the pillar was found to be steady. Korar is 14 miles S.E.; Sakur, 14 miles south; Terora, 6 miles south in taluka Mahagaon, and on the south bank of the Aran: Hiuri is 3 miles N.E.

## SAKRI.

This station is on a range of trap hills, 1½ miles south of the village of Sakri, taluka Pusad, zillah sirkar Mahur, suba Berar: Pusad is 10 miles S.W.



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The following is a list of villages circumjacent to the station:—

| N. | | | E. | | | S. | | | W. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Miles. | | | Miles. | | | Miles. | | | | |
| Etala ..... | 4 | Taluka Chikni. | Kaligaon ... | 4 | Taluka Chikni. | Sainkhera ... | 2 | Taluka Ganj and Chikni. | Oradgaon ... | | Taluka Pusad. |
| Tankli ..... | 6 | | Kourgaon ... | 6 | | Bori ..... | 2 | | Mahagon ... | | |
| Bilora..... | 8 | | Malegaon ... | 6 | | Kasola ..... | 8 | | | | |
| Chirkuta ... | 10 | | Havelni ..... | 4 | | Kanakhera... | 12 | | | | |
| | | Taluka Karinja. | Onoli ..... | 3 | | | | | | | |
| Digres ..... | 6 | | | | | | | | | | |

The former platform was found undisturbed, 3 feet 9 inches high, and the upper mark differing 3 inches from the lower. The pillar of the new platform is built of good masonry, and the annulus of stone and mud; both having a foundation of 2 feet 3 inches. The distance between the upper and lower marks is 55·5 inches, which is also the height of platform above the surface of the hill. The pillar was found perfectly steady.

## MAHUR.

This station is on a lofty table-topped hill, one mile S.E. of the well-known town of Mahur, and east of the fort, from which it is separated by a narrow ravine. The road to the mat,h or temple, passes a few yards west of the station. The old platform was apparently in good order, but the upper mark differed considerably from the lower one; the distance between the two marks was measured 7 feet 6 inches. The new station consists of a pillar of strong masonry and isolating annulus of stones cemented by mud, both having a foundation of 2 feet. The upper mark is 96·8 inches above the lower one, and the latter is on a level with the hill surface. There is also a middle mark exactly 4 feet above the lower one. The pillar, though built of masonry and completely isolated from top to bottom, did not afford a perfectly steady support for the instrument. The telescope was found to be subject to a slight vibration when people walked about the platform, but the level apparently was not affected.

## SUKLI.

This station is upon the range 3 miles north of the village of Sukli, taluka Omarkher, sirkar Mahur, suba Berar. The hill is also called Apa Shahi, and sometimes Sahib log ka Pahar: Omarkher is 6½ miles south; Mahur taluka lies to the north and N.E.; Pusad taluka to the N.W.—Pusad being about 22 miles distant. The road from Omarkher to Mahur passes about one mile east of the station. The former platform was found apparently undisturbed, but the upper mark differed 7 inches from the lower. The distance between the marks was 30·5 inches. The pillar and isolating annulus of

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the new platform are both built of masonry, having a foundation of 14 inches. The lower mark is on a level with the surface of the ground, and the upper mark 40 inches above it.

## BITERGAON.

This station is on an eminent table-topped point of a rugged chain of hills, 2·75 miles north of the village of Bitergaon, pargana Omarkher. These hills are evidently a branch of the Shivni range, although disconnected by a transverse valley, through which the Pain Ganga finds an outlet. Omarkher is a well-known village, about 17½ miles due west of Bitergaon. The old platform was found in a ruinous state, and the mark-stone had been removed from its proper place. The new station has a pier of masonry, surrounded by an annulus of stones cemented with mud: the foundations are 18 inches deep, and superstructure 74 inches, which is the distance between the marks. Near the station is a thatched hut, which is a Mahadeo temple.

## SHIVNI.

This station is on a lofty point of the Nirmal or Sikpal hills, and is locally called Marel Devi ka Guta. About 2 miles further east there are two conspicuous conical hills, called Satarwan Konda. The station has been named from the miserable hamlet of Shivni or rather Seoni, which is 4 miles south, and near Telari: it belongs to the taluka of Kusamit Kulari, zillah sirkar Nander. The kasba of Aparaopet is 6 miles S.E. of Seoni village, and belongs to the Nirmal district. The centre-mark of the old platform was found out of its proper place; a new point was therefore assumed, as nearly as possible in the centre of the old platform. The new station has a pier and isolating annulus of excellent masonry, with a foundation 33 inches deep on firm ground; the superstructure is 51 inches high, which is the distance between the upper and the lower marks.

## TERBAN.

This station is on a table-topped range, running east and west. The Bokar valley lies to the south; the valley of the Pain Ganga to the north. This range is 1½ mile broad, and is flanked on the south by a lower plateau, about three-quarters of a mile in breadth. The village of Terban is a small chaoburja, about three-quarters of a mile south of the station, and belongs to the kasba of Bokar, zillah Nander, suba Mohamadabad (Beder). Bokar, or Abu Bakr, is 5 miles to the south; the pargana of Thamsa is on the north of the range. The old platform was found with a truncated mowa tree in the centre, which appeared to have been used to mark the station; this tree has been extracted by the root. The new station is built of masonry, and consists of a solid pier 4 feet in diameter, surrounded by an annulus to isolate it from the platform; the foundations are 25 inches deep: the lower mark is on a level with the surface of the ground, and the upper mark is 63·1 inches above the former.

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## BHESA.

This station is on the higher of two conoidal trap hills, east of the large kasba of Bhesa, in zillah sirkar Nander. The station is a few yards S.E. of the darga of a Mahomedan saint, called Kancha Walli, whose shrine is much frequented by the inhabitants of the circumjacent villages. The old platform was found in good order, and apparently undisturbed, and the centre of the new platform corresponds with that of the old one. The new platform is built of masonry, and the centre pier is isolated in the usual manner: the foundations are 18 inches deep, upon solid ground. The lower mark is on a level with the surface of the hill, and the distance between the upper and lower marks is 52·5 inches.

## SOMTANA.

This station is upon a hill of an irregular frustum shape, on an eminent part of the range north of the Godaveri. The hill itself is locally known by the name of Balaraj Guta, from the tomb of a Mahomedan saint, a few hundred yards south of the station. The village of Somtana lies in a narrow sequestered valley, about 2 miles S.E., and belongs to the taluka of Taligaon, taraf Chikara, pargana Nander. It is to be remarked, that there are many villages bearing the name of Somtana in this tract of country. The kasba of Taligaon is about 4 miles, a little west of south; and Umri is a considerable village, about 3 miles distant in the same direction: the large kasba, called Bokar, or Abu Bakr, is 10 miles distant in a northerly direction. This station was twice visited, viz.:—once, in April, 1838; and a second time, in November of the same year; the second visit having been rendered necessary by some supposed unsteadiness of the platform built on the previous occasion. The old circular platform, when visited in April, was found surmounted with the usual pile of stones, and apparently in good order and undisturbed. On uncovering the lower mark, it was found to be $3\frac{1}{4}$ inches S.E. of the upper one; this mark being on a flat stone was removed, and the soil cleared away to the rock *in situ*. As the position of the old mark fell on the edge of one of the decomposing boulders, the new point could not be engraved on the rock itself, but was made on a large block of hard basalt, and duly fixed to correspond with the former mark. During the second visit, a circular pier of brick and mortar, 4 feet in diameter, was constructed for the great theodolite, isolated from the platform by a well, also of the same material: the foundations being 18 inches deep, and on solid ground, the instrument, when placed on the pier, in November, was found to be free from all external influence or disturbance. The distance between the upper and lower marks is 37·45 inches.

## YEMSHA.

This station is at the N.W. extremity of a cluster of granite hills, on the south bank of the Godaveri. The hill (locally known by the name of Kamoli Guta) is about 3 furlongs east of the village of Yemsha, or Yemcham, kasba Banola, taluka Mudhal:

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Banola is about 5 miles to the east; and the village of Basar, on the opposite bank of the Godaveri, is 3 miles N.W. The old platform was found with the mark-stone and feet-stones undisturbed: this mark has been now referred down to the rock *in situ*, upon which it has been deeply engraved. A solid pier of masonry has been constructed for the great theodolite; and the isolation of the pier from the platform has been very carefully managed, partly by segments of masonry, and partly by a flooring resting upon blocks of granite, unconnected with that portion of the rock upon which the pier has its foundation. The distance between the lower and upper mark is 44·1 inches.

## SHEVALINGAPA.

This station, or Shivalingpasha, is on a conspicuous hill rising several hundred feet above the surrounding trap formation. It is called after a Gosain, or Jogi, who established a temple to Mahadeo on its summit, with a small village contiguous to it. A site of this nature being ill adapted for an Indian village, it was deserted on the death of the hermit. The temple is built of solid masonry, perforated by narrow vaults and long passages: it is about 12 feet high, and flanked on 3 sides by mounds of earth, which impart to it a subterranean character. The station is at the east extremity of the southern mound. The old platform was found in good order, and undisturbed: the mound on which it was built, being an artificial elevation, did not seem well calculated to afford a steady foundation for the instrument; an excavation was therefore made into the mound, and at the depth of $5\frac{1}{2}$ feet the earth appeared to be well consolidated. A pier of masonry, surrounded by an isolating annulus of the same material, was built up from this depth to the former level. The instrument, when placed upon the pier, was found to be steady, and the isolation appeared to be perfect. The distance between the upper and lower marks is 55 inches. The hill of Shevalingapa belongs to the village of Dhongaon (about 2 miles east), kasba Biloli, pargana Logaon, zillah Nander. At the village of Betmugra, which is 5 miles S.W., there is another hill temple by Shevalingapa, and with the same characteristic excavations. The high road from Hydrabad to Hingoli lies about 8 miles S.W. of the station.

## BAKTAPUR.

This station is on the N.E. extremity of a small hill, or eminence, rising above a table land, apparently connected with the Kaolas range. The village of Baktapur is situated about 200 yards east of the station; it is in the taluka of Madnur, a large kasba about 2 miles east; the well-known village of Deglur is distant about 4 miles to the north. The old platform was found in good order, and unviolated; but the upper centre-mark differed 3 inches from the lower one: it was, therefore, necessary to construct a pillar of masonry for the great theodolite, surrounded by a strong isolating annulus of the same durable material: the masonry is very hard, and well set; and the instrument was found to stand upon it free from all shake or vibration. The upper and lower



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marks are deeply engraved in large stone blocks, firmly imbedded in the masonry; and the distance between them is 48·3 inches.

## YENAGAPALI.

This station is on a long narrow ridge, at the western extremity of the table land: the ridge runs north and south, and is of a very abrupt declivity on the east and west. The small hamlet of Yenagapali is at the S.E. foot of the hill, and belongs to the taluka of Bans-wadya, a large kasba about 7 or 8 miles S.W.: the large village of Konapur is $2\frac{1}{2}$ miles S.S.E., and being well known in the adjacent districts is a good direction for finding the station. The hill being covered with soil, it was impracticable to mark the station on the rock *in situ:* the station marks are engraved on large stones deeply imbedded in the masonry of the pier erected for the support of the great theodolite: the foundation of this pier is 2 feet deep, and the distance between the upper and lower marks 39·5 inches. The well which surrounds the pier, and isolates it from the platform, is built of stones and earth, because a sufficient quantity of lime could not be procured; the isolation of the instrument from the platform was, however, found perfect. The station of Yenagapali was formerly marked by a stone in the centre of a mound of earth; this stone was found 4 feet west of the mound; and, as there was no lower mark, the new station was made to coincide, as nearly as could be estimated, with the position which the former mark-stone seemed to have occupied.

## BURGAPALI.

This station is a small hauteur upon a table land, $3\frac{1}{2}$ miles south of Kaolas, which is a large fortified place, and the capital of the ancient sirkar of that name. A raja resides in the fort. The station is named from a hamlet, one mile east, in the kasba of Kaolas. A road or pathway from Kaolas to Tarkal runs a few feet west of the platform. The old platform was found apparently in good order, and unviolated; but the upper mark differed 2 feet from the normal of the lower one. The platform had been constructed of basalt boulders, which are most unfavourable for building; and the black soil used to bind the stones, being susceptible of very great expansion and contraction, a platform built of such materials could not but be unsteady; it was therefore considered necessary to construct a pillar and isolating well of masonry with a good foundation; and they were accordingly neatly built, with the best marl lime, granitic soil, and picked stones, selected from the adjacent water courses. The soil on the table land is of considerable depth, and it was therefore impracticable to place a mark on the rock *in situ:* the lower mark-stone has, however, been well imbedded in masonry. The distance between the marks is 48·0 inches. The instrument was found to be very steady during the observations, and perfectly free from all shake or vibration.

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## BACHAPALI.

This station is upon a small granite hill about 300 feet high, and covered with thick jungle. The hill is locally called Dewanguta, and belongs to the village of Masanpali, pargana Narainkhera. Bachapali is, however, the nearest village, being about $1\frac{1}{2}$ mile south of the station: the high road from Nander to Hydrabad runs to the west of the hill about 3 miles. Colonel Lambton's mark was found engraved on the rock *in situ*. Owing to the irregular surface and awkward form of the rock, it was impracticable to build an isolated platform in the usual manner. The pillar required a foundation 7 feet wide, which was accordingly constructed with granite stones, and marl lime, and granitic sand. A dry stone wall, 14 feet square and 2 feet thick, surrounds this pillar; the bay, or vacant space between the pillar and wall, being floored with poles, &c., for the observers to stand upon. The instrument was thus isolated in a very perfect manner, and remained remarkably steady during the observations. Distance between the mark-stones, 16·5 inches.

## DAMARGIDA.

This station is upon an extensive range of heights formed of basaltic rocks, and bounding the Manjra valley on the north: the heights have gentle declivities to the south, and, being covered with soil, are partially cultivated. The observatory is about one mile N.E. from the small village of Damargida, in the taluka of Narainkhera, kasba Borincha, sirkar Kaolas. The village is in jagir to Sadaswagan Fakir. Narainkhera is a large village, about 6 miles east; and Chilargi, about 5 miles a little to the west of south: the road from Chilargi to Hangarga runs a few yards east of the observatory. There are two piers for instruments in the observatory, 8 feet apart, and duly placed east and west of each other; the great theodolite stood on the east pillar during the observations of the angles: the isolation of the pier was duly tested and found perfect. The piers are both marked, at the level of the surface of the ground, by a dot and concentric circle on a piece of brass mounted in a large basalt stone firmly imbedded in the masonry. Below this level similar marks are likewise inserted in the masonry, viz.:— in the east pillar, at 2 feet 5 inches; in the west pillar, at 3 feet $10\frac{1}{4}$ inches. The floor of the observatory being 5 feet above ground, the usual marks are also inserted at that level. The only trace of the station of observation used by Colonel Lambton was a small circular platform of masonry, about 7 feet diameter and 6 inches deep, of which the upper and lower mark-stones could not be found. The centre of the platform (as nearly as practicable) corresponds with the centre of the eastern pier of the present observatory.

## DUDALA.

This station is on the range of highlands which extend in an east and west direction along the north bank of Manjra River: it is about one mile north of the village Dudala, pargana Tekmal, sirkar Medak. Provisions are procurable at Aladurgam, east

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3 miles, and Udatpur, S.E. 2 miles. This station was found marked by a granite stone, measuring 16 inches by 12 × 12 inches, in the centre of a mound about 8 inches above the ground. The hill being covered with a thick stratum of black soil, affording a very inefficient foundation, it was considered necessary to build an isolated pillar of masonry for the great theodolite: this was accordingly done, with the best stones procurable, good marl lime, and river detritus. The present lower mark is 6 inches below Colonel Lambton's point, and the upper mark is 32·9 inches above the former. Materials being wanting, a foundation of 12 inches was given to the pillar; although, in such a soil, a foundation of 3 or 4 feet would have been desirable. The steadiness of the instrument was successfully tested by examining the level, while a person trod heavily round the platform.

## MALGI.

This station is near the northern extremity of a hill, locally called Boiar Ghat, in the vicinity of the village of Malgi, which lies about three-quarters of a mile N.E. The hill is of an irregular form, resembling the letter S, and about half-a-mile long, 30 or 40 yards broad, and 300 feet high. The station is marked on the iron-stone rock *in situ*, about one foot below the surface of the hill. A pillar of masonry, 4 feet in diameter, has been constructed for the great theodolite; and the upper mark is 17·6 inches above that in the rock. A platform 16 feet square, duly oriented, surrounds the centre pier, leaving an annular space $2\frac{1}{2}$ inches broad, to isolate the latter from the observers. The angle between Dudala and Damargida was measured with the instrument standing on the rock *in situ*, the axis of the telescope being 63 inches above the lower mark. The steadiness of the instrument was carefully tested; in proof of which it may be stated, that the indications of the level were watched while another person walked with a heavy step round the instrument, and no perceptible change or vibration was detected. No trace of the station used by the late Colonel Lambton could be found, although a strict and minute search was instituted. The former mark-stone was found at the foot of the cliff; and the villagers pointed out the spot as the one formerly used: but the non-coincidence of the angles shews that the positions are not the same: the spot where the angles would coincide with the former ones is close to the edge of the cliff; and, as the former mark was not to be found, the present spot was selected as the most advantageous. The disappearance of the old mark from the rock may perhaps be owing to the engraving having been filled up with the dust and gravel, of the same colour and texture as the rock itself: an attempt has been made to prevent a recurrence of this accident in the present instance.

## WEST END OF BASE.

This station is on a stony ridge near the hamlet of Bapur in the Haveli taluka of Beder. The fortress of Beder is 2 miles south; the village of Gadgi 1·4 miles south-east, and Agrar about 2 miles south-east. The Mausoleum near Fatepur is 1·5

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miles north-east, and the village of Bankeli nearly one mile north. The station is not on the highest part of the ridge, having been intentionally selected at a lower level, partly for convenience of measurement and partly to avoid obstructions on the line. The rays emanating from the West End are, however, all free from the influence of intermediate ground. The platform is 16·9 inches high, with a foundation of 21·5 inches on basalt rock. The distance between upper and lower marks is 21·4 inches: the marks are dots engraved on brass plugs, fixed in long basalt stones by means of lead. The pier for the great theodolite is of stone masonry four feet in diameter and circumscribed by an annulus also of masonry, by which it is isolated from the rest of the platform. The rock *in situ* occurs 3 inches below the surface of the ground, and therefore the footing of the pier has been sunk 18·5 inches into the rock; the latter is a basaltic trap of a friable nature, readily splitting into small rhomboidal fragments, and on account of this peculiarity of structure it was impracticable to mark the rock itself.

## EAST END OF BASE.

This station is in a field 1·2 mile east of the village of Malgi, in the taluka of Beder; it is situated intermediately to the villages of Malgi and Ratnapur, the latter being about a mile N.E. The hill on which the principal station of Malgi is fixed is about a mile S.W.; the town of Beder is 5 miles W.N.W. The black soil at the East End is 3 feet deep, below which there is a stratum of stiff loam affording favourable foundation for the pier of the platform at a depth of 56 inches. The platform is 17 inches high, and constructed on the isolating principle, the pier and annulus being both of stone masonry. There are 3 marks in the pier; an upper mark, 17 inches above the ground, and a middle and lower mark at 4 inches and 33·75 inches respectively below the surface. The marks are engraved on brass plugs, fixed in long basalt stones.

## STATION A ON THE BASE LINE.

Station A on the Base Line is 2·934 miles from the West End, and is situated on a gentle swell of land, about a quarter of a mile north of the small village of Sholapur. The station can be altered to the extent of 2 or 3 sets of bars either way, but there is no other ground that can be used for dividing the base into three sections.

## STATION B ON THE BASE LINE.

Station B on the Base Line is 1·744 miles from the East End, and is situated on a swell in the fields N.W. of Malgi village. This swell is the only ground available for the trisectional division of the base.

## STATION $\alpha$ or BEDER FORT, COUNTERSCARP OF DITCH.

This is the only position available for the minor triangulation. The ditch of the fort has been excavated in the iron-stone rock, leaving a ridge 14 feet thick at the edge



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of the hill. The village of Mamankheri is N. 30° W. $\frac{3}{8}$ mile; Hamelapur N. 39° E. 1 mile; Mirganj N. 56° E. $\frac{1}{4}$ mile; Agrar N. 81° E. $\frac{1}{2}$ mile; Waldodi, N. 118° E. $\frac{1}{2}$ mile.

### STATION β, or MALKAPUR HILL.—Nos. 1 & 2.

The village of Malkapur is situated between these two hills: they are isolated hills of trap formation, capped with iron-stone. There are fakirs' tombs on both these hills: the tomb on No. 1 offers no obstruction, but that on No. 2 occupies the only available ground at top, and therefore the station has been placed on the northern face of the hill.

### STATION γ, or MALENA, FOOT OF HILL.

This station is at the foot of Malena hill, connected with that on which Malgi, G. T. Survey station is fixed, and it is of the same geological character.

### MUNGANAL.

This station, situated between the villages of Munganal and Khandokheri in the taluka of Aorad, is placed upon a conspicuous hill, about 150 feet above the general level of the table land. An image of Lachmi stands close to the platform, from which circumstance the hill is locally known as Lachmi Devi ka pahar. The villages of Munganal and Khandokheri are both situated in narrow tortuous vallies; the former 2 miles E. by S., the latter $1\frac{1}{2}$ mile N.W. of the station. The kasba village of Aorad lies 3 miles N.E. The old platform being destroyed, a new one was built of masonry on the isolating principle, the foundation being on the rock *in situ*, which is friable basalt, and therefore not capable of receiving a mark itself. The distance between the upper and lower marks is 22 inches, and the upper mark is also 22 inches above the surface of the hill.

## SERIES C.

### SHILAPALI.

This station is on an earthen mound, 35·58 feet above the table land, and about a mile west of the small village of Shilapali, taluka Hasanabad, kasba Nialkal, in the ancient sirkar of Beder. The well-known village of Sangam is about 4 miles east, and Mungi about $2\frac{1}{2}$ miles north. Both the villages are on the high road from Beder to Hydrabad. Nialkal is a large village about 5 miles north; Beder 13 miles N.W.; the

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village of Putpali is 2 miles S.W., and Kuparnagar 2 miles S.E. The mound on which the station is erected being composed of black mould, it was found necessary to sink the foundations to a depth of 4 feet. The platform is 7 feet 11 inches high, and constructed on the isolating principle. The pier contains four mark-stones, of which the second, third, and fourth are respectively 38·1 inches, 70·5 inches, and 135·75 inches below the upper. The pier and isolating annulus are built of stone masonry, and the rest of the platform is strongly constructed of blocks of iron-stone. No trace could be discovered of the old platform at this station, with the exception of a mark-stone which was found lying 3 or 4 yards to the west.

## TADMANUR, OR TARMANUR.

This station is situated on an undulation or swell of ground one mile W. by S. of the village of Tarmanur, in the taluka Tekmal. The small village of Raipad, or Raipar, is three-quarters of a mile west; Tadilmai, 3 miles N. by E.; the well-known village of Jogipet is 6 miles E. by N., and Kaslabad about 5 miles to the N.W. The old trigonometrical mark was found apparently undisturbed, and the centre of the new station corresponds thereto. On account of the unsteady character of the black soil with which the ground is covered, it was necessary to sink the foundations of the pillar to a depth of 3 feet. The platform is constructed of stone masonry, on the isolating principle, and is perfectly steady and free from vibration. The distance between the mark-stones is 38 inches.

## GORAEGAT.

This station is on an isolated iron-stone hill, in the form of a conoidal frustum, at the southern foot of which is situated the small village whose name has been adopted for the station. About 20 yards S.W. of the platform there is a small granite *laht*, or pillar, dedicated to Sang Mesar, to which offerings are made. The village of Goraegat is near the border of the Kohir and Kalupgar talukas, to the former of which it belongs. Its situation with respect to the following villages is as follows:—$1\frac{1}{4}$ mile west of Goplaram, a village with a Chaoburja fort on a hill; 3 miles S.W. of Munpali, on the high road from Hydrabad to Beder; one mile S.W. of Polhampali; $1\frac{3}{4}$ mile S. of Kamampali, on the high road; 2 miles E. of Maktampali; 2 miles E. by N. of Kamkole; $1\frac{1}{4}$ mile N. of Budara; 6 miles W. by N. of Sadashipet, a well-known town on the high road; 4 miles S. by E. of Chilmara, a well-known village on the high road. The old platform at this station having been destroyed, the site for the new station was selected according to the information given by the villagers; the new platform is neatly constructed of good masonry on the isolating principle, and the foundation being on the iron-stone rock, a very secure and steady support is obtained for the instrument. There are three mark-stones imbedded in the masonry; the lowest being at the surface of the ground, and the others 1·969 feet and 4·385 feet respectively above the former.

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## TOPKONDA.

The station of Topkonda is named from a small village $1\frac{1}{4}$ mile E. in the taluka of Alur: it is about 12 miles E. of Momimpet, and 3 miles N.W. of Dhobipet, a large village on the road from Momimpet to Hydrabad: the station is also about 12 miles W. of Patancheru, a well-known village with a Dak Bungalow on the Beder road; 5 miles S. by W. of Kandi, a halting village on the same road, and 9 miles S.E. of Sadashipet, a town with a Dak Bungalow, also on that road. Gadilgura is the nearest village to the station, being three-quarters of a mile S., and at the foot of the hill; Guntapali lies, $1\frac{1}{2}$ mile W.N.W. The old trigonometrical mark at this station was found in good order and undisturbed, the mark-stone being buried in the ground and level with its surface. The new station is built with good masonry on the isolating principle, and being founded on the iron-stone rock affords a secure and steady support for observation. The new upper mark is 2 feet above the surface of the ground, and the lower mark $1\frac{1}{2}$ feet below the same level: the distance between the marks is $3\frac{1}{2}$ feet.

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# HEIGHTS OF PRINCIPAL STATIONS

OF THE

# SERIES OF TRIANGLES

EXTENDING FROM

# THE SERONJ BASE TO THE BEDER BASE.



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Height of Bhaorasa above the Sea 1500·4 Feet.

| Terrestrial Refraction. | | Subtended Angle. | Heights Deduced. | | |
|---|---|---|---|---|---|
| Seconds. | Decimal of contained Arc. | | Comparative. | Above the Sea Level. | Mean. |
| 90″ | ·062 | 0° 7′ 24″·6 | Gargaja..... + 317·9 Feet | Gargaja..... 1818·3 Feet | 1820·9 |
| 100 | ·069 | 0 1 35·2 | Gargaja..... — 67·8 | Gargaja..... 1823·4 | |
| 94 | ·072 | 0 0 4·6 | Ehmadpur.... + 2·9 | Ehmadpur .. 1823·8 | 1825·2 |
| 93 | ·066 | 0 1 33·7 | Ehmadpur.... — 64·6 | Ehmadpur .. 1826·6 | |
| 81 | ·065 | 0 6 41·2 | Ander ..... + 246·6 | Ander ..... 2067·5 | 2068·5 |
| 74 | ·071 | 0 7 58·5 | Ander ..... + 244·2 | Ander ..... 2069·4 | |
| 91 | ·076 | 0 1 59·2 | Gidgarh..... — 69·8 | Gidgarh .... 1998·7 | 1998·2 |
| 63 | ·070 | 0 6 29·0 | Gidgarh..... + 172·4 | Gidgarh .... 1997·6 | |
| 77 | ·067 | 0 2 26·5 | Ladi ..... — 82·4 | Ladi ..... 1986·1 | 1986·6 |
| 71 | ·070 | 0 0 22·6 | Ladi ..... — 11·2 | Ladi ..... 1987·0 | |
| 114 | ·072 | 0 1 42·2 | Ranipur..... — 80·2 | Ranipur .... 1988·3 | 1991·4 |
| 89 | ·068 | 0 0 12·1 | Ranipur..... + 7·8 | Ranipur .... 1994·4 | |
| 81 | ·069 | 0 5 35·3 | Samasgarh.... + 193·6 | Samasgarh .. 2180·2 | 2180·4 |
| 79 | ·066 | 0 5 11·7 | Samasgarh.... + 182·4 | Samasgarh .. 2180·6 | |
| 110 | ·070 | 0 5 8·7 | Bhimbet .... + 237·2 | Bhimbet .... 2228·6 | 2231·8 |
| 77 | ·067 | 0 7 14·6 | Bhimbet .... + 246·6 | Bhimbet .... 2233·2 | |
| 93 | ·071 | 0 1 23·0 | Bhimbet .... + 53·3 | Bhimbet .... 2233·7 | |
| 105 | ·069 | 0 3 45·5 | Morpani .... — 168·7 | Morpani .... 2063·1 | 2060·1 |
| 124 | ·067 | 0 1 12·4 | Morpani .... + 65·6 | Morpani .... 2057·0 | |
| 138 | ·069 | 0 10 21·0 | Tek ..... + 609·5 | Tek ..... 2841·3 | 2839·4 |
| 120 | ·071 | 0 16 54·6 | Tek ..... + 848·3 | Tek ..... 2839·7 | |
| 54 | ·075 | 0 36 36·0 | Tek ..... + 777·0 | Tek ..... 2837·1 | |
| 141 | ·065 | 0 7 5·0 | Narwargarh .. + 451·8 | Narwargarh .. 2683·6 | 2681·2 |
| 89 | ·065 | 0 15 24·8 | Narwargarh .. + 618·7 | Narwargarh .. 2678·8 | |

amargida reckoned as the origin.



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above the Sea 1500·4 Feet.

| tended ngle. | Heights Deduced. | | | |
|---|---|---|---|---|
| | Comparative. | | Above the Sea Level. | Mean. |
| ′ 39″·2 | Narwargarh.. — | Feet 154·5 | Narwargarh.. | Feet * 2684·9 | |
| 35·1 | Dhaba Deo.. — | 28·4 | Dhaba Deo .. | 2811·0 | 2811·6 |
| 28·5 | Dhaba Deo.. + | 749·8 | Dhaba Deo .. | 2809·9 | |
| 50·8 | Dhaba Deo.. + | 132·8 | Dhaba Deo .. | 2814·0 | |
| 27·0 | Alampur .... — | 80·6 | Alampur .... | 2600·6 | 2599·6 |
| 20·3 | Alampur .... — | 213·1 | Alampur .... | 2598·5 | |
| 52·4 | Nilgarh .... — | 166·6 | Nilgarh..... | 2645·0 | 2644·4 |
| 44·2 | Nilgarh .... — | 36·5 | Nilgarh..... | 2644·7 | |
| 21·4 | Nilgarh .... + | 43·8 | Nilgarh..... | 2643·4 | |
| 8·0 | Jagdhar .... + | 3·8 | Jagdhar..... | 2815·4 | 2812·9 |
| 32·2 | Jagdhar .... + | 210·0 | Jagdhar..... | 2809·6 | |
| 14·3 | Jagdhar .... + | 169·2 | Jagdhar..... | 2813·6 | |
| 30·6 | Dhar ..... + | 1126·2 | Dhar..... | 3770·6 | 3771·3 |
| 24·2 | Dhar ..... + | 959·0 | Dhar..... | 3771·9 | |
| 23·3 | Salbaldi .... + | 395·5 | Salbaldi..... | * 3208·4 | |
| 16·6 | Salbaldi .... + | 556·3 | Salbaldi..... | 3200·7 | 3200·7 |
| 57·3 | Salbaldi .... — | 566·9 | Salbaldi..... | * 3204·4 | |
| 7·0 | Ner ..... — | 1663·8 | Ner ..... | 1536·9 | 1535·1 |
| 2·1 | Ner ..... — | 2238·0 | Ner ..... | 1533·3 | |
| 6·3 | Ashti ..... — | 2573·3 | Ashti..... | 1198·0 | 1201·2 |
| 58·8 | Ashti ..... — | 1996·4 | Ashti..... | 1204·3 | |
| 42·7 | Ashti ..... — | 392·0 | Ashti..... | * 1143·1 | |
| 42·1 | Badali ..... + | 139·1 | Badali ..... | 1674·2 | 1674·5 |
| 29·1 | Badali ..... + | 473·5 | Badali ..... | 1674·7 | |

Observations cannot be had.

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Height of Bhaorasa above the Sea 1500·4 Feet.

| Terrestrial Refraction. | | Subtended Angle. | Heights Deduced. | | |
|---|---|---|---|---|---|
| Seconds. | Decimal of contained Arc. | | Comparative. | Above the Sea Level. | Mean. |
| 40″ | ·045 | 0° 16′ 32″·8 | Badgaon ....— 435·4 Feet | Badgaon ....1239·1 Feet | 1239·1 |
| 372 | ·338 | 0 4 48·5 | Badgaon ....+ 156·1 | Badgaon ....1357·3 | Not Simultaneous. |
| 325 | ·254 | 0 6 35·0 | Wirur .....— 248·8 | Wirur .....1286·3 | Not Simultaneous. |
| 42 | ·042 | 0 12 43·2 | Wirur .....— 371·3 | Wirur .....1303·2 | |
| 255 | ·205 | 0 7 27·9 | Ikjhera .....+ 274·5 | Ikjhera .....1577·7 | 1535·6 |
| 199 | ·121 | 0 3 14·3 | Ikjhera .....— 156·7 | Ikjhera .....1517·8 | |
| 204 | ·128 | 0 5 47·9 | Ikjhera .....+ 272·2 | Ikjhera .....1511·3 | |
| 353 | ·369 | 0 7 46·6 | Pilkher .....+ 219·8 | Pilkher .....1458·9 | 1466·6 |
| 58 | ·046 | 0 1 38·3 | Pilkher .....— 61·4 | Pilkher .....1474·2 | |
| 71 | ·059 | 0 0 16·3 | Kopdi .....+ 9·6 | Kopdi .....1545·2 | 1547·1 |
| 21 | ·042 | 0 5 37·7 | Kopdi .....+ 82·4 | Kopdi .....1549·0 | |
| 44 | ·052 | 0 3 52·3 | Bam .....— 97·3 | Bam .....1438·3 | 1438·4 |
| 70 | ·060 | 0 3 8·3 | Bam .....— 108·7 | Bam .....1438·4 | |
| 84 | ·063 | 0 12 6·6 | Sakri .....+ 480·6 | Sakri .....1919·0 | 1920·2 |
| 67 | ·055 | 0 10 23·4 | Sakri .....+ 374·2 | Sakri .....1921·3 | |
| 93 | ·062 | 0 14 23·2 | Mahur .....+ 641·8 | Mahur .....2080·2 | 2079·6 |
| 61 | ·060 | 0 5 18·8 | Mahur .....+ 158·8 | Mahur .....2079·0 | |
| 57 | ·060 | 0 6 33·6 | Sukli .....— 185·1 | Sukli .....1894·5 | 1895·2 |
| 65 | ·057 | 0 0 43·8 | Sukli .....— 24·4 | Sukli .....1895·8 | |
| 74 | ·081 | 0 0 45·0 | Bitergaon ....— 20·3 | Bitergaon....2059·3 | 2059·6 |
| 113 | ·119 | 0 5 52·1 | Bitergaon ....+ 164·7 | Bitergaon....2059·9 | |
| 152 | ·111 | 0 5 57·3 | Terban .....— 240·5 | Terban .....1819·1 | 1842·2 |
| 233 | ·165 | 0 0 42·9 | Terban .....— 29·9 | Terban .....1865·3 | |
| 56 | ·059 | 0 5 19·1 | Shivni .....+ 149·9 | Shivni .....2209·5 | |



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above the Sea 500·4 Feet.

| tended ngle. | Heights Deduced. | | | |
|---|---|---|---|---|
| | Comparative. | | Above the Sea Level. | Mean. |
| | | Feet | | Feet |
| 28″·0 | Shivni ..... + | 432·6 | Shivni ..... | 2274·8 | 2242·2 |
| 57·9 | Bhesa ..... — | 564·1 | Bhesa ..... | 1678·1 | 1662·5 |
| 31·3 | Bhesa ..... — | 195·4 | Bhesa ..... | 1646·8 | |
| 15·1 | Somthana .. + | 169·8 | Somthana .... | 1832·3 | 1824·1 |
| 11·3 | Somthana .. — | 26·3 | Somthana .... | 1815·9 | |
| 25·8 | Yemsha .... — | 195·3 | Yemsha .... | 1467·2 | 1463·3 |
| 5·9 | Yemsha .... — | 364·7 | Yemsha .... | 1459·4 | |
| 36·0 | Shevalingapa + | 222·2 | Shevalingapa | 1685·5 | 1684·0 |
| 57·5 | Shevalingapa — | 141·6 | Shevalingapa | 1682·5 | |
| 50·8 | Baktapur.... + | 212·6 | Baktapur .... | 1675·9 | 1676·1 |
| 17·3 | Baktapur.... — | 7·8 | Baktapur .... | 1676·2 | |
| 11·8 | Yenagapali .. + | 675·2 | Yenagapali .. | 2138·5 | 2137·6 |
| 16·1 | Yenagapali .. + | 453·8 | Yenagapali .. | 2137·8 | |
| 58·0 | Yenagapali .. + | 460·5 | Yenagapali .. | 2136·6 | |
| 17·3 | Burgapali .. — | 290·2 | Burgapali .... | 1847·4 | 1847·0 |
| 34·1 | Burgapali .. + | 170·4 | Burgapali .... | 1846·5 | |
| 44·2 | Bachapali .. — | 419·0 | Bachapali .... | 1718·6 | 1717·1 |
| 59·8 | Bachapali .. — | 131·4 | Bachapali .... | 1715·6 | |
| 43·7 | Damargida .. + | 332·6 | Damargida .. | 2049·7 | 2050·5 |
| 39·1 | Damargida .. + | 204·2 | Damargida .. | 2051·2 | |
| 35·4 | Dudala .... — | 14·5 | Dudala ..... | 2036·0 | 2035·6 |
| 28·3 | Dudala .... + | 318·1 | Dudala ..... | 2035·2 | |
| 19·5 | Malgi ..... + | 286·7 | Malgi ..... | 2322·3 | 2321·6 |
| 17·0 | Malgi ..... + | 270·3 | Malgi ..... | 2320·8 | |

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haorasa above the Sea 1500·4 Feet.

| ion. / l of ied | Subtended Angle. | Heights Deduced. | | |
|---|---|---|---|---|
| | | Comparative. | Above the Sea Level. | Mean. |
| | | Feet | Feet | Feet |
| 9 | 0 18 39·9 | Munganal .... + 651·1 | Munganal.... 2327·2 | |
| 3 | 0 14 36·3 | Munganal .... + 483·1 | Munganal.... 2330·1 | 2329·1 |
| 3 | 0 8 4·9 | Munganal .... + 279·5 | Munganal.... 2330·0 | |
| 5 | 0 7 30·6 | West End Base— 238·9 | W. End Base 2090·2 | |
| 9 | 0 2 7·5 | West End Base+ 38·3 | W. End Base 2088·8 | 2089·4 |
| 3 | 0 19 42·8 | West End Base— 232·3 | W. End Base 2089·3 | |
| 1 | 0 0 53·1 | East End Base + 15·9 | E. End Base 2066·4 | |
| 3 | 0 1 5·4 | East End Base + 29·1 | E. End Base 2064·7 | 2066·3 |
| 4 | 0 1 47·27 | East End Base — 21·6 | E. End Base 2067·8 | |

t of Damargida above the sea to be 2050·5 Feet, whereas that furnished by
hts from Damargida to the Himalayas.



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# PARTICULARS OF A BASE LINE,

MEASURED WITH COMPENSATION BARS IN

## THE VALLEY OF THE MANJRA,

NEAR

## THE TOWN OF BEDER, IN THE DEKAN,

IN THE

MONTHS OF OCTOBER AND DECEMBER, 1841,

BY CAPTAIN WAUGH,

AND THE ASSISTANTS OF THE SURVEYOR-GENERAL OF INDIA.

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## RESULT OF BAR COMPARISON BEFORE THE MEASUREMENT.

| Date. | Sets. | Sums of Mean Temperatures. | Micrometer Readings. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Standard. | Compensation. | | | | | |
| | | | A | A | B | C | D | E | H |
| | | | r. d. | r. d. | r. d. | r. d. | r. d. | r. d. | r. d. |
| 12th to 14th October 1841. | 8 | 610·250 | 17 57·15 | 8 98·3 | 7 47·4 | 9 14·6 | 10 74·0 | 9 02·2 | 8 16·8 |
| | 9 | 791·925 | 35 4·50 | 9 32·7 | 8 14·1 | 10 44·5 | 11 61·4 | 9 14·1 | 8 06·0 |
| | 11 | 809·275 | 14 89·65 | 7 97·8 | 5 98·8 | 8 70·8 | 9 36·7 | 7 20·6 | 6 62·5 |
| | 9 | 774·575 | 30 29·90 | 7 15·3 | 6 21·1 | 8 44·1 | 9 80·8 | 7 05·6 | 6 06·4 |
| | 11 | 824·325 | 14 57·80 | 5 60·8 | 3 65·1 | 6 10·4 | 8 15·7 | 4 92·0 | 4 42·1 |
| | 9 | 784·125 | 28 27·50 | 4 17·7 | 3 13·1 | 5 23·5 | 6 66·6 | 3 92·8 | 3 05·2 |
| | 57 | 4594·475 | 140 66·50 | 43 22·6 | 34 59·6 | 48 07·9 | 56 35·2 | 41 27·3 | 36 39·0 |
| Means. | | 80·605 | 2 46·781 | 0 75·835 | 0 60·695 | 0 84·349 | 0 98·863 | 0 72·409 | 0 63·842 |

## VALUES OF THE COMPENSATION BARS IN TERMS OF THE STANDARD BAR A.

| Characteristic mark on the Bar. | Mean Temperature. | $nb\,(t-62°)$ $n = ·0000068007$ $b = 120$ Inches. | Mean Micrometer Readings. | | $nb\,(t-62°)-s$ | $nb\,(t-62°)-s-s$ | Mean excess of one Set of Bars. |
|---|---|---|---|---|---|---|---|
| | | | r. d. 20 6·967 = 0·1 of an Inch. | | | | |
| | | | r. d. | Parts of an Inch. | | | |
| | | | + | + | | | |
| Standard..... A | 80·605 + 0·045 = 80·650 | +·0152200 | 2 46·781 | ·0122962 | +·0029238 | ..... | 0·0409633 |
| Compensation..... A | | ..... | 0 75·835 | ·0037786 | ..... | ·0067024 | |
| „ ..... B | | ..... | 0 60·695 | ·0030242 | ..... | ·0059480 | |
| „ ..... C | | ..... | 0 84·349 | ·0042028 | ..... | ·0071266 | |
| „ ..... D | | ..... | 0 98·863 | ·0049260 | ..... | ·0078498 | |
| „ ..... E | | ..... | 0 72·409 | ·0036079 | ..... | ·0065317 | |
| „ ..... H | | ..... | 0 63·842 | ·0031810 | ..... | ·0061048 | |

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## RESULTS OF BAR COMPARISONS AFTER THE MEASUREMENT.

| Date. | Sets. | Sums of Mean Temperatures. | Micrometer Readings. Standard. A | Compensation. A | B | C | D | E | H |
|---|---|---|---|---|---|---|---|---|---|
| | | | r. d. | r. d. | r. d. | r. d. | r. d. | r. d. | r. d. |
| 6th to 8th December 1841. | 10 | 645·875 | 23 05·95 | 30 99·5 | 28 63·7 | 30 69·1 | 32 49·8 | 29 86·1 | 29 78·6 |
| | 9 | 722·250 | 40 82·25 | 28 50·5 | 25 05·8 | 27 09·0 | 28 44·6 | 26 19·5 | 25 55·9 |
| | 9 | 574·750 | 13 93·05 | 22 24·3 | 20 08·4 | 22 25·9 | 23 54·0 | 21 27·6 | 21 23·9 |
| | 1 | 71·375 | 2 63·05 | 2 30·0 | 2 07·1 | 2 34·1 | 2 48·1 | 2 28·9 | 2 20·1 |
| | 7 | 560·900 | 26 16·95 | 15 29·1 | 13 92·3 | 16 08·7 | 16 90·5 | 15 05·6 | 17 09·4 |
| | 2 | 161·950 | 7 63·10 | 4 34·2 | 3 94·1 | 4 54·0 | 4 73·1 | 4 18·0 | 4 03·3 |
| | 8 | 497·950 | 4 37·00 | 13 93·2 | 11 90·7 | 13 78·8 | 14 81·1 | 12 85·2 | 12 95·9 |
| | 2 | 140·375 | 3 39·65 | 3 09·4 | 2 64·8 | 3 20·3 | 3 50·4 | 3 10·2 | 3 00·1 |
| | 7 | 574·575 | 24 1·25 | 10 96·5 | 9 59·2 | 11 69·5 | 12 51·6 | 10 77·4 | 10 18·6 |
| | 2 | 166·425 | 7 15·45 | 3 08·7 | 2 76·2 | 3 31·3 | 3 49·0 | 2 97·3 | 2 78·4 |
| | 57 | 4116·425 | 153 17·70 | 134 75·4 | 120 62·3 | 135 00·7 | 142 92·2 | 128 55·8 | 128 84·2 |
| Means. | | 72·218 | 2 68·732 | 2 36·411 | 2 11·619 | 2 36·854 | 2 50·740 | 2 25·540 | 2 26·039 |

## VALUES OF THE COMPENSATION BARS IN TERMS OF THE STANDARD BAR A.

| Characteristic mark on the Bar. | Mean Temperature. | $nb.(t-62°)$ $n=·0000068007$ $b=120$ Inches. | Mean Micrometer Readings. r. d. 20 8·034=0·1 of an Inch. r. d. | Parts of an Inch. | $nb.(t-62°)-s$ | $nb.(t-62°)-s+a$ | Mean excess of one Set of Bars. |
|---|---|---|---|---|---|---|---|
| | | | + | + | | | |
| Standard ..... A | 72·218 + 0·045 = 72·263. | + 0·0083755 | 2 68·732 | ·0133828 | — 0·0050073 | ..... | 0·0390388 |
| Compensation ..... A | | ..... | 2 36·411 | ·0117733 | ..... | ·0067660 | |
| „ ..... B | | ..... | 2 11·619 | ·0105386 | ..... | ·0055313 | |
| „ ..... C | | ..... | 2 36·854 | ·0117953 | ..... | ·0067880 | |
| „ ..... D | | ..... | 2 50·740 | ·0124868 | ..... | ·0074795 | |
| „ ..... E | | ..... | 2 25·540 | ·0112319 | ..... | ·0062246 | |
| „ ..... H | | ..... | 2 26·039 | ·0112567 | ..... | ·0062494 | |



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### 1st PARTIAL BASE from the W. End to the 244th set inclusive.

WEST END TO REGISTER A.

| | |
|---|---|
| The mean Microscope correction for the first 48 sets as given in the field book is in parts of an inch | +0·3044208 |
| ,, ,, ,, next 107 sets is | +0·5782494 |
| ,, ,, ,, 89 sets is | +0·4537131 |
| The bar correction for 244 sets is | +9·6748684 |
| To which add 244×63×12 amounting to | 184464· |
| Add also 1·239 inches, the excess of Register A above the 244th set at 86° reduced to the temperature of 62° | +1·2386935 |
| Therefore the length from the W. End to Register A at the level it was measured is in inches | 184476·2499452 |
| To which apply the correction for the height above the level of the sea | −17·74071 |
| Whence the partial line W. End to Register A at the level of the sea will be | 184458·5092352 |

### 2nd PARTIAL BASE from the 244th set to the 518th set inclusive.

REGISTER A TO REGISTER B.

| | |
|---|---|
| The mean Microscope correction for the first 109 sets as given in the field book is in parts of an inch | +0·5960556 |
| ,, ,, ,, next 2 sets is | +0·0116578 |
| ,, ,, ,, ,, 163 sets is | +0·9318710 |
| The bar correction for 274 sets is | +10·8644014 |
| To which add 274×63×12 amounting to | 207144· |
| Apply also 1·917 in. excess of the 518th set above Regr B at 78°·4 redd to 62° | −1·9166759 |
| Apply also the excess of Register A as above explained | −1·2386935 |
| Therefore the length from Register A to Register B at the level it was measured is in inches | 207153·2486164 |
| To which apply the correction for the height above the level of the sea | −19·57663 |
| Whence the partial base Register A to Register B at the level of the sea will be | 207133·6719864 |

### 3rd PARTIAL BASE from the 519th to the 660th set inclusive.

REGISTER B TO EAST END.

| | |
|---|---|
| The mean Microscope correction for 142 sets as given in the field book is in parts of an inch | +0·7894490 |
| The bar correction for 142 sets is | +5·6304562 |
| To which add 142×63×12 amounting to | 107352· |
| Add also 0·233 parts of an inch, being the excess of E. End above the 660th set at 74°·4 reduced to 62° | +0·2329702 |
| Add also the defect of Register B as above explained | +1·9166759 |
| Therefore the length from Register B to E. end at the level it was measured is in inches | 107360·5695513 |
| To which apply the correction for the height above the level of the sea | −10·31747 |
| Whence the partial base Register B to E. end at the level of the sea will be | 107350·2520813 |

### REMARKS.

1st Partial Base or W. End Base to Register A is in excess of the 244th set by 1·239 inches.

2nd Partial Base or Register A to Register B is in defect of 518th set by 1·917 inches.

3rd Partial Base or Register B to E. end Base is in excess of the 660th set by 0·233 inches.

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## DEDUCTION of the whole BASE.

| | |
|---|---|
| The excess of 6 Bars above the stand$^{d}$ A red$^{d}$ to 62° before the meas$^{t}$, is in parts of an inch | +0·0402633 |
| The like excess after the measurement is | +0·0390388 |
| Whence the mean excess to be used is | +0·0396511 |

| | |
|---|---|
| The mean error of the Microscopes as registered between the 18$^{th}$ and 25$^{th}$ October is +0·0063421 with which 48 Sets were measured; and 48 × 0·0063421 in parts of an inch | = +0·3044208 |
| The mean error for the next 107 sets is 0·0054042 giving | +0·5782494 |
| ,, ,, ,, 89 sets is 0·0050979 giving | +0·4537131 |
| ,, ,, ,, 109 sets is 0·0054684 giving | +0·5960556 |
| ,, ,, ,, 2 sets is 0·0058289 giving | +0·0116578 |
| ,, ,, ,, 163 sets is 0·0057170 giving | +0·9318710 |
| ,, ,, ,, 142 sets is 0·0055595 giving | +0·7894490 |
| The sum of which gives for the total Microscope error in inches | +3·6654167 |
| The correction for the compensation bars due to 660 sets is +0·0396511 × 660= | +26·1697260 |
| The measured excess at the E. End is 0·233 of an inch at 74°·4 which reduced to the temperature of 62° is | +0·2329702 |
| Therefore the total correction for Bars, Microscopes, &c. is | +30·0681129 |
| Which in the denomination of the standard A assumed to be 10 feet is | +2·5056761 |
| The value of 660 lengths of standard A taken at 10 feet is | 41580· |
| Therefore the total measured length of the Base is in term of standard A and scale A in feet | 41582·5056761 |
| The reduction to the level of the Sea in lat. 17° 55′ 32″ is | −3·9695671 |
| Whence the total length of the Beder Base at the level of the Sea is in feet | 41578·5361086 |

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## OBSERVED ANGLES OF PARTIAL TRIANGLES.

### At REGISTER A.—May and June 1841.

| Zero. | Register B and Station β. | | | Station β and Station α. | | | Station α and West End Base. | | |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ ″ | | | ° ′ ″ | | | ° ′ ″ | | |
| 0 | 38 17 47·840 | (3) | | 82 23 7·047 | (3) | | 59 19 4·460 | (3) | |
| 180 | 47·273 | (3) | | 7·213 | (3) | | 3·187 | (3) | |
| 9 | 47·795 | (3) | | 6·675 | (4) | | 4·180 | (4) | |
| 189 | 48·040 | (4) | | 8·487 | (3) | | 3·960 | (3) | |
| 18 | 48·140 | (3) | | 6·967 | (3) | | 3·413 | (3) | |
| 198 | 47·720 | (3) | | 7·033 | (3) | | 4·073 | (3) | |
| 27 | 47·180 | (3) | | 7·280 | (3) | | 3·867 | (3) | |
| 207 | 47·087 | (3) | | 6·960 | (3) | | 4·540 | (3) | |
| Means | 38 17 47·634 | | Prob. = 0·133 | 82 23 7·208 | | Prob. = 0·181 | 59 19 3·960 | | Prob. = 0·156 |

### At REGISTER B.—June 1841.

| Zero. | East End Base and Station γ. | | | Station γ and Station β. | | | Station β and Register A. | | |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ ″ | | | ° ′ ″ | | | ° ′ ″ | | |
| 0 | 49 11 0·580 | (3) | | 68 44 31·573 | (3) | | 62 4 29·807 | (3) | |
| 180 | 1·053 | (3) | | 31·067 | (3) | | 29·167 | (3) | |
| 9 | 0·167 | (3) | | 31·213 | (3) | | 28·920 | (3) | |
| 189 | 1·040 | (3) | | 31·460 | (3) | | 29·360 | (3) | |
| 18 | 1·447 | (3) | | 30·927 | (3) | | 28·313 | (3) | |
| 198 | 1·340 | (3) | | 31·833 | (3) | | 28·507 | (3) | |
| 27 | 0·913 | (3) | | 31·447 | (3) | | 28·867 | (3) | |
| 207 | 0·007 | (3) | | 32·887 | (3) | | 28·013 | (3) | |
| Means | 49 11 0·818 | | Prob. = 0·173 | 68 44 31·551 | | Prob. = 0·202 | 62 4 28·869 | | Prob. = 0·193 |

### At STATION β.—June 1841.

| Zero. | Station α and Register A. | | | Register A and Register B. | | | Register B and Station γ. | | |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ ″ | | | ° ′ ″ | | | ° ′ ″ | | |
| 0 | 31 54 44·707 | (3) | | 79 37 43·220 | (3) | | 33 46 10·813 | (3) | |
| 180 | 44·933 | (3) | | 42·720 | (3) | | 9·960 | (3) | |
| 9 | 44·327 | (3) | | 43·127 | (3) | | 10·953 | (3) | |
| 189 | 44·913 | (3) | | 42·727 | (3) | | 10·853 | (3) | |
| 18 | 44·180 | (3) | | 44·087 | (3) | | 10·453 | (3) | |
| 198 | 44·900 | (3) | | 42·167 | (3) | | 10·007 | (3) | |
| 27 | 44·633 | (3) | | 43·627 | (3) | | 10·473 | (3) | |
| 207 | 43·993 | (3) | | 42·840 | (3) | | 10·307 | (3) | |
| Means | 31 54 44·573 | | Prob. = 0·120 | 79 37 43·064 | | Prob. = 0·197 | 33 46 10·477 | | Prob. = 0·125 |

### At STATION α.—May 1841.

| Zero. | West End Base and Register A. | | | Register A and Station β. | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ ″ | | | ° ′ ″ | | | | | |
| 0 | 85 1 61·127 | (3) | | 65 42 6·953 | (3) | | | | |
| 180 | 58·680 | (3) | | 8·540 | (3) | | | | |
| 9 | 60·387 | (3) | | 8·127 | (3) | | | | |
| 189 | 59·687 | (3) | | 9·173 | (3) | | | | |
| 18 | 60·067 | (3) | | 8·973 | (3) | | | | |
| 198 | 59·080 | (3) | | 9·227 | (3) | | | | |
| 27 | 59·907 | (3) | | 9·033 | (3) | | | | |
| 207 | 58·580 | (3) | | 9·060 | (3) | | | | |
| Means | 85 1 59·689 | | Prob. = 0·290 | 65 42 8·636 | | Prob. = 0·256 | | | |

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## OBSERVED ANGLES OF PARTIAL TRIANGLES.

### At WEST END BASE.—May 1841.

| Zero. | Register A and Station α. | | | | | |
|---|---|---|---|---|---|---|
| | ° | ′ | ″ | | | |
| 0 | 35 | 38 | 56·200 | (3) | | |
| 180 | | | 55·327 | (3) | | |
| 9 | | | 54·460 | (3) | Prob. = 0·223 | |
| 189 | | | 55·513 | (3) | | |
| 18 | | | 56·053 | (3) | | |
| 198 | | | 56·587 | (3) | | |
| 27 | | | 55·767 | (3) | | |
| 207 | | | 56·293 | (3) | | |
| Means | 35 | 38 | 55·775 | | | |

### At STATION γ.—June 1841.

| Zero. | Station β and Register B. | | | | | Register B and East End Base. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ′ | ″ | | | ° | ′ | ″ | | | |
| 0 | 77 | 29 | 17·507 | (3) | | 87 | 5 | 11·693 | (3) | | |
| 180 | | | 15·813 | (3) | | | | 11·173 | (3) | | |
| 9 | | | 17·193 | (3) | Prob. = 0·223 | | | 10·420 | (3) | Prob. = 0·163 | |
| 189 | | | 15·853 | (3) | | | | 11·273 | (3) | | |
| 18 | | | 17·760 | (3) | | | | 10·607 | (3) | | |
| 198 | | | 15·993 | (3) | | | | 11·207 | (3) | | |
| 27 | | | 17·060 | (3) | | | | 10·407 | (3) | | |
| 207 | | | 16·560 | (3) | | | | 10·747 | (3) | | |
| Means | 77 | 29 | 16·717 | | | 87 | 5 | 10·941 | | | |

### At EAST END BASE.—June 1841.

| Zero. | Station γ and Register B. | | | | | |
|---|---|---|---|---|---|---|
| | ° | ′ | ″ | | | |
| 0 | 43 | 43 | 47·813 | (3) | | |
| 180 | | | 47·187 | (3) | | |
| 9 | | | 47·127 | (3) | Prob. = 0·098 | |
| 189 | | | 47·560 | (3) | | |
| 18 | | | 47·827 | (3) | | |
| 198 | | | 47·693 | (3) | | |
| 27 | | | 47·193 | (3) | | |
| 207 | | | 47·680 | (3) | | |
| Means | 43 | 43 | 47·510 | | | |



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## COMPUTATION OF PARTIAL TRIANGLES ABOUT THE BASE.

Register A to Register B = 207133·6719864 Inches...Log 5·3162507; Miles 3·2692.

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Inches. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|---|
| 0·133 | Register A ..... | 38° 17′ 47″·634 | — 0·013 | + 0·120 | + 0·107 | 38° 17′ 47″·741 | 9·7922042 | 186054·643 | 2·9365 |
| 0·193 | Register B ..... | 62 4 28·869 | — 0·013 | + 0·174 | + 0·161 | 62 4 29·030 | 9·9462356 | 130499·569 | 2·0597 |
| 0·197 | Station β ..... | 79 37 43·064 | — 0·013 | + 0·178 | + 0·165 | 79 37 43·229 | 9·9928458 | Logs. | |
| | | 179 59 59·567 | — 0·039 | + 0·472 | + 0·433 | 180 0 0·000 | | 5·2696405 | |
| | | | | | | | | 5·1156091 | |

Register A to Station β = 186054·643 Inches...Log 5·2696405; Miles 2·9365.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·181 | Register A ..... | 82 23 7·208 | — 0·011 | — 0·125 | — 0·136 | 82 23 7·072 | 9·9961532 | 107911·225 | 1·7031 |
| 0·120 | Station β ..... | 31 54 44·573 | — 0·011 | — 0·083 | — 0·094 | 31 54 44·479 | 9·7231447 | 202336·933 | 3·1934 |
| 0·256 | Station α ..... | 65 42 8·636 | — 0·011 | — 0·176 | — 0·187 | 65 42 8·449 | 9·9597186 | Logs. | |
| | | 180 0 0·417 | — 0·033 | — 0·384 | — 0·417 | 180 0 0·000 | | 5·0330666 | |
| | | | | | | | | 5·3060751 | |

Register A to Station α = 107911·225 Inches...Log 5·0330666; Miles 1·7031.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·156 | Register A ..... | 59 19 3·960 | — 0·009 | + 0·141 | + 0·132 | 59 19 4·092 | 9·9345039 | 184459·509 | 2·9113 |
| 0·290 | Station α ..... | 85 1 59·689 | — 0·010 | + 0·262 | + 0·252 | 85 1 59·941 | 9·9983663 | 159235·037 | 2·5132 |
| 0·223 | W. End Beder Base | 35 38 55·775 | — 0·009 | + 0·201 | + 0·192 | 35 38 55·967 | 9·7655318 | Logs. | |
| | | 179 59 59·424 | — 0·028 | + 0·604 | + 0·576 | 180 0 0·000 | | 5·2659011 | |
| | | | | | | | | 5·2020387 | |

Register B to Station β = 130499·569 Inches...Log 5·1156091; Miles 2·0597.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·202 | Register B ..... | 68 44 31·551 | — 0·005 | + 0·466 | + 0·461 | 68 44 32·012 | 9·9693966 | 74303·533 | 1·1727 |
| 0·125 | Station β ..... | 33 46 10·477 | — 0·005 | + 0·289 | + 0·284 | 33 46 10·761 | 9·7449619 | 124578·835 | 1·9662 |
| 0·223 | Station γ ..... | 77 29 16·717 | — 0·005 | + 0·515 | + 0·510 | 77 29 17·227 | 9·9895615 | Logs. | |
| | | 179 59 58·745 | — 0·015 | + 1·270 | + 1·255 | 180 0 0·000 | | 4·8710095 | |
| | | | | | | | | 5·0954442 | |

Register B to Station γ = 74303·517 Inches...Log 4·8710095; Miles 1·1727.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·173 | Register B ..... | 49 11 0·818 | — 0·003 | + 0·302 | + 0·299 | 49 11 1·117 | 9·8789860 | 107351·074 | 1·6943 |
| 0·153 | Station γ ..... | 87 5 10·941 | — 0·004 | + 0·268 | + 0·264 | 87 5 11·205 | 9·9994382 | 81349·374 | 1·2839 |
| 0·098 | E. End Beder Base | 43 43 47·510 | — 0·003 | + 0·171 | + 0·168 | 43 43 47·678 | 9·8396413 | Logs. | |
| | | 179 59 59·269 | — 0·010 | + 0·741 | + 0·731 | 180 0 0·000 | | 5·0308064 | |
| | | | | | | | | 4·9103542 | |

| | By Triangulation. | By Measurement. | Diff. Inches. |
|---|---|---|---|
| Register A to Register B..... | | 207133·672 | |
| West End Base to Register A ..... | 184459·509 | 184458·509 | + 1·000 |
| East End Base to Register B..... | 107351·074 | 107350·252 | + 0·822 |
| Beder Base ..... | 498944·255 | 498942·433 | + 1·822 |

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# RESULTS

OF

# CIRCUMPOLAR STAR OBSERVATIONS—

# SECTION KALIANPUR TO DAMARGIDA.

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## SERIES B.

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G. T. Station Ehmadpur Lat. 23° 36′ 21″ Long. 77° 43′ 15″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4th 18° & 198° | R | ε Ursæ Minoris | ° ′ ″ 7 42 39·73 | ° ′ ″ W. 8 25 12·74 | h. m. s. 17 2 33·45 | h. m. s. 5 46 25·79 | h. m. s. 22 48 59·24 | h. 4+ m. s. 48 45 | | h. 22+ m. s. 29 2·99 | ° ′ ″ 4 59 3·75 | ″ 113·98 | 10°+ ′ ″ 2 11·44 | π+1° 38′ ″ 52·68 | π+(1° 38′)+{R 53·957 L 55·342} | F.R. 6 ..... F.L. 6 | h. m. s. 23 32 46·37 γ Cephei | h. m. s. (5 52 26·0 − 5·91)=5 52 20·09 | h. m. s. 6 19 33·72 | |
| | R | | | | | | | 51 8 | | 31 26·30 | 4 23 14·10 | 88·26 | 2 38·82 | 54·34 | | | | | | |
| | L | | | | | | | 57 57 | | 38 16·19 | 2 40 45·75 | 32·87 | 3 34·28 | 54·41 | | | | | | |
| | L | | | | | | | 59 40 | | 39 59·41 | 2 14 57·45 | 23·16 | 3 46·38 | 56·80 | | | | | | |
| | R | | | | | | | 65 52 | | 46 12·22 | 0 41 45·30 | 2·21 | 4 3·44 | 52·91 | | | | | | |
| | R | | | | | | | 67 43 | | 48 3·46 | 0 13 56·70 | 0·25 | 4 6·46 | 53·97 | | | | | | |
| | L | | | | | | | 75 40 | | 56 1·50 | 1 45 33·90 | 14·11 | 3 54·66 | 56·03 | | | | | | |
| | L | | | | | | | 77 19 | | 57 40·71 | 2 10 22·05 | 21·51 | 3 45·46 | 54·23 | | | | | | |
| | R | | | | | | | 82 58 | | 63 20·45 | 3 35 18·15 | 58·57 | 3 8·86 | 54·69 | | | | | | |
| | R | | | | | | | 84 50 | | 65 12·69 | 4 3 21·75 | 74·79 | 2 53·10 | 55·15 | | | | | | |
| | L | | | | | | | 91 46 | | 72 9·60 | 5 47 35·40 | 152·23 | 1 36·16 | 55·65 | | | | | | |
| | L | | | | | | | 93 41 | | 74 4·85 | 6 16 24·15 | 178·41 | 1 9·26 | 54·93 | | | | | | |
| Dec. 5th 9° & 189° | R | ε Ursæ Minoris | ° ′ ″ 7 42 40·12 | ° ′ ″ W. 8 25 13·17 | h. m. s. 17 2 33·41 | h. m. s. 5 46 25·78 | h. m. s. 22 48 59·19 | h. 4+ m. s. 39 20 | | h. 22+ m. s. 22 44·49 | ° ′ ″ 6 33 40·50 | ″ 197·75 | 10°+ ′ ″ 0 48·22 | π+1° 38′ ″ 52·80 | π+(1° 38′)+{R 54·085 L 52·272} | F.R. 6 ..... F.L. 6 | h. m. s. 23 32 46·29 γ Cephei | h. m. s. (5 49 12·3+0·39)=5 49 12·69 | h. m. s. 6 16 26·40 | |
| | R | | | | | | | 41 52 | | 25 16·82 | 5 55 35·55 | 161·26 | 1 23·60 | 51·69 | | | | | | |
| | L | | | | | | | 53 33 | | 36 59·34 | 2 59 57·75 | 41·20 | 3 22·70 | 50·73 | | | | | | |
| | L | | | | | | | 55 30 | | 38 56·60 | 2 30 38·85 | 28·86 | 3 35·78 | 51·47 | | | | | | |
| | R | | | | | | | 61 17 | | 44 44·35 | 1 3 42·60 | 5·15 | 4 0·94 | 52·92 | | | | | | |
| | R | | | | | | | 62 56 | | 46 23·57 | 0 38 54·30 | 1·92 | 4 5·50 | 54·25 | | | | | | |
| | L | | | | | | | 68 15 | | 51 43·26 | 0 41 1·05 | 2·13 | 4 2·66 | 51·62 | | | | | | |
| | L | | | | | | | 70 11 | | 53 39·51 | 1 10 4·80 | 6·22 | 4 0·48 | 53·53 | | | | | | |
| | R | | | | | | | 76 53 | | 60 22·39 | 2 50 48·00 | 36·89 | 3 32·18 | 55·90 | | | | | | |
| | R | | | | | | | 78 48 | | 62 17·64 | 3 19 36·75 | 50·36 | 3 19·76 | 56·95 | | | | | | |
| | L | | | | | | | 84 53 | | 68 23·43 | 4 51 3·60 | 106·87 | 2 19·22 | 52·92 | | | | | | |
| | L | | | | | | | 87 10 | | 70 40·73 | 5 25 23·10 | 133·47 | 1 53·06 | 53·36 | | | | | | |
| Dec. 5th 9° & 189° | R | ε Ursæ Minoris | ° ′ ″ 7 42 40·32 | ° ′ ″ E. 8 25 13·39 | h. m. s. 17 2 33·38 | h. m. s. 5 46 25·77 | h. m. s. 11 16 7·61 | h. 16+ m. s. 52 11 | | h. 10+ m. s. 37 11·77 | ° ′ ″ 9 43 57·60 | ″ 427·38 | 6°+ ′ ″ 39 12·70 | π+1° 38′ ″ 53·31 | π+(1° 38′)+{R 57·510 L 55·767} | F.R. 6 ..... F.L. 6 | h. m. s. 23 32 46·29 γ Cephei | h. m. s. (5 49 12·3+0·39)=5 49 12·69 | h. m. s. 6 16 26·40 | |
| | R | | | | | | | 54 35 | | 39 36·08 | 9 7 52·95 | 376·53 | 40 2·80 | 54·06 | | | | | | |
| | L | | | | | | | 61 23 | | 46 24·98 | 7 25 39·45 | 249·72 | 42 10·64 | 53·03 | | | | | | |
| | L | | | | | | | 64 10 | | 49 12·34 | 6 43 49·05 | 205·22 | 42 52·08 | 56·09 | | | | | | |
| | R | | | | | | | 71 20 | | 56 23·29 | 4 56 4·80 | 110·58 | 44 24·00 | 58·81 | | | | | | |
| | R | | | | | | | 73 15 | | 58 18·54 | 4 27 16·05 | 90·16 | 44 44·00 | 59·23 | | | | | | |
| | L | | | | | | | 79 35 | | 64 39·37 | 2 52 3·60 | 37·44 | 45 39·48 | 56·47 | | | | | | |
| | L | | | | | | | 81 18 | | 66 22·60 | 2 26 15·15 | 27·06 | 45 50·76 | 55·57 | | | | | | |
| | R | | | | | | | 88 45 | | 73 50·58 | 0 34 15·45 | 1·49 | 46 13·04 | 58·86 | | | | | | |
| | R | | | | | | | 91 5 | | 76 10·88 | 0 0 49·05 | 0·00 | 46 12·60 | 60·79 | | | | | | |
| | L | | | | | | | 101 59 | | 87 6·32 | 2 44 40·65 | 34·49 | 45 42·06 | 56·84 | | | | | | |
| | L | | | | | | | 104 20 | | 89 27·63 | 3 20 0·30 | 50·91 | 45 25·88 | 56·60 | | | | | | |
| Dec. 6th 0° & 180° | R | ε Ursæ Minoris | ° ′ ″ 7 42 40·51 | ° ′ ″ W. 8 25 13·59 | h. m. s. 17 2 33·37 | h. m. s. 5 46 25·77 | h. m. s. 22 48 59·14 | h. 4+ m. s. 39 32 | | h. 22+ m. s. 26 5·77 | ° ′ ″ 5 43 20·55 | ″ 150·32 | 10°+ ′ ″ 1 39·40 | π+1° 38′ ″ 56·13 | π+(1° 38′)+{R 57·313 L 50·302} | F.R. 6 ..... F.L. 6 | h. m. s. 23 32 46·21 γ Cephei | h. m. s. (5 46 4·0 − 0·31)=5 46 3·69 | h. m. s. 6 13 17·48 | |
| | R | | | | | | | 41 26 | | 28 0·02 | 5 14 46·80 | 126·30 | 2 4·02 | 56·73 | | | | | | |
| | L | | | | | | | 46 55 | | 33 29·74 | 3 52 21·00 | 68·74 | 2 55·04 | 50·19 | | | | | | |
| | L | | | | | | | 48 41 | | 35 15·98 | 3 25 47·40 | 53·90 | 3 8·98 | 49·29 | | | | | | |
| | R | | | | | | | 54 45 | | 41 20·77 | 1 54 35·55 | 16·69 | 3 58·32 | 61·42 | | | | | | |
| | R | | | | | | | 56 23 | | 42 58·99 | 1 30 2·25 | 10·30 | 3 59·86 | 56·57 | | | | | | |
| | L | | | | | | | 61 57 | | 48 33·72 | 0 6 21·30 | 0·05 | 4 3·10 | 49·56 | | | | | | |
| | L | | | | | | | 63 50 | | 50 26·97 | 0 21 57·45 | 0·61 | 4 3·34 | 50·36 | | | | | | |
| | R | | | | | | | 69 28 | | 56 5·71 | 1 46 38·55 | 14·40 | 3 55·72 | 56·53 | | | | | | |
| | R | | | | | | | 71 12 | | 57 49·94 | 2 12 42·00 | 22·29 | 3 47·80 | 56·50 | | | | | | |
| | L | | | | | | | 78 6 | | 64 44·84 | 3 56 25·50 | 70·60 | 2 54·82 | 51·83 | | | | | | |
| | L | | | | | | | 80 45 | | 67 24·19 | 4 36 15·75 | 96·31 | 2 27·86 | 50·58 | | | | | | |

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G. T. Station Ehmadpur Lat. 23° 36′ 21″ Long. 77° 43′ 15″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. | Chronom. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *'s N. P. D. | *'s Elongation. | *'s A.R. | *'s Horary Angle. | *'s Sidereal Time of Maximum. | M. Solar. | Sidereal. | ∂ P | ∂ Z | | | | | A.R. | Chronom. Time. | Error. | Rate. |
| Dec. 6th 0° & 180° | R | ε Ursæ Minoris | ° ′ ″ 7 42 40·72 | E. 8° 25′ 13″·82 | H. M. S. 17 2 33·35 | H. M. S. 5 46 25·76 | H. M. S. 11 16 7·59 | | H. 10+ M. S. 42 6·55 | ° ′ ″ 8 30 15·60 | ″ 326·88 | 6°+ ′ ″ 40 53·90 | π+1° 38′ ″ 53·04 | | | H. M. S. 23 32 46·21 γ Cephei | H. M. S. (5 46 4·0−0·31)=5 46 3·69 | H. M. S. 6 13 17·48 | M. S. 3 8·92 |
| | R | | | | | | | | H. 16+ M. S. 53 57 | | | | | | | | | | |
| | R | | | | | | | | 57 0 | | | | | | | | | | |
| | L | | | | | | | | 63 26 | | | | | | | | | | |
| | L | | | | | | | | 65 26 | | | | | | | | | | |
| | R | | | | | | | | 71 35 | | | | | | | | | | |
| | R | | | | | | | | 73 4 | | | | | | | | | | |
| | L | | | | | | | | 78 46 | | | | | | | | | | |
| | L | | | | | | | | 80 35 | | | | | | | | | | |
| | R | | | | | | | | 86 6 | | | | | | | | | | |
| | R | | | | | | | | 87 37 | | | | | | | | | | |
| | L | | | | | | | | 92 56 | 1 15 45·60 | 7·29 | 46 9·38 | 57·15 | π+(° 1 38′)+{ R 58″·124 / L 56·482 } | F.R. 8 ..... F.L. 6 | | | | |
| | L | | | | | | | | 94 30 | 1 39 18·75 | 12·53 | 46 5·30 | 55·99 | | | | | | |
| | R | | | | | | | | 100 48 | 3 14 1·05 | 47·90 | 45 26·90 | 59·02 | | | | | | |
| | R | | | | | | | | 102 48 | 3 44 4·95 | 63·93 | 45 10·20 | 59·69 | | | | | | |
| Dec. 7th 27° & 207° | L | ε Ursæ Minoris | ° ′ ″ 7 42 40·91 | W. 8° 25′ 14″·03 | H. M. S. 17 2 33·33 | H. M. S. 5 46 25·75 | H. M. S. 22 48 59·08 | | H. 4+ M. S. 33 36 | H. 22+ M. S. 23 16·72 | ° ′ ″ 6 25 35·40 | ″ 189·69 | 10°+ ′ ″ 1 0·60 | π+1° 38′ ″ 56·26 | | H. M. S. 23 32 46·13 γ Cephei | H. M. S. (5 42 56·0+0·37)=5 42 56·37 | H. M. S. 6 10 10·24 | M. S. 3 7·24 |
| | L | | | | | | | | 35 31 | 25 11·97 | 5 56 46·65 | 162·35 | 1 25·44 | 53·76 | | | | | |
| | R | | | | | | | | 41 33 | 31 14·76 | 4 26 4·80 | 90·19 | 2 39·54 | 55·70 | | | | | |
| | R | | | | | | | | 43 17 | 32 58·99 | 4 0 1·35 | 73·36 | 2 56·26 | 55·59 | | | | | |
| | L | | | | | | | | 50 10 | 39 52·88 | 2 16 33·00 | 23·71 | 3 44·90 | 54·58 | | | | | |
| | L | | | | | | | | 52 6 | 41 49·14 | 1 47 29·10 | 14·68 | 3 51·88 | 52·53 | | | | | |
| | R | | | | | | | | 59 20 | 49 4·08 | 0 1 15·00 | 0·00 | 4 9·04 | 55·01 | π+(° 1 38′)+{ R 56″·295 / L 54·598 } | F.R. 6 ..... F.L. 6 | | | |
| | R | | | | | | | | 61 48 | 51 32·40 | 0 38 19·80 | 1·86 | 4 9·20 | 57·03 | | | | | |
| | L | | | | | | | | 68 30 | 58 15·27 | 2 19 2·85 | 24·47 | 3 45·74 | 56·18 | | | | | |
| | L | | | | | | | | 70 30 | 60 15·53 | 2 49 6·75 | 36·17 | 3 32·14 | 54·28 | | | | | |
| | R | | | | | | | | 78 58 | 68 44·64 | 4 56 23·40 | 110·81 | 2 20·44 | 57·22 | | | | | |
| | R | | | | | | | | 81 16 | 71 2·94 | 5 30 57·90 | 138·07 | 1 53·18 | 57·22 | | | | | |
| Dec. 7th 18° & 198° | R | ε Ursæ Minoris | ° ′ ″ 7 42 41·12 | E. 8° 25′ 14″·26 | H. M. S. 17 2 33·31 | H. M. S. 5 46 25·75 | H. M. S. 11 16 7·56 | | H. 16+ M. S. 48 20 | H. 10+ M. S. 39 37·98 | ° ′ ″ 9 7 23·70 | ″ 375·87 | 6°+ ′ ″ 40 4·00 | π+1° 38′ ″ 54·39 | | H. M. S. 23 32 46·13 γ Cephei | H. M. S. (5 42 56·0+0·37)=5 42 56·37 | H. M. S. 6 10 10·24 | M. S. 3 7·24 |
| | R | | | | | | | | 50 20 | 41 38·25 | 8 37 19·65 | 335·95 | 40 40·60 | 57·71 | | | | | |
| | L | | | | | | | | 57 51 | 49 10·24 | 6 44 19·80 | 205·75 | 42 51·72 | 56·79 | | | | | |
| | L | | | | | | | | 59 44 | 51 3·49 | 6 16 1·05 | 178·05 | 43 20·08 | 56·13 | | | | | |
| | R | | | | | | | | 66 42 | 58 2·42 | 4 31 17·10 | 92·89 | 44 44·58 | 56·79 | | | | | |
| | R | | | | | | | | 69 0 | 60 20·72 | 3 56 42·60 | 70·77 | 45 5·98 | 57·51 | | | | | |
| | L | | | | | | | | 76 36 | 67 57·73 | 2 2 27·45 | 18·98 | 45 59·10 | 56·18 | | | | | |
| | L | | | | | | | | 78 17 | 69 38·95 | 1 37 9·15 | 11·95 | 46 6·28 | 56·03 | π+(° 1 38′)+{ R 56″·399 / L 55·748 } | F.R. 8 ..... F.L. 6 | | | |
| | R | | | | | | | | 85 0 | 76 22·84 | 0 3 49·20 | 0·02 | 46 16·60 | 57·64 | | | | | |
| | R | | | | | | | | 86 44 | 78 7·07 | 0 29 52·65 | 1·13 | 46 17·52 | 55·61 | | | | | |
| | L | | | | | | | | 92 16 | 83 39·81 | 1 53 3·75 | 16·25 | 46 3·40 | 54·61 | | | | | |
| | L | | | | | | | | 94 9 | 85 33·06 | 2 21 22·50 | 25·41 | 45 54·10 | 54·75 | | | | | |
| | R | | | | | | | | 100 56 | 92 20·95 | 4 3 20·85 | 75·41 | 45 1·00 | 57·85 | | | | | |
| | R | | | | | | | | 103 18 | 94 43·27 | 4 38 55·65 | 99·13 | 44 41·44 | 53·69 | | | | | |
| Dec. 8th 27° & 207° | R | ε Ursæ Minoris | ° ′ ″ 7 42 41·52 | E. 8° 25′ 14·70 | H. M. S. 17 2 33·28 | H. M. S. 5 46 25·74 | H. M. S. 11 16 7·54 | | H. 16+ M. S. 48 20 | H. 10+ M. S. 42 48·90 | ° ′ ″ 8 19 39·60 | ″ 313·53 | 6°+ ′ ″ 41 3·18 | π+1° 38′ ″ 57·99 | | H. M. S. 23 32 46·04 γ Cephei | H. M. S. (5 39 46·0−0·22)=5 39 45·78 | H. M. S. 6 6 59·74 | M. S. 3 10·50 |
| | R | | | | | | | | 49 58 | 44 27·12 | 7 55 6·30 | 283·63 | 41 30·80 | 60·27 | | | | | |
| | L | | | | | | | | 56 25 | 50 54·97 | 6 18 8·55 | 180·07 | 43 17·56 | 57·07 | | | | | |
| | L | | | | | | | | 58 17 | 52 47·22 | 5 50 4·80 | 154·42 | 43 44·12 | 56·16 | | | | | |
| | R | | | | | | | | 66 6 | 60 37·26 | 3 52 34·20 | 68·32 | 45 6·90 | 59·48 | | | | | |
| | R | | | | | | | | 68 2 | 62 33·51 | 3 23 30·45 | 52·34 | 45 23·36 | 59·00 | | | | | |
| | L | | | | | | | | 74 1 | 68 33·31 | 1 53 33·45 | 16·33 | 46 3·46 | 54·91 | | | | | |
| | L | | | | | | | | 76 8 | 70 40·59 | 1 21 44·25 | 8·46 | 46 10·64 | 55·60 | π+(° 1 38′)+{ R 58″·968 / L 55·482 } | F.R. 8 ..... F.L. 6 | | | |
| | R | | | | | | | | 82 15 | 76 48·40 | 0 10 12·90 | 0·13 | 46 15·40 | 59·17 | | | | | |
| | R | | | | | | | | 84 50 | 79 23·74 | 0 49 3·00 | 3·05 | 46 13·52 | 58·13 | | | | | |
| | L | | | | | | | | 89 50 | 84 24·40 | 2 4 12·90 | 19·61 | 45 59·20 | 55·89 | | | | | |
| | L | | | | | | | | 91 45 | 86 19·66 | 2 33 1·80 | 29·78 | 45 51·66 | 53·26 | | | | | |
| | R | | | | | | | | 98 26 | 93 1·54 | 4 13 30·00 | 81·85 | 44 53·04 | 59·81 | | | | | |
| | R | | | | | | | | 100 20 | 94 55·80 | 4 42 3·90 | 101·37 | 44 35·44 | 57·89 | | | | | |



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G. T. Station Bhimbet Lat. 22° 50′ 2″ Long. 77° 39′ 42″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Siderial Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 25th 0° & 180° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·12 | W. ° ′ ″ 3 42 6·71 | h. m. s. 18 23 52·12 | h. m. s. 5 54 14·80 | h. m. s. 0 18 6·92 | h. m. s. 6 11 | | h. m. s. 52 33·37 | ° ′ ″ 6 23 23·25 | ″ 82·84 | ° ′ ″ 26 56·74 | ″ 40·61 | π+16° 7′ | | | h. m. s. 1 15 59·23 θ′ Ceti | h. m. s. (6 29 26+0·00)=6 29 26·00 | h. m. s. 5 13 26·77 | |
| | L | | | | | | | 8 42 | | 55 4·70 | 5 45 33·30 | 67·29 | 26 42·16 | 41·58 | | | | | | |
| | R | | | | | | | 17 4 | | 63 27·79 | 3 39 46·95 | 27·21 | 25 57·30 | 36·80 | | | | | | |
| | R | | | | | | | 19 17 | | 65 41·08 | 3 6 27·60 | 19·58 | 25 50·06 | 37·19 | | | | | | |
| | L | | | | | | | 26 9 | | 72 33·98 | 1 23 14·10 | 3·90 | 25 35·78 | 38·59 | | | | | | |
| | L | | | | | | | 31 10 | | 77 35·63 | 0 7 49·35 | 0·03 | 25 33·08 | 39·76 | | | | | | |
| | R | | | | | | | 39 6 | | 85 32·67 | 1 51 26·25 | 6·98 | 25 36·42 | 36·15 | | | | | | |
| | R | | | | | | | 41 44 | | 88 11·01 | 2 31 1·35 | 12·82 | 25 43·64 | 37·53 | | | | | | |
| | L | | | | | | | 49 20 | | 95 48·00 | 4 25 16·20 | 39·49 | 26 12·48 | 39·70 | | | | | | |
| | L | | | | | | | 51 12 | | 97 40·24 | 4 53 19·80 | 48·28 | 26 20·42 | 38·85 | | | | | | |
| | R | | | | | | | 57 10 | | 103 39·02 | 6 23 1·50 | 82·23 | 26 52·52 | 37·00 | | | | | | |
| | R | | | | | | | 60 14 | | 106 43·42 | 7 9 7·50 | 103·15 | 27 12·82 | 36·38 | | | | | | |
| Dec. 25th 0° & 180° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·12 | E. ° ′ ″ 3 42 6·94 | h. m. s. 18 23 52·07 | h. m. s. 5 54 14·79 | h. m. s. 12 29 37·28 | h. m. s. 3 45 | | h. m. s. 51 40·96 | ° ′ ″ 9 29 4·80 | ″ 181·05 | ° ′ ″ 46 42·24 | ″ 36·35 | π+16° 7′ | | | h. m. s. 1 15 59·23 θ′ Ceti | h. m. s. (6 29 26+0·00)=6 29 26·00 | h. m. s. 5 13 26·77 | |
| | L | | | | | | | 6 44 | | 54 40·35 | 8 44 13·95 | 153·74 | 47 8·94 | 35·74 | | | | | | |
| | R | | | | | | | 14 35 | | 62 32·38 | 6 46 13·50 | 92·46 | 48 8·58 | 34·10 | | | | | | |
| | R | | | | | | | 17 30 | | 65 27·76 | 6 2 22·80 | 73·62 | 48 26·10 | 32·78 | | | | | | |
| | L | | | | | | | 25 29 | | 73 27·80 | 4 2 22·20 | 32·98 | 49 9·60 | 35·64 | | | | | | |
| | L | | | | | | | 27 29 | | 75 28·06 | 3 32 18·30 | 25·31 | 49 17·36 | 35·73 | | | | | | |
| | R | | | | | | | 35 40 | | 83 40·13 | 1 29 17·25 | 4·48 | 49 38·76 | 36·30 | | | | | | |
| | R | | | | | | | 37 45 | | 85 45·40 | 0 57 58·20 | 1·89 | 49 39·68 | 34·63 | | | | | | |
| | L | | | | | | | 44 20 | | 92 21·26 | 0 40 59·70 | 0·95 | 49 42·36 | 36·37 | | | | | | |
| | L | | | | | | | 46 10 | | 94 11·50 | 1 8 33·30 | 2·65 | 49 40·22 | 35·93 | | | | | | |
| | R | | | | | | | 53 16 | | 101 18·42 | 2 55 17·10 | 17·30 | 49 22·82 | 33·18 | | | | | | |
| | R | | | | | | | 55 32 | | 103 34·72 | 3 29 21·60 | 24·69 | 49 16·30 | 34·05 | | | | | | |
| | L | | | | | | | 62 8 | | 110 11·58 | 5 8 34·50 | 53·66 | 48 50·24 | 36·96 | | | | | | |
| | L | | | | | | | 64 20 | | 112 23·86 | 5 41 38·70 | 65·78 | 48 37·78 | 36·62 | | | | | | |
| Dec. 26th 9° & 189° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·31 | W. ° ′ ″ 3 42 7·15 | h. m. s. 18 23 52·03 | h. m. s. 5 54 14·79 | h. m. s. 0 18 6·82 | h. m. s. 2 24 | | h. m. s. 51 53·70 | ° ′ ″ 6 33 16·80 | ″ 87·18 | ° ′ ″ 26 59·38 | ″ 39·35 | π+16° 7′ | | | h. m. s. 1 15 59·22 θ′ Ceti | h. m. s. (6 26 18·6−0·02)=6 26 18·58 | h. m. s. 5 10 19·37 | h. m. s. −3 7·41 |
| | L | | | | | | | 4 8 | | 53 37·92 | 6 7 13·50 | 76·01 | 26 47·16 | 38·30 | | | | | | |
| | R | | | | | | | 10 40 | | 60 10·77 | 4 29 0·75 | 40·78 | 26 12·66 | 39·03 | | | | | | |
| | R | | | | | | | 12 29 | | 62 0·01 | 4 1 42·15 | 32·91 | 26 3·98 | 38·22 | | | | | | |
| | L | | | | | | | 20 1 | | 69 32·99 | 2 8 27·45 | 9·29 | 25 41·16 | 39·02 | | | | | | |
| | L | | | | | | | 21 40 | | 71 12·21 | 1 43 39·15 | 6·05 | 25 39·54 | 40·64 | | | | | | |
| | R | | | | | | | 28 40 | | 78 13·12 | 0 1 34·50 | 0·00 | 25 31·60 | 38·75 | | | | | | |
| | R | | | | | | | 30 54 | | 80 27·41 | 0 35 8·85 | 0·69 | 25 32·56 | 39·02 | | | | | | |
| | L | | | | | | | 39 20 | | 88 54·51 | 2 41 55·35 | 14·73 | 25 47·24 | 39·66 | | | | | | |
| | L | | | | | | | 41 12 | | 90 46·76 | 3 9 59·10 | 20·27 | 25 51·68 | 38·56 | | | | | | |
| | R | | | | | | | 47 40 | | 97 15·60 | 4 47 11·70 | 46·28 | 26 18·12 | 38·99 | | | | | | |
| | R | | | | | | | 49 22 | | 98 57·82 | 5 12 45·00 | 54·87 | 26 26·08 | 38·36 | | | | | | |
| Dec. 26th 9° & 189° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·46 | E. ° ′ ″ 3 42 7·31 | h. m. s. 18 23 51·98 | h. m. s. 5 54 14·78 | h. m. s. 12 29 37·20 | h. m. s. 6 28 | | h. m. s. 57 33·80 | ° ′ ″ 8 0 51·00 | ″ 129·43 | ′ ″ 47 35·58 | ″ 37·70 | π+16° 7′ | | | h. m. s. 1 15 59·22 θ′ Ceti | h. m. s. (6 26 18·6−0·02)=6 26 18·58 | h. m. s. 5 10 19·37 | h. m. s. −3 7·41 |
| | L | | | | | | | 8 49 | | 59 55·11 | 7 25 31·35 | 111·16 | 47 53·38 | 37·23 | | | | | | |
| | R | | | | | | | 16 22 | | 67 29·12 | 5 32 1·20 | 61·83 | 48 38·60 | 33·12 | | | | | | |
| | R | | | | | | | 18 15 | | 69 22·37 | 5 3 42·45 | 51·75 | 48 49·40 | 33·84 | | | | | | |
| | L | | | | | | | 25 51 | | 76 59·38 | 3 9 27·30 | 20·16 | 49 24·28 | 37·13 | | | | | | |
| | L | | | | | | | 28 8 | | 79 16·68 | 2 35 7·80 | 13·52 | 49 30·84 | 37·05 | | | | | | |
| | R | | | | | | | 34 51 | | 86 0·58 | 0 54 9·30 | 1·65 | 49 42·40 | 36·74 | | | | | | |
| | R | | | | | | | 38 3 | | 89 13·00 | 0 6 3·00 | 0·02 | 49 41·62 | 34·33 | | | | | | |
| | L | | | | | | | 43 31 | | 94 41·73 | 1 16 7·95 | 3·26 | 49 43·42 | 39·37 | | | | | | |
| | L | | | | | | | 45 5 | | 96 15·94 | 1 39 41·10 | 5·59 | 49 39·80 | 38·08 | | | | | | |
| | R | | | | | | | 50 28 | | 101 39·65 | 3 0 36·75 | 18·37 | 49 22·30 | 33·36 | | | | | | |
| | R | | | | | | | 52 0 | | 103 11·86 | 3 23 39·90 | 23·37 | 49 17·26 | 33·32 | | | | | | |

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G. T. Station Bhimbet Lat. 22° 50′ 2″ Long. 77° 39′ 42″ A.D. 1838—*continued.*

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 27th 18° & 198° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·61 | ° ′ ″ W. 3 42 7·47 | H. M. S. 18 23 51·94 | H. M. S. 5 54 14·78 | H. M. S. 0 18 6·72 | H. 5+ M. S. 0 24 | | H. 23+ M. S. 53 4·78 | ° ′ ″ 6 15 29·10 | ″ 79·47 | ° ′ ″ 26 51·72 | ″ 39·72 | | | H. M. S. 1 15 59·21 | H. M. S. (6 23 7·4+0·03)=6 23 7·43 | H. M. S. 5 7 8·22 | M. S. −3 11·14 |
| | L | | | | | | | 2 20 | | 55 1·03 | 5 46 25·35 | 67·64 | 26 40·24 | 40·07 | | | θ′ Ceti | | | |
| | R | | | | | | | 9 48 | | 62 30·03 | 3 54 10·35 | 30·89 | 26 3·28 | 39·86 | | | | | | |
| | R | | | | | | | 11 35 | | 64 17·26 | 3 27 21·90 | 24·22 | 25 55·94 | 39·19 | | | | | | |
| | L | | | | | | | 19 52 | | 72 35·36 | 1 22 50·40 | 3·86 | 25 37·56 | 41·17 | | | | | | |
| | L | | | | | | | 25 10 | | 77 54·07 | 0 3 9·75 | 0·01 | 25 33·14 | 40·60 | | | | | | |
| | R | | | | | | | 33 25 | | 86 10·17 | 2 0 51·75 | 8·21 | 25 39·22 | 38·48 | | | | | | |
| | R | | | | | | | 36 10 | | 88 55·53 | 2 42 12·15 | 14·78 | 25 45·94 | 38·63 | | | | | | |
| | L | | | | | | | 44 10 | | 96 56·60 | 4 42 28·20 | 44·78 | 26 17·30 | 39·99 | | | | | | |
| | L | | | | | | | 46 0 | | 98 46·84 | 5 10 1·80 | 53·92 | 26 31·42 | 44·97 | | | | | | |
| | R | | | | | | | 53 15 | | 106 2·81 | 6 59 1·35 | 98·37 | 27 9·72 | 38·82 | | | | | | |
| | R | | | | | | | 55 39 | | 108 27·13 | 7 35 6·15 | 115·98 | 27 28·04 | 39·53 | | | | | | |
| Dec. 27th 18° & 198° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·76 | ° ′ ″ E. 3 42 7·63 | H. M. S. 18 23 51·90 | H. M. S. 5 54 14·77 | H. M. S. 12 29 37·13 | H. 17+ M. S. 1 29 | | H. 11+ M. S. 55 43·63 | ° ′ ″ 8 28 22·50 | ″ 144·62 | ° ′ ″ 47 18·92 | ″ 35·91 | | | H. M. S. 1 15 59·21 | H. M. S. (6 23 7·4+0·03)=6 23 7·43 | H. M. S. 5 7 8·22 | M. S. −3 11·14 |
| | L | | | | | | | 3 41 | | 57 55·92 | 7 55 18·15 | 126·47 | 47 38·78 | 37·62 | | | θ′ Ceti | | | |
| | R | | | | | | | 14 29 | | 68 45·32 | 5 12 57·15 | 54·94 | 48 47·86 | 35·17 | | | | | | |
| | R | | | | | | | 18 39 | | 72 55·86 | 4 10 19·05 | 35·18 | 49 6·84 | 34·39 | | | | | | |
| | L | | | | | | | 25 50 | | 80 7·79 | 2 22 20·10 | 11·39 | 49 34·84 | 38·60 | | | | | | |
| | L | | | | | | | 28 1 | | 82 19·07 | 1 49 30·90 | 6·74 | 49 38·24 | 37·35 | | | | | | |
| | R | | | | | | | 35 30 | | 89 49·05 | 0 2 58·80 | 0·00 | 49 41·50 | 33·87 | | | | | | |
| | R | | | | | | | 37 4 | | 91 23·25 | 0 26 31·80 | 0·40 | 49 40·30 | 33·07 | | | | | | |
| | L | | | | | | | 42 10 | | 96 29·91 | 1 43 11·70 | 6·00 | 49 38·64 | 37·01 | | | | | | |
| | L | | | | | | | 45 10 | | 99 30·30 | 2 28 17·55 | 12·38 | 49 33·12 | 37·87 | | | | | | |
| | R | | | | | | | 50 34 | | 104 55·00 | 3 49 28·05 | 29·67 | 49 11·76 | 33·80 | | | | | | |
| | R | | | | | | | 52 13 | | 106 34·22 | 4 14 16·35 | 36·43 | 49 4·22 | 33·02 | | | | | | |
| Dec. 28th 27° & 207° | L | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·91 | ° ′ ″ W. 3 42 7·80 | H. M. S. 18 23 51·86 | H. M. S. 5 54 14·77 | H. M. S. 0 18 6·63 | H. 4+ M. S. 57 20 | | H. 23+ M. S. 53 7·54 | ° ′ ″ 6 14 46·35 | ″ 79·17 | ° ′ ″ 26 49·98 | ″ 38·61 | | | H. M. S. 1 15 59·21 | H. M. S. (6 23 7·4+0·03)=6 23 7·43 | | |
| | L | | | | | | | 59 16 | | 55 3·79 | 5 45 42·60 | 67·36 | 26 39·06 | 39·50 | | | θ′ Ceti | | | |
| | R | | | | | | | 64 45 | | 60 33·50 | 4 23 16·95 | 39·06 | 26 7·26 | 36·00 | | | | | | |
| | R | | | | | | | 66 11 | | 61 59·69 | 4 1 44·10 | 32·92 | 26 2·30 | 37·18 | | | | | | |
| | L | | | | | | | 71 3 | | 66 52·32 | 2 48 34·65 | 16·01 | 25 49·20 | 40·99 | | | | | | |
| | L | | | | | | | 72 22 | | 68 11·49 | 2 28 47·10 | 12·47 | 25 44·40 | 39·73 | | | | | | |
| | R | | | | | | | 79 10 | | 75 0·37 | 0 46 33·90 | 1·22 | 25 30·78 | 37·36 | | | | | | |
| | R | | | | | | | 82 26 | | 78 16·80 | 0 2 32·55 | 0·00 | 25 29·22 | 37·02 | | | | | | |
| | L | | | | | | | 87 29 | | 83 20·45 | 1 18 27·30 | 3·46 | 25 37·66 | 42·00 | | | | | | |
| | L | | | | | | | 88 58 | | 84 49·64 | 1 40 45·15 | 5·71 | 25 38·92 | 41·01 | | | | | | |
| | R | | | | | | | 93 26 | | 89 18·22 | 2 47 53·85 | 15·84 | 25 43·82 | 35·78 | | | | | | |
| | R | | | | | | | 95 0 | | 90 52·43 | 3 11 27·00 | 20·59 | 25 50·34 | 37·55 | | | | | | |
| Dec. 28th 27° & 207° | R | ∂ Ursæ Minoris | ° ′ ″ 3 24 42·06 | ° ′ ″ E. 3 42 7·96 | H. M. S. 18 23 51·83 | H. M. S. 5 54 14·76 | H. M. S. 12 29 37·07 | H. 16+ M. S. 57 35 | | H. 11+ M. S. 54 56·02 | ° ′ ″ 8 40 15·75 | ″ 151·44 | ° ′ ″ 47 13·50 | ″ 36·98 | | | H. M. S. 1 15 59·21 | H. M. S. (6 23 7·4+0·03)=6 23 7·43 | | |
| | R | | | | | | | 59 36 | | 56 57·28 | 8 9 56·85 | 134·36 | 47 28·54 | 34·94 | | | θ′ Ceti | | | |
| | L | | | | | | | 72 1 | | 69 23·89 | 5 3 17·70 | 51·61 | 48 50·30 | 33·95 | | | | | | |
| | L | | | | | | | 74 37 | | 72 0·23 | 4 24 12·60 | 39·18 | 49 4·82 | 36·04 | | | | | | |
| | R | | | | | | | 81 5 | | 78 29·07 | 2 47 0·00 | 15·67 | 49 26·98 | 34·69 | | | | | | |
| | R | | | | | | | 83 8 | | 80 32·33 | 2 16 11·10 | 10·42 | 49 31·22 | 33·68 | | | | | | |
| | L | | | | | | | 92 20 | | 89 45·53 | 0 2 6·90 | 0·00 | 49 45·28 | 37·32 | | | | | | |
| | L | | | | | | | 94 10 | | 91 35·77 | 0 29 40·50 | 0·50 | 49 43·54 | 36·08 | | | | | | |
| | R | | | | | | | 99 50 | | 97 16·50 | 1 54 51·45 | 7·43 | 49 34·00 | 33·47 | | | | | | |
| | R | | | | | | | 101 45 | | 99 11·75 | 2 23 40·20 | 11·62 | 49 28·86 | 32·52 | | | | | | |
| | L | | | | | | | 107 51 | | 105 18·54 | 3 55 22·05 | 31·21 | 49 12·48 | 35·73 | | | | | | |
| | L | | | | | | | 109 37 | | 107 4·77 | 4 21 55·50 | 38·66 | 49 7·56 | 38·26 | | | | | | |

Observed transit of θ′ Ceti—29th Dec. for Time and Rate of Chronometer.

*'s A.R. H. 1 M. 15 S. 59·19 Chron. Time (H. 6 M. 16 S. 54·4 + 0·03) = H. 6 M. 16 S. 54·43. Error H. 5 M. 0 S. 55·24. Rate M. 3 S. 6·49.

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G. T. Station Nilgarh Lat. 21° 45′ 50″ Long. 77° 41′ 46″ A.D. 1839.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ✱'s Transit. | | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | ∂ P | ∂ Z | | | | | A.R. | Chronom. Time. | Error. | Rate. |
| Feb. 14th 0° & 180° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 16.81 | E. ° ′ ″ 5 19 5.21 | h. m. s. 10 5 25.04 | h. m. s. 5 52 5.54 | h. m. s. 4 13 19.50 | h.6+ m. s. 30 19 | | h.3+ m. s. 59 13.85 | ° ′ ″ 3 31 24.75 | ″ 35.95 | 127°+ m. s. 14 19.12 | π+132° 32′ ″ 48.38 | π+(13° 32′)+{L 48.617 R 46.867} | F.R. 6 ..... F.L. 6 | h. m. s. 5 6 49.23 β Orionis | h. m. s. (7 44 2)—(6 16.51)=7 37 45.49 | h. m. s. 2 30 56.26 | |
| | L | | | | | | | 33 14 | | 62 9.23 | 2 47 34.05 | 22.60 | 14 7.36 | 49.97 | | | | | | |
| | R | | | | | | | 40 44 | | 69 40.22 | 0 54 49.20 | 2.42 | 13 45.06 | 47.85 | | | | | | |
| | R | | | | | | | 42 50 | | 71 46.50 | 0 23 15.00 | 0.44 | 13 42.50 | 47.27 | | | | | | |
| | L | | | | | | | 50 0 | | 78 57.44 | 1 24 29.10 | 5.76 | 13 50.84 | 50.29 | | | | | | |
| | L | | | | | | | 52 20 | | 81 17.75 | 1 59 33.75 | 11.54 | 13 54.24 | 47.91 | | | | | | |
| | R | | | | | | | 59 36 | | 88 34.71 | 3 48 48.15 | 42.29 | 14 23.24 | 46.16 | | | | | | |
| | R | | | | | | | 61 51 | | 90 50.00 | 4 22 37.50 | 55.73 | 14 37.08 | 46.56 | | | | | | |
| | L | | | | | | | 70 18 | | 99 18.12 | 6 29 39.30 | 122.78 | 15 44.48 | 46.91 | | | | | | |
| | L | | | | | | | 72 16 | | 101 16.38 | 6 59 13.20 | 142.13 | 16 5.16 | 48.24 | | | | | | |
| | R | | | | | | | 80 40 | | 109 41.49 | 9 5 29.85 | 240.76 | 17 43.32 | 47.77 | | | | | | |
| | R | | | | | | | 82 33 | | 111 34.73 | 9 33 48.45 | 266.42 | 18 6.80 | 45.59 | | | | | | |
| Feb. 15th 9° & 189° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 16.47 | E. ° ′ ″ 5 19 4.85 | h. m. s. 10 5 25.10 | h. m. s. 5 52 5.55 | h. m. s. 4 13 19.55 | h.6+ m. s. 17 43 | | h.3+ m. s. 49 46.10 | ° ′ ″ 5 53 21.75 | ″ 100.24 | 127°+ m. s. 15 26.42 | π+132° 32′ ″ 51.03 | π+(13° 32′)+{L 50.007 R 48.382} | F.R. 6 ..... F.L. 6 | h. m. s. 5 6 49.22 β Orionis | h. m. s. (7 36 46)—(2 10.02)=7 34 35.98 | h. m. s. 2 27 46.76 | |
| | L | | | | | | | 20 5 | | 52 8.41 | 5 17 47.10 | 81.11 | 15 6.48 | 50.22 | | | | | | |
| | R | | | | | | | 28 10 | | 60 14.48 | 3 16 16.05 | 30.99 | 14 16.10 | 49.96 | | | | | | |
| | R | | | | | | | 30 29 | | 62 33.78 | 2 41 26.55 | 20.98 | 14 5.12 | 48.99 | | | | | | |
| | L | | | | | | | 37 20 | | 69 25.69 | 0 58 27.90 | 2.75 | 13 49.68 | 51.78 | | | | | | |
| | L | | | | | | | 42 20 | | 74 26.35 | 0 16 42.00 | 0.23 | 13 44.64 | 49.26 | | | | | | |
| | R | | | | | | | 49 54 | | 82 1.34 | 2 10 26.85 | 13.74 | 13 57.70 | 48.81 | | | | | | |
| | R | | | | | | | 51 50 | | 83 57.60 | 2 39 30.75 | 20.54 | 14 3.12 | 47.43 | | | | | | |
| | L | | | | | | | 59 1 | | 91 9.55 | 4 27 30.00 | 57.82 | 14 42.36 | 49.39 | | | | | | |
| | L | | | | | | | 60 42 | | 92 50.77 | 4 52 48.30 | 69.29 | 14 52.80 | 48.36 | | | | | | |
| | R | | | | | | | 68 23 | | 100 32.78 | 6 48 18.45 | 134.82 | 15 58.14 | 48.17 | | | | | | |
| | R | | | | | | | 70 26 | | 102 36.05 | 7 19 7.50 | 155.96 | 16 18.04 | 46.93 | | | | | | |
| Feb. 15th 9° & 189° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 16.29 | W. ° ′ ″ 5 19 4.65 | h. m. s. 10 5 25.12 | h. m. s. 5 52 5.56 | h. m. s. 15 57 30.68 | h.17+ m. s. 39 24 | | 15°+ m. s. 12 56.21 | ° ′ ″ 11 8 37.05 | ″ 361.78 | 137°+ m. s. 45 52.76 | π+132° 32′ ″ 49.89 | π+(13° 32′)+{L 47.230 R 48.470} | F.R. 6 ..... F.L. 6 | h. m. s. 5 6 49.22 β Orionis | h. m. s. (7 36 46)—(2 10.02)=7 34 35.98 | h. m. s. 2 27 46.76 | |
| | L | | | | | | | 41 53 | | 15 25.54 | 10 31 17.10 | 322.49 | 46 28.86 | 46.70 | | | | | | |
| | R | | | | | | | 51 10 | | 24 43.75 | 8 11 43.95 | 195.61 | 48 37.80 | 48.76 | | | | | | |
| | R | | | | | | | 53 42 | | 27 16.08 | 7 33 39.00 | 166.46 | 49 6.22 | 48.03 | | | | | | |
| | L | | | | | | | 61 36 | | 35 11.11 | 5 34 53.35 | 90.66 | 50 20.06 | 46.07 | | | | | | |
| | L | | | | | | | 63 39 | | 37 14.38 | 5 4 4.50 | 74.73 | 50 35.94 | 46.02 | | | | | | |
| | R | | | | | | | 70 33 | | 44 9.28 | 3 20 21.00 | 32.42 | 51 21.02 | 48.79 | | | | | | |
| | R | | | | | | | 72 52 | | 46 28.58 | 2 45 31.50 | 22.12 | 51 30.24 | 47.71 | | | | | | |
| | L | | | | | | | 79 30 | | 53 7.45 | 1 5 48.45 | 3.49 | 51 48.92 | 47.76 | | | | | | |
| | L | | | | | | | 82 40 | | 56 17.86 | 0 18 12.30 | 0.27 | 51 51.32 | 46.94 | | | | | | |
| | R | | | | | | | 88 14 | | 61 52.59 | 1 5 28.65 | 3.45 | 51 50.84 | 49.64 | | | | | | |
| | R | | | | | | | 95 0 | | 68 39.47 | 2 47 11.85 | 22.50 | 51 30.04 | 47.89 | | | | | | |
| Feb. 16th 18° & 198° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 16.12 | E. ° ′ ″ 5 19 4.47 | h. m. s. 10 5 25.14 | h. m. s. 5 52 5.56 | h. m. s. 4 13 19.58 | h.6+ m. s. 17 17 | | h.3+ m. s. 52 28.17 | ° ′ ″ 5 12 51.15 | ″ 78.62 | 127°+ m. s. 15 4.82 | π+132° 32′ ″ 50.67 | π+(13° 32′)+{L 48.535 R 51.090} | F.R. 6 ..... F.L. 6 | h. m. s. 5 6 49.20 β Orionis | h. m. s. (7 31 28.4)—(0.06)=7 31 28.34 | h. m. s. 2 24 39.14 | |
| | L | | | | | | | 21 3 | | 56 14.66 | 4 16 13.80 | 52.78 | 14 35.92 | 47.61 | | | | | | |
| | R | | | | | | | 28 55 | | 64 7.69 | 2 17 58.35 | 15.33 | 14 3.00 | 52.14 | | | | | | |
| | R | | | | | | | 30 50 | | 66 2.94 | 1 49 9.60 | 9.60 | 13 56.02 | 50.89 | | | | | | |
| | L | | | | | | | 36 30 | | 71 43.68 | 0 23 58.50 | 0.46 | 13 45.50 | 49.51 | | | | | | |
| | L | | | | | | | 38 35 | | 73 48.95 | 0 7 20.55 | 0.04 | 13 43.66 | 48.09 | | | | | | |
| | R | | | | | | | 47 20 | | 82 35.10 | 2 18 52.80 | 15.57 | 14 2.34 | 51.24 | | | | | | |
| | R | | | | | | | 49 50 | | 85 5.42 | 2 56 27.60 | 25.15 | 14 10.96 | 50.28 | | | | | | |
| | L | | | | | | | 60 2 | | 95 18.75 | 5 29 47.55 | 87.92 | 15 12.08 | 48.63 | | | | | | |
| | L | | | | | | | 62 51 | | 98 8.12 | 6 12 8.10 | 111.97 | 15 34.20 | 46.70 | | | | | | |
| | R | | | | | | | 70 19 | | 105 37.10 | 8 4 22.80 | 189.79 | 16 57.04 | 51.72 | | | | | | |
| | R | | | | | | | 72 53 | | 108 11.43 | 8 42 57.75 | 221.26 | 17 27.06 | 50.27 | | | | | | |

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## G. T. Station Nilgarh Lat. 21° 45′ 50″ Long. 77° 41′ 46″ A.D. 1839.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 16th 18° & 198° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 15·96 | W. 5° 19′ 4″·30 | H. M. S. 10 5 25·15 | H. M. S. 5 52 5·57 | H. M. S. 15 57 30·72 | H. 17+ M. S. 29 14 | | H. 15+ M. S. 5 53·00 | ° ′ ″ 12 54 25·80 | ″ 485·35 | 137°+ ′ ″ 43 48·50 | π+132° 32′ ″ 49·55 | π+(132° 32′)+{ L 49″·190 R 48·872 } | F.R. 6 ..... F.L. 6 | H. M. S. 5 6 49·20 β Orionis | H. M. S. (7 31 28·4−0·06)=7 31 28·34 | H. M. S. 2 24 39·14 | M. S. 3 7·62 |
| | L | | | | | | | 32 30 | | 9 9·42 | 12 5 19·50 | 425·75 | 44 47·46 | 48·91 | | | | | | |
| | R | | | | | | | 41 18 | | 17 58·57 | 9 53 2·25 | 284·58 | 47 7·70 | 47·98 | | | | | | |
| | R | | | | | | | 43 44 | | 20 24·89 | 9 16 27·45 | 250·53 | 47 40·50 | 46·73 | | | | | | |
| | L | | | | | | | 52 40 | | 29 22·06 | 7 2 9·90 | 144·13 | 49 30·18 | 50·01 | | | | | | |
| | L | | | | | | | 55 13 | | 31 55·39 | 6 23 49·95 | 119·13 | 49 54·10 | 48·93 | | | | | | |
| | L | | | | | | | 62 35 | | 39 18·36 | 4 33 5·40 | 60·27 | 50 53·74 | 49·71 | | | | | | |
| | R | | | | | | | 65 58 | | 42 41·80 | 3 42 13·80 | 39·89 | 51 13·32 | 48·91 | | | | | | |
| | R | | | | | | | 76 0 | | 52 45·11 | 1 11 24·15 | 4·11 | 51 50·26 | 50·07 | | | | | | |
| | | | | | | | | 79 40 | | 56 25·59 | 0 16 16·95 | 0·21 | 51 51·76 | 47·67 | | | | | | |
| | R | | | | | | | 87 0 | | 63 46·55 | 1 33 57·45 | 7·11 | 51 48·08 | 50·89 | | | | | | |
| | R | | | | | | | 89 10 | | 65 56·83 | 2 6 31·65 | 12·89 | 51 40·42 | 49·01 | | | | | | |
| Feb. 17th 27° & 207° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 15·79 | E. 5° 19′ 4″·12 | H. M. S. 10 5 25·16 | H. M. S. 5 52 5·57 | H. M. S. 4 13 19·59 | H. 6+ M. S. 18 32 | | H. 3+ M. S. 56 51·55 | ° ′ ″ 4 7 0·60 | ″ 49·05 | 127°+ ′ ″ 14 35·60 | π+132° 32′ ″ 50·67 | π+(132° 32′)+{ L 49″·813 R 51·997 } | F.R. 6 ..... F.L. 6 | H. M. S. 5 6 49·19 β Orionis | H. M. S. (7 28 20·5+0·01)=7 28 20·51 | H. M. S. 2 21 31·32 | M. S. 3 7·82 |
| | L | | | | | | | 21 27 | | 59 46·94 | 3 23 9·75 | 33·20 | 14 18·82 | 49·74 | | | | | | |
| | R | | | | | | | 28 49 | | 67 9·90 | 1 32 25·35 | 6·88 | 13 56·44 | 53·68 | | | | | | |
| | R | | | | | | | 31 8 | | 69 29·20 | 0 57 35·85 | 2·67 | 13 51·14 | 52·59 | | | | | | |
| | L | | | | | | | 36 36 | | 74 57·92 | 0 24 34·95 | 0·49 | 13 46·24 | 49·87 | | | | | | |
| | L | | | | | | | 39 8 | | 77 30·25 | 1 2 39·90 | 3·17 | 13 49·32 | 50·27 | | | | | | |
| | R | | | | | | | 47 24 | | 85 47·33 | 3 6 56·10 | 28·22 | 14 17·00 | 52·90 | | | | | | |
| | R | | | | | | | 49 31 | | 87 54·60 | 3 38 45·15 | 38·65 | 14 24·72 | 50·19 | | | | | | |
| | L | | | | | | | 57 55 | | 96 19·70 | 5 45 1·65 | 96·24 | 15 21·86 | 49·74 | | | | | | |
| | L | | | | | | | 60 28 | | 98 53·04 | 6 23 21·75 | 118·83 | 15 43·30 | 48·59 | | | | | | |
| | R | | | | | | | 68 0 | | 106 26·02 | 8 16 36·45 | 199·50 | 17 7·58 | 52·20 | | | | | | |
| | R | | | | | | | 70 32 | | 108 58·35 | 8 54 41·40 | 231·30 | 17 37·60 | 50·42 | | | | | | |
| Feb. 17th 27° & 207° | R | 29 Camelopardalis Hev. | ° ′ ″ 4 56 15·64 | W. 5° 19′ 3″·95 | H. M. S. 10 5 25·16 | H. M. S. 5 52 5·57 | H. M. S. 15 57 30·73 | H. 17+ M. S. 32 24 | | H. 15+ M. S. 12 12·36 | ° ′ ″ 11 19 35·55 | ″ 373·74 | 137°+ ′ ″ 45 38·42 | π+132° 32′ ″ 48·21 | π+(132° 32′)+{ R 50″·142 L 49·035 } | F.R. 6 ..... F.L. 6 | H. M. S. 5 6 49·19 β Orionis | H. M. S. (7 28 20·5+0·01)=7 28 20·51 | H. M. S. 2 21 31·32 | M. S. 3 7·82 |
| | R | | | | | | | 34 45 | | 14 33·67 | 10 44 15·90 | 335·88 | 46 16·20 | 48·13 | | | | | | |
| | L | | | | | | | 43 41 | | 23 30·85 | 8 29 58·20 | 210·39 | 48 21·50 | 47·94 | | | | | | |
| | L | | | | | | | 46 6 | | 25 56·17 | 7 53 38·40 | 181·46 | 48 49·94 | 47·45 | | | | | | |
| | R | | | | | | | 55 0 | | 34 51·34 | 5 39 50·85 | 93·37 | 50 21·88 | 51·30 | | | | | | |
| | R | | | | | | | 56 58 | | 36 49·60 | 5 10 16·95 | 77·81 | 50 36·28 | 50·14 | | | | | | |
| | L | | | | | | | 66 40 | | 46 32·88 | 2 44 27·75 | 21·84 | 51 33·94 | 51·83 | | | | | | |
| | L | | | | | | | 68 51 | | 48 44·17 | 2 11 38·40 | 13·99 | 51 38·74 | 48·78 | | | | | | |
| | R | | | | | | | 76 30 | | 56 24·18 | 0 16 38·25 | 0·22 | 51 55·42 | 51·69 | | | | | | |
| | R | | | | | | | 78 50 | | 58 44·48 | 0 18 26·25 | 0·27 | 51 55·06 | 51·38 | | | | | | |
| | L | | | | | | | 87 29 | | 67 24·63 | 2 28 28·50 | 17·74 | 51 35·90 | 49·69 | | | | | | |
| | L | | | | | | | 90 9 | | 70 4·98 | 3 8 33·75 | 28·61 | 51 23·86 | 48·52 | | | | | | |
| Feb. 18th 0° & 180° | L | 29 Camelopardalis Hev. | ° ′ ″ 4 56 15·33 | W. 5° 19′ 3″·62 | H. M. S. 10 5 25·16 | H. M. S. 5 52 5·58 | H. M. S. 15 57 30·74 | H. 17+ M. S. 33 36 | | H. 15+ M. S. 16 34·46 | ° ′ ″ 10 14 4·20 | ″ 305·12 | 137°+ ′ ″ 46 50·40 | π+132° 32′ ″ 51·90 | π+(132° 32′)+{ L 50″·483 R 50·588 } | F.R. 6 ..... F.L. 6 | H. M. S. 5 6 49·17 β Orionis | H. M. S. (7 25 11−0·04)=7 25 10·96 | H. M. S. 2 18 21·79 | M. S. 3 9·53 |
| | L | | | | | | | 36 37 | | 19 35·86 | 9 28 43·20 | 261·69 | 47 31·78 | 49·85 | | | | | | |
| | R | | | | | | | 45 36 | | 28 36·05 | 7 13 40·35 | 152·10 | 49 22·52 | 51·00 | | | | | | |
| | R | | | | | | | 48 31 | | 31 31·43 | 6 29 49·65 | 122·88 | 49 49·80 | 49·06 | | | | | | |
| | L | | | | | | | 58 10 | | 41 11·71 | 4 4 45·45 | 48·40 | 51 6·36 | 51·14 | | | | | | |
| | L | | | | | | | 60 26 | | 43 28·00 | 3 30 41·10 | 35·85 | 51 17·42 | 49·65 | | | | | | |
| | R | | | | | | | 68 20 | | 51 23·05 | 1 31 55·35 | 6·82 | 51 47·10 | 50·30 | | | | | | |
| | R | | | | | | | 70 20 | | 53 23·31 | 1 1 51·45 | 3·09 | 51 51·74 | 51·21 | | | | | | |
| | L | | | | | | | 77 0 | | 60 4·19 | 0 38 21·75 | 1·19 | 51 53·18 | 50·75 | | | | | | |
| | L | | | | | | | 79 10 | | 62 14·48 | 1 10 56·10 | 4·05 | 51 49·18 | 49·61 | | | | | | |
| | R | | | | | | | 86 0 | | 69 5·38 | 2 53 39·60 | 24·27 | 51 32·50 | 53·15 | | | | | | |
| | R | | | | | | | 88 10 | | 71 15·66 | 3 26 13·80 | 34·21 | 51 18·22 | 48·81 | | | | | | |



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G. T. Station Badgaon Lat. 20° 44′ 23″ Long. 77° 38′ 59″ A.D. 1839.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 19th 0° & 180° | L | λ Ursæ Minoris | ° ′ ″ 1 10 30·50 | W. 1 ° 15 ′ 23″·73 | H. M. S. 20 21 3·21 | H. M. S. 5 58 13·18 | H. M. S. 2 19 16·39 | H. 8+ M. S. 9 53 | | H. 1+ M. S. 52 48·09 | ° ′ ″ 6 37 4·50 | ″ 30·16 | ° ′ ″ 14 53·76 | π + 0° 0′ + ″ 0·19 | π + (0° 0′) { L.+ 1″·330 R.— 1·585 } | F.R. 6 ..... F.L. 6 | | | | |
| | L | | | | | | | | | 55 46·50 | 5 52 28·35 | 23·77 | 15 0·62 | + 0·66 | | | | | | |
| | R | | | | | | | 12 51 | | 67 39·14 | 2 54 18·75 | 5·81 | 15 16·48 | — 1·44 | | | | | | |
| | R | | | | | | | 24 42 | | 70 42·56 | 2 8 27·45 | 3·16 | 15 19·18 | — 1·39 | | | | | | |
| | L | | | | | | | 27 45 | | 85 13·56 | 1 29 17·55 | 1·53 | 15 24·22 | + 2·02 | | | | | | |
| | L | | | | | | | 42 14 | | 87 28·88 | 2 3 7·35 | 2·90 | 15 22·04 | + 1·21 | | | | | | |
| | R | | | | | | | 44 29 | | 98 57·46 | 4 55 16·05 | 16·66 | 15 5·44 | — 1·63 | | | | | | |
| | R | | | | | | | 55 56 | | 102 34·96 | 5 49 38·55 | 23·35 | 14 59·20 | — 1·18 | | | | | | |
| | L | | | | | | | 59 33 | | 114 48·65 | 8 53 3·90 | 54·20 | 14 31·62 | + 2·09 | | | | | | |
| | L | | | | | | | 71 45 | | 118 22·14 | 9 46 26·25 | 65·56 | 14 19·98 | + 1·81 | | | | | | |
| | R | | | | | | | 75 18 | | 128 42·57 | 12 21 32·70 | 104·63 | 13 36·92 | — 2·18 | | | | | | |
| | R | | | | | | | 85 37 | | 131 34·96 | 13 4 38·55 | 117·08 | 13 24·96 | — 1·69 | | | | | | |
| | | | | | | | | 88 29 | | | | | | | | | | | | |
| Jan. 19th 0° & 180° | R | λ Ursæ Minoris | ° ′ ″ 1 10 30·65 | E. 1 ° 15 ′ 23″·89 | H. M. S. 20 21 3·07 | H. M. S. 5 58 13·18 | H. M. S. 14 22 49·89 | H. 20+ M. S. 5 57 | | H. 13+ M. S. 50 31·15 | ° ′ ″ 8 4 41·10 | ″ 44·83 | ° ′ ″ 14 39·65 | π + 0° 0′ — ″ 0·60 | π + (0° 0′) { R. + 1″·080 L. + 0·486 } | F.R. 7 ..... F.L. 8 | | | | |
| | R | | | | | | | 8 23 | | 52 57·49 | 7 28 6·00 | 38·33 | 14 45·32 | + 0·24 | | | | | | |
| | L | | | | | | | 20 14 | | 64 50·13 | 4 29 56·40 | 13·93 | 15 9·70 | + 0·26 | | | | | | |
| | L | | | | | | | 23 4 | | 67 40·52 | 3 47 20·55 | 9·88 | 15 13·06 | + 0·95 | | | | | | |
| | R | | | | | | | 35 24 | | 80 2·23 | 0 41 54·90 | 0·34 | 15 22·76 | + 0·79 | | | | | | |
| Jan. 20th 9° & 189° | L | λ Ursæ Minoris | ° ′ ″ 1 10 30·81 | E. 1 ° 15 ′ 24″·07 | H. M. S. 20 21 2·93 | H. M. S. 5 58 13·17 | H. M. S. 2 19 16·10 | H. 8+ M. S. 8 14 | | H. 1+ M. S. 54 28·08 | ° ′ ″ 6 12 0·30 | ″ 26·48 | ° ′ ″ 14 59·08 | π + 0° 0′ + ″ 1·49 | π + (0° 0′) { L.+ 0″·800 R.— 1·705 } | F.R. 6 ..... F.L. 6 | H. M. S. 3 37 56·30 | H. M. S. (9 51 28·3—0·36)=9 51 27·94 | H. M. S. 6 13 31·64 | |
| | L | | | | | | | 11 25 | | 57 39·52 | 5 24 8·70 | 20·10 | 15 5·08 | + 1·11 | | | | | | |
| | R | | | | | | | 22 32 | | 68 48·06 | 2 37 0·60 | 4·72 | 15 18·20 | — 1·15 | | | | | | |
| | R | | | | | | | 25 27 | | 71 43·46 | 1 53 9·60 | 2·45 | 15 20·18 | — 1·44 | | | | | | |
| | L | | | | | | | 36 15 | | 82 32·95 | 0 49 12·75 | 0·46 | 15 24·22 | + 0·61 | | | | | | |
| | L | | | | | | | 38 25 | | 84 43·25 | 1 21 47·25 | 1·28 | 15 23·18 | + 0·39 | | | | | | |
| | R | | | | | | | 52 34 | | 98 54·21 | 4 54 31·65 | 16·58 | 15 6·04 | — 1·45 | | | | | | |
| | R | | | | | | | 55 9 | | 101 29·57 | 5 33 22·05 | 21·23 | 15 1·54 | — 1·30 | | | | | | |
| | L | | | | | | | 69 42 | | 116 4·58 | 9 12 7·20 | 58·14 | 14 26·68 | + 0·75 | | | | | | |
| | L | | | | | | | 72 17 | | 118 39·94 | 9 50 57·60 | 66·58 | 14 17·94 | + 0·45 | | | | | | |
| | R | | | | | | | 86 19 | | 132 43·88 | 13 21 56·70 | 122·28 | 13 19·46 | — 2·33 | | | | | | |
| | R | | | | | | | 88 45 | | 135 10·22 | 13 58 31·80 | 133·63 | 13 7·88 | — 2·56 | | | | | | |
| Jan. 20th 9° & 189° | R | λ Ursæ Minoris | ° ′ ″ 1 10 30·96 | E. 1 ° 15 ′ 24″·23 | H. M. S. 20 21 2·80 | H. M. S. 5 58 13·17 | H. M. S. 2 19 16·63 | H. 19+ M. S. 59 2 | | H. 13+ M. S. 46 54·41 | ° ′ ″ 8 58 48·30 | ″ 55·37 | ° ′ ″ 14 28·00 | π + 0° 0′ + ″ 0·86 | π + (0° 0′) { R. + 2″·469 L.— 0·137 } | F.R. 10 ..... F.L. 6 | H. M. S. 3 37 56·30 | H. M. S. (9 51 28·3—0·36)=9 51 27·94 | H. M. S. 6 13 31·64 | |
| | R | | | | | | | 61 44 | | 49 36·79 | 8 18 12·60 | 47·36 | 14 35·06 | + 1·81 | | | | | | |
| | L | | | | | | | 75 5 | | 62 59·64 | 4 57 29·85 | 16·91 | 15 8·70 | — 1·38 | | | | | | |
| | L | | | | | | | 77 24 | | 65 18·96 | 4 22 40·05 | 13·19 | 15 12·32 | — 1·28 | | | | | | |
| | R | | | | | | | 89 40 | | 77 36·65 | 1 18 14·70 | 1·17 | 15 20·30 | + 2·76 | | | | | | |
| | R | | | | | | | 93 12 | | 81 9·14 | 0 25 7·35 | 0·12 | 15 22·22 | + 1·89 | | | | | | |
| Jan. 21st 18° & 198° | L | λ Ursæ Minoris | ° ′ ″ 1 10 31·11 | W. 1 ° 15 ′ 24·39 | H. M. S. 20 21 2·67 | H. M. S. 5 58 13·16 | H. M. S. 2 19 15·83 | H. 8+ M. S. 15 35 | | H. 2+ M. S. 5 9·31 | ° ′ ″ 3 31 37·80 | ″ 8·57 | ° ′ ″ 15 13·58 | π + 0° 0′ — ″ 2·24 | π + (0° 0′) { L.— 0″·451 R.+ 0·265 } | F.R. 10 ..... F.L. 10 | H. M. S. 3 37 56·29 | H. M. S. (9 48 8·9+0·27)=9 48 9·17 | H. M. S. 6 10 12·88 | |
| | L | | | | | | | 18 7 | | 7 41·66 | 2 53 32·55 | 5·76 | 15 17·60 | — 1·03 | | | | | | |
| | R | | | | | | | 30 6 | | 19 42·32 | 0 6 37·35 | 0·01 | 15 25·38 | + 1·00 | | | | | | |
| | R | | | | | | | 32 7 | | 21 43·60 | 0 36 56·55 | 0·26 | 15 24·30 | + 0·17 | | | | | | |
| | L | | | | | | | 48 10 | | 37 48·82 | 4 38 14·85 | 14·80 | 15 9·36 | — 0·23 | | | | | | |
| | L | | | | | | | 50 37 | | 40 16·16 | 5 15 4·95 | 18·97 | 15 4·38 | — 1·04 | | | | | | |
| | R | | | | | | | 66 32 | | 56 13·36 | 9 14 22·95 | 58·61 | 14 26·12 | + 0·34 | | | | | | |
| | R | | | | | | | 68 33 | | 58 14·64 | 9 44 42·15 | 65·18 | 14 19·10 | — 0·11 | | | | | | |
| | | | | | | | | | | M. S. 3 18·76 | | | | | | | | | | |

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G. T. Station Badgaon Lat. 20° 44′ 23″ Long. 77° 38′ 59″ A.D. 1839.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 22nd 27° & 207° | | λ Ursæ Minoris | ° ′ ″ 1 10 31·42 | ° ′ ″ W. 1 15 24·72 | H. M. S. 20 21 2·43 | H. M. S. 5 58 13·16 | H. M. S. 2 19 15·59 | H. 8+ M. S. | | H. 2+ M. S. | ° ′ ″ | ″ | 1°+ M. S. | π + 0° 0′ | | | H. M. S. | H. M. S. | H. M. S. | H. M. S. |
| | R | | | | | | | 10 13 | | 3 6·29 | 4 2 19·50 | 11·24 | 15 14·62 | + 1″·14 | | | | | | |
| | R | | | | | | | 13 18 | | 6 11·71 | 3 15 58·20 | 7·35 | 15 17·54 | + 0·17 | | | | | | |
| | L | | | | | | | 22 9 | | 15 3·94 | 1 2 54·75 | 0·76 | 15 24·42 | + 0·46 | | | | | | |
| | L | | | | | | | 24 21 | | 17 16·25 | 0 29 50·10 | 0·17 | 15 25·00 | + 0·45 | | | | | | |
| | R | | | | | | | 37 6 | | 30 3·01 | 2 41 51·30 | 5·01 | 15 18·90 | — 0·81 | | | | | | |
| | R | | | | | | | 38 59 | | 31 56·28 | 3 10 10·35 | 6·92 | 15 17·54 | — 0·26 | | | | | | |
| | L | | | | | | | 51 34 | | 44 33·02 | 6 19 21·45 | 27·49 | 14 56·14 | — 1·09 | | | | | | |
| | L | | | | | | | 54 13 | | 47 12·39 | 6 59 12·00 | 33·56 | 14 50·46 | — 0·70 | | | | | | |
| | R | | | | | | | 67 22 | | 60 23·21 | 10 16 54·30 | 72·54 | 14 12·66 | + 0·48 | | | | | | |
| | R | | | | | | | 70 11 | | 63 12·60 | 10 59 15·15 | 82·80 | 14 1·42 | — 0·50 | | | | | | |
| | L | | | | | | | 82 58 | | 76 1·38 | 14 11 26·85 | 137·76 | 13 6·08 | — 0·88 | | | | | | |
| | L | | | | | | | 85 46 | | 78 49·77 | 14 53 32·70 | 151·63 | 12 52·06 | — 1·03 | | | | | | |
| Jan. 22nd 27° & 207° | | λ Ursæ Minoris | ° ′ ″ 1 10 31·57 | ° ′ ″ E. 1 15 24·88 | H. M. S. 20 21 2·32 | H. M. S. 5 58 13·15 | H. M. S. 14 22 49·17 | H. 19+ M. S. | | H. 13+ M. S. | ° ′ ″ | ″ | 1°+ M. S. | π + 0° 0′ | | | H. M. S. | H. M. S. | H. M. S. | H. M. S. |
| | R | | | | | | | 45 5 | | 39 33·75 | 10 48 51·30 | 80·22 | 14 3·64 | + 1″·02 | | | | | | |
| | R | | | | | | | 59 1 | | 53 31·66 | 7 19 22·65 | 36·86 | 14 47·26 | + 0·76 | | | | | | |
| | L | | | | | | | 72 12 | | 66 44·47 | 4 1 10·50 | 11·12 | 15 13·68 | + 0·08 | | | | | | |
| | L | | | | | | | 75 0 | | 69 32·85 | 3 19 4·80 | 7·58 | 15 17·98 | — 0·68 | | | | | | |
| | R | | | | | | | 85 7 | | 79 41·24 | 0 46 58·95 | 0·42 | 15 22·78 | + 1·68 | | | | | | |
| | R | | | | | | | 89 32 | | 84 6·85 | 0 19 25·20 | 0·07 | 15 23·60 | + 1·21 | | | | | | |
| Jan. 23rd 18° & 198° | | λ Ursæ Minoris | ° ′ ″ 1 10 31·72 | ° ′ ″ W. 1 15 25·04 | H. M. S. 20 21 2·21 | H. M. S. 5 58 13·15 | H. M. S. 2 19 15·36 | H. 8+ M. S. | | H. 2+ M. S. | ° ′ ″ | ″ | 1°+ M. S. | π + 0° 0′ | | | H. M. S. | H. M. S. | H. M. S. | H. M. S. |
| | L | | | | | | | 9 37 | | 5 47·88 | 3 21 52·20 | 7·80 | 15 18·68 | + 1″·44 | | | | | | |
| | L | | | | | | | 12 21 | | 8 32·25 | 2 40 46·65 | 4·95 | 15 19·64 | — 0·45 | | | | | | |
| | R | | | | | | | 22 15 | | 18 27·61 | 0 11 56·25 | 0·03 | 15 24·56 | — 0·45 | | | | | | |
| | R | | | | | | | 24 50 | | 21 2·97 | 0 26 54·15 | 0·14 | 15 23·30 | — 1·60 | | | | | | |
| | L | | | | | | | 39 10 | | 35 24·93 | 4 2 23·55 | 11·23 | 15 13·60 | — 0·21 | | | | | | |
| | L | | | | | | | 41 36 | | 37 51·27 | 4 38 58·65 | 14·83 | 15 9·60 | — 0·56 | | | | | | |
| | R | | | | | | | 53 54 | | 50 10·95 | 7 43 53·85 | 41·08 | 14 44·34 | + 0·38 | | | | | | |
| | R | | | | | | | 55 47 | | 52 4·21 | 8 12 12·75 | 46·23 | 14 37·76 | — 1·05 | | | | | | |
| | L | | | | | | | 70 37·5 | | 66 56·75 | 11 55 20·85 | 97·42 | 13 48·66 | + 1·04 | | | | | | |
| | L | | | | | | | 73 42 | | 70 1·67 | 12 41 34·65 | 110·35 | 13 33·46 | — 1·23 | | | | | | |
| | R | | | | | | | 82 15 | | 78 35·84 | 14 50 7·20 | 150·49 | 12 53·62 | — 0·93 | | | | | | |
| | R | | | | | | | 84 46 | | 81 7·19 | 15 27 57·45 | 163·46 | 12 41·18 | — 0·40 | | | | | | |
| Jan. 23rd 18° & 198° | | λ Ursæ Minoris | ° ′ ″ 1 10 31·88 | ° ′ ″ E. 1 15 25·21 | H. M. S. 20 21 2·11 | H. M. S. 5 58 13·14 | H. M. S. 14 22 48·97 | H. 19+ M. S. | | H. 13+ M. S. | ° ′ ″ | ″ | 1°+ M. S. | π + 0° 0′ | | | H. M. S. | H. M. S. | H. M. S. | H. M. S. |
| | R | | | | | | | 48 38 | | 46 25·43 | 9 5 53·10 | 56·85 | 14 25·94 | + 2″·42 | | | | | | |
| | R | | | | | | | 51 41 | | 49 28·85 | 8 20 1·80 | 47·72 | 14 36·34 | + 1·15 | | | | | | |
| | L | | | | | | | 66 56 | | 64 45·96 | 4 30 45·15 | 14·02 | 15 11·54 | — 0·35 | | | | | | |
| | L | | | | | | | 70 0 | | 67 50·39 | 3 44 38·70 | 9·65 | 15 15·50 | + 0·06 | | | | | | |
| | R | | | | | | | 80 53 | | 78 44·89 | 1 1 1·20 | 0·71 | 15 20·12 | + 4·38 | | | | | | |
| | R | | | | | | | 83 14 | | 81 6·22 | 0 25 41·25 | 0·13 | 15 21·38 | + 3·70 | | | | | | |
| | L | | | | | | | 94 3 | | 91 56·71 | 2 16 56·10 | 3·59 | 15 20·28 | + 1·34 | | | | | | |
| | L | | | | | | | 96 41 | | 94 35·08 | 2 56 31·65 | 5·97 | 15 18·18 | + 1·06 | | | | | | |

Vide Jan. 21st A.N.

π + (0° 0′) { R. + 1″·449 / L. + 0·376 }

F.R. 8 ..... F.L. 8

H. M. S. 3 37 56·28 η Tauri

H. M. S. (9 44 49·9 — 0·03) = 9 44 49·87

Vide Jan. 21st A.N.

π + (0° 0′) { R. + 3″·099 / L. + 1·213 }

F.R. 8 ..... F.L. 10

H. M. S. 3 37 56·27 η Tauri

H. M. S. (9 41 32·8 — 0·02) = 9 41 32·78

π + 0° 0′

π + (0° 0′) { R. + 0″·037 / L. — 0·465 }

F.R. 6 ..... F.L. 6

H. M. S. 3 37 56·28 η Tauri

H. M. S. (9 44 49·9 — 0·03) = 9 44 49·87

H. M. S. 6 3 36·51

H. M. S. 3 17·08

H. M. S. 6 6 53·59

H. M. S. 3 19·29

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G. T. Station Badgaon Lat. 20° 44′ 23″ Long. 77° 38′ 59″ A.D. 1839.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *'s N. P. D. | *'s Elongation. | *'s A.R. | *'s Horary Angle. | *'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | A.R. | Chronom. Time. | Error. | Rate. |
| Jan. 24th 9° & 189° | R | λ Ursæ Minoris | ° ′ ″ 1 10 32·18 | ° ′ ″ E. 1 15 25·53 | h. m. s. 20 21 1·92 | h. m. s. 5 58 13·14 | h. m. s. 14 22 48·78 | h. 19+ m. s. 29 52 | | h. 13+ m. s. 30 55·68 | ° ′ ″ 12 58 16·50 | ″ 115·23 | ° ′ ″ 13 27 92 | π + 0° 0′ + 2″·38 | Vide Jan. 29th A.M. | Vide Jan. 20th A.M. | h. m. s. 3 37 56·26 | h. m. s. (9 38 14·0 + 0·12) = 9 38 14·12 | h. m. s. 6 0 17·66 | m. s. 3 18·65 |
| | R | | | | | | | 32 35 | | 33 39·05 | 12 17 25·95 | 103·52 | 13 38·54 | + 3·47 | | | | | | |
| | L | | | | | | | 52 38 | | 53 44·82 | 7 15 59·40 | 36·30 | 14 48·84 | + 0·39 | | | | | | |
| | L | | | | | | | 55 12 | | 56 19·17 | 6 37 24·15 | 30·17 | 14 54·94 | + 0·42 | | | | | | |
| | R | | | | | | | 69 42 | | 70 51·17 | 2 59 24·15 | 6·16 | 15 16·24 | + 3·13 | | | | | | |
| | R | | | | | | | 72 50 | | 73 59·60 | 2 12 17·70 | 3·35 | 15 18·88 | + 3·30 | | | | | | |
| | L | | | | | | | 83 6 | | 84 17·02 | 0 22 3·60 | 0·09 | 15 24·86 | + 0·58 | | | | | | |
| | L | | | | | | | 86 35 | | 87 46·50 | 1 14 25·80 | 1·06 | 15 24·02 | + 0·45 | | | | | | |
| | R | | | | | | | 94 55 | | 96 7·65 | 3 19 43·05 | 7·64 | 15 15·58 | + 2·31 | | | | | | |
| | R | | | | | | | 97 47 | | 99 0·04 | 4 2 48·90 | 11·29 | 15 11·46 | + 2·78 | | | | | | |
| Jan. 25th 0° & 180° | R | λ Ursæ Minoris | ° ′ ″ 1 10 32·49 | ° ′ ″ E. 1 15 25·86 | h. m. s. 20 21 1·75 | h. m. s. 5 58 13·13 | h. m. s. 14 22 48·62 | h. 19+ m. s. 33 9 | | h. 13+ m. s. 37 31·68 | ° ′ ″ 11 19 14·10 | ″ 87·89 | ° ′ ″ 13 56·48 | π + 0° 0′ + 1″·49 | Vide Jan. 19th A.M. | Vide Jan. 19th A.M. | h. m. s. 3 37 56·24 | h. m. s. (9 34 56·2 − 0·11) = 9 34 56·09 | h. m. s. 5 56 59·85 | m. s. 3 18·10 |
| | R | | | | | | | 36 7 | | 40 30·09 | 10 34 37·95 | 76·77 | 14 7·84 | + 1·25 | | | | | | |
| | L | | | | | | | 71 3 | | 75 30·91 | 1 49 25·65 | 2·29 | 15 23·28 | + 0·29 | | | | | | |
| | L | | | | | | | 73 9 | | 77 47·22 | 1 15 21·00 | 1·09 | 15 24·50 | + 0·27 | | | | | | |
| | L | | | | | | | 81 44 | | 86 13·38 | 0 51 11·40 | 0·50 | 15 25·22 | + 0·14 | | | | | | |
| | L | | | | | | | 83 36 | | 88 5·64 | 1 19 15·30 | 1·20 | 15 24·10 | + 0·56 | | | | | | |
| | R | | | | | | | 90 36 | | 95 6·60 | 3 4 29·70 | 6·52 | 15 17·08 | + 2·26 | | | | | | |
| | R | | | | | | | 92 55 | | 97 25·92 | 3 39 19·50 | 9·21 | 15 14·52 | + 2·13 | | | | | | |
| | L | | | | | | | 100 42 | | 105 14·00 | 5 36 20·70 | 21·65 | 15 3·72 | + 0·49 | | | | | | |
| | L | | | | | | | 102 53 | | 107 25·30 | 6 9 10·20 | 26·09 | 14 58·84 | + 0·93 | | | | | | |
| Jan. 27th 27° & 207° | L | λ Ursæ Minoris | ° ′ ″ 1 10 33·12 | ° ′ ″ E. 1 15 26·54 | h. m. s. 20 21 1·47 | h. m. s. 5 58 13·11 | h. m. s. 14 22 48·36 | h. 19+ m. s. 32 55·5 | | h. 13+ m. s. 43 57·85 | ° ′ ″ 9 42 37·65 | ″ 64·75 | ° ′ ″ 14 24·36 | π + 0° 0′ − 2″·57 | Vide Jan. 22nd A.M. | Vide Jan. 22nd A.M. | h. m. s. 3 37 56·92 | | | m. s. 3 19·88 |
| | L | | | | | | | 35 43 | | 46 45·74 | 9 0 39·30 | 55·78 | 14 28·58 | + 2·18 | | | | | | |
| | R | | | | | | | 50 3 | | 61 7·73 | 5 25 9·45 | 20·21 | 15 3·26 | + 3·07 | | | | | | |
| | R | | | | | | | 52 39 | | 63 44·09 | 4 46 4·05 | 15·65 | 15 10·60 | + 0·29 | | | | | | |
| | L | | | | | | | 65 6 | | 76 12·83 | 1 38 52·95 | 1·87 | 15 24·54 | + 0·13 | | | | | | |
| | L | | | | | | | 70 21 | | 81 28·56 | 0 19 57·00 | 0·08 | 15 26·04 | + 0·42 | | | | | | |
| | R | | | | | | | 83 59 | | 95 8·45 | 3 5 1·35 | 6·56 | 15 19·42 | + 0·56 | | | | | | |
| | R | | | | | | | 86 8 | | 97 17·75 | 3 37 20·85 | 9·04 | 15 14·50 | + 3·00 | | | | | | |
| | L | | | | | | | 97 7 | | 108 18·28 | 6 22 28·80 | 28·00 | 14 56·22 | + 2·32 | | | | | | |
| | L | | | | | | | 99 18 | | 110 29·58 | 6 55 18·30 | 33·01 | 14 52·40 | + 1·13 | | | | | | |
| Jan. 28th 18° & 198° | L | λ Ursæ Minoris | ° ′ ″ 1 10 33·43 | ° ′ ″ E. 1 15 26·87 | h. m. s. 20 21 1·36 | h. m. s. 5 58 13·11 | h. m. s. 14 22 48·25 | h. 19+ m. s. 43 58 | | h. 13+ m. s. 58 22·21 | ° ′ ″ 6 6 30·60 | ″ 25·67 | ° ′ ″ 14 58·46 | π + 0° 0′ + 2″·74 | Vide Jan. 23rd A.M. | Vide Jan. 23rd A.M. | h. m. s. 3 37 56·20 | h. m. s. (9 24 58·0 + 0·09) = 9 24 58·09 | h. m. s. 5 47 1·89 | m. s. 3 19·88 |
| | L | | | | | | | 46 37 | | 61 4·89 | 5 25 50·40 | 20·30 | 15 3·68 | + 2·89 | | | | | | |
| | R | | | | | | | 58 40 | | 73 6·25 | 2 25 30·00 | 4·05 | 15 18·68 | + 4·14 | | | | | | |
| | R | | | | | | | 62 20 | | 76 46·76 | 1 30 22·35 | 1·56 | 15 23·44 | + 1·87 | | | | | | |
| | L | | | | | | | 72 21 | | 86 49·16 | 1 0 13·65 | 0·69 | 15 25·06 | + 1·12 | | | | | | |
| | L | | | | | | | 75 40 | | 90 8·62 | 1 50 5·55 | 2·32 | 15 23·06 | + 1·49 | | | | | | |
| | R | | | | | | | 87 38 | | 102 8·28 | 4 50 0·45 | 16·10 | 15 7·02 | + 3·75 | | | | | | |
| | R | | | | | | | 89 47 | | 104 17·58 | 5 22 19·95 | 19·89 | 15 3·60 | + 3·38 | | | | | | |
| | L | | | | | | | 98 32 | | 113 3·80 | 7 33 53·25 | 39·43 | 14 47·02 | + 0·42 | | | | | | |
| | L | | | | | | | 100 54 | | 115 26·13 | 8 9 28·20 | 45·85 | 14 39·66 | + 1·36 | | | | | | |

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G. T. Station Sakri Lat. 20° 0′ 13″ Long. 77° 44′ 34″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ✻'s Transit. | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✻'s N. P. D. | ✻'s Elongation. | ✻'s A.R. | ✻'s Horary Angle. | ✻'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | ∂ P | ∂ Z | Star and Lamp. | | | | A.R. | Chronom. Time. | Error. | Rate. |
| Dec. 24th 0° & 180° | R | δ Ursæ Minoris | ° ′ ″ 3 24 40·61 | W. ° ′ ″ 3 37 50·24 | h. m. s. 18 23 52·21 | h. m. s. 5 55 1·55 | h. m. s. 24 18 53·76 | h. m. s. 33 5 | | h. m. s. 49 26·03 | ° ′ ″ 7 21 55·95 | ″ 107·92 | ° ′ ″ 36 0·60 | π + 0° 0′ — 1·72 | | | h. m. s. 1 15 59·24 θ′ Ceti | | | |
| | R | | | | | | | 36 12 | | 52 33·47 | 6 35 4·35 | 86·24 | 36 22·48 | — 1·52 | | | | | | |
| | L | | | | | | | 49 8 | | 65 31·27 | 3 20 37·35 | 22·23 | 37 27·78 | — 0·23 | | | | | | |
| | L | | | | | | | 51 55 | | 68 18·66 | 2 38 46·50 | 13·92 | 37 36·14 | — 0·18 | | | | | | |
| | R | | | | | | | 62 3 | | 78 28·07 | 0 6 25·35 | 0·02 | 37 47·68 | — 2·54 | | | | | | |
| | R | | | | | | | 64 54 | | 81 19·47 | 0 36 25·65 | 0·73 | 37 46·34 | — 3·17 | | | | | | |
| | L | | | | | | | 75 45 | | 92 11·99 | 3 19 33·45 | 21·94 | 37 29·02 | + 0·72 | | | | | | |
| | L | | | | | | | 78 50 | | 95 17·42 | 4 5 54·90 | 33·30 | 37 16·12 | — 0·82 | | | | | | |
| | R | | | | | | | 89 21 | | 105 49·88 | 6 44 1·80 | 89·74 | 36 17·40 | — 3·10 | | | | | | |
| | R | | | | | | | 92 14 | | 108 43·29 | 7 27 22·95 | 109·97 | 35 57·84 | — 2·43 | | | | | | |
| | L | | | | | | | 101 13 | | 117 43·54 | 9 42 26·70 | 186·06 | 34 42·48 | — 1·70 | | | | | | |
| | L | | | | | | | 103 24 | | 119 54·84 | 10 15 16·20 | 207·52 | 34 23·34 | + 0·62 | | | | | | |
| Dec. 25th 9° & 189° | R | δ Ursæ Minoris | ° ′ ″ 3 24 40·91 | W. ° ′ ″ 3 37 50·56 | h. m. s. 18 23 52·12 | h. m. s. 5 55 1·54 | h. m. s. 24 18 53·66 | h. m. s. 30 36 | | h. m. s. 50 17·57 | ° ′ ″ 7 9 1·35 | ″ 101·70 | ° ′ ″ 36 6·68 | π + 0° 0′ — 2·18 | | | h. m. s. (1 15 59·23) θ′ Ceti | | | |
| | R | | | | | | | 33 20 | | 53 1·95 | 6 27 55·65 | 83·15 | 36 25·90 | — 1·51 | | | | | | |
| | L | | | | | | | 42 35 | | 62 18·24 | 4 8 51·30 | 34·21 | 37 14·90 | — 1·45 | | | | | | |
| | L | | | | | | | 44 58 | | 64 41·58 | 3 33 1·20 | 25·06 | 37 23·06 | — 2·44 | | | | | | |
| | R | | | | | | | 57 16 | | 77 1·29 | 0 28 5·55 | 0·44 | 37 47·14 | — 2·98 | | | | | | |
| | R | | | | | | | 60 12 | | 79 57·70 | 0 16 0·60 | 0·14 | 37 47·02 | — 3·40 | | | | | | |
| | L | | | | | | | 71 46 | | 91 33·32 | 3 9 54·90 | 19·87 | 37 27·74 | — 2·95 | | | | | | |
| | L | | | | | | | 74 34 | | 94 21·71 | 3 52 0·75 | 29·65 | 37 18·10 | — 2·81 | | | | | | |
| | R | | | | | | | 85 32 | | 105 21·24 | 6 36 53·70 | 86·61 | 36 21·48 | — 2·47 | | | | | | |
| | R | | | | | | | 88 15 | | 108 4·62 | 7 17 44·40 | 105·30 | 36 3·92 | — 1·34 | | | | | | |
| | L | | | | | | | 98 14 | | 118 5·01 | 9 47 50·25 | 189·51 | 34 38·72 | — 2·33 | | | | | | |
| | L | | | | | | | 100 41·5 | | 120 32·85 | 10 24 47·85 | 213·98 | 34 14·28 | — 2·30 | | | | | | |
| Dec. 25th 9° & 189° | R | δ Ursæ Minoris | ° ′ ″ 3 24 41·11 | E. ° ′ ″ 3 37 50·77 | h. m. s. 18 23 52·07 | h. m. s. 5 55 1·54 | h. m. s. 12 28 50·53 | h. m. s. 39 50 | | h. m. s. 1 13·24 | ° ′ ″ 6 54 19·35 | ″ 94·36 | ° ′ ″ 36 14·54 | π + 0° 0′ + 1·87 | | | h. m. s. (1 15 59·23) θ′ Ceti | | | |
| | R | | | | | | | 43 3 | | 4 26·69 | 6 5 57·60 | 73·66 | 36 36·30 | + 0·81 | | | | | | |
| | L | | | | | | | 61 25 | | 22 51·25 | 1 29 49·20 | 4·45 | 37 47·82 | — 1·50 | | | | | | |
| | L | | | | | | | 64 0 | | 25 26·61 | 0 50 58·80 | 1·43 | 37 48·48 | + 0·86 | | | | | | |
| | R | | | | | | | 78 12 | | 39 40·59 | 2 42 30·90 | 14·59 | 37 32·50 | + 3·68 | | | | | | |
| | R | | | | | | | 80 20 | | 41 48·88 | 3 14 35·25 | 20·91 | 37 29·06 | + 0·80 | | | | | | |
| Dec. 26th 18° & 198° | R | δ Ursæ Minoris | ° ′ ″ 3 24 41·31 | W. ° ′ ″ 3 37 50·98 | h. m. s. 18 23 52·03 | h. m. s. 5 55 1·53 | h. m. s. 24 18 53·56 | h. m. s. 36 4 | | h. m. s. 59 7·08 | ° ′ ″ 4 56 37·20 | ″ 48·61 | ° ′ ″ 37 0·22 | π + 0° 0′ — 2·15 | | | h. m. s. 1 15 59·22 θ′ Ceti | | | |
| | R | | | | | | | 38 4 | | 61 7·36 | 4 26 33·00 | 39·25 | 37 9·54 | — 2·19 | | | | | | |
| | L | | | | | | | 46 40 | | 69 44·56 | 2 17 15·00 | 10·40 | 37 38·30 | — 2·28 | | | | | | |
| | L | | | | | | | 49 0 | | 72 4·88 | 1 42 10·20 | 5·76 | 37 42·90 | — 2·32 | | | | | | |
| | R | | | | | | | 58 12 | | 81 18·16 | 0 36 9·00 | 0·72 | 37 45·60 | — 4·66 | | | | | | |
| | R | | | | | | | 60 34 | | 83 40·49 | 1 11 43·95 | 2·84 | 37 44·20 | — 3·94 | | | | | | |
| | L | | | | | | | 70 42 | | 93 49·91 | 3 44 5·25 | 27·66 | 37 19·96 | — 3·36 | | | | | | |
| | L | | | | | | | 72 47 | | 95 55·20 | 4 15 24·60 | 35·92 | 37 11·22 | — 3·84 | | | | | | |
| | R | | | | | | | 82 0 | | 105 9·48 | 6 33 58·80 | 85·34 | 36 19·86 | — 5·78 | | | | | | |
| | R | | | | | | | 83 58 | | 107 7·76 | 7 3 33·00 | 98·60 | 36 7·02 | — 5·36 | | | | | | |
| | L | | | | | | | 93 49 | | 117 0·13 | 9 31 38·55 | 179·26 | 34 48·68 | — 3·04 | | | | | | |
| | L | | | | | | | 96 4·5 | | 119 15·94 | 10 5 35·70 | 201·09 | 34 27·18 | — 2·71 | | | | | | |

$\pi + (0° 0') - \left\{ \begin{matrix} R\ 2''.413 \\ L\ 0''.265 \end{matrix} \right\}$ F.R. 6 ..... F.L. 6 — (8 59 26·1 + 0·06) = 8 59 26·16 — 7 43 26·92

$\pi + (0° 0') + \left\{ \begin{matrix} R\ 0''.773 \\ L\ 0''.124 \end{matrix} \right\}$ F.R. 10 ..... F.L. 8 — (8 56 5·8 — 0·07) = 8 56 5·73 — 7 40 6·50

$\pi + (0° 0') - \left\{ \begin{matrix} R\ 4''.013 \\ L\ 2''.925 \end{matrix} \right\}$ F.R. 6 ..... F.L. 6 — (8 52 45·5 — 0·05) = 8 52 45·45 — 7 36 46·23

3 20·27 — 3 20·42



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**G. T. Station Sakri Lat. 20° 0′ 13″ Long. 77° 44′ 34″ A.D. 1838.**

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 27th 27° & 207° | R | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·61 | E. ° ′ ″ 3 37 51·30 | h. m. s. 18 23 51·94 | h. m. s. 5 55 1·52 | h. m. s. 24 18 53·46 | h. 7+ m. s. 30 56 | | h. 23+ m. s. 57 17·44 | ° ′ ″ 5 24 0·30 | ″ 58·00 | 3°+ ′ ″ 36 52·22 | π + 0° 0′ — ″ 1·08 | π+(0° 0′)−{ R ″ 2·417 L 1·965 } | F.R. 6 ..... F.L. 6 | h. m. s. 1 15 59·21 θ′ Ceti | h. m. s. (8 49 26·9+0·02)=8 49 26·92 | h. m. s. 7 33 27·71 | h. m. s. 3 18·52 |
| | R | | | | | | | 33 7 | | 59 28·74 | 4 51 10·80 | 46·84 | 37 2·78 | — 1·68 | | | | | | |
| | L | | | | | | | 41 50 | | 68 12·95 | 2 40 7·65 | 14·16 | 37 35·28 | — 1·86 | | | | | | |
| | L | | | | | | | 44 8 | | 70 31·26 | 2 5 33·00 | 8·70 | 37 41·34 | — 1·26 | | | | | | |
| | R | | | | | | | 54 24 | | 80 48·68 | 0 28 48·30 | 0·46 | 37 48·40 | — 2·44 | | | | | | |
| | R | | | | | | | 56 50 | | 83 15·02 | 1 5 23·40 | 2·36 | 37 46·32 | — 2·62 | | | | | | |
| | L | | | | | | | 69 26 | | 95 52·76 | 4 14 49·50 | 35·76 | 37 13·00 | — 2·54 | | | | | | |
| | L | | | | | | | 71 32 | | 97 59·05 | 4 46 23·85 | 45·15 | 37 3·16 | — 2·99 | | | | | | |
| | R | | | | | | | 81 3 | | 107 31·37 | 7 9 28·65 | 101·38 | 36 6·90 | — 3·02 | | | | | | |
| | R | | | | | | | 83 25 | | 109 53·69 | 7 45 3·45 | 118·82 | 35 48·82 | — 3·66 | | | | | | |
| | L | | | | | | | 91 57·5 | | 118 27·37 | 9 53 28·65 | 193·16 | 34 36·04 | — 2·10 | | | | | | |
| | L | | | | | | | 94 5 | | 120 35·17 | 10 25 25·65 | 214·42 | 34 15·84 | — 1·04 | | | | | | |
| Dec. 27th 27° & 207° | R | ∂ Ursæ Minoris | ° ′ ″ 3 24 41·76 | E. ° ′ ″ 3 37 51·46 | h. m. s. 18 23 51·90 | h. m. s. 5 55 1·52 | h. m. s. 12 28 50·38 | h. 19+ m. s. 7 10 | | h. 11+ m. s. 35 7·40 | ° ′ ″ 13 25 44·70 | ″ 354·86 | 3°+ ′ ″ 31 54·94 | π + 0° 0′ + ″ 1·66 | π+(0° 0′)+{ R ″ 2·045 L 0·588 } | F.R. 6 ..... F.L. 6 | h. m. s. 1 15 59·21 θ′ Ceti | h. m. s. (8 49 26·9+0·02)=8 49 26·92 | h. m. s. 7 33 27·71 | h. m. s. 3 18·52 |
| | R | | | | | | | 9 55 | | 37 52·77 | 12 44 24·15 | 319·60 | 32 31·22 | + 0·64 | | | | | | |
| | L | | | | | | | 22 36 | | 50 35·52 | 9 33 42·90 | 180·56 | 34 53·08 | — 2·18 | | | | | | |
| | L | | | | | | | 25 13 | | 53 12·88 | 8 54 22·50 | 156·74 | 35 14·22 | + 0·50 | | | | | | |
| | R | | | | | | | 38 39 | | 66 40·73 | 5 32 24·75 | 60·80 | 36 48·18 | + 2·48 | | | | | | |
| | R | | | | | | | 41 35 | | 69 37·14 | 4 48 18·60 | 45·76 | 37 3·56 | + 2·14 | | | | | | |
| | L | | | | | | | 55 30 | | 83 34·05 | 1 19 4·95 | 3·45 | 37 47·98 | + 0·03 | | | | | | |
| | L | | | | | | | 58 36 | | 86 40·48 | 0 32 28·50 | 0·58 | 37 51·16 | — 0·28 | | | | | | |
| | R | | | | | | | 69 47 | | 97 53·02 | 2 15 39·60 | 10·16 | 37 37·96 | + 3·34 | | | | | | |
| | R | | | | | | | 72 49 | | 100 55·44 | 3 1 15·90 | 18·15 | 37 31·30 | + 2·01 | | | | | | |
| | L | | | | | | | 86 7 | | 114 15·27 | 6 21 13·35 | 80·31 | 36 27·78 | + 3·37 | | | | | | |
| | L | | | | | | | 88 55 | | 117 3·66 | 7 3 19·20 | 99·03 | 36 10·34 | + 2·09 | | | | | | |
| Dec. 28th 18° & 198° | R | ∂ Ursæ Minoris | ° ′ ″ 3 24 42·06 | E. ° ′ ″ 3 37 51·78 | h. m. s. 18 23 51·83 | h. m. s. 5 55 1·51 | h. m. s. 12 28 50·32 | h. 19+ m. s. 5 26 | | h. 11+ m. s. 36 41·97 | ° ′ ″ 13 2 5·25 | ″ 334·47 | 3°+ ′ ″ 32 15·12 | π + 0° 0′ + ″ 2·19 | π+(0° 0′) {R. + ″ 1·618 L. — 0·610} | F.R. 6 ..... F.L. 6 | h. m. s. 1 15 59·20 θ′ Ceti | h. m. s. (8 46 8·8+0·17)=8 46 8·97 | h. m. s. 7 30 9·77 | h. m. s. 3 17·94 |
| | R | | | | | | | 8 49 | | 40 5·43 | 12 11 13·35 | 292·62 | 32 58·70 | + 0·46 | | | | | | |
| | L | | | | | | | 24 40 | | 55 58·63 | 8 12 55·35 | 133·43 | 35 41·80 | — 3·45 | | | | | | |
| | L | | | | | | | 27 38·5 | | 58 57·54 | 7 28 11·70 | 110·38 | 36 3·26 | — 1·86 | | | | | | |
| | R | | | | | | | 41 30 | | 72 50·96 | 3 59 50·40 | 31·68 | 37 19·10 | + 1·00 | | | | | | |
| | R | | | | | | | 44 6 | | 75 27·32 | 3 20 45·00 | 22·20 | 37 28·22 | + 1·36 | | | | | | |
| | L | | | | | | | 52 53 | | 84 15·54 | 1 8 41·70 | 2·60 | 37 49·68 | — 0·50 | | | | | | |
| | L | | | | | | | 56 39 | | 88 2·06 | 0 12 3·90 | 0·08 | 37 50·36 | + 1·34 | | | | | | |
| | R | | | | | | | 70 29 | | 101 53·97 | 3 15 54·75 | 21·20 | 37 27·74 | + 2·84 | | | | | | |
| | R | | | | | | | 73 14 | | 104 39·35 | 3 57 15·45 | 31·10 | 37 18·82 | + 1·86 | | | | | | |
| | L | | | | | | | 86 19 | | 117 46·16 | 7 13 57·60 | 104·07 | 36 7·34 | + 0·37 | | | | | | |
| | L | | | | | | | 89 32 | | 120 59·61 | 8 2 19·35 | 128·56 | 35 42·78 | + 0·44 | | | | | | |
| Dec. 29th 9° & 189° | R | ∂ Ursæ Minoris | ° ′ ″ 3 24 42·41 | E. ° ′ ″ 3 37 52·15 | h. m. s. 18 23 51·77 | h. m. s. 5 55 1·51 | h. m. s. 12 28 50·26 | h. 19+ m. s. 10 10 | | h. 11+ m. s. 44 46·47 | ° ′ ″ 11 0 56·85 | ″ 239·35 | 3°+ ′ ″ 33 53·32 | π + 0° 0′ — ″ 0·52 | Vide Dec. 25th A.M. | Vide Dec. 25th A.M. | h. m. s. 1 15 59·19 θ′ Ceti | h. m. s. (8 42 49·8+0·26)=8 42 50·06 | h. m. s. 7 26 50·87 | h. m. s. 3 18·90 |
| | R | | | | | | | 12 39 | | 47 15·82 | 10 23 36·60 | 213·19 | 34 20·54 | — 1·58 | | | | | | |
| | L | | | | | | | 25 32 | | 60 10·61 | 7 9 54·75 | 101·59 | 36 9·56 | + 1·00 | | | | | | |
| | L | | | | | | | 28 9 | | 62 47·97 | 6 30 34·35 | 83·89 | 36 27·90 | + 0·36 | | | | | | |
| | R | | | | | | | 40 51 | | 75 31·74 | 3 19 37·80 | 21·96 | 37 30·52 | — 0·33 | | | | | | |
| | R | | | | | | | 43 35 | | 78 16·12 | 2 38 32·10 | 13·85 | 37 36·92 | + 1·38 | | | | | | |
| | L | | | | | | | 56 30 | | 91 12·92 | 0 35 39·90 | 0·70 | 37 51·82 | — 0·37 | | | | | | |
| | L | | | | | | | 60 14 | | 94 57·44 | 1 31 47·70 | 4·65 | 37 47·56 | — 0·06 | | | | | | |
| | R | | | | | | | 70 19 | | 105 3·84 | 4 3 23·70 | 32·73 | 37 19·64 | — 0·22 | | | | | | |
| | R | | | | | | | 73 10 | | 107 55·24 | 4 46 14·70 | 45·27 | 37 5·04 | + 1·84 | | | | | | |
| | L | | | | | | | 83 37·5 | | 118 24·20 | 7 23 29·10 | 108·69 | 36 2·60 | + 0·86 | | | | | | |
| | L | | | | | | | 86 16 | | 121 3·07 | 8 3 12·15 | 129·03 | 35 43·28 | — 0·16 | | | | | | |

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## G. T. Station Sakri Lat. 20° 0′ 13″ Long. 77° 44′ 34″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Hour Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 30th o° & 180° | R | δ Ursæ Minoris | ° ′ ″ 3 24 42·76 | ° ′ ″ E. 3 37 52·53 | H. M. S. 18 23 51·72 | H. M. S. 5 55 1·50 | H. M. S. 12 28 50·22 | H. 19+ M. S. 3 23 | | H. 11+ M. S. 41 19·26 | ° ′ ″ 11 52 44·40 | ″ 278·12 | ° ′ ″ 3°+ 33 13·12 | π + o° o′ + ″1·29 | π + (o° o′) { R. + ″0·393 L. + 0·102 | F.R. 6 ..... F.L. 6 | H. M. S. 1 15 59·18 θ′ Ceti | H. M. S. (8 39 30·0+0·03)=8 39 30·03 | H. M. S. 7 23 30·85 | M. S. 3 20·02 |
| | R | | | | | | | 5 57 | | 43 53·62 | 11 14 9·00 | 248·97 | 33 43·00 | + 0·56 | | | | | | |
| | R | | | | | | | 18 10 | | 56 8·33 | 8 10 28·35 | 132·13 | 35 41·80 | − 1·40 | | | | | | |
| | L | | | | | | | 20 42 | | 58 40·68 | 7 32 23·10 | 112·46 | 36 2·00 | − 1·93 | | | | | | |
| | L | | | | | | | 30 24 | | 68 24·03 | 5 6 32·85 | 51·72 | 37 1·26 | − 0·45 | | | | | | |
| | R | | | | | | | 33 31 | | 71 31·47 | 4 19 41·25 | 37·14 | 37 16·48 | − 1·09 | | | | | | |
| | R | | | | | | | 43 15 | | 81 16·83 | 1 53 20·85 | 7·08 | 37 44·90 | + 0·55 | | | | | | |
| | L | | | | | | | 47 14 | | 85 16·39 | 0 53 27·45 | 1·58 | 37 48·84 | + 2·11 | | | | | | |
| | L | | | | | | | 64 5 | | 102 9·74 | 3 19 52·80 | 22·07 | 37 29·70 | + 0·76 | | | | | | |
| | R | | | | | | | 67 5 | | 105 10·16 | 4 4 59·10 | 33·16 | 37 18·08 | + 1·29 | | | | | | |
| | R | | | | | | | 79 41 | | 117 47·92 | 7 14 25·50 | 104·30 | 36 7·84 | + 0·39 | | | | | | |
| | L | | | | | | | 82 17·5 | | 120 24·78 | 7 53 38·40 | 123·98 | 35 47·66 | + 0·89 | | | | | | |

**Observed Transit of θ′ Ceti—31st Dec. for Time and Rate of Chronometer.**

H. M. S. H. M. S. H. M. S. H. M. S. M. S.
*'s A.R. 1 15 59·17. Chronom. Time (8 36 9·3 + 0·12) = 8 36 9·42. Error 7 20 10·25. Rate 3 20·60.

## G. T. Station Somtana Lat. 19° 4′ 59″ Long. 77° 41′ 43″ A.D. 1838.

| Nov. 17th o° & 180° | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Hour Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 22·25 | ° ′ ″ E. 6 59 32·21 | H. M. S. 3 51 44·73 | H. M. S. 5 50 48·85 | H. M. S. 22 0 55·88 | H. 7+ M. S. 27 57 | | H. 21+ M. S. 40 41·46 | ° ′ ″ 5 3 36·29 | ″ 96·949 | ′ ″ 6°+ 57 47·82 | π+o° o′ + ″7·440 | π + (o° o′) + { R 8·581 L 4·950 } | F.R. 6 ..... F.L. 6 | H. M. S. 22 56 44·56 α Pegasi | H. M. S. (8 43 49·8—0·21)=8 43 49·59 | H. M. S. 14 12 54·97 | M. S. 3 18·96 |
| | R | | | | | | | 30 48 | | 43 32·86 | 4 20 45·36 | 71·562 | 58 13·82 | + 6·827 | | | | | | |
| | L | | | | | | | 41 56 | | 54 42·40 | 1 33 22·25 | 9·197 | 59 17·98 | + 5·032 | | | | | | |
| | L | | | | | | | 44 30 | | 57 16·75 | 0 54 46·91 | 3·167 | 59 24·48 | + 4·562 | | | | | | |
| | R | | | | | | | 53 2 | | 65 49·94 | 1 13 30·83 | 5·712 | 59 17·06 | + 9·437 | | | | | | |
| | R | | | | | | | 55 39 | | 68 27·30 | 1 52 51·26 | 13·468 | 59 9·74 | + 9·001 | | | | | | |
| | L | | | | | | | 64 26 | | 77 15·51 | 4 4 54·50 | 63·504 | 58 23·98 | + 4·725 | | | | | | |
| | L | | | | | | | 66 30 | | 79 19·80 | 4 35 58·80 | 80·660 | 58 6·16 | + 5·389 | | | | | | |
| | R | | | | | | | 75 45 | | 88 36·08 | 6 55 3·02 | 182·616 | 56 21·22 | + 8·373 | | | | | | |
| | R | | | | | | | 78 18 | | 91 9·44 | 7 33 23·31 | 217·961 | 55 43·84 | + 10·408 | | | | | | |
| | L | | | | | | | 89 22 | | 102 14·97 | 10 19 46·29 | 407·601 | 52 39·56 | + 5·048 | | | | | | |
| | L | | | | | | | 91 40 | | 104 33·29 | 10 54 21·08 | 454·405 | 51 52·86 | + 4·944 | | | | | | |
| Nov. 17th o° & 180° | R | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 22·09 | ° ′ ″ W. 6 59 32·04 | H. M. S. 3 51 44·77 | H. M. S. 5 50 48·85 | H. M. S. 9 42 33·62 | H. 19+ M. S. 2 38 | | H. 9+ M. S. 16 59·15 | ° ′ ″ 6 23 37·05 | ″ 155·971 | ′ ″ 6°+ 57 1·10 | π+o° o′ + ″5·032 | π + (o° o′) + { R 5·068 L 3·391 } | F.R. 9 ..... F.L. 6 | H. M. S. 22 56 44·56 α Pegasi | H. M. S. (8 43 49·8—0·21)=8 43 49·59 | H. M. S. 14 12 54·97 | M. S. 3 18·96 |
| | R | | | | | | | 5 53·5 | | 20 15·11 | 5 34 37·74 | 118·638 | 57 38·88 | + 5·479 | | | | | | |
| | L | | | | | | | 18 34 | | 32 57·37 | 2 24 3·77 | 21·953 | 59 14·04 | + 3·954 | | | | | | |
| | L | | | | | | | 20 45·5 | | 35 9·18 | 1 51 6·69 | 13·055 | 59 21·08 | + 2·096 | | | | | | |
| | R | | | | | | | 29 39 | | 44 3·92 | 0 22 34·40 | 0·538 | 59 35·38 | + 3·879 | | | | | | |
| | R | | | | | | | 32 5 | | 46 30·26 | 0 59 9·48 | 3·693 | 59 33·54 | + 5·194 | | | | | | |
| Nov. 18th 9° & 189° | L | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 21·92 | ° ′ ″ E. 6 59 31·86 | H. M. S. 3 51 44·82 | H. M. S. 5 50 48·86 | H. M. S. 22 0 55·96 | H. 7+ M. S. 12 15 | | H. 21+ M. S. 28 17·77 | ° ′ ″ 8 9 32·91 | ″ 251·284 | ′ ″ 6°+ 55 11·62 | π + o° o′ + ″8·955 | π + (o° o′) + { R 9·044 L 4·467 } | F.R. 6 ..... F.L. 6 | H. M. S. 22 56 44·55 α Pegasi | H. M. S. (8 40 29·8—0·31)=8 40 29·49 | H. M. S. 14 16 15·06 | M. S. 3 20·09 |
| | R | | | | | | | 14 41·5 | | 30 44·61 | 7 32 50·31 | 215·150 | 55 48·32 | + 8·389 | | | | | | |
| | R | | | | | | | 26 16 | | 42 20·72 | 4 38 48·63 | 81·791 | 58 6·46 | + 3·608 | | | | | | |
| | L | | | | | | | 28 23·5 | | 44 28·52 | 4 6 51·69 | 64·151 | 58 22·96 | + 4·748 | | | | | | |
| | L | | | | | | | 35 49 | | 51 55·05 | 2 15 13·68 | 19·280 | 59 2·48 | + 10·099 | | | | | | |
| | R | | | | | | | 38 2 | | 54 8·36 | 1 41 54·05 | 10·953 | 59 12·60 | + 8·306 | | | | | | |
| | L | | | | | | | 48 22 | | 64 29·80 | 0 53 27·54 | 3·020 | 59 24·32 | + 4·519 | | | | | | |
| | L | | | | | | | 50 37 | | 66 45·11 | 1 27 17·24 | 8·054 | 59 19·02 | + 4·785 | | | | | | |
| | R | | | | | | | 63 55 | | 80 4·97 | 4 47 15·03 | 87·390 | 57 55·36 | + 9·109 | | | | | | |
| | R | | | | | | | 66 15·5 | | 82 25·79 | 5 22 27·42 | 110·154 | 57 32·30 | + 9·405 | | | | | | |
| | L | | | | | | | 76 17 | | 92 28·69 | 7 53 10·86 | 237·430 | 55 29·86 | + 4·569 | | | | | | |
| | L | | | | | | | 78 54·8 | | 95 6·85 | 8 32 43·35 | 278·827 | 54 48·46 | + 4·572 | | | | | | |

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G. T. Station Somtana Lat. 19° 4′ 59″ Long. 77° 41′ 43″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 18th 9° & 189° | R | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 21·75 | W. ° ′ ″ 6 59 31·68 | h. m. s. 3 51 44·86 | h. m. s. 5 50 48·86 | h. m. s. 9 42 33·72 | h. 19+ m. s. 8 1 | | h. 9+ m. s. 25 43·40 | ° ′ ″ 4 12 34·82 | ″ 67·548 | ° + m. s. 58 31·00 | π + 0° 0′ ″ + 6·869 | π + (0° 0′) + { R 4·960 L 3·533 } | F.R. 6 ..... F.L. 8 | h. m. s. 22 56 44·55 α Pegasi | (8 40 29·8 — 0·31) = 8 40 29·49 | h. m. s. 14 16 15·06 | m. s. 3 20·09 |
| | R | | | | | | | 11 38 | | 29 20·90 | 3 18 12·27 | 41·575 | 58 57·38 | + 7·276 | | | | | | |
| | L | | | | | | | 23 32 | | 41 16·56 | 0 19 17·42 | 0·393 | 59 34·68 | + 3·394 | | | | | | |
| | L | | | | | | | 28 7 | | 45 52·19 | 0 49 37·14 | 2·599 | 59 30·32 | + 1·240 | | | | | | |
| Nov. 19th 18° & 198° | L | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 21·40 | W. ° ′ ″ 6 59 31·31 | h. m. s. 3 51 44·94 | h. m. s. 5 50 48·87 | h. m. s. 9 42 33·81 | h. 18+ m. s. 45 35 | | h. 9+ m. s. 6 34·74 | ° ′ ″ 8 59 46·07 | ″ 309·051 | ° + m. s. 54 23·54 | π + 0° 0′ ″ + 1·282 | π + (0° 0′) + { L 1·850 R 5·221 } | F.R. 4 ..... F.L. 6 | h. m. s. 22 56 44·54 α Pegasi | (8 37 9·9 — 0·37) = 8 37 9·53 | h. m. s. 14 19 35·01 | m. s. 3 19·95 |
| | L | | | | | | | 48 18 | | 9 18·12 | 8 18 55·40 | 263·996 | 55 8·56 | + 1·247 | | | | | | |
| | R | | | | | | | 62 57 | | 23 59·16 | 4 38 39·80 | 82·235 | 58 13·24 | + 4·166 | | | | | | |
| | R | | | | | | | 65 9·5 | | 26 11·97 | 4 5 27·68 | 63·789 | 58 32·38 | + 4·860 | | | | | | |
| | L | | | | | | | 75 25 | | 36 28·89 | 1 31 13·74 | 8·799 | 59 26·22 | + 3·710 | | | | | | |
| | L | | | | | | | 78 16 | | 39 20·29 | 0 48 22·80 | 2·473 | 59 30·32 | + 1·484 | | | | | | |
| | L | | | | | | | 88 0 | | 49 5·65 | 1 37 57·54 | 10·122 | 59 27·92 | + 6·733 | | | | | | |
| | R | | | | | | | 90 37 | | 51 43·01 | 2 17 18·00 | 19·875 | 59 16·56 | + 5·126 | | | | | | |
| | R | | | | | | | 99 23·5 | | 60 30·73 | 4 29 13·83 | 76·276 | 58 17·50 | + 2·467 | | | | | | |
| | L | | | | | | | 101 48 | | 62 55·57 | 5 5 26·37 | 98·118 | 57 54·10 | + 0·909 | | | | | | |
| Nov. 20th 18° & 198° | R | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 21·22 | E. ° ′ ″ 6 59 31·12 | h. m. s. 3 51 44·98 | h. m. s. 5 50 48·87 | h. m. s. 22 0 56·11 | h. 7+ m. s. 6 20 | | h. 21+ m. s. 29 2·90 | ° ′ ″ 7 58 18·23 | ″ 239·914 | ° + m. s. 55 24·08 | π + 0° 0′ ″ + 7·124 | π + (0° 0′) + { R 8·013 L 2·433 } | F.R. 6 ..... F.L. 6 | h. m. s. 22 56 44·53 α Pegasi | (8 33 49·9 — 0·45) = 8 33 49·45 | h. m. s. 14 22 55·08 | m. s. 3 20·07 |
| | R | | | | | | | 8 30 | | 31 13·20 | 7 25 43·70 | 208·467 | 55 55·06 | + 7·591 | | | | | | |
| | L | | | | | | | 20 18 | | 43 2·84 | 4 28 19·05 | 75·760 | 58 14·14 | + 1·218 | | | | | | |
| | L | | | | | | | 22 46·5 | | 45 31·69 | 3 51 6·38 | 56·235 | 58 32·04 | + 2·843 | | | | | | |
| | R | | | | | | | 35 3 | | 57 49·90 | 0 46 33·24 | 2·288 | 59 20·62 | + 8·210 | | | | | | |
| | R | | | | | | | 42 6 | | 64 53·88 | 0 59 26·49 | 3·734 | 59 20·20 | + 7·184 | | | | | | |
| | L | | | | | | | 52 49 | | 75 38·37 | 3 40 33·87 | 51·494 | 58 37·56 | + 2·064 | | | | | | |
| | L | | | | | | | 54 52 | | 77 41·66 | 4 11 23·16 | 66·908 | 58 21·28 | + 2·930 | | | | | | |
| | R | | | | | | | 63 50·5 | | 86 41·41 | 6 26 19·41 | 158·176 | 56 44·04 | + 8·902 | | | | | | |
| | R | | | | | | | 66 17·8 | | 89 9·05 | 7 3 14·03 | 189·890 | 56 12·16 | + 9·068 | | | | | | |
| | L | | | | | | | 75 10·5 | | 98 2·98 | 9 16 43·08 | 328·788 | 53 59·52 | + 2·810 | | | | | | |
| | L | | | | | | | 77 20 | | 100 12·78 | 9 49 10·08 | 368·284 | 53 20·10 | + 2·734 | | | | | | |
| Nov. 20th 27° & 207° | L | 146 Rangifer. (41 Bode) | ° ′ ″ 6 36 21·04 | W. ° ′ ″ 6 59 30·93 | h. m. s. 3 51 45·02 | h. m. s. 5 50 48·88 | h. m. s. 9 42 33·90 | h. 18+ m. s. 37 4·5 | | h. 9+ m. s. 1 23·57 | ° ′ ″ 10 17 34·85 | ″ 404·701 | ° + m. s. 52 46·90 | π + 0° 0′ ″ + 0·674 | π + (0° 0′) + { L 3·113 R 5·265 } | F.R. 8 ..... F.L. 9 | h. m. s. 22 56 44·53 α Pegasi | (8 33 49·9 — 0·45) = 8 33 49·45 | h. m. s. 14 22 55·08 | m. s. 3 20·07 |
| | L | | | | | | | 40 25·8 | | 4 45·34 | 9 27 8·34 | 341·225 | 53 51·72 | + 2·018 | | | | | | |
| | R | | | | | | | 59 32·5 | | 23 54·70 | 4 39 47·93 | 82·906 | 58 13·64 | + 5·619 | | | | | | |
| | R | | | | | | | 63 9·5 | | 27 32·20 | 3 45 25·37 | 53·789 | 58 43·84 | + 6·702 | | | | | | |
| | L | | | | | | | 76 3 | | 40 27·50 | 0 31 35·94 | 1·055 | 59 33·46 | + 3·588 | | | | | | |
| | L | | | | | | | 79 40· | | 44 5·00 | 0 22 46·61 | 0·548 | 59 31·26 | + 0·881 | | | | | | |
| | R | | | | | | | 89 46·5 | | 54 12·91 | 2 54 45·23 | 32·180 | 59 3·40 | + 4·653 | | | | | | |
| | R | | | | | | | 94 49 | | 59 16·11 | 4 10 33·24 | 66·078 | 58 31·68 | + 6·831 | | | | | | |

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G. T. Station Somtana Lat. 19° 4′ 59″ Long. 77° 1′ 43″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 21st 27° & 207° | L | 146 Rangifer. (41 Bode) | 6° 36′ 20″·84 | E. 6° 59′ 30″·72 | H. M. S. 3 51 45·05 | H. M. S. 5 50 48·88 | H. M. S. 22 0 56·17 | H. 7+ M. S. 6 56·5 | | H. 21+ M. S. 32 59·98 | 6° 59′ 2″·96 | 184″·339 | 6° 22′ 22″·82 | π + 0° 0′ + 3″·557 | π + (0° 0′) + { L 3″·141 / R 8″·705 } | F.R. 6 ..... F.L. 6 | H. M. S. 22 56 44·52 α Pegasi | H. M. S. (8 30 29·9 − 0·49) = 8 30 29·41 | H. M. S. 14 26 15·11 | H. M. S. 3 20·03 |
| | L | | | | | | | 9 15 | | 35 18·80 | 6 24 20·64 | 155·160 | 56 52·12 | + 3·436 | | | | | | |
| | R | | | | | | | 20 18 | | 46 23·34 | 3 38 12·56 | 50·142 | 58 31·90 | + 8·674 | | | | | | |
| | R | | | | | | | 22 18 | | 48 23·62 | 3 8 8·39 | 37·291 | 58 45·84 | + 7·585 | | | | | | |
| | L | | | | | | | 32 7 | | 58 13·98 | 0 40 32·88 | 1·735 | 59 26·12 | + 2·861 | | | | | | |
| | L | | | | | | | 34 23 | | 60 30·30 | 0 6 28·14 | 0·044 | 59 27·14 | + 3·532 | | | | | | |
| | R | | | | | | | 45 11 | | 71 19·80 | 2 35 54·41 | 25·713 | 58 56·30 | + 8·703 | | | | | | |
| | R | | | | | | | 47 32 | | 73 41·13 | 3 11 14·33 | 38·700 | 58 42·98 | + 9·036 | | | | | | |
| | L | | | | | | | 57 5 | | 83 15·46 | 5 34 49·26 | 118·769 | 57 28·90 | + 3·047 | | | | | | |
| | L | | | | | | | 60 0·5 | | 86 11·37 | 6 18 47·88 | 152·064 | 56 56·24 | + 2·412 | | | | | | |
| | R | | | | | | | 70 13 | | 96 25·29 | 8 52 16·70 | 300·517 | 54 21·06 | + 9·139 | | | | | | |
| | R | | | | | | | 72 30 | | 98 42·61 | 9 26 36·47 | 340·583 | 53 41·04 | + 9·093 | | | | | | |
| Nov. 21st 0° & 180° | R | 146 Rangifer. (41 Bode) | 6° 36′ 20″·65 | W. 6° 59′ 30″·51 | H. M. S. 3 51 45·09 | H. M. S. 5 50 48·88 | H. M. S. 9 42 33·97 | H. 18+ M. S. 32 45 | | H. 9+ M. S. 0 22·96 | 10° 32′ 45″·11 | 424″·844 | 6° 52′ 31″·68 | π + 0° 0′ + 6″·010 | Vide Nov. 17th A.M. | Vide Nov. 17th A.M. | H. M. S. 22 56 44·52 α Pegasi | H. M. S. (8 30 29·9 − 0·49) = 8 30 29·41 | | |
| | R | | | | | | | 36 11 | | 3 49·44 | 9 41 8·03 | 358·288 | 53 36·96 | + 4·734 | | | | | | |
| | L | | | | | | | 51 40 | | 19 20·57 | 5 48 21·08 | 128·573 | 57 25·66 | + 3·719 | | | | | | |
| | L | | | | | | | 54 35·5 | | 22 16·47 | 5 4 22·53 | 98·128 | 57 55·50 | + 3·114 | | | | | | |
| | R | | | | | | | 67 24 | | 35 6·73 | 1 51 48·60 | 13·219 | 59 22·30 | + 5·005 | | | | | | |
| | R | | | | | | | 70 10 | | 37 53·11 | 1 10 12·90 | 5·211 | 59 30·64 | + 5·337 | | | | | | |
| | L | | | | | | | 84 37 | | 52 22·10 | 2 27 1·92 | 22·788 | 59 11·62 | + 3·894 | | | | | | |
| | L | | | | | | | 87 15·5 | | 55 0·96 | 3 6 44·88 | 36·742 | 58 57·34 | + 3·568 | | | | | | |
| | R | | | | | | | 98 35 | | 66 22·02 | 5 57 0·75 | 133·936 | 57 21·52 | + 4·942 | | | | | | |
| Nov. 22nd 9° & 189° | L | 146 Rangifer. (41 Bode) | 6° 36′ 20″·27 | W. 6° 59′ 30″·11 | H. M. S. 3 51 45·14 | H. M. S. 5 50 48·89 | H. M. S. 9 42 34·03 | H. 18+ M. S. 39 43 | | H. 9+ M. S. 10 40·11 | 7° 58′ 28″·79 | 242″·767 | 6° 55′ 31″·86 | π + 0° 0′ + 4″·515 | Vide Nov. 18th A.M. | Vide Nov. 18th A.M. | H. M. S. 22 56 44·50 α Pegasi | H. M. S. (8 27 11·9 − 0·16) = 8 27 11·74 | H. M. S. 14 29 32·76 | H. M. S. 3 17·65 |
| | L | | | | | | | 42 21 | | 13 18·47 | 7 18 53·34 | 204·209 | 56 9·58 | + 3·677 | | | | | | |
| | R | | | | | | | 54 5·5 | | 25 4·59 | 4 22 21·59 | 72·881 | 58 20·76 | + 3·529 | | | | | | |
| | R | | | | | | | 57 3·5 | | 28 3·00 | 3 37 45·47 | 50·188 | 58 43·80 | + 3·876 | | | | | | |
| | L | | | | | | | 71 18 | | 42 19·46 | 0 3 38·55 | 0·014 | 59 34·54 | + 4·442 | | | | | | |
| | L | | | | | | | 73 40 | | 44 41·79 | 0 31 56·34 | 1·077 | 59 32·44 | + 3·405 | | | | | | |
| | R | | | | | | | 84 12 | | 55 15·24 | 3 10 18·11 | 38·151 | 58 56·22 | + 4·259 | | | | | | |
| | R | | | | | | | 86 34 | | 57 37·56 | 3 45 53·00 | 53·724 | 58 40·34 | + 3·952 | | | | | | |
| | L | | | | | | | 96 53 | | 67 57·98 | 6 20 59·30 | 152·467 | 57 0·84 | + 3·195 | | | | | | |
| | L | | | | | | | 100 30 | | 71 35·48 | 7 15 21·78 | 198·911 | 56 15·60 | + 4·399 | | | | | | |
| Nov. 23rd 27° & 207° | L | 146 Rangifer. (41 Bode) | 6° 36′ 19″·89 | W. 6° 59′ 29″·71 | H. M. S. 3 51 45·17 | H. M. S. 5 50 48·90 | H. M. S. 9 42 34·07 | H. 18+ M. S. 41 13·5 | | H. 9+ M. S. 15 30·08 | 6° 45′ 59″·88 | 174″·710 | 6° 41′ 42″ | π + 0° 0′ + 6″·420 | Vide Nov. 20th A.M. | Vide Nov. 20th A.M. | H. M. S. 22 56 44·49 α Pegasi | H. M. S. (8 23 53·8 + 0·08) = 8 23 53·88 | H. M. S. 14 32 50·61 | H. M. S. 3 17·85 |
| | L | | | | | | | 44 17·5 | | 18 34·51 | 5 59 53·48 | 137·240 | 57 15·18 | + 2·710 | | | | | | |
| | R | | | | | | | 59 20·5 | | 33 39·60 | 2 13 37·04 | 18·881 | 59 17·08 | + 6·251 | | | | | | |
| | R | | | | | | | 62 15 | | 36 34·51 | 1 29 53·46 | 8·542 | 59 24·94 | + 3·772 | | | | | | |
| | L | | | | | | | 73 59 | | 48 20·14 | 1 26 31·05 | 7·896 | 59 25·12 | + 3·306 | | | | | | |
| | R | | | | | | | 76 49 | | 51 10·54 | 2 9 6·96 | 17·577 | 59 15·92 | + 3·787 | | | | | | |
| | R | | | | | | | 85 29·5 | | 59 52·24 | 4 19 32·60 | 70·892 | 58 24·50 | + 5·682 | | | | | | |
| | L | | | | | | | 87 54 | | 62 17·08 | 4 55 45·12 | 92·001 | 58 0·32 | + 2·611 | | | | | | |
| | L | | | | | | | 100 12 | | 74 36·79 | 8 0 40·82 | 242·281 | 55 32·06 | + 4·631 | | | | | | |



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G. T. Station Damargida Lat. 18° 3′ 15″ Long. 77° 42′ 31″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✻'s N. P. D. | Computed Terms. ✻'s Elongation. | Computed Terms. ✻'s A.R. | Computed Terms. ✻'s Horary Angle. | Computed Terms. ✻'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ′ P | Computed Space. δ′ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ✻'s Transit. A.R. | ✻'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 4th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 33 1·09 | ° ′ ″ E. 1 37 50·26 | h. m. s. 1 2 13·00 | h. m. s. 5 57 58·67 | h. m. s. 19 4 14·33 | h. m. s. 57 51 | | h. m. s. 43 5·87 | ° ′ ″ 5 17 6·80 | ″ 24·926 | ° ′ ″ 37 21·40 | π + 0° 0′ + 3·938 | | | h. m. s. 20 35 56·59 | h. m. s. (8 50 24·8 + 1·244) = 8 50 26·04 | h. m. s. 11 45 30·55 | m. s. 3 20·0 |
| | R | | | | | | | 59 46 | | 45 1·14 | 4 48 17·79 | 20·605 | 37 25·94 | + 3·719 | | | | | | |
| | L | | | | | | | 67 30 | | 52 46·22 | 2 52 1·65 | 7·342 | 37 46·94 | − 4·018 | | | | | | |
| | L | | | | | | | 69 40 | | 54 56·52 | 2 19 27·12 | 4·825 | 37 48·00 | − 2·561 | | | | | | |
| | R | | | | | | | 76 28 | | 61 45·47 | 0 37 12·92 | 0·344 | 37 47·20 | + 2·720 | | | | | | |
| | R | | | | | | | 78 36 | | 63 53·76 | 0 5 8·46 | 0·007 | 37 46·18 | + 4·077 | | | | | | |
| | L | | | | | | | 87 12 | | 72 30·96 | 2 4 9·50 | 3·828 | 37 49·62 | − 3·184 | | | | | | |
| | L | | | | | | | 89 7 | | 74 26·23 | 2 32 58·50 | 5·811 | 37 48·40 | − 3·947 | | | | | | |
| | R | | | | | | | 97 25 | | 82 45·38 | 4 37 45·83 | 19·156 | 37 26·54 | + 4·568 | | | | | | |
| | R | | | | | | | 99 16 | | 84 36·64 | 5 5 34·70 | 23·184 | 37 22·78 | + 4·300 | | | | | | |
| | L | | | | | | | 107 18 | | 92 39·76 | 7 6 21·47 | 45·118 | 37 5·84 | − 0·694 | | | | | | |
| | L | | | | | | | 109 24 | | 94 46·05 | 7 37 55·85 | 52·042 | 37 1·38 | − 3·158 | | | | | | |
| Oct. 4th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 33 0·89 | ° ′ ″ W. 1 37 50·06 | h. m. s. 1 2 13·07 | h. m. s. 5 57 58·68 | h. m. s. 7 0 11·74 | h. m. s. 43 25 | | h. m. s. 30 18·46 | ° ′ ″ 7 28 19·20 | ″ 49·882 | ° ′ ″ 37 2·10 | π + 0° 0′ + 1·927 | π + (0 0′) { R. + 1·829 L. − 2·323 } | F.R. 10 ..... F.L. 8 | h. m. s. 20 35 56·59 | h. m. s. (8 50 24·8 + 1·244) = 8 50 26·04 | h. m. s. 11 45 30·55 | m. s. 3 20·0 |
| | R | | | | | | | 49 58 | | 36 52·37 | 5 49 50·46 | 30·383 | 37 20·36 | + 0·688 | | | | | | |
| Oct. 5th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 0·69 | ° ′ ″ E. 1 37 49·84 | h. m. s. 1 2 13·12 | h. m. s. 5 57 58·68 | h. m. s. 19 4 14·44 | h. m. s. 53 27 | | h. m. s. 42 2·53 | ° ′ ″ 5 32 58·58 | ″ 27·477 | ° ′ ″ 37 19·48 | π + 0° 0′ + 2·886 | π + (0 0′) { R. + 1·905 L. − 3·039 } | F.R. 12 ..... F.L. 12 | h. m. s. 20 35 56·57 | h. m. s. (8 47 3·9 + 1·25) = 8 47 5·15 | h. m. s. 11 48 51·42 | m. s. 3 20·88 |
| | R | | | | | | | 56 8 | | 44 43·91 | 4 52 37·95 | 21·228 | 37 27·94 | + 0·675 | | | | | | |
| | L | | | | | | | 67 48 | | 56 25·54 | 1 57 13·49 | 3·410 | 37 48·82 | − 2·387 | | | | | | |
| | L | | | | | | | 70 3 | | 58 40·85 | 1 23 23·76 | 1·726 | 37 51·04 | − 2·923 | | | | | | |
| | R | | | | | | | 77 40 | | 66 18·92 | 0 31 7·22 | 0·240 | 37 47·06 | + 2·543 | | | | | | |
| | R | | | | | | | 80 0 | | 68 39·24 | 1 6 12·11 | 1·088 | 37 46·84 | + 1·915 | | | | | | |
| | L | | | | | | | 90 58 | | 79 38·78 | 3 51 5·12 | 13·258 | 37 40·22 | − 3·635 | | | | | | |
| | L | | | | | | | 93 23 | | 82 4·12 | 4 27 25·19 | 17·755 | 37 34·48 | − 2·392 | | | | | | |
| | R | | | | | | | 104 36 | | 93 18·68 | 7 16 3·71 | 47·190 | 37 1·40 | + 1·253 | | | | | | |
| | R | | | | | | | 107 0 | | 95 43·02 | 7 52 8·73 | 55·315 | 36 52·32 | + 2·208 | | | | | | |
| | L | | | | | | | 117 42 | | 106 26·52 | 10 33 1·19 | 99·350 | 36 14·32 | − 3·827 | | | | | | |
| | L | | | | | | | 120 3 | | 108 47·84 | 11 8 21·11 | 110·725 | 36 0·80 | − 1·682 | | | | | | |
| Oct. 5th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 0·49 | ° ′ ″ W. 1 37 49·63 | h. m. s. 1 2 13·19 | h. m. s. 5 57 58·68 | h. m. s. 7 0 11·87 | h. m. s. 47 0 | | h. m. s. 37 14·85 | ° ′ ″ 5 44 15·23 | ″ 29·418 | ° ′ ″ 37 20·06 | π + 0° 0′ − 0·156 | π + (0 0′) { R. + 1·167 L. − 2·871 } | F.R. 10 ..... F.L. 10 | h. m. s. 20 35 56·57 | h. m. s. (8 47 3·9 + 1·25) = 8 47 5·15 | h. m. s. 11 48 51·42 | m. s. 3 20·88 |
| | R | | | | | | | 49 20 | | 39 35·18 | 5 9 10·35 | 23·729 | 37 25·30 | − 0·605 | | | | | | |
| | L | | | | | | | 58 38 | | 48 54·47 | 2 49 20·96 | 7·120 | 37 40·86 | − 1·654 | | | | | | |
| | L | | | | | | | 60 39 | | 50 55·75 | 2 19 1·76 | 4·799 | 37 41·54 | − 3·295 | | | | | | |
| | R | | | | | | | 69 55 | | 60 13·04 | 0 0 17·58 | 0·000 | 37 51·92 | + 2·286 | | | | | | |
| | R | | | | | | | 72 11 | | 62 29·35 | 0 34 22·31 | 0·293 | 37 49·04 | − 0·301 | | | | | | |
| | L | | | | | | | 82 26 | | 72 35·76 | 3 5 58·35 | 8·579 | 37 38·96 | − 2·095 | | | | | | |
| | L | | | | | | | 84 20 | | 74 40·04 | 3 37 2·66 | 11·683 | 37 34·90 | − 3·051 | | | | | | |

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G. T. Station Damargida Lat. 18° 3′ 15″ Long. 77° 42′ 31″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ✻'s Transit. | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✻'s N. P. D. | ✻'s Elongation. | ✻'s A.R. | ✻'s Horary Angle. | ✻'s Sidereal Time of Maximum. | M. Solar. | Sidereal. | ∂ P | ∂ Z | | | | | A.R. | Chronom. Time. | Error. / Rate. |
| Oct. 6th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 0·29 | E. 1 ° 37 ′ 49″·42 | h. m. s. 1 2 13·23 | h. m. s. 5 57 58·69 | h. m. s. 19 4 14·54 | | h. 6+ m. s. 50 42 | | h. 18+ m. s. 42 37·50 | ° ′ ″ 5 24 15·62 | ″ 26·057 | 1°+ ′ ″ 37 20·08 | π + 0° 0′ + ″ 3·286 | | | h. m. s. 20 35 56·54 α Cygni | h. m. s. 11 52 11·22 | |
| | R | | | | | | | | 52 36 | | 44 31·76 | 4 55 41·66 | 21·672 | 37 26·46 | + 1·291 | | | | | |
| | L | | | | | | | | 61 13 | | 53 9·96 | 2 46 8·67 | 6·847 | 37 44·66 | — 2·084 | | | | | |
| | L | | | | | | | | 63 28 | | 55 25·27 | 2 12 18·99 | 4·344 | 37 47·90 | — 2·821 | | | | | |
| | R | | | | | | | | 72 26 | | 64 24·52 | 0 2 29·72 | 0·002 | 37 47·40 | + 2·021 | | | | | |
| | R | | | | | | | | 74 23 | | 66 21·79 | 0 31 48·80 | 0·251 | 37 46·66 | + 2·512 | | | | | |
| | L | | | | | | | | 83 36 | | 75 36·07 | 2 50 23·01 | 7·207 | 37 44·90 | — 2·684 | | | | | |
| | L | | | | | | | | 85 32 | | 77 32·34 | 3 19 27·05 | 9·876 | 37 42·00 | — 2·453 | | | | | |
| | R | | | | | | | | 94 4 | | 86 5·53 | 5 27 44·85 | 26·664 | 37 21·98 | + 0·779 | | | | | |
| | R | | | | | | | | 96 10 | | 88 11·82 | 5 59 19·23 | 32·047 | 37 15·70 | + 1·676 | | | | | |
| | L | | | | | | | | 106 34 | | 98 37·27 | 8 35 40·92 | 65·970 | 36 46·14 | — 2·687 | | | | | |
| | L | | | | | | | | 110 14 | | 102 17·78 | 9 30 48·57 | 80·806 | 36 31·48 | — 2·863 | | | | | |
| Oct. 6th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 0·09 | W. 1 ° 37 ′ 49″·21 | h. m. s. 1 2 13·30 | h. m. s. 5 57 58·69 | h. m. s. 7 0 11·99 | | h. 18+ m. s. 45 37 | | h. 6+ m. s. 39 12·46 | ° ′ ″ 5 14 52·89 | ″ 24·612 | 1°+ ′ ″ 37 23·24 | π + 0° 0′ — ″ 1·361 | | | h. m. s. 20 35 56·54 α Cygni | h. m. s. 11 52 11·22 | |
| | R | | | | | | | | 47 50 | | 41 25·77 | 4 41 33·24 | 19·679 | 37 28·90 | — 0·634 | | | | | |
| | L | | | | | | | | 58 20 | | 51 57·24 | 2 3 41·19 | 3·798 | 37 44·10 | — 1·315 | | | | | |
| | L | | | | | | | | 60 32 | | 54 9·55 | 1 30 36·57 | 2·038 | 37 43·14 | — 4·035 | | | | | |
| | R | | | | | | | | 71 40 | | 65 19·11 | 1 16 46·80 | 1·463 | 37 47·64 | — 0·110 | | | | | |
| | R | | | | | | | | 73 58 | | 67 37·43 | 1 51 21·63 | 3·077 | 37 44·00 | — 2·136 | | | | | |
| | L | | | | | | | | 85 8 | | 78 48·99 | 4 39 15·08 | 19·330 | 37 25·94 | — 3·943 | | | | | |
| | L | | | | | | | | 87 55 | | 81 36·38 | 5 21 5·93 | 25·551 | 37 20·36 | — 3·302 | | | | | |
| Oct. 7th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 32 59·89 | E. 1 ° 37 ′ 49″·00 | h. m. s. 1 2 13·33 | h. m. s. 5 57 58·70 | h. m. s. 19 4 14·63 | | h. 6+ m. s. 49 10 | | h. 18+ m. s. 44 26·73 | ° ′ ″ 4 56 58·47 | ″ 21·859 | 1°+ ′ ″ 37 25·28 | π + 0° 0′ + ″ 1·863 | | | h. m. s. 20 35 56·52 α Cygni | h. m. s. 11 55 32·30 | |
| | R | | | | | | | | 51 8 | | 46 25·01 | 4 27 24·35 | 17·726 | 37 29·30 | + 1·976 | | | | | |
| | L | | | | | | | | 59 10 | | 54 28·13 | 2 26 37·47 | 5·333 | 37 48·02 | — 4·351 | | | | | |
| | L | | | | | | | | 61 29 | | 56 47·46 | 1 51 47·61 | 3·101 | 37 48·64 | — 2·739 | | | | | |
| | R | | | | | | | | 69 20 | | 64 39·56 | 0 6 13·88 | 0·010 | 37 48·38 | + 0·612 | | | | | |
| | R | | | | | | | | 71 20 | | 66 39·84 | 0 36 18·08 | 0·327 | 37 47·16 | + 1·515 | | | | | |
| | L | | | | | | | | 80 20 | | 75 41·09 | 2 51 36·96 | 7·311 | 37 43·56 | — 1·869 | | | | | |
| | L | | | | | | | | 83 21 | | 78 42·52 | 3 36 58·29 | 11·687 | 37 40·26 | — 2·945 | | | | | |
| | R | | | | | | | | 91 59 | | 87 21·73 | 5 46 46·43 | 29·847 | 37 17·02 | + 2·135 | | | | | |
| | R | | | | | | | | 94 4 | | 89 27·02 | 6 18 5·79 | 35·479 | 37 11·40 | + 2·123 | | | | | |
| | L | | | | | | | | 103 31 | | 98 55·34 | 8 40 10·64 | 67·119 | 36 44·20 | — 2·317 | | | | | |
| | L | | | | | | | | 106 0 | | 101 24·69 | 9 17 30·86 | 77·085 | 36 35·44 | — 3·523 | | | | | |
| Oct. 7th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 32 59·69 | W. 1 ° 37 ′ 48″·79 | h. m. s. 1 2 13·40 | h. m. s. 5 57 58·70 | h. m. s. 7 0 12·09 | | h. 18+ m. s. 39 17 | | h. 6+ m. s. 36 13·22 | ° ′ ″ 5 59 43·19 | ″ 32·115 | 1°+ ′ ″ 37 17·52 | π + 0° 0′ + ″ 0·843 | | | h. m. s. 20 35 56·52 α Cygni | h. m. s. 11 55 32·30 | |
| | R | | | | | | | | 41 35 | | 38 31·54 | 5 25 8·36 | 26·239 | 37 23·22 | + 0·667 | | | | | |
| | L | | | | | | | | 51 27 | | 48 24·92 | 2 56 47·61 | 7·759 | 37 37·58 | — 3·453 | | | | | |
| | L | | | | | | | | 54 23 | | 51 21·33 | 2 12 41·45 | 4·371 | 37 42·28 | — 2·141 | | | | | |
| | R | | | | | | | | 68 10 | | 65 10·26 | 1 14 32·52 | 1·379 | 37 49·08 | + 1·667 | | | | | |
| | R | | | | | | | | 70 51 | | 67 51·64 | 1 54 53·16 | 3·274 | 37 44·02 | — 1·498 | | | | | |
| | L | | | | | | | | 79 20 | | 76 21·83 | 4 2 26·00 | 14·571 | 37 33·02 | — 1·201 | | | | | |
| | L | | | | | | | | 82 33 | | 79 35·28 | 4 50 47·75 | 20·959 | 37 26·18 | — 1·653 | | | | | |

$\pi + (0\ 0') \left\{ \begin{matrix} \text{R.} + 0''.176 \\ \text{L.} - 3''.000 \end{matrix} \right\}$ — F.R. 8 ..... F.L. 8 — (8 40 23·0 + 1·22) = 8 40 24·22 — 3 21·08

$\pi + (0\ 0') \left\{ \begin{matrix} \text{R.} + 2''.157 \\ \text{L.} - 2''.560 \end{matrix} \right\}$ — F.R. 12 ..... F.L. 12 — (8 40 23·0 + 1·22) = 8 40 24·22 — 3 21·08

$\pi + (0\ 0') - \left\{ \begin{matrix} \text{R } 0''.327 \\ \text{L } 3''.753 \end{matrix} \right\}$ — F.R. 10 ..... F.L. 10 — (8 43 43·9 + 1·42) = 8 43 45·32 — 3 19·80

$\pi + (0\ 0') \left\{ \begin{matrix} \text{R.} + 1''.425 \\ \text{L.} - 3''.401 \end{matrix} \right\}$ — F.R. 10 ..... F.L. 10 — (8 43 43·9 + 1·42) = 8 43 45·32 — 3 19·80

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G. T. Station Damargida Lat. 18° 3′ 15″ Long. 77° 42′ 31″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ✱'s Transit. | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | M. Solar. | Sidereal. | ∂ P | ∂ Z | | | | A.R. | Chronom. Time. | Error. | Rate. |
| Oct. 8th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 32 59·59 | ° ′ ″ E. 1 37 48·69 | h. m. s. 1 2 13·41 | h. m. s. 5 57 58·70 | h. m. s. 19 4 14·70 | h.6+ m. s. 41 3 | | h.18+ m. s. 39 40·35 | ° ′ ″ 6 8 35·34 | ″ 33·653 | ° ′ ″ 1°+ 37 13·46 | π + 0° 0′ ″ + 1·573 | Vide Oct. 4th A.N. | Vide Oct. 4th A.N. | h. m. s. 20 35 56·50 α Cygni | h. m. s. (8 37 1·8+1·10)=8 37 2·90 | h. m. s. 11 58 53·60 | h. m. s. 3 21·30 |
| | R | | | | | | | 43 21 | | 41 58·67 | 5 34 0·51 | 27·642 | 37 20·48 | + 0·564 | | | | | | |
| | L | | | | | | | 54 43 | | 53 22·26 | 2 43 6·62 | 6·599 | 37 43·28 | — 1·193 | | | | | | |
| | L | | | | | | | 56 57 | | 55 36·58 | 2 9 31·92 | 4·162 | 37 45·36 | — 0·836 | | | | | | |
| | R | | | | | | | 65 32 | | 64 12·78 | 0 0 28·88 | 0·000 | 37 46·00 | + 2·686 | | | | | | |
| | R | | | | | | | 67 55 | | 66 36·11 | 0 35 21·12 | 0·310 | 37 43·18 | + 5·196 | | | | | | |
| | L | | | | | | | 77 6 | | 75 48·40 | 2 53 25·43 | 7·466 | 37 44·68 | — 3·460 | | | | | | |
| | L | | | | | | | 79 17 | | 77 59·70 | 3 26 15·02 | 10·560 | 37 40·86 | — 2·734 | | | | | | |
| | R | | | | | | | 87 58 | | 86 41·92 | 5 36 48·27 | 28·154 | 37 18·76 | + 1·772 | | | | | | |
| | R | | | | | | | 90 40 | | 89 24·30 | 6 17 23·94 | 35·347 | 37 11·36 | + 1·979 | | | | | | |
| | L | | | | | | | 101 40 | | 100 25·84 | 9 2 47·06 | 73·068 | 36 39·02 | — 3·402 | | | | | | |
| | L | | | | | | | 104 18 | | 103 4·21 | 9 42 22·59 | 84·098 | 36 26·34 | — 1·752 | | | | | | |
| Oct. 8th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 32 59·39 | ° ′ ″ W. 1 37 48·48 | h. m. s. 1 2 13·48 | h. m. s. 5 57 58·71 | h. m. s. 7 0 12·18 | h.18+ m. s. 39 26 | | h.6+ m. s. 39 44·31 | ° ′ ″ 5 6 58·07 | ″ 23·388 | ° ′ ″ 1°+ 37 28·58 | π+0° 0′ ″ + 3·491 | Vide Oct. 4th A.M. | Vide Oct. 4th A.M. | h. m. s. 20 35 56·50 α Cygni | h. m. s. (8 37 1·8+1·10)=8 37 2·90 | h. m. s. 11 58 53·60 | h. m. s. 3 21·30 |
| | R | | | | | | | 41 39 | | 41 57·62 | 4 33 38·39 | 18·586 | 37 34·00 | + 4·109 | | | | | | |
| | L | | | | | | | 54 0 | | 54 20·36 | 1 27 57·35 | 1·920 | 37 47·12 | + 0·563 | | | | | | |
| | L | | | | | | | 56 0 | | 56 20·64 | 0 57 53·12 | 0·832 | 37 47·36 | — 0·285 | | | | | | |
| | R | | | | | | | 64 25 | | 64 46·82 | 1 8 39·63 | 1·170 | 37 48·22 | + 0·913 | | | | | | |
| | R | | | | | | | 66 15 | | 66 37·08 | 1 36 13·50 | 2·297 | 37 47·32 | + 1·140 | | | | | | |
| | L | | | | | | | 75 1 | | 75 24·31 | 3 48 2·00 | 12·892 | 37 34·24 | — 1·345 | | | | | | |
| | L | | | | | | | 76 47 | | 77 10·56 | 4 14 35·72 | 16·068 | 37 28·44 | — 3·969 | | | | | | |
| Oct. 9th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 32 59·19 | ° ′ ″ E. 1 37 48·27 | h. m. s. 1 2 13·48 | h. m. s. 5 57 58·71 | h. m. s. 19 4 14·77 | h.6+ m. s. 34 55 | | h.18+ m. s. 36 53·93 | ° ′ ″ 6 50 12·60 | ″ 41·665 | ° ′ ″ 1°+ 37 4·00 | π+0° 0′ ″ + 2·600 | Vide Oct. 7th A.N. | Vide Oct. 7th A.N. | h. m. s. 20 35 56·47 α Cygni | h. m. s. (8 33 39·8+1·04)=8 33 40·84 | h. m. s. 12 2 15·63 | h. m. s. 3 22·03 |
| | R | | | | | | | 37 52 | | 39 51·34 | 6 5 51·38 | 33·154 | 37 13·28 | + 1·831 | | | | | | |
| | L | | | | | | | 45 28 | | 47 28·41 | 4 11 35·34 | 15·691 | 37 35·86 | — 3·286 | | | | | | |
| | L | | | | | | | 47 35 | | 49 35·71 | 3 39 45·89 | 11·974 | 37 38·36 | — 2·069 | | | | | | |
| | R | | | | | | | 56 26 | | 58 27·95 | 1 26 42·21 | 1·865 | 37 44·00 | + 2·400 | | | | | | |
| | R | | | | | | | 61 45 | | 63 47·70 | 0 6 46·01 | 0·011 | 37 45·68 | + 2·574 | | | | | | |
| | L | | | | | | | 70 8 | | 72 11·88 | 1 59 16·68 | 3·531 | 37 47·10 | — 2·366 | | | | | | |
| | L | | | | | | | 72 12 | | 74 16·17 | 2 30 21·05 | 5·611 | 37 43·92 | — 1·266 | | | | | | |
| | R | | | | | | | 81 5 | | 83 10·42 | 4 43 54·78 | 20·006 | 37 25·68 | + 2·579 | | | | | | |
| | R | | | | | | | 83 6 | | 85 11·70 | 5 14 14·04 | 24·507 | 37 20·08 | + 3·678 | | | | | | |
| | L | | | | | | | 92 17 | | 94 23·99 | 7 32 18·41 | 50·755 | 36 59·70 | — 2·190 | | | | | | |
| | L | | | | | | | 94 32 | | 96 39·31 | 8 6 8·16 | 58·623 | 36 51·44 | — 1·798 | | | | | | |
| Oct. 9th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 32 58·99 | ° ′ ″ W. 1 37 48·06 | h. m. s. 1 2 13·55 | h. m. s. 5 57 58·72 | h. m. s. 7 0 12·26 | h.18+ m. s. 52 52 | | h.6+ m. s. 56 34·13 | ° ′ ″ 0 54 31·94 | ″ 0·738 | ° ′ ″ 1°+ 37 45·02 | π + 0° 0′ ″ — 2·298 | Vide Oct. 7th A.M. | Vide Oct. 7th A.M. | h. m. s. 20 35 56·47 α Cygni | h. m. s. (8 33 39·8+1·04)=8 33 40·84 | h. m. s. 12 2 15·63 | h. m. s. 3 22·03 |
| | R | | | | | | | 55 47 | | 59 29·54 | 0 10 40·83 | 0·028 | 37 49·90 | + 1·872 | | | | | | |
| | L | | | | | | | 77 46 | | 81 31·61 | 5 19 50·25 | 25·346 | 37 18·66 | — 4·050 | | | | | | |
| | L | | | | | | | 80 53 | | 84 39·05 | 6 6 41·78 | 33·305 | 37 11·18 | — 3·571 | | | | | | |
| | R | | | | | | | 91 9 | | 94 56·48 | 8 41 3·29 | 67·153 | 36 41·64 | + 0·737 | | | | | | |
| | R | | | | | | | 93 13 | | 97 0·77 | 9 12 7·62 | 75·377 | 36 32·10 | — 0·579 | | | | | | |
| | L | | | | | | | 103 44 | | 107 33·24 | 11 50 14·66 | 124·504 | 35 39·26 | — 4·292 | | | | | | |
| | L | | | | | | | 106 5 | | 109 54·57 | 12 25 34·59 | 137·137 | 35 27·28 | — 3·639 | | | | | | |

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G. T. Station Damargida Lat. 18° 3′ 15″ Long. 77° 42′ 31″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 10th 18° & 19° | R | α Ursæ Minoris | ° ′ ″ 1 32 58·79 | ° ′ ″ E. 1 37 47·85 | H. M. S. 1 2 13·55 | H. M. S. 5 57 58·72 | H. M. S. 19 4 14·83 | H. 6+ M. S. 27 18 | | H. 18+ M. S. 32 37·15 | ° ′ ″ 7 54 25·16 | ″ 55·693 | ° ′ ″ 36 52·42 | π + 0° 0′ −0″·268 | Vide Oct. 6th A.M. | Vide Oct. 6th A.M. | H. M. S. 20 35 56·45 α Cygni | H. M. S. (8 30 18·9+1·21)=8 30 20·11 | H. M. S. 12 5 36·34 | H. M. S. 3 20·71 |
| | R | | | | | | | 29 18 | | 34 37·43 | 7 24 20·97 | 48·871 | 36 57·14 | +1·834 | | | | | | |
| | L | | | | | | | 39 28 | | 44 48·85 | 4 51 29·66 | 21·056 | 37 30·90 | −4·111 | | | | | | |
| | R | | | | | | | 41 11 | | 46 32·09 | 4 25 41·06 | 17·495 | 37 34·80 | −4·450 | | | | | | |
| | L | | | | | | | 51 10 | | 56 32·48 | 1 55 35·15 | 3·314 | 37 44·56 | −0·029 | | | | | | |
| | L | | | | | | | 61 39 | | 67 2·95 | 0 42 1·83 | 0·438 | 37 46·26 | +1·147 | | | | | | |
| | | | | | | | | 77 44 | | 83 10·20 | 4 43 50·54 | 19·995 | 37 32·64 | −4·790 | | | | | | |
| | | | | | | | | 79 48 | | 85 14·48 | 5 14 54·87 | 24·611 | 37 28·30 | −5·066 | | | | | | |
| Oct. 10th 18° & 19° | R | α Ursæ Minoris | ° ′ ″ 1 32 58·59 | ° ′ ″ W. 1 37 47·64 | H. M. S. 1 2 13·62 | H. M. S. 5 57 58·72 | H. M. S. 7 0 12·34 | H. 18+ M. S. 23 40 | | H. 6+ M. S. 30 39·78 | ° ′ ″ 7 23 8·36 | ″ 48·715 | ° ′ ″ 36 59·44 | π + 0° 0′ +0″·520 | Vide Oct. 6th A.M. | Vide Oct. 6th A.M. | H. M. S. 20 35 56·45 α Cygni | H. M. S. (8 30 18·9+1·21)=8 30 20·11 | H. M. S. 12 5 36·34 | H. M. S. 3 20·71 |
| | R | | | | | | | 25 50 | | 32 50·09 | 6 50 33·78 | 41·820 | 37 7·18 | +1·365 | | | | | | |
| | L | | | | | | | 40 39 | | 47 41·17 | 3 7 47·54 | 8·753 | 37 36·46 | −2·422 | | | | | | |
| | L | | | | | | | 43 58 | | 51 0·64 | 2 17 55·53 | 4·678 | 37 36·92 | −6·037 | | | | | | |
| | R | | | | | | | 53 45 | | 60 49·01 | 0 9 10·11 | 0·021 | 37 47·90 | +0·286 | | | | | | |
| | R | | | | | | | 55 40 | | 62 44·28 | 0 37 59·15 | 0·358 | 37 47·54 | +0·263 | | | | | | |
| | L | | | | | | | 65 46 | | 72 51·70 | 3 9 50·46 | 8·936 | 37 35·10 | −3·599 | | | | | | |
| | L | | | | | | | 68 11 | | 75 17·04 | 3 46 10·56 | 12·681 | 37 31·06 | −3·894 | | | | | | |
| | R | | | | | | | 81 54 | | 89 1·97 | 7 12 24·50 | 46·282 | 37 2·10 | +0·747 | | | | | | |
| | R | | | | | | | 83 41 | | 90 49·22 | 7 39 13·25 | 52·188 | 36 53·24 | −2·207 | | | | | | |
| | L | | | | | | | 93 0 | | 100 9·53 | 9 59 17·91 | 88·756 | 36 14·68 | −4·199 | | | | | | |
| | L | | | | | | | 95 50 | | 102 59·93 | 10 41 53·88 | 101·773 | 36 1·08 | −4·782 | | | | | | |
| Oct. 11th 9° & 18° | R | α Ursæ Minoris | ° ′ ″ 1 32 58·39 | ° ′ ″ E. 1 37 47·42 | H. M. S. 1 2 13·61 | H. M. S. 5 57 58·73 | H. M. S. 19 4 14·88 | H. 6+ M. S. 26 57 | | H. 18+ M. S. 35 38·50 | ° ′ ″ 7 9 5·66 | ″ 45·575 | ° ′ ″ 37 0·60 | π + 0° 0′ +1″·249 | Vide Oct. 5th A.M. | Vide Oct. 5th A.M. | H. M. S. 20 35 56·42 α Cygni | H. M. S. (8 26 56·8+1·24)=8 26 58·04 | H. M. S. 12 8 58·38 | H. M. S. 3 22·04 |
| | R | | | | | | | 29 30 | | 38 11·86 | 6 30 45·27 | 37·807 | 37 8·14 | +1·477 | | | | | | |
| | L | | | | | | | 38 33 | | 47 16·13 | 4 14 41·19 | 16·077 | 37 34·26 | −2·913 | | | | | | |
| | L | | | | | | | 40 42 | | 49 25·43 | 3 42 21·65 | 12·257 | 37 38·90 | −3·733 | | | | | | |
| | R | | | | | | | 49 38 | | 58 22·69 | 1 28 2·81 | 1·923 | 37 43·34 | +2·161 | | | | | | |
| | R | | | | | | | 54 29 | | 63 14·37 | 0 15 7·58 | 0·057 | 37 46·48 | +0·887 | | | | | | |
| | L | | | | | | | 65 34 | | 74 20·93 | 2 31 30·81 | 5·697 | 37 43·70 | −1·973 | | | | | | |
| | L | | | | | | | 68 9 | | 76 56·29 | 3 10 21·26 | 8·993 | 37 41·84 | −3·409 | | | | | | |
| | R | | | | | | | 78 28 | | 87 16·75 | 5 45 28·02 | 29·614 | 37 15·34 | +2·470 | | | | | | |
| | R | | | | | | | 80 42 | | 89 31·06 | 6 19 2·73 | 35·648 | 37 8·64 | +3·136 | | | | | | |
| | L | | | | | | | 93 2 | | 101 52·79 | 9 24 28·76 | 78·999 | 36 31·30 | −2·875 | | | | | | |
| | L | | | | | | | 95 38 | | 104 29·16 | 10 3 34·23 | 90·300 | 36 21·84 | −4·716 | | | | | | |
| Oct. 11th 9° & 18° | R | α Ursæ Minoris | ° ′ ″ 1 32 58·19 | ° ′ ″ W. 1 37 47·22 | H. M. S. 1 2 13·68 | H. M. S. 5 57 58·73 | H. M. S. 7 0 12·41 | H. 18+ M. S. 25 53 | | H. 6+ M. S. 36 15·25 | ° ′ ″ 5 59 17·40 | ″ 32·030 | ° ′ ″ 37 18·70 | π + 0° 0′ +3″·515 | Vide Oct. 6th A.M. | Vide Oct. 6th A.M. | H. M. S. 20 35 56·42 α Cygni | H. M. S. (8 26 56·8+1·24)=8 26 58·04 | H. M. S. 12 8 58·38 | H. M. S. 3 22·04 |
| | R | | | | | | | 28 20 | | 38 42·59 | 5 22 27·26 | 25·801 | 37 24·72 | +3·306 | | | | | | |
| | L | | | | | | | 43 27 | | 53 51·71 | 1 35 10·50 | 2·248 | 37 42·82 | −2·147 | | | | | | |
| | L | | | | | | | 45 51 | | 56 16·04 | 0 59 5·46 | 0·866 | 37 42·54 | −3·809 | | | | | | |
| | R | | | | | | | 56 22 | | 66 48·52 | 1 39 1·64 | 2·432 | 37 46·54 | +1·757 | | | | | | |
| | R | | | | | | | 58 40 | | 69 6·84 | 2 13 36·47 | 4·427 | 37 41·80 | −0·988 | | | | | | |
| | L | | | | | | | 67 22 | | 77 50·06 | 4 24 24·74 | 17·326 | 37 27·70 | −2·189 | | | | | | |
| | L | | | | | | | 69 19 | | 79 47·33 | 4 53 43·83 | 21·378 | 37 23·58 | −2·257 | | | | | | |
| | R | | | | | | | 78 55 | | 89 24·67 | 7 18 3·99 | 47·496 | 37 2·18 | +2·461 | | | | | | |
| | R | | | | | | | 81 14 | | 91 44·00 | 7 52 53·87 | 55·332 | 36 52·28 | +0·397 | | | | | | |
| | L | | | | | | | 90 49 | | 101 20·34 | 10 16 59·00 | 94·046 | 36[a] 9·94 | −3·229 | | | | | | |
| | L | | | | | | | 93 24 | | 103 55·70 | 10 55 49·43 | 106·211 | 35[b] 56·02 | −4·984 | | | | | | |

[a b] In the General Report M.S. these stand 37′, 36′ which are clearly clerical errors, and I have accordingly taken the liberty to correct them.



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G. T. Station Damargida Lat. 18° 3′ 15″ Long. 77° 42′ 31″ A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 12th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 32 57·79 | W. ° ′ ″ 1 37 46·79 | h. m. s. 1 2 13·72 | h. m. s. 5 57 58·74 | h. m. s. 7 0 12·46 | h. m. s. 18+ 31 28 | | h. m. s. 6+ 45 12·68 | ° ′ ″ 3 44 56·72 | ″ 12·557 | ° ′ ″ 37 36·18 | π + 0° 0′ + 1·943 | Vide Oct. 4th A.M. | Vide Oct. 4th A.M. | h. m. s. 11 35 56·39 α Cygni | h. m. s. (8 23 35·8 + 1·04) = 8 23 36·84 | h. m. s. 12 12 19·56 | m. s. 3 21·18 |
| | R | | | | | | | 33 54 | | 47 39·02 | 3 8 21·60 | 8·804 | 37 39·36 | + 1·370 | | | | | | |
| | L | | | | | | | 43 9 | | 56 55·31 | 0 49 17·18 | 0·603 | 37 43·36 | − 2·831 | | | | | | |
| | L | | | | | | | 45 47 | | 59 33·68 | 0 9 41·64 | 0·023 | 37 43·58 | − 3·191 | | | | | | |
| | R | | | | | | | 54 28 | | 68 15·90 | 2 0 51·60 | 3·623 | 37 45·62 | + 2·449 | | | | | | |
| | R | | | | | | | 56 10 | | 69 58·13 | 2 26 25·17 | 5·316 | 37 41·74 | + 0·262 | | | | | | |
| | L | | | | | | | 65 43 | | 79 32·47 | 4 50 0·23 | 20·838 | 37 21·08 | − 4·876 | | | | | | |
| | L | | | | | | | 68 10 | | 81 59·81 | 5 26 50·37 | 26·461 | 37 17·68 | − 2·653 | | | | | | |

Observations at G. T. Station Somtana in April 1838 superseded by those made in November 1838 as already detailed.

| April 2nd 0° & 180° | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | α Ursæ Minoris | ° ′ ″ 1 33 10·71 | W. ° ′ ″ 1 38 35·97 | h. m. s. 1 0 32·22 | h. m. s. 5 57 51·27 | h. m. s. 6 58 23·49 | h. m. s. 5+ 40 18 | | h. m. s. 6+ 43 36·85 | ° ′ ″ 3 41 39·60 | ″ 12·30 | ° ′ ″ 38 28·18 | π + 0° 0′ + 4·51 | π + (0° 0′) + { R 3″·000 L 7·222 } | F. R. 6 ..... F. L. 6 | h. m. s. (8 0 39·52) 15 Argus | h. m. s. (6 57 9·8 − 2·14) = 6 57 7·66 | h. m. s. 1 3 31·86 | m. s. −4 3·09 |
| | R | | | | | | | 42 33 | | 45 52·23 | 3 7 48·90 | 8·83 | 38 31·66 | + 4·52 | | | | | | |
| | L | | | | | | | 50 10 | | 53 30·52 | 1 13 14·55 | 1·34 | 38 40·88 | + 6·25 | | | | | | |
| | L | | | | | | | 52 15 | | 55 35·88 | 0 41 54·15 | 0·44 | 38 41·80 | + 6·27 | | | | | | |
| | R | | | | | | | 59 34 | | 62 56·12 | 1 8 9·45 | 1·16 | 38 35·88 | + 1·07 | | | | | | |
| | R | | | | | | | 61 32 | | 64 54·45 | 1 37 44·40 | 2·39 | 38 35·06 | + 1·48 | | | | | | |
| | L | | | | | | | 68 35 | | 71 58·64 | 3 23 47·25 | 10·38 | 38 35·04 | + 9·45 | | | | | | |
| | L | | | | | | | 70 52 | | 74 16·03 | 3 58 8·10 | 14·17 | 38 29·68 | + 7·88 | | | | | | |
| | R | | | | | | | 78 46 | | 82 11·37 | 5 56 58·20 | 31·82 | 38 6·98 | + 2·83 | | | | | | |
| | R | | | | | | | 80 49 | | 84 14·71 | 6 27 48·30 | 37·54 | 38 2·02 | + 3·59 | | | | | | |
| | L | | | | | | | 88 20 | | 91 46·99 | 8 20 52·50 | 62·56 | 37 40·50 | + 7·09 | | | | | | |
| | L | | | | | | | 90 35 | | 94 2·37 | 8 54 43·20 | 71·28 | 37 31·08 | + 6·39 | | | | | | |
| April 3rd 9° & 189° | | | | | | | | | | | | | | | | | | | | |
| | R | α Ursæ Minoris | ° ′ ″ 1 33 11·01 | E. ° ′ ″ 1 38 36·44 | h. m. s. 1 0 32·23 | h. m. s. 5 57 51·26 | h. m. s. 19 2 40·97 | h. m. s. 17+ 10 28 | | h. m. s. 18+ 19 45·84 | ° ′ ″ 10 43 46·95 | ″ 103·20 | ° ′ ″ 36 51·42 | π + 0° 0′ + 1·82 | π + (0° 0′) + { R 6″·591 L 3·920 } | F.R. 12 ..... F.L. 10 | h. m. s. 8 0 39·50 15 (Argus) | h. m. s. (6 53 6·2 − 1·43) = 6 53 4·77 | h. m. s. 1 7 34·73 | m. s. −4 2·87 |
| | R | | | | | | | 12 43 | | 22 6·23 | 10 8 41·10 | 92·30 | 36 55·08 | + 9·06 | | | | | | |
| | L | | | | | | | 20 57 | | 30 16·59 | 8 6 5·70 | 58·94 | 37 33·94 | + 3·56 | | | | | | |
| | L | | | | | | | 23 23 | | 32 42·99 | 7 29 29·70 | 50·42 | 37 42·84 | + 3·18 | | | | | | |
| | R | | | | | | | 31 19 | | 40 40·32 | 5 30 9·75 | 27·23 | 38 1·92 | + 7·29 | | | | | | |
| | R | | | | | | | 33 49 | | 43 10·74 | 4 52 33·45 | 21·39 | 38 10·54 | + 4·51 | | | | | | |
| | L | | | | | | | 41 38 | | 51 1·04 | 2 54 58·95 | 7·65 | 38 25·08 | + 3·71 | | | | | | |
| | R | | | | | | | 44 4 | | 53 27·45 | 2 18 22·80 | 4·79 | 38 28·42 | + 3·23 | | | | | | |
| | R | | | | | | | 52 0 | | 61 24·77 | 0 19 3·00 | 0·09 | 38 28·82 | + 7·53 | | | | | | |
| | R | | | | | | | 54 0 | | 63 25·11 | 0 11 2·10 | 0·03 | 38 29·36 | + 7·05 | | | | | | |

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**Observations at G. T. Station Somtana in April 1838 superseded by those made in November 1838 as already detailed.**

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| April 5th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 11·61 | W. ° ′ ″ 1 38 36·92 | H. M. S. 1 0 32·26 | H. M. S. 5 57 51·25 | H. M. S. 6 58 23·51 | H. 5+ M. S. 22 59 | | H. 6+ M. S. 38 19·67 | ° ′ ″ 5 0 57·60 | ″ 22·67 | ° ′ ″ 38 14·20 | π + 0° 0′ — 0·05 | | F.R. 6 ..... F.L. 6 | H. M. S. (8 0 39·46) 15 Argus | H. M. S. (6 45 4·9+0·18)=6 45 5·08 | H. M. S. 1 15 34·38 | M. S. 3 59·83 |
| | R | | | | | | | 24 3 | | 39 23·85 | 4 44 54·90 | 20·31 | 38 20·66 | + 4·05 | | | | | | |
| | L | | | | | | | 34 49 | | 50 11·64 | 2 2 58·05 | 3·78 | 38 39·26 | + 6·12 | | | | | | |
| | L | | | | | | | 36 50 | | 52 12·98 | 1 32 37·95 | 2·15 | 38 38·62 | + 3·85 | | | | | | |
| | R | | | | | | | 45 57 | | 61 21·50 | 0 44 29·85 | 0·50 | 38 38·18 | + 1·76 | | | | | | |
| | R | | | | | | | 48 8 | | 63 32·87 | 1 17 20·40 | 1·50 | 38 36·16 | + 0·74 | | | | | | |
| | L | | | | | | | 54 28 | | 69 53·93 | 2 52 36·30 | 7·45 | 38 34·66 | + 5·19 | | | | | | |
| | L | | | | | | | 56 40 | | 72 6·29 | 3 25 41·70 | 10·58 | 38 31·36 | + 5·02 | | | | | | |
| | R | | | | | | | 64 50 | | 80 17·66 | 5 28 32·25 | 26·96 | 38 13·12 | + 3·16 | | | | | | |
| | R | | | | | | | 66 45 | | 82 12·98 | 5 57 22·05 | 31·89 | 38 8·32 | + 3·29 | | | | | | |
| | L | | | | | | | 74 2 | | 89 31·19 | 7 46 55·20 | 54·40 | 37 46·78 | + 4·26 | | | | | | |
| | L | | | | | | | 76 49 | | 92 18·66 | 8 28 47·25 | 64·57 | 37 36·24 | + 3·89 | | | | | | |
| April 5th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 11·76 | E. ° ′ ″ 1 38 37·08 | H. M. S. 1 0 32·28 | H. M. S. 5 57 51·24 | H. M. S. 19 2 41·04 | H. 17+ M. S. 9 30 | | H. 18+ M. S. 26 52·71 | ° ′ ″ 8 57 4·95 | ″ 71·93 | ° ′ ″ 37 18·16 | π + 0° 0′ + 6·99 | | F.R. 6 ..... F.L. 6 | H. M. S. (8 0 39·46) 15 Argus | H. M. S. (6 45 4·9+0·18)=6 45 5·08 | H. M. S. 1 15 34·38 | M. S. 3 59·83 |
| | R | | | | | | | 11 53 | | 29 16·12 | 8 21 13·80 | 62·67 | 37 27·08 | + 7·33 | | | | | | |
| | L | | | | | | | 22 18 | | 39 42·93 | 5 44 31·65 | 29·65 | 38 4·68 | + 2·75 | | | | | | |
| | L | | | | | | | 24 6 | | 41 31·24 | 5 17 27·00 | 25·18 | 38 6·34 | + 5·56 | | | | | | |
| | R | | | | | | | 31 5 | | 48 31·46 | 3 32 23·70 | 11·28 | 38 17·22 | + 8·58 | | | | | | |
| | R | | | | | | | 33 22 | | 50 48·85 | 2 58 2·85 | 7·93 | 38 21·06 | + 8·09 | | | | | | |
| | L | | | | | | | 39 42 | | 57 9·95 | 1 22 46·35 | 1·71 | 38 32·94 | + 2·43 | | | | | | |
| | L | | | | | | | 41 40 | | 59 8·29 | 0 53 11·25 | 0·71 | 38 32·62 | + 3·75 | | | | | | |
| | R | | | | | | | 47 56 | | 65 25·38 | 0 41 5·10 | 0·42 | 38 29·32 | + 7·34 | | | | | | |
| | R | | | | | | | 49 45 | | 67 14·69 | 1 8 24·75 | 1·17 | 38 27·80 | + 8·11 | | | | | | |
| | L | | | | | | | 58 33 | | 76 4·22 | 3 20 47·70 | 10·09 | 38 23·08 | + 3·91 | | | | | | |
| | L | | | | | | | 61 3 | | 78 34·66 | 3 58 24·30 | 14·23 | 38 19·80 | + 3·05 | | | | | | |
| April 6th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 11·91 | W. ° ′ ″ 1 38 37·24 | H. M. S. 1 0 32·30 | H. M. S. 5 57 51·24 | H. M. S. 6 58 23·54 | H. 5+ M. S. 34 1 | | H. 6+ M. S. 53 32·88 | ° ′ ″ 1 12 39·90 | ″ 1·32 | ° ′ ″ 38 40·98 | π + 0° 0′ + 5·06 | | F.R. 6 ..... F.L. 6 | H. M. S. (8 0 39·45) 15 Argus | H. M. S. (6 40 56·0—0·04)=6 40 55·96 | H. M. S. 1 19 43·49 | M. S. 4 9·11 |
| | R | | | | | | | 35 55 | | 55 27·21 | 0 44 4·95 | 0·49 | 38 43·00 | + 6·25 | | | | | | |
| | L | | | | | | | 42 14 | | 61 47·31 | 0 50 56·55 | 0·65 | 38 40·10 | + 3·51 | | | | | | |
| | L | | | | | | | 44 20 | | 63 53·67 | 1 22 31·95 | 1·70 | 38 38·56 | + 3·02 | | | | | | |
| | R | | | | | | | 50 27 | | 70 1·73 | 2 54 32·85 | 7·62 | 38 36·02 | + 6·40 | | | | | | |
| | R | | | | | | | 52 14 | | 71 49·04 | 3 21 22·50 | 10·14 | 38 32·90 | + 5·80 | | | | | | |
| | L | | | | | | | 58 12 | | 77 48·08 | 4 51 8·10 | 21·18 | 38 19·76 | + 3·70 | | | | | | |
| | L | | | | | | | 59 59 | | 79 35·39 | 5 17 57·75 | 25·26 | 38 16·40 | + 4·42 | | | | | | |
| | R | | | | | | | 65 46 | | 85 23·39 | 6 44 57·75 | 40·95 | 38 3·84 | + 7·55 | | | | | | |
| | R | | | | | | | 67 46 | | 87 23·74 | 7 15 3·00 | 47·25 | 37 56·06 | + 6·07 | | | | | | |
| | L | | | | | | | 74 30 | | 94 8·90 | 8 56 20·40 | 71·73 | 37 29·62 | + 4·11 | | | | | | |
| | L | | | | | | | 76 40 | | 96 19·28 | 9 28 56·10 | 80·69 | 37 17·80 | + 1·25 | | | | | | |
| April 6th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 12·01 | E. ° ′ ″ 1 38 37·34 | H. M. S. 1 0 32·33 | H. M. S. 5 57 51·24 | H. M. S. 19 2 41·09 | H. 17+ M. S. 5 29 | | H. 18+ M. S. 26 59·58 | ° ′ ″ 8 55 26·65 | ″ 71·47 | ° ′ ″ 37 18·82 | π + 0° 0′ + 7·05 | | F.R. 4 ..... F.L. 4 | H. M. S. (8 0 39·45) 15 Argus | H. M. S. (6 40 56·0—0·04)=6 40 55·96 | H. M. S. 1 19 43·49 | M. S. 4 9·11 |
| | R | | | | | | | 7 56 | | 29 27·00 | 8 18 31·35 | 62·00 | 37 27·12 | + 8·22 | | | | | | |
| | L | | | | | | | 16 20 | | 37 52·44 | 6 12 9·75 | 34·59 | 37 59·00 | + 3·75 | | | | | | |
| | L | | | | | | | 19 10 | | 40 42·92 | 5 29 32·55 | 27·13 | 38 7·38 | + 2·83 | | | | | | |
| | R | | | | | | | 28 42 | | 50 16·56 | 3 6 7·95 | 8·66 | 38 21·24 | + 7·44 | | | | | | |
| | R | | | | | | | 30 48 | | 52 22·92 | 2 34 32·55 | 5·97 | 38 22·46 | + 8·91 | | | | | | |
| | L | | | | | | | 39 44 | | 61 20·45 | 0 20 9·60 | 0·10 | 38 36·80 | + 0·44 | | | | | | |
| | L | | | | | | | 41 46 | | 63 22·80 | 0 10 25·65 | 0·03 | 38 33·52 | + 3·79 | | | | | | |

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**Observations at G. T. Station Somtana in April 1838 superseded by those made in November 1838 as already detailed.**

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| April 7th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 33 12·26 | ° ′ ″ E. 1 38 37·61 | h. m. s. 1 0 32·38 | h. m. s. 5 57 51·23 | h. m. s. 19 2 41·15 | h. 17+ m. s. 3 56 | | h. 18+ m. s. 29 31·16 | ° ′ ″ 8 17 29·85 | ″ 61·75 | ′ ″ 1° + 37 27·94 | π + 0° 0′ + ″ 7·92 | π + (0° 0′) + { R ″ 7·903 L 3·795 } | F.R. 10 ....., F.L. 10 | h. m. s. (8 0 39·43) 15 Argus | h. m. s. (6 36 49·9 − 0·16) = 6 36 49·74 | m. s. 1 23 49·69 | m. s. 4 6·20 |
| | R | | | | | | | 6 10 | | 31 45·54 | 7 43 54·15 | 53·71 | 37 36·26 | + 7·64 | | | | | | |
| | L | | | | | | | 14 45 | | 40 21·98 | 5 34 47·55 | 28·00 | 38 4·78 | + 4·83 | | | | | | |
| | L | | | | | | | 17 18 | | 42 55·41 | 4 56 26·10 | 21·96 | 38 12·24 | + 3·41 | | | | | | |
| | R | | | | | | | 24 30 | | 50 8·62 | 3 8 7·95 | 8·85 | 38 20·54 | + 8·22 | | | | | | |
| | R | | | | | | | 26 50 | | 52 29·02 | 2 33 1·95 | 5·86 | 38 24·74 | + 7·01 | | | | | | |
| | L | | | | | | | 45 17 | | 70 59·12 | 2 4 29·55 | 3·88 | 38 30·54 | + 3·19 | | | | | | |
| | L | | | | | | | 47 4 | | 72 46·42 | 2 31 19·05 | 5·73 | 38 28·76 | + 3·12 | | | | | | |
| April 8th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 12·56 | ° ′ ″ E. 1 38 37·92 | h. m. s. 1 0 32·46 | h. m. s. 5 57 51·22 | h. m. s. 19 2 41·24 | h. 16+ m. s. 56 32 | | h. 18+ m. s. 26 7·94 | ° ′ ″ 9 8 19·50 | ″ 74·97 | ′ ″ 1° + 37 15·92 | π + 0° 0′ + ″ 7·03 | Vide April 3rd A.M. | Vide April 3rd A.M. | h. m. s. (8 0 39·41) 15 Argus | h. m. s. (6 32 48·1 + 0·10) = 6 32 48·20 | m. s. 1 27 51·21 | m. s. 4 1·52 |
| | R | | | | | | | 59 15 | | 28 51·39 | 8 27 27·75 | 64·24 | 37 27·26 | + 6·42 | | | | | | |
| | L | | | | | | | 68 20 | | 37 57·92 | 6 10 49·80 | 34·35 | 37 58·70 | + 4·87 | | | | | | |
| | L | | | | | | | 70 22 | | 40 0·26 | 5 40 14·70 | 28·92 | 38 4·68 | + 4·32 | | | | | | |
| | R | | | | | | | 78 15 | | 47 54·58 | 3 41 39·90 | 12·28 | 38 17·80 | + 7·84 | | | | | | |
| | R | | | | | | | 80 21 | | 50 0·94 | 3 10 4·50 | 9·03 | 38 22·34 | + 6·55 | | | | | | |
| | L | | | | | | | 87 10 | | 56 51·08 | 1 27 32·40 | 1·92 | 38 32·60 | + 3·40 | | | | | | |
| | L | | | | | | | 89 0 | | 58 41·39 | 0 59 57·75 | 0·90 | 38 32·58 | + 4·44 | | | | | | |
| | R | | | | | | | 96 28 | | 66 10·64 | 0 52 21·00 | 0·69 | 38 28·82 | + 8·41 | | | | | | |
| | R | | | | | | | 98 28 | | 68 10·98 | 1 22 26·10 | 1·70 | 38 30·64 | + 5·58 | | | | | | |
| | L | | | | | | | 105 55 | | 75 39·23 | 3 14 29·85 | 9·47 | 38 24·12 | + 4·33 | | | | | | |
| | L | | | | | | | 107 44 | | 77 28·54 | 3 41 49·50 | 12·32 | 38 21·44 | + 4·16 | | | | | | |
| April 9th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 33 12·86 | ° ′ ″ E. 1 38 38·24 | h. m. s. 1 0 32·55 | h. m. s. 5 57 51·22 | h. m. s. 19 2 41·33 | h. 16+ m. s. 51 43 | | h. 18+ m. s. 25 19·91 | ° ′ ″ 9 20 21·30 | ″ 78·30 | ′ ″ 1° + 37 13·46 | π + 0° 0′ + ″ 6·48 | Vide April 7th A.M. | Vide April 7th A.M. | h. m. s. (8 0 39·39) 15 Argus | h. m. s. (6 28 46·90 + 0·17) = 6 28 47·07 | m. s. 1 31 52·32 | m. s. 4 1·11 |
| | R | | | | | | | 54 5 | | 27 42·31 | 8 44 45·30 | 68·69 | 37 20·84 | + 8·71 | | | | | | |
| | L | | | | | | | 61 59 | | 35 37·64 | 6 45 55·35 | 41·15 | 37 52·44 | + 4·65 | | | | | | |
| | L | | | | | | | 64 9 | | 37 48·00 | 6 13 19·95 | 34·81 | 37 59·04 | + 4·39 | | | | | | |
| | R | | | | | | | 71 52 | | 45 32·30 | 4 17 15·45 | 16·55 | 38 11·56 | + 10·13 | | | | | | |
| | R | | | | | | | 73 50 | | 47 30·63 | 3 47 40·50 | 12·96 | 38 16·68 | + 8·60 | | | | | | |
| | L | | | | | | | 80 42 | | 54 23·78 | 2 4 23·25 | 3·87 | 38 30·68 | + 3·69 | | | | | | |
| | L | | | | | | | 82 48 | | 56 30·13 | 1 32 48·00 | 2·15 | 38 33·10 | + 2·99 | | | | | | |
| | R | | | | | | | 90 1 | | 63 44·35 | 0 15 45·30 | 0·06 | 38 31·80 | + 6·38 | | | | | | |
| | R | | | | | | | 91 52 | | 65 35·66 | 0 43 34·95 | 0·48 | 38 29·82 | + 7·94 | | | | | | |
| | L | | | | | | | 98 13 | | 71 57·72 | 2 19 5·85 | 4·84 | 38 29·62 | + 3·78 | | | | | | |
| | L | | | | | | | 100 43 | | 74 28·14 | 2 56 42·15 | 7·82 | 38 26·52 | + 3·90 | | | | | | |

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# SYNOPSIS OF OBSERVED AZIMUTHS

# SECTION KALIANPUR TO DAMARGIDA.

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## SERIES B.



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ε Ursæ Minoris at Ehmadpur G. T. Station 1838. $\pi + (1^\circ\ 38') +$

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6th December. | | 5th December. | | 4th December. | | 7th December. | | 6th December. | | 5th December. | | 7th December. | | 8th December. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 50″·19 | 56″·13 | 50″·73 | 52″·80 | 54″·41 | 52″·68 | 56″·26 | 55″·70 | 54″·65 | 53″·04 | 53″·03 | 53″·31 | 56″·79 | 54″·39 | 57″·07 | 57″·99 |
| 49·29 | 56·73 | 51·47 | 51·69 | 56·80 | 54·34 | 53·76 | 55·59 | 57·45 | 56·79 | 56·09 | 54·06 | 56·13 | 57·71 | 56·16 | 60·27 |
| 49·56 | 61·42 | 51·62 | 52·92 | 56·03 | 52·91 | 54·58 | 55·01 | 56·70 | 58·79 | 56·47 | 58·81 | 56·18 | 56·79 | 54·91 | 59·48 |
| 50·36 | 56·57 | 53·53 | 54·25 | 54·23 | 53·97 | 52·53 | 57·03 | 56·95 | 58·50 | 55·57 | 59·23 | 56·03 | 57·51 | 55·60 | 59·00 |
| 51·83 | 56·53 | 52·92 | 55·90 | 55·65 | 54·69 | 56·18 | 57·22 | 57·15 | 59·36 | 56·84 | 58·86 | 54·61 | 57·64 | 55·89 | 59·17 |
| 50·58 | 56·50 | 53·36 | 56·95 | 54·93 | 55·15 | 54·28 | 57·22 | 55·99 | 59·80 | 56·60 | 60·79 | 54·75 | 55·61 | 53·26 | 58·13 |
| | | | | | | | | | 59·02 | | | | 57·85 | | 59·81 |
| | | | | | | | | | 59·69 | | | | 53·69 | | 57·89 |
| 50·302 | 57·313 | 52·272 | 54·085 | 55·342 | 53·957 | 54·598 | 56·295 | 56·482 | 58·124 | 55·767 | 57·510 | 55·748 | 56·399 | 55·482 | 58·968 |

Resulting Azimuth of the Referring Lamp ..

Mean of the Western Elongation ..... $\pi + (1^\circ\ 38'\ 54''\cdot271)$
Mean of the Eastern Elongation ..... $\pi + (1\ 38\ 56\cdot810)$
General Mean ..... $\pi + (1\ 38\ 55\cdot541)$

δ Ursæ Minoris at Bhimbet G. T. Station 1838. $\pi - (16^\circ\ 7') -$

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25th December. | | 26th December. | | 27th December. | | 28th December. | | 25th December. | | 26th December. | | 27th December. | | 28th December. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 40″·61 | 36″·80 | 39″·35 | 39″·03 | 39″·72 | 39″·86 | 38″·61 | 36″·00 | 36″·35 | 34″·10 | 37″·70 | 33″·12 | 35″·91 | 35″·17 | 33″·95 | 36″·98 |
| 41·58 | 37·19 | 38·30 | 38·22 | 40·07 | 39·19 | 39·50 | 37·18 | 35·74 | 32·78 | 37·23 | 33·84 | 37·62 | 34·39 | 36·04 | 34·94 |
| 38·59 | 36·15 | 39·02 | 38·75 | 41·17 | 38·48 | 40·99 | 37·36 | 35·64 | 36·30 | 37·13 | 36·74 | 38·60 | 33·87 | 37·32 | 34·69 |
| 39·76 | 37·53 | 40·64 | 39·02 | 40·60 | 38·63 | 39·73 | 37·02 | 35·73 | 34·63 | 37·05 | 34·33 | 37·35 | 33·07 | 36·08 | 33·68 |
| 39·70 | 37·00 | 39·66 | 38·99 | 39·99 | 38·82 | 42·00 | 35·78 | 36·37 | 33·18 | 39·37 | 33·36 | 37·01 | 33·80 | 35·73 | 33·47 |
| 38·85 | 36·38 | 38·56 | 38·36 | 44·97 | 39·53 | 41·01 | 37·55 | 35·93 | 34·05 | 38·08 | 33·32 | 37·87 | 33·02 | 38·26 | 32·52 |
| | | | | | | | | 36·96 | | | | | | | |
| | | | | | | | | 36·62 | | | | | | | |
| 39·848 | 36·842 | 39·255 | 38·728 | 41·087 | 39·085 | 40·307 | 36·815 | 36·168 | 34·173 | 37·760 | 34·118 | 37·393 | 33·887 | 36·230 | 34·380 |

Resulting Azimuth of the Referring Lamp ..

Mean of Western Elongation ..... $\pi - (16^\circ\ 7'\ 38''\cdot996)$
Mean of Eastern Elongation ..... $\pi - (16\ 7\ 35\cdot514)$
General Mean ..... $\pi - (16\ 7\ 37\cdot255)$

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29 Camelopardalis Hev. at Nilgarh G. T. Station 1839. $\pi + (132^\circ\ 32')$ +

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14th February. | | 15th February. | | 16th February. | | 17th February. | | 18th February. | | 15th February. | | 16th February. | | 17th February. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 48″·38 | 7″·85 | 51″·03 | 49″·96 | 50″·67 | 52″·14 | 50″·67 | 53″·68 | 51″·90 | 51″·00 | 49″·89 | 48″·76 | 49″·55 | 47″·98 | 47″·94 | 48″·21 |
| 49·97 | 47·27 | 50·22 | 48·99 | 47·61 | 50·89 | 49·74 | 52·59 | 49·85 | 49·06 | 46·70 | 48·03 | 48·91 | 46·73 | 47·45 | 48·13 |
| 50·29 | 46·16 | 51·78 | 48·81 | 49·51 | 51·24 | 49·87 | 52·90 | 51·14 | 50·30 | 46·07 | 48·79 | 50·01 | 49·71 | 51·83 | 51·30 |
| 47·91 | 46·56 | 49·26 | 47·43 | 48·09 | 50·28 | 50·27 | 50·19 | 49·65 | 51·21 | 46·02 | 47·71 | 48·93 | 48·91 | 48·78 | 50·14 |
| 46·91 | 47·77 | 49·39 | 48·17 | 48·63 | 51·72 | 49·74 | 52·20 | 50·75 | 53·15 | 47·76 | 49·64 | 50·07 | 50·89 | 49·69 | 51·69 |
| 48·24 | 45·59 | 48·36 | 46·93 | 46·70 | 50·27 | 48·59 | 50·42 | 49·61 | 48·81 | 46·94 | 47·89 | 47·67 | 49·01 | 48·52 | 51·38 |
| 48·617 | 46·867 | 50·007 | 48·382 | 48·535 | 51·090 | 49·813 | 51·997 | 50·483 | 50·588 | 47·230 | 48·470 | 49·190 | 48·872 | 49·035 | 50·142 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi + (132^\circ\ 32'\ 49''\cdot414)$
- Mean of Western Elongation ..... $\pi + (132\ 32\ 49\cdot251)$
- General Mean ..... $\pi + (132\ 32\ 49\cdot333)$

λ Ursæ Minoris at Badgaon G. T. Station 1839. $\pi + (0^\circ\ 0')$

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19th January. | | 20th January. | | 21st & 23rd January. | | 22nd January. | | 19th & 25th January. | | 20th & 24th January. | | 23rd & 28th January. | | 22nd & 27th January. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| −1″·44 | +0″·19 | −1″·15 | +1″·49 | +1″·00 | −2″·24 | +1″·14 | +0″·46 | −0″·60 | +0″·26 | +0″·86 | −1″·38 | +2″·42 | −0″·35 | +1″·02 | +0″·08 |
| −1·39 | +0·66 | −1·44 | +1·11 | +0·17 | −1·03 | +0·17 | +0·45 | +0·24 | +0·95 | +1·81 | −1·28 | +1·15 | +0·06 | +0·76 | −0·68 |
| −1·63 | +2·02 | −1·45 | +0·61 | +0·34 | −0·23 | −0·81 | −1·09 | +0·79 | +0·29 | +2·76 | +0·39 | +4·38 | +1·34 | +1·68 | −2·57 |
| −1·18 | +1·21 | −1·30 | +0·39 | −0·11 | −1·04 | −0·26 | −0·70 | +1·49 | +0·27 | +1·89 | +0·42 | +3·70 | +1·06 | +1·21 | +2·18 |
| −2·18 | +2·09 | −2·33 | +0·75 | −0·45 | +1·44 | +0·48 | −0·88 | +1·25 | +0·14 | +2·38 | +0·58 | +4·14 | +2·74 | +3·07 | +0·13 |
| −1·69 | +1·81 | −2·56 | +0·45 | −1·60 | −0·45 | −0·50 | −1·03 | +2·26 | +0·56 | +3·47 | +0·45 | +1·87 | +2·89 | +0·29 | +0·42 |
| | | | | +0·38 | −0·21 | | | +2·13 | +0·49 | +3·13 | | +3·75 | +1·12 | +0·56 | +2·32 |
| | | | | −1·05 | −0·56 | | | | +0·93 | +3·30 | | +3·38 | +1·49 | +3·00 | +1·13 |
| | | | | −0·93 | +1·04 | | | | | +2·31 | | | +0·42 | | |
| | | | | −0·40 | −1·23 | | | | | +2·78 | | | +1·36 | | |
| −1·585 | +1·330 | −1·705 | +0·800 | −0·265 | −0·451 | +0·037 | −0·465 | +1·080 | +0·486 | +2·469 | −0·137 | +3·099 | +1·213 | +1·449 | +0·376 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation ..... $\pi - (0^\circ\ 0'\ 0''\cdot288)$
- Mean of Eastern Elongation ..... $\pi + (0\ 0\ 1\cdot254)$
- General Mean ..... $\pi + (0\ 0\ 0\cdot483)$

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δ Ursæ Minoris at Sakri G. T. Station 1838. $\pi + (0^\circ\ 0')$

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24th December. | | 25th December. | | 26th December. | | 27th December. | | 30th December. | | 25th & 29th December. | | 28th December. | | 27th December. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| −1″·72 | −0″·23 | −2″·18 | −1″·45 | −2″·15 | −2″·28 | −1″·08 | −1″·86 | +1″·29 | −1″·40 | +1″·87 | −1″·50 | +2″·19 | −3″·45 | +1″·66 | −2″·18 |
| −1·52 | −0·18 | −1·51 | −2·44 | −2·19 | −2·32 | −1·68 | −1·26 | +0·56 | −1·93 | +0·81 | +0·86 | +0·46 | −1·86 | +0·64 | +0·50 |
| −2·54 | +0·72 | −2·98 | −2·95 | −4·66 | −3·36 | −2·44 | −2·54 | −0·45 | +0·55 | +3·68 | +1·00 | +1·00 | −0·50 | +2·48 | +0·03 |
| −3·17 | −0·82 | −3·40 | −2·81 | −3·94 | −3·84 | −2·62 | −2·99 | −1·09 | +2·11 | +0·80 | +0·36 | +1·36 | +1·34 | +2·14 | −0·28 |
| −3·10 | −1·70 | −2·47 | −2·33 | −5·78 | −3·04 | −3·02 | −2·10 | +0·76 | +0·39 | −0·52 | −0·37 | +2·84 | +0·37 | +3·34 | +3·37 |
| −2·43 | +0·62 | −1·34 | −2·30 | −5·36 | −2·71 | −3·66 | −1·04 | +1·29 | +0·89 | −1·58 | −0·06 | +1·86 | +0·44 | +2·01 | +2·09 |
| | | | | | | | | | | −0·33 | +0·86 | | | | |
| | | | | | | | | | | +1·38 | −0·16 | | | | |
| | | | | | | | | | | −0·22 | | | | | |
| | | | | | | | | | | +1·84 | | | | | |
| −2·413 | −0·265 | −2·313 | −2·380 | −4·013 | −2·925 | −2·417 | −1·965 | +0·393 | +0·102 | +0·773 | +0·124 | +1·618 | −0·610 | +2·045 | +0·588 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation ..... $\pi - (0^\circ\ 0'\ 2''\cdot336)$
- Mean of Eastern Elongation ..... $\pi + (0\ 0\ 0\cdot629)$
- General Mean ..... $\pi - (0\ 0\ 0\cdot854)$

146 Rangifer. (41 Bode) at Somtana G. T. Station 1838. $\pi + (0^\circ\ 0') +$

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17th November. | | 18th November. | | 20th November. | | 21st November. | | 17th & 21st November. | | 18th & 22nd November. | | 19th November. | | 20th & 23rd November. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 270° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 270° |
| 7″·44 | 5″·03 | 8″·96 | 3″·61 | 7″·12 | 1″·22 | 8″·67 | 3″·56 | 5″·03 | 3″·95 | 6″·87 | 3″·39 | 4″·17 | 1″·28 | 5″·62 | 0″·67 |
| 6·83 | 4·56 | 8·39 | 4·75 | 7·59 | 2·84 | 7·59 | 3·44 | 5·48 | 2·10 | 7·28 | 1·24 | 4·86 | 1·25 | 6·70 | 2·02 |
| 9·44 | 4·73 | 10·10 | 4·52 | 8·21 | 2·06 | 8·70 | 2·86 | 3·88 | 3·72 | 3·53 | 4·52 | 6·73 | 3·71 | 4·65 | 3·59 |
| 9·00 | 5·39 | 8·31 | 4·79 | 7·18 | 2·93 | 9·04 | 3·53 | 5·19 | 3·11 | 3·88 | 3·68 | 5·13 | 1·48 | 6·83 | 0·88 |
| 8·37 | 5·05 | 9·11 | 4·57 | 8·90 | 2·81 | 9·14 | 3·05 | 6·01 | 3·89 | 4·26 | 4·44 | | 2·47 | 6·25 | 6·42 |
| 10·41 | 4·94 | 9·41 | 4·57 | 9·07 | 2·73 | 9·09 | 2·41 | 4·73 | 3·57 | 3·95 | 3·41 | | 0·91 | 3·77 | 2·71 |
| | | | | | | | | 5·01 | | | 3·20 | | | 5·68 | 3·31 |
| | | | | | | | | 5·34 | | | 4·40 | | | 2·61 | 3·79 |
| | | | | | | | | 4·94 | | | | | | | 4·63 |
| 8·581 | 4·950 | 9·044 | 4·467 | 8·013 | 2·433 | 8·705 | 3·141 | 5·068 | 3·391 | 4·960 | 3·533 | 5·221 | 1·850 | 5·265 | 3·113 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi + (0^\circ\ 0'\ 6''\cdot167)$
- Mean of Western Elongation ..... $\pi + (0\ 0\ 4\cdot050)$
- General Mean ..... $\pi + (0\ 0\ 5\cdot109)$

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α Ursæ Minoris at Damargida G. T. Station Eastern Pillar 1838. $\pi + (0^\circ\ 0')$

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4th & 8th October. | | 5th & 11th October. | | 6th & 10th October. | | 7th & 9th October. | | 4th, 8th & 12th October. | | 5th & 11th October. | | 6th & 10th October. | | 7th & 9th October. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| + 3·94 | − 4·02 | + 2·89 | − 2·39 | + 3·29 | − 2·08 | + 1·86 | − 4·35 | + 1·93 | + 0·56 | − 0·16 | − 1·65 | − 1·36 | − 1·32 | + 0·84 | − 3·45 |
| + 3·72 | − 2·56 | + 0·68 | − 2·92 | + 1·29 | − 2·82 | + 1·98 | − 2·74 | + 0·69 | − 0·29 | − 0·61 | − 3·30 | − 0·63 | − 4·04 | + 0·67 | − 2·14 |
| + 2·72 | − 3·18 | + 2·54 | − 3·64 | + 2·02 | − 2·68 | + 0·61 | − 1·87 | + 3·49 | − 1·35 | + 2·29 | − 2·10 | − 0·11 | − 3·94 | + 1·67 | − 1·20 |
| + 4·08 | − 3·95 | + 1·92 | − 2·39 | + 2·51 | − 2·45 | + 1·52 | − 2·95 | + 4·11 | − 3·97 | − 0·30 | − 3·05 | − 2·14 | − 3·30 | − 1·50 | − 1·65 |
| + 4·57 | − 0·69 | + 1·25 | − 3·83 | + 0·78 | − 2·69 | + 2·14 | − 2·32 | + 0·91 | − 2·83 | + 3·52 | − 2·15 | + 0·52 | − 2·42 | − 2·30 | − 4·05 |
| + 4·30 | − 3·16 | + 2·21 | − 1·68 | + 1·68 | − 2·86 | + 2·12 | − 3·52 | + 1·14 | − 3·19 | + 3·31 | − 3·81 | + 1·37 | − 6·04 | + 1·87 | − 3·57 |
| + 1·57 | − 1·19 | + 1·25 | − 2·91 | − 0·27 | − 4·11 | + 2·60 | − 3·29 | + 1·94 | − 4·88 | + 1·76 | − 2·19 | + 0·29 | − 3·60 | + 0·74 | − 4·29 |
| + 0·56 | − 0·84 | + 1·48 | − 3·73 | + 1·83 | − 4·45 | + 1·83 | − 2·07 | + 1·37 | − 2·65 | − 0·99 | − 2·26 | + 0·26 | − 3·89 | − 0·58 | − 3·64 |
| + 2·69 | − 3·46 | + 2·16 | − 1·97 | − 0·03 | − 4·79 | + 2·40 | − 2·37 | + 2·45 | | + 2·46 | − 3·23 | + 0·75 | − 4·20 | | |
| + 5·20 | − 2·73 | + 0·89 | − 3·41 | + 1·15 | − 5·07 | + 2·57 | − 1·27 | + 0·26 | | + 0·40 | − 4·98 | − 2·21 | − 4·78 | | |
| + 1·77 | − 3·40 | + 2·47 | − 2·88 | | | + 2·58 | − 2·19 | | | | | | | | |
| + 1·98 | − 1·75 | + 3·14 | − 4·72 | | | + 3·68 | − 1·80 | | | | | | | | |
| + 3·091 | − 2·578 | + 1·905 | − 3·039 | + 1·425 | − 3·401 | + 2·157 | − 2·560 | + 1·829 | − 2·323 | + 1·167 | − 2·871 | − 0·327 | − 3·753 | + 0·176 | − 3·000 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi - (0^\circ\ 0'\ 0''.376)$
- Mean of Western Elongation ..... $\pi - (0\ 0\ 1''.138)$
- General Mean ..... $\pi - (0\ 0\ 0''.757)$

α Ursæ Minoris at Somtana G. T. Station 1838. $\pi + (0^\circ\ 0')$

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2nd April. | | 3rd April. | | 5th April. | | 6th April. | | 7th & 9th April. | | 3rd & 8th April. | | 5th April. | | 6th April. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| + 4·51 | + 6·25 | + 3·16 | + 8·18 | − 0·05 | + 6·12 | + 5·06 | + 3·51 | + 7·92 | + 4·83 | + 1·82 | + 3·56 | + 6·99 | + 2·75 | + 7·05 | + 3·75 |
| + 4·52 | + 6·27 | + 1·91 | + 7·22 | + 4·05 | + 3·85 | + 6·25 | + 3·02 | + 7·64 | + 3·41 | + 9·06 | + 3·18 | + 7·33 | + 5·56 | + 8·22 | + 2·83 |
| + 1·07 | + 9·45 | + 2·26 | + 5·86 | + 1·76 | + 5·19 | + 6·40 | + 3·70 | + 8·22 | + 3·19 | + 7·29 | + 3·71 | + 8·58 | + 2·43 | + 7·44 | + 0·44 |
| + 1·48 | + 7·88 | + 0·50 | + 7·16 | + 0·74 | + 5·02 | + 5·80 | + 4·42 | + 7·01 | + 3·12 | + 4·51 | + 3·23 | + 8·09 | + 3·75 | + 8·91 | + 3·79 |
| + 2·83 | + 7·09 | + 0·93 | + 8·06 | + 3·16 | + 4·26 | + 7·55 | + 4·11 | + 6·48 | + 4·65 | + 7·53 | + 4·87 | + 7·34 | + 3·91 | | |
| + 3·59 | + 6·39 | − 0·39 | + 4·59 | + 3·29 | + 3·89 | + 6·07 | + 1·25 | + 8·71 | + 4·39 | + 7·05 | + 4·32 | + 8·11 | + 3·05 | | |
| | | | | | | | | + 10·13 | + 3·69 | + 7·03 | + 3·40 | | | | |
| | | | | | | | | + 8·60 | + 2·99 | + 6·42 | + 4·44 | | | | |
| | | | | | | | | + 6·38 | + 3·78 | + 7·84 | + 4·33 | | | | |
| | | | | | | | | + 7·94 | + 3·90 | + 6·55 | + 4·16 | | | | |
| | | | | | | | | | | + 8·41 | | | | | |
| | | | | | | | | | | + 5·58 | | | | | |
| + 3·000 | + 7·222 | + 1·395 | + 6·845 | + 2·158 | + 4·722 | + 6·188 | + 3·335 | + 7·903 | + 3·795 | + 6·591 | + 3·920 | + 7·740 | + 3·575 | + 7·905 | + 2·703 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation ..... $\pi + (0^\circ\ 0'\ 4''.358)$
- Mean of Eastern Elongation ..... $\pi + (0\ 0\ 5''.518)$
- General Mean ..... $\pi + (0\ 0\ 4''.938)$

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# SYNOPSIS

OF

## LATITUDES, LONGITUDES, AZIMUTHS, &c. OF THE PRINCIPAL STATIONS

OF THE

# GREAT ARC SERIES OF TRIANGLES

## SECTION KALIANPUR AND DAMARGIDA.

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SERIES B.

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| No. | Stations of the eye A. | | | | | Stations of the object B. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. | Log. of Geodetic Line. | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. |
| 1 | Bhaorasa ..... | 24° 8′ 4″·28 | 78° 3′ 7″·90 | 355° 2′ 22″·35 | 5·1686661 | Gargaja..... | 23° 43′ 48″·62 | 78° 5′ 25″·14 | 175° 3′ 18″·01 |
| | Kamkhera..... | 23 59 45·47 | 77 45 34·03 | 311 4 6·45 | 5·1666914 | Gargaja..... | .. .. .. | .. .. .. | 131 12 8·34 |
| | Kamkhera..... | .. .. .. | .. .. .. | 5 11 51·33 | 5·1531738 | Ehmadpur .... | 23 36 21·29 | 77 43 15·42 | 185 10 55·42 |
| | Gargaja..... | 23 43 48·62 | 78 5 25·14 | 70 0 38·92 | 5·1192198 | Ehmadpur .... | .. .. .. | .. .. .. | 249 51 45·10 |
| 5 | Gargaja..... | .. .. .. | .. .. .. | 21 58 4·68 | 5·1030835 | Ander ..... | 23 24 23·22 | 77 56 55·89 | 201 54 41·04 |
| | Ehmadpur..... | 23 36 21·29 | 77 43 15·42 | 313 27 17·40 | 5·0223091 | Ander ..... | .. .. .. | .. .. .. | 133 32 44·66 |
| | Ehmadpur..... | .. .. .. | .. .. .. | 28 49 19·45 | 4·9609969 | Gidgarh..... | 23 23 7·48 | 77 35 22·35 | 208 46 10·86 |
| | Ander ..... | 23 24 23·22 | 77 56 55·89 | 86 26 30·89 | 5·0818180 | Gidgarh ..... | .. .. .. | .. .. .. | 266 17 57·22 |
| | Ander ..... | .. .. .. | .. .. .. | 35 16 44·32 | 5·0644345 | Ladi ..... | 23 8 44·40 | 77 44 58·01 | 215 12 0·62 |
| 10 | Gidgarh..... | 23 23 7·48 | 77 35 22·35 | 328 19 28·21 | 5·0098971 | Ladi ..... | .. .. .. | .. .. .. | 148 23 15·61 |
| | Ander ..... | 23 24 23·22 | 77 56 55·89 | 341 13 18·05 | 5·2090317 | Ranipur..... | 22 59 4·70 | 78 6 13·42 | 161 16 57·63 |
| | Ladi ..... | 23 8 44·40 | 77 44 58·01 | 296 5 24·44 | 5·1228162 | Ranipur..... | .. .. .. | .. .. .. | 116 13 44·14 |
| | Gidgarh ..... | 23 23 7·48 | 77 35 22·35 | 32 16 39·95 | 5·0816482 | Samasgarh..... | 23 6 15·93 | 77 23 51·95 | 212 12 7·49 |
| | Ladi ..... | 23 8 44·40 | 77 44 58·01 | 82 50 35·98 | 5·0759596 | Samasgarh..... | .. .. .. | .. .. .. | 262 42 18·73 |
| 15 | Ladi ..... | .. .. .. | .. .. .. | 14 36 3·97 | 5·0682080 | Bhimbet ..... | 22 50 2·22 | 77 39 42·67 | 194 34 0·81 |
| | Samasgarh..... | 23 6 15·93 | 77 23 51·95 | 317 49 47·75 | 5·1220868 | Bhimbet ..... | .. .. .. | .. .. .. | 137 55 58·79 |
| | Ranipur..... | 22 59 4·70 | 78 6 13·42 | 69 52 39·09 | 5·1999289 | Bhimbet ..... | .. .. .. | .. .. .. | 249 42 19·81 |
| | Ranipur ..... | .. .. .. | .. .. .. | 17 34 0·04 | 5·2713617 | Morpani ..... | 22 29 39·52 | 77 56 12·17 | 197 30 7·59 |
| | Bhimbet ..... | 22 50 2·22 | 77 39 42·67 | 323 2 11·87 | 5·1883670 | Morpani ..... | .. .. .. | .. .. .. | 143 8 33·19 |
| 20 | Ranipur ..... | 22 59 4·70 | 78 6 13·42 | 354 34 20·86 | 5·2366026 | Tek ..... | 22 30 43·53 | 78 9 7·38 | 174 35 28·08 |
| | Bhimbet ..... | 22 50 2·22 | 77 39 42·67 | 305 11 3·31 | 5·3062783 | Tek ..... | .. .. .. | .. .. .. | 125 22 23·60 |
| | Morpani ..... | 22 29 39·52 | 77 56 12·17 | 264 52 50·04 | 4·8631409 | Tek ..... | .. .. .. | .. .. .. | 84 57 46·75 |
| | Bhimbet ..... | 22 50 2·22 | 77 39 42·67 | 1 40 54·68 | 5·3409509 | Narwargarh .... | 22 13 50·20 | 77 38 34·16 | 181 40 28·48 |
| | Morpani ..... | 22 29 39·52 | 77 56 12·17 | 46 5 13·47 | 5·1397773 | Narwargarh .... | .. .. .. | .. .. .. | 225 58 30·91 |
| 25 | Tek ..... | 22 30 43·53 | 78 9 7·38 | 59 22 26·40 | 5·3013167 | Narwargarh .... | .. .. .. | .. .. .. | 239 10 48·62 |
| | Morpani ..... | 22 29 39·52 | 77 56 12·17 | 357 6 44·65 | 5·1687372 | Dhaba Deo .... | 22 5 19·70 | 77 57 31·18 | 177 7 14·62 |
| | Tek ..... | 22 30 43·53 | 78 9 7·38 | 23 4 12·29 | 5·2229062 | Dhaba Deo .... | .. .. .. | .. .. .. | 202 59 48·07 |
| | Narwargarh .... | 22 13 50·20 | 77 38 34·16 | 295 40 25·32 | 5·0742019 | Dhaba Deo .... | .. .. .. | .. .. .. | 115 47 34·23 |
| | Narwargarh .... | .. .. .. | .. .. .. | 7 33 33·86 | 4·7944292 | Alampur ..... | 22 3 38·18 | 77 37 7·04 | 187 33 1·04 |
| 30 | Dhaba Deo .... | 22 5 19·70 | 77 57 31·18 | 84 58 46·69 | 5·0628804 | Alampur ..... | .. .. .. | .. .. .. | 264 51 6·62 |
| | Narwargarh .... | 22 13 50·20 | 77 38 34·16 | 353 54 53·57 | 5·2316980 | Nilgarh ..... | 21 45 49·92 | 77 41 45·92 | 173 56 5·41 |
| | Dhaba Deo .... | 22 5 19·70 | 77 57 31·18 | 37 3 55·09 | 5·1697142 | Nilgarh ..... | .. .. .. | .. .. .. | 216 58 2·08 |
| | Alampur ..... | 22 3 38·18 | 77 37 7·04 | 346 17 38·58 | 5·0450630 | Nilgarh ..... | .. .. .. | .. .. .. | 166 19 22·66 |
| | Dhaba Deo .... | 22 5 19·70 | 77 57 31·18 | 348 22 43·70 | 4·9861987 | Jagdhar..... | 21 49 39·22 | 78 0 58·31 | 168 24 1·12 |
| 35 | Alampur ..... | 22 3 38·18 | 77 37 7·04 | 302 3 57·41 | 5·2017045 | Jagdhar..... | .. .. .. | .. .. .. | 122 12 52·29 |
| | Nilgarh ..... | 21 45 49·92 | 77 41 45·92 | 257 54 50·13 | 5·0454244 | Jagdhar..... | .. .. .. | .. .. .. | 78 1 58·03 |
| | Nilgarh ..... | .. .. .. | .. .. .. | 321 4 46·41 | 5·1924020 | Salbaldi..... | 21 25 48·03 | 77 59 1·66 | 141 11 7·66 |
| | Jagdhar..... | 21 49 39·22 | 78 0 58·31 | 4 21 52·11 | 5·1608070 | Salbaldi..... | .. .. .. | .. .. .. | 184 21 9·09 |
| | Nilgarh ..... | 21 45 49·92 | 77 41 45·92 | 16 43 13·83 | 5·0374635 | Dhar ..... | 21 28 35·04 | 77 36 13·82 | 196 41 11·49 |
| 40 | Jagdhar..... | 21 49 39·22 | 78 0 58·31 | 47 44 46·50 | 5·2773859 | Dhar ..... | .. .. .. | .. .. .. | 227 35 38·75 |
| | Salbaldi..... | 21 25 48·03 | 77 59 1·66 | 97 30 1·28 | 5·1149046 | Dhar ..... | .. .. .. | .. .. .. | 277 21 40·99 |
| | Salbaldi..... | .. .. .. | .. .. .. | 359 45 24·52 | 5·0005259 | Ner ..... | 21 9 15·63 | 77 59 6·15 | 179 45 26·14 |
| | Dhar ..... | 21 28 35·04 | 77 36 13·82 | 311 58 3·90 | 5·2422521 | Ner ..... | .. .. .. | .. .. .. | 132 6 22·77 |
| | Salbaldi..... | 21 25 48·03 | 77 59 1·66 | 37 45 16·40 | 5·2456061 | Ashti..... | 21 2 47·35 | 77 40 3·62 | 217 38 24·13 |
| 45 | Dhar ..... | 21 28 35·04 | 77 36 13·82 | 352 3 50·85 | 5·1976839 | Ashti..... | .. .. .. | .. .. .. | 172 5 14·21 |
| | Ner ..... | 21 9 15·63 | 77 59 6·15 | 70 9 3·05 | 5·0608634 | Ashti..... | .. .. .. | .. .. .. | 250 2 11·72 |
| | Ner ..... | .. .. .. | .. .. .. | 27 42 8·13 | 5·0073950 | Badali ..... | 20 54 22·73 | 77 50 47·35 | 207 39 9·12 |
| | Ashti..... | 21 2 47·35 | 77 40 3·62 | 309 49 0·75 | 4·9000872 | Badali ..... | .. .. .. | .. .. .. | 129 52 51·21 |
| | Ner ..... | 21 9 15·63 | 77 59 6·15 | 338 11 29·18 | 5·1137217 | Wirur ..... | 20 49 19·63 | 78 7 35·06 | 158 14 31·45 |
| 50 | Badali ..... | 20 54 22·73 | 77 50 47·35 | 287 41 39·37 | 5·0014291 | Wirur ..... | .. .. .. | .. .. .. | 107 47 38·29 |
| | Ashti..... | 21 2 47·35 | 77 40 3·62 | 3 9 25·26 | 5·0477748 | Badgaon ..... | 20 44 22·51 | 77 38 58·85 | 183 9 2·17 |

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| No. | Stations of the eye A. | | | | | Stations of the object B. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. | Log. of Geodetic line. | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. |
| | Badali ..... | 20° 54′ 22″·73 | 77° 50′ 47″·35 | 48° 0′ 54″·36 | 4·9564452 | Badgaon ..... | 20° 44′ 22″·51 | 77° 38′ 58″·85 | 227° 56′ 42″·49 |
| | Badali ..... | .. .. .. | .. .. .. | 337 2 13·03 | 5·2208977 | Ikjhera ..... | 20 29 4·47 | 78 2 9·85 | 157 6 14·23 |
| | Wirur ..... | 20 49 19·63 | 78 7 35·06 | 14 9 18·80 | 5·1017963 | Ikjhera ..... | .. .. .. | .. .. .. | 194 7 24·07 |
| 55 | Badgaon ..... | 20 44 22·51 | 77 38 58·85 | 304 57 37·29 | 5·2077599 | Ikjhera ..... | .. .. .. | .. .. .. | 125 5 47·02 |
| | Badgaon ..... | .. .. .. | .. .. .. | 357 59 39·35 | 4·9874455 | Pilkher ..... | 20 28 20·06 | 77 39 34·61 | 177 59 51·96 |
| | Ikjhera ..... | 20 29 4·47 | 78 2 9·85 | 88 4 26·42 | 5·1103008 | Pilkher ..... | .. .. .. | .. .. .. | 267 56 32·25 |
| | Ikjhera ..... | .. .. .. | .. .. .. | 65 8 5·56 | 5·0849615 | Kopdi ..... | 20 20 36·50 | 77 42 50·24 | 245 1 21·07 |
| | Pilkher ..... | 20 28 20·06 | 77 39 34·61 | 338 17 35·56 | 4·7018041 | Kopdi ..... | .. .. .. | .. .. .. | 158 18 43·79 |
| 60 | Ikjhera ..... | 20 29 4·47 | 78 2 9·85 | 357 45 57·23 | 4·9362648 | Bam ..... | 20 14 49·12 | 78 2 45·21 | 177 46 9·52 |
| | Kopdi ..... | 20 20 36·50 | 77 42 50·24 | 287 4 1·00 | 5·0755840 | Bam ..... | .. .. .. | .. .. .. | 107 10 55·50 |
| | Kopdi ..... | .. .. .. | .. .. .. | 355 24 2·36 | 5·0926758 | Sakri ..... | 20 0 13·30 | 77 44 34·34 | 175 24 38·28 |
| | Bam ..... | 20 14 49·12 | 78 2 45·21 | 49 41 17·22 | 5·1348556 | Sakri ..... | .. .. .. | .. .. .. | 229 35 1·85 |
| | Bam ..... | .. .. .. | .. .. .. | 8 40 56·38 | 5·1856781 | Mahur ..... | 19 49 46·27 | 77 58 42·71 | 188 39 33·27 |
| 65 | Sakri ..... | 20 0 13·30 | 77 44 34·34 | 307 57 52·50 | 5·0116617 | Mahur ..... | .. .. .. | .. .. .. | 128 2 41·52 |
| | Sakri ..... | .. .. .. | .. .. .. | 0 27 56·06 | 5·0611303 | Sukli ..... | 19 41 12·12 | 77 44 24·55 | 180 27 52·75 |
| | Mahur ..... | 19 49 46·27 | 77 58 42·71 | 57 42 51·76 | 4·9867127 | Sukli ..... | .. .. .. | .. .. .. | 237 38 1·64 |
| | Mahur ..... | .. .. .. | .. .. .. | 356 45 52·52 | 4·9688348 | Bitergaon ..... | 19 34 25·00 | 77 59 37·66 | 176 46 11·03 |
| | Sukli ..... | 19 41 12·12 | 77 44 24·55 | 295 9 22·20 | 4·9843057 | Bitergaon ..... | .. .. .. | .. .. .. | 115 14 28·98 |
| 70 | Sukli ..... | .. .. .. | .. .. .. | 2 31 47·40 | 5·1572907 | Terban ..... | 19 17 29·39 | 77 43 18·35 | 182 31 25·33 |
| | Bitergaon ..... | 19 34 25·00 | 77 59 37·66 | 42 29 52·23 | 5·1425108 | Terban ..... | .. .. .. | .. .. .. | 222 24 26·39 |
| | Bitergaon ..... | .. .. .. | .. .. .. | 321 2 2·73 | 4·9862369 | Shivni ..... | 19 21 57·89 | 78 10 14·06 | 141 5 34·83 |
| | Terban ..... | 19 17 29·39 | 77 43 18·35 | 259 59 47·78 | 5·1960740 | Shivni ..... | .. .. .. | .. .. .. | 80 8 42·59 |
| | Terban ..... | .. .. .. | .. .. .. | 303 16 56·90 | 5·0851017 | Bheisa ..... | 19 6 26·69 | 78 0 58·96 | 123 22 45·71 |
| 75 | Shivni ..... | 19 21 57·89 | 78 10 14·06 | 29 32 42·44 | 5·0331664 | Bheisa ..... | .. .. .. | .. .. .. | 209 29 39·53 |
| | Terban ..... | 19 17 29·39 | 77 43 18·35 | 6 52 22·70 | 4·8819173 | Somtana ..... | 19 4 59·40 | 77 41 43·27 | 186 51 51·46 |
| | Bheisa ..... | 19 6 26·69 | 78 0 58·96 | 85 30 35·76 | 5·0459787 | Somtana ..... | .. .. .. | .. .. .. | 265 24 17·66 |
| | Bheisa ..... | .. .. .. | .. .. .. | 359 53 18·37 | 4·9558780 | Yemsha ..... | 18 51 31·00 | 78 1 0·79 | 179 53 18·95 |
| | Somtana ..... | 19 4 59·40 | 77 41 43·27 | 306 13 40·08 | 5·1392166 | Yemsha ..... | .. .. .. | .. .. .. | 126 19 56·40 |
| 80 | Somtana ..... | .. .. .. | .. .. .. | 8 59 27·64 | 5·0898502 | Shevalingapa.... | 18 44 54·99 | 77 38 23·24 | 188 58 22·82 |
| | Yemsha ..... | 18 51 31·00 | 78 1 0·79 | 73 1 52·11 | 5·1347529 | Shevalingapa.... | .. .. .. | .. .. .. | 252 54 34·51 |
| | Yemsha ..... | .. .. .. | .. .. .. | 2 5 8·21 | 5·1839478 | Yenagapali .... | 18 26 17·60 | 78 0 3·05 | 182 4 49·72 |
| | Shevalingapa.... | 18 44 54·99 | 77 38 23·24 | 311 58 37·76 | 5·2261034 | Yenagapali .... | .. .. .. | .. .. .. | 132 5 32·24 |
| | Yemsha ..... | 18 51 31·00 | 78 1 0·79 | 45 49 33·23 | 5·2787882 | Baktapur ..... | 18 29 36·67 | 77 37 24·58 | 225 41 59·71 |
| 85 | Shevalingapa.... | 18 44 54·99 | 77 38 23·24 | 3 29 16·26 | 4·9675050 | Baktapur ..... | .. .. .. | .. .. .. | 183 28 57·56 |
| | Yenagapali .... | 18 26 17·60 | 78 0 3·05 | 98 47 22·21 | 5·1214929 | Baktapur ..... | .. .. .. | .. .. .. | 278 40 11·90 |
| | Yenagapali .... | .. .. .. | .. .. .. | 56 41 17·30 | 5·0310342 | Burgapali ..... | 18 16 32·09 | 77 44 31·47 | 236 36 23·89 |
| | Baktapur ..... | 18 29 36·67 | 77 37 24·58 | 332 31 49·70 | 4·9502089 | Burgapali ..... | .. .. .. | .. .. .. | 152 34 4·35 |
| | Baktapur ..... | .. .. .. | .. .. .. | 36 27 30·51 | 5·0788777 | Munganal ..... | 18 13 39·97 | 77 25 5·22 | 216 23 37·62 |
| 90 | Burgapali ..... | 18 16 32·09 | 77 44 31·47 | 81 16 12·82 | 5·0558309 | Munganal ..... | .. .. .. | .. .. .. | 261 10 7·54 |
| | Yenagapali .... | 18 26 17·60 | 78 0 3·05 | 15 7 53·67 | 5·0206187 | Bachapali ..... | 18 9 33·85 | 77 55 19·15 | 195 6 24·52 |
| | Burgapali ..... | 18 16 32·09 | 77 44 31·47 | 304 1 6·73 | 4·8770284 | Bachapali ..... | .. .. .. | .. .. .. | 124 4 29·23 |
| | Bachapali ..... | 18 9 33·85 | 77 55 19·15 | 1 11 51·49 | 4·9093626 | Dudala ..... | 17 56 9·23 | 77 55 1·57 | 181 11 46·04 |
| | Munganal ..... | 18 13 39·97 | 77 25 5·22 | 333 4 54·66 | 5·0388094 | W. End Base .. | 17 57 33·00 | 77 33 38·07 | 153 7 33·94 |
| 95 | Dudala ..... | 17 56 9·23 | 77 55 1·57 | 80 2 26·66 | 4·9619539 | E. End Base .. | 17 53 31·50 | 77 39 27·12 | 259 57 39·18 |
| | W. End Base .. | 17 57 33·00 | 77 33 38·07 | 305 50 32·61 | 4·6188692 | E. End Base .. | .. .. .. | .. .. .. | 125 52 20·08 |
| | Burgapali ..... | 18 16 32·09 | 77 44 31·47 | 8 12 39·37 | 4·9091898 | Damargida .... | 18 3 15·86 | 77 42 31·36 | 188 12 1·92 |
| | Bachapali ..... | 18 9 33·85 | 77 55 19·15 | 62 47 37·75 | 4·9205653 | Damargida .... | .. .. .. | .. .. .. | 242 43 39·10 |
| | Munganal ..... | 18 13 39·97 | 77 25 5·22 | 301 55 1·41 | 5·0751861 | Damargida .... | .. .. .. | .. .. .. | 122 0 27·17 |
| 100 | Dudala ..... | 17 56 9·23 | 77 55 1·57 | 120 45 16·36 | 4·9254131 | Damargida .... | .. .. .. | .. .. .. | 300 41 24·55 |
| | W. End Base .. | 17 57 33·00 | 77 33 38·07 | 236 4 46·81 | 4·7923886 | Damargida .... | .. .. .. | .. .. .. | 56 7 31·70 |
| | E. End Base .. | 17 53 31·50 | 77 39 27·12 | 196 46 57·10 | 4·7892802 | Damargida .... | .. .. .. | .. .. .. | 16 47 53·95 |



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# RESULTS OF OBSERVATIONS FOR AMPLITUDE

# SECTION KALIANPUR—DAMARGIDA.

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## SERIES B.

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# RECAPITULATION

OF

## CERTAIN PARTICULARS DETAILED IN THE INTRODUCTORY PAGES.

THE series which follows consists of observations made simultaneously to determine by means of the zenith distances of certain selected stars the celestial arc of amplitude between the stations of Kalianpur in latitude 24° 7′ 11″ longitude 77° 41′ 45″, and Damargida in latitude 18° 3′ 15″ longitude 77° 42′ 31″.

The portion of these observations at the northern limit of the section was commenced at Kalianpur on the 24th November 1840 and terminated on the 11th January 1841. The stars were observed partly by Lieut.-Colonel Everest F.R.S., &c. of the Bengal Artillery, Surveyor-General and Superintendent of the Great Trigonometrical Survey of India, and partly by Lieut. Renny of the Bengal Engineers 1st assistant of the G. T. Survey of India.

The portion at the southern limit was commenced on the 24th November 1840 and terminated on the 11th January 1841, and was effected entirely by Lieut. A. S. Waugh of the Bengal Engineers Astronomical assistant G. T. Survey, assisted by George Logan Esq. 1st assistant of the G. T. Survey.

The observations therefore may be considered as strictly simultaneous, for the deviations from simultaneity are too few to deserve notice.

The stars are thirty-two in number, of which sixteen are situated to the north and the remaining sixteen to the south of both zeniths.

The instruments and methods employed at both stations were precisely the same as those employed in the section Kaliana-Kalianpur, Series A. The instrument designated "Simms" was used at Kalianpur and that called "Troughton" at Damargida.

It will appear from the Synopsis, page 191 that the amplitude derived from this series is 6° 3′ 55″·9733; that the latitude of Kalianpur is 24° 7′ 11″·3175 and that of Damargida 18° 3′ 15″·3442.

The elements used in computing the corrections in column 6 are not precisely the same as those by which the latitude is deduced, for the reasons assigned in the prefatory statement of the Arc Kalianpur-Kaliana: the amplitude also may be liable to some trifling inaccuracy on the same account.

In this course of observations the clock by Earnshaw was used at Kalianpur and that by Jones at Damargida care having been taken to keep the index of each pendulum at the same division of its graduated head as was opposite it when used the preceding season at Kaliana.

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No. 1 (253) 12 TRIANGULI *c*. North 4° 50′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Nov. 24 | E | | 16·650 | +4·463 | −13·411 | −0·144 | +0·233 | − 8·859 | 7·791 | |
| 25 | W | α 20° | 18·950 | +4·487 | −13·501 | +0·109 | +0·169 | − 8·736 | 10·214 | 8·386 |
| 26 | E | | 14·700 | +4·501 | −13·579 | +0·465 | +1·016 | − 7·597 | 7·103 | |
| 27 | W | | 19·325 | +4·503 | −13·654 | −2·354 | +0·614 | −10·891 | 8·434 | |
| 28 | E | | 21·225 | +4·484 | −13·728 | −2·931 | −0·106 | −12·281 | 8·944 | |
| 30 | W | α 40° | 21·225 | +4·490 | −13·873 | +2·748 | −2·074 | − 8·709 | 12·516 | 10·285 |
| Dec. 1 | E | | 19·775 | +4·483 | −13·941 | −2·066 | +0·804 | −10·720 | 9·055 | |
| 2 | W | | 19·050 | +4·457 | −14·009 | +1·824 | −0·698 | − 8·426 | 10·624 | |
| 3 | E | | 16·400 | +4·450 | −14·074 | +1·406 | 0·000 | − 8·218 | 8·182 | |
| 4 | W | α 60° | 17·350 | +4·432 | −14·136 | −1·166 | +0·656 | −10·214 | 7·136 | 8·119 |
| 5 | W | | 19·350 | +4·432 | −14·197 | −0·916 | −0·021 | −10·702 | 8·648 | |
| 6 | E | | 16·325 | +4·432 | −14·256 | +1·544 | +0·466 | − 7·814 | 8·511 | |
| 7 | E | | 16·125 | +4·430 | −14·314 | +1·354 | +1·270 | − 7·260 | 8·865 | |
| 8 | W | α (1) | 17·400 | +4·448 | −14·368 | −1·270 | +0·868 | −10·322 | 7·078 | |
| 9 | E | 30° | 17·700 | +4·461 | −14·418 | +1·565 | +0·042 | − 8·350 | 9·350 | 8·318 |
| 10 | W | | 18·550 | +4·456 | −14·470 | −0·514 | −0·042 | −10·570 | 7·980 | |
| 11 | E | | 17·725 | +4·448 | −14·519 | +0·786 | +0·317 | − 8·968 | 8·757 | |
| 12 | W | α (1) | 19·625 | +4·463 | −14·567 | −0·708 | −0·148 | −10·960 | 8·665 | |
| 13 | E | 50° | 18·825 | +4·482 | −14·610 | +1·040 | −0·169 | − 9·257 | 9·568 | 8·717 |
| 14 | W | | 18·650 | +4·494 | −14·653 | −0·019 | −0·593 | −10·771 | 7·879 | |
| 15 | E | | 18·025 | +4·472 | −14·693 | +1·695 | −0·275 | − 8·801 | 9·224 | |
| 16 | W | α (1) | 18·525 | +4·463 | −14·730 | −0·630 | +0·317 | −10·580 | 7·945 | |
| 17 | E | 70° | 16·675 | +4·470 | −14·767 | +1·915 | +0·423 | − 7·959 | 8·716 | 8·385 |
| 18 | W | | 19·850 | +4·482 | −14·801 | −1·539 | −0·339 | −12·197 | 7·653 | |

Mean 4° 50′ 8″·7017

### Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Dec. 19 | E | | 18·975 | +4·499 | −14·831 | +0·268 | −0·190 | −10·254 | 8·721 | |
| 20 | W | α 20° | 16·125 | +4·479 | −14·859 | −0·664 | +1·630 | − 9·414 | 6·711 | 7·589 |
| 21 | E | | 17·825 | +4·480 | −14·889 | +0·978 | 0·000 | − 9·431 | 8·394 | |
| 22 | W | | 17·575 | +4·472 | −14·916 | −0·411 | −0·190 | −11·045 | 6·530 | |
| 23 | E | | 20·875 | +4·461 | −14·938 | −0·330 | −0·974 | −11·781 | 9·094 | |
| 24 | W | α 40° | 16·950 | +4·464 | −14·958 | −0·190 | +0·317 | −10·367 | 6·583 | 7·799 |
| 25 | E | | 21·000 | +4·461 | −14·976 | +0·195 | −0·720 | −11·040 | 9·960 | |
| 26 | W | | 15·875 | +4·485 | −14·994 | +0·214 | −0·021 | −10·316 | 5·559 | |
| 27 | E | | 20·550 | +4·453 | −15·009 | +1·221 | −0·402 | − 9·737 | 10·813 | |
| 28 | W | α 60° | 15·625 | +4·424 | −15·022 | −1·570 | +1·503 | −10·665 | 4·960 | 8·087 |
| 29 | E | | 19·350 | +4·433 | −15·031 | +1·275 | −0·995 | −10·318 | 9·032 | |
| 30 | W | | 17·000 | +4·422 | −15·038 | −0·260 | +1·418 | − 9·458 | 7·542 | |
| 31 | E | | 19·575 | +4·407 | −15·042 | +1·399 | +0·085 | − 9·151 | 10·624 | |
| Jan. 1 | W | α (1) | 18·100 | +4·388 | −15·045 | −1·285 | +0·148 | −11·794 | 6·306 | |
| 2 | E | 30° | 19·775 | +4·407 | −15·045 | +1·984 | −0·741 | − 9·395 | 10·380 | 8·260 |
| 3 | W | | 17·925 | +4·424 | −15·044 | −1·915 | +0·339 | −12·196 | 5·729 | |
| 4 | E | | 21·550 | +4·415 | −15·041 | −0·318 | −1·101 | −12·045 | 9·505 | |
| 5 | W | α (1) | 18·225 | +4·424 | −15·035 | +0·146 | +0·339 | −10·126 | 8·099 | |
| 6 | E | 50° | 20·675 | +4·420 | −15·027 | +0·246 | −0·762 | −11·123 | 9·552 | 8·674 |
| 7 | W | | 18·100 | +4·413 | −15·017 | +0·381 | −0·339 | −10·562 | 7·538 | |
| 8 | E | | 20·275 | +4·408 | −15·004 | +0·753 | −0·910 | −10·753 | 9·522 | |
| 9 | W | α (1) | 15·075 | +4·414 | −14·990 | +2·711 | −0·042 | − 7·907 | 7·168 | |
| 10 | E | 70° | 19·475 | +4·393 | −14·974 | +1·460 | +0·190 | − 8·931 | 10·544 | 8·416 |
| 11 | W | | 17·900 | +4·392 | −14·955 | −1·140 | +0·233 | −11·470 | 6·430 | |

Mean 4° 50′ 8″·1375

Mean Result of both Faces..... 4° 50′ 8″·4196



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## G. T. STATION KALIANPUR.

No. 2 (262) 29 Arietis ω. South 9° 47′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 11″·200 | +9″·095 | +11″·426 | −0″·144 | −0″·423 | +19″·954 | 31″·154 | |
| 25 | E | α | 16·025 | +9·144 | +11·422 | +0·109 | −0·762 | +19·913 | 35·938 | 32″·962 |
| 26 | W | 20° | 12·000 | +9·173 | +11·418 | +0·465 | −0·381 | +20·675 | 32·675 | |
| 27 | E | | 13·950 | +9·178 | +11·411 | −2·354 | −0·106 | +18·129 | 32·079 | |
| 28 | W | | 15·650 | +9·137 | +11·403 | −2·931 | +0·212 | +17·821 | 33·471 | |
| 30 | E | α | 10·950 | +9·150 | +11·387 | +2·748 | +0·698 | +23·983 | 34·933 | 33·402 |
| Dec. 1 | W | 40° | 12·525 | +9·138 | +11·376 | −2·066 | +0·804 | +19·252 | 31·777 | |
| 2 | E | | 10·775 | +9·083 | +11·365 | +1·824 | +0·381 | +22·653 | 33·428 | |
| 3 | W | | 11·950 | +9·068 | +11·352 | +1·406 | −0·169 | +21·657 | 33·607 | |
| 4 | E | α | 15·200 | +9·033 | +11·337 | −1·166 | −1·799 | +17·405 | 32·605 | 33·628 |
| 5 | E | 60° | 16·275 | +9·034 | +11·323 | −0·916 | −1·079 | +18·362 | 34·637 | |
| 6 | W | | 12·375 | +9·031 | +11·306 | +1·544 | −0·593 | +21·288 | 33·663 | |
| 7 | W | | 12·550 | +9·030 | +11·290 | +1·354 | −0·889 | +20·785 | 33·335 | |
| 8 | E | α (1) | 14·925 | +9·067 | +11·271 | −1·270 | −0·889 | +18·179 | 33·104 | |
| 9 | W | 30° | 14·775 | +9·090 | +11·249 | +1·565 | −0·804 | +21·100 | 35·875 | 33·881 |
| 10 | E | | 14·900 | +9·077 | +11·230 | −0·514 | −1·482 | +18·311 | 33·211 | |
| 11 | W | | 11·450 | +9·066 | +11·208 | +0·786 | −0·021 | +21·039 | 32·489 | |
| 12 | E | α (1) | 10·525 | +9·097 | +11·187 | −0·708 | +0·571 | +20·147 | 30·672 | |
| 13 | W | 50° | 12·525 | +9·136 | +11·163 | +1·040 | −0·085 | +21·254 | 33·779 | 32·943 |
| 14 | E | | 15·675 | +9·157 | +11·139 | −0·019 | −1·122 | +19·155 | 34·830 | |
| 15 | W | | 10·250 | +9·112 | +11·113 | +1·695 | +0·720 | +22·640 | 32·890 | |
| 16 | E | α (1) | 14·725 | +9·093 | +11·085 | −0·630 | −0·148 | +19·400 | 34·125 | |
| 17 | W | 70° | 14·275 | +9·109 | +11·059 | +1·915 | −0·889 | +21·194 | 35·469 | 34·200 |
| 18 | E | | 16·875 | +9·134 | +11·031 | −1·539 | −1·185 | +17·441 | 34·316 | |

Mean 9° 47′ 33″·5027

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 13″·975 | +9″·170 | +11″·000 | +0″·268 | +0″·360 | +20″·798 | 34″·773 | |
| 20 | E | α | 13·125 | +9·127 | +10·968 | −0·664 | −1·079 | +18·352 | 31·477 | 33″·301 |
| 21 | W | 20° | 15·275 | +9·132 | +10·940 | +0·978 | −0·910 | +20·140 | 35·415 | |
| 22 | E | | 12·750 | +9·114 | +10·909 | −0·411 | −0·825 | +18·787 | 31·537 | |
| 23 | W | | 13·550 | +9·090 | +10·875 | −0·330 | +1·058 | +20·693 | 34·243 | |
| 24 | E | α | 11·000 | +9·101 | +10·841 | −0·190 | +0·106 | +19·858 | 30·858 | 32·753 |
| 25 | W | 40° | 15·600 | +9·091 | +10·806 | +0·195 | −0·275 | +19·817 | 35·417 | |
| 26 | E | | 11·175 | +9·138 | +10·772 | +0·214 | −0·804 | +19·320 | 30·495 | |
| 27 | W | | 14·800 | +9·076 | +10·736 | +1·221 | +0·487 | +21·520 | 36·320 | |
| 28 | E | α | 14·025 | +9·017 | +10·700 | −1·570 | −1·503 | +16·644 | 30·669 | |
| 29 | W | 60° | 16·450 | +9·035 | +10·661 | +1·275 | −1·143 | +19·828 | 36·278 | 34·037 |
| 30 | E | | 14·925 | +9·012 | +10·622 | −0·260 | −1·418 | +17·956 | 32·881 | |
| 31 | W | | 13·250 | +8·981 | +10·581 | +1·399 | −0·042 | +20·919 | 34·169 | |
| Jan. 1 | E | α (1) | 12·050 | +8·944 | +10·539 | −1·285 | +0·296 | +18·494 | 30·544 | |
| 2 | W | 30° | 14·550 | +8·983 | +10·498 | +1·984 | −0·593 | +20·872 | 35·422 | 32·722 |
| 3 | E | | 14·125 | +9·017 | +10·456 | −1·915 | −0·931 | +16·627 | 30·752 | |
| 4 | W | | 15·625 | +8·997 | +10·414 | −0·318 | 0·000 | +19·093 | 34·718 | |
| 5 | E | α (1) | 12·200 | +9·017 | +10·370 | +0·146 | −0·063 | +19·470 | 31·670 | |
| 6 | W | 50° | 15·425 | +9·008 | +10·327 | +0·246 | −0·296 | +19·285 | 34·710 | 33·116 |
| 7 | E | | 11·475 | +8·994 | +10·282 | +0·381 | +0·233 | +19·890 | 31·365 | |
| 8 | W | | 12·875 | +8·985 | +10·236 | +0·753 | 0·000 | +19·974 | 32·849 | |
| 9 | E | α (1) | 10·375 | +8·994 | +10·190 | +2·711 | −0·868 | +21·027 | 31·402 | |
| 10 | W | 70° | 14·350 | +8·952 | +10·143 | +1·460 | −0·677 | +19·878 | 34·228 | 32·526 |
| 11 | E | | 14·225 | +8·952 | +10·096 | −1·140 | −0·508 | +17·400 | 31·625 | |

Mean 9° 47′ 33″·0758

Mean Result of both Faces..... 9° 47′ 33″·2893

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## G. T. STATION KALIANPUR.

### No. 3 (277) 33 ARIETIS. North 2° 15′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | | 25″·875 | +2″·079 | −12″·926 | −0″·144 | +0″·254 | −10″·737 | 15″·138 | |
| 25 | W | α 20° | 25·450 | +2·090 | −12·991 | +0·109 | +0·952 | − 9·840 | 15·610 | 14″·880 |
| 26 | E | | 23·650 | +2·097 | −13·055 | +0·465 | +1·312 | − 9·181 | 14·469 | |
| 27 | W | | 28·225 | +2·098 | −13·116 | −2·354 | −0·550 | −13·922 | 14·303 | |
| 28 | E | | 28·900 | +2·088 | −13·176 | −2·931 | −0·741 | −14·760 | 14·140 | |
| 30 | W | α 40° | 27·800 | +2·091 | −13·295 | +2·748 | −0·339 | − 8·795 | 19·005 | 15·015 |
| Dec. 1 | E | | 27·575 | +2·089 | −13·350 | −2·066 | −0·910 | −14·237 | 13·338 | |
| 2 | W | | 22·700 | +2·076 | −13·405 | +1·824 | +0·381 | − 9·124 | 13·576 | |
| 3 | E | | 26·375 | +2·072 | −13·457 | +1·406 | −0·021 | −10·000 | 16·375 | |
| 4 | W | α 60° | 27·925 | +2·065 | −13·507 | −1·166 | +1·164 | −11·444 | 16·481 | 15·843 |
| 5 | W | | 25·975 | +2·065 | −13·557 | −0·916 | +1·333 | −11·075 | 14·900 | |
| 6 | E | | 25·250 | +2·064 | −13·604 | +1·544 | +0·360 | − 9·636 | 15·614 | |
| 7 | E | | 24·750 | +2·064 | −13·651 | +1·354 | +0·720 | − 9·513 | 15·237 | |
| 8 | W | α (1) 30° | 26·100 | +2·073 | −13·693 | −1·270 | +1·016 | −11·874 | 14·226 | 15·417 |
| 9 | E | | 26·025 | +2·077 | −13·733 | +1·565 | +0·275 | − 9·816 | 16·209 | |
| 10 | W | | 26·750 | +2·074 | −13·775 | −0·514 | +1·460 | −10·755 | 15·995 | |
| 11 | E | | 25·525 | +2·072 | −13·813 | +0·786 | +0·190 | −10·765 | 14·760 | |
| 12 | W | α (1) 50° | 26·800 | +2·080 | −13·851 | −0·708 | −0·508 | −12·987 | 13·813 | 14·876 |
| 13 | E | | 25·675 | +2·089 | −13·885 | +1·040 | +0·148 | −10·608 | 15·067 | |
| 14 | W | | 26·525 | +2·092 | −13·919 | −0·019 | +1·185 | −10·661 | 15·864 | |
| 15 | E | | 23·350 | +2·082 | −13·949 | +1·695 | −0·698 | −10·870 | 12·480 | |
| 16 | W | α (1) 70° | 26·425 | +2·078 | −13·978 | −0·630 | +0·360 | −12·170 | 14·255 | 14·427 |
| 17 | E | | 23·825 | +2·082 | −14·006 | +1·915 | +1·016 | − 8·993 | 14·832 | |
| 18 | W | | 28·375 | +2·088 | −14·033 | −1·539 | +1·249 | −12·235 | 16·140 | |

Mean 2° 15′ 15″·0763

#### Face B to the fixed Microscopes. A D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | | 26″·525 | +2″·096 | −14″·055 | +0″·268 | −0″·487 | −12″·178 | 14″·347 | |
| 20 | W | α 20° | 24·000 | +2·086 | −14·076 | −0·664 | +0·614 | −12·040 | 11·960 | 13″·866 |
| 21 | E | | 25·350 | +2·088 | −14·099 | +0·978 | +0·910 | −10·123 | 15·227 | |
| 22 | W | | 25·550 | +2·083 | −14·119 | −0·411 | +0·825 | −11·622 | 13·928 | |
| 23 | E | | 28·325 | +2·078 | −14·134 | −0·330 | −0·952 | −13·338 | 14·987 | |
| 24 | W | α 40° | 25·300 | +2·081 | −14·148 | −0·190 | −0·169 | −12·426 | 12·874 | 14·505 |
| 25 | E | | 28·325 | +2·078 | −14·162 | +0·195 | +0·021 | −11·868 | 16·457 | |
| 26 | W | | 25·150 | +2·088 | −14·174 | +0·214 | +0·423 | −11·449 | 13·701 | |
| 27 | E | | 27·425 | +2·075 | −14·184 | +1·221 | −0·677 | −11·565 | 15·860 | |
| 28 | W | α 60° | 24·550 | +2·062 | −14·192 | −1·570 | +1·016 | −12·684 | 11·866 | 14·663 |
| 29 | E | | 27·025 | +2·065 | −14·197 | +1·275 | +1·058 | − 9·799 | 17·226 | |
| 30 | W | | 24·850 | +2·060 | −14·200 | −0·260 | +1·249 | −11·151 | 13·699 | |
| 31 | E | | 26·825 | +2·053 | −14·201 | +1·399 | −0·190 | −10·939 | 15·886 | |
| Jan. 1 | W | α (1) 30° | 26·175 | +2·045 | −14·201 | −1·285 | −0·296 | −13·737 | 12·438 | 14·789 |
| 2 | E | | 27·350 | +2·054 | −14·199 | +1·984 | +0·593 | − 9·568 | 17·782 | |
| 3 | W | | 26·675 | +2·061 | −14·195 | −1·915 | +0·423 | −13·626 | 13·049 | |
| 4 | E | | 29·700 | +2·056 | −14·189 | −0·318 | −0·169 | −12·620 | 17·080 | |
| 5 | W | α (1) 50° | 26·275 | +2·061 | −14·182 | +0·146 | −0·317 | −12·292 | 13·983 | 15·422 |
| 6 | E | | 28·400 | +2·059 | −14·173 | +0·246 | +0·254 | −11·614 | 16·786 | |
| 7 | W | | 25·500 | +2·056 | −14·161 | +0·381 | +0·063 | −11·661 | 13·839 | |
| 8 | E | | 28·450 | +2·054 | −14·148 | +0·753 | −0·169 | −11·510 | 16·940 | |
| 9 | W | α (1) 70° | 23·075 | +2·055 | −14·133 | +2·711 | +0·339 | − 9·028 | 14·047 | 15·180 |
| 10 | E | | 27·375 | +2·046 | −14·117 | +1·460 | +0·339 | −10·272 | 17·103 | |
| 11 | W | | 25·650 | +2·047 | −14·098 | −1·140 | +0·169 | −13·022 | 12·628 | |

Mean 2° 15′ 14″·7375

Mean Result of both Faces..... 2° 15′ 14″·9069

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No. 4 (298) 39 Ariktis *b*. North 4° 27′+

Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 55″·350 | +4″·118 | −13″·035 | +0″·144 | +0″·593 | − 8″·180 | 47″·170 | |
| 25 | E | α | 52·275 | +4·142 | −13·113 | −0·109 | +0·677 | − 8·403 | 43·872 | 46″·649 |
| 26 | W | 20° | 55·600 | +4·155 | −13·190 | −0·465 | +1·587 | − 7·913 | 47·687 | |
| 27 | E | | 53·900 | +4·158 | −13·264 | +2·354 | +0·720 | − 6·032 | 47·868 | |
| 28 | W | | 54·200 | +4·136 | −13·337 | +2·931 | −0·402 | − 6·672 | 47·528 | |
| 30 | E | α | 59·225 | +4·143 | −13·481 | −2·748 | −0·783 | −12·869 | 46·356 | |
| Dec. 1 | W | 40° | 53·450 | +4·140 | −13·549 | +2·066 | +0·741 | − 6·602 | 46·848 | 46·865 |
| 2 | E | | 57·250 | +4·114 | −13·617 | −1·824 | +0·804 | −10·523 | 46·727 | |
| 3 | W | | 55·450 | +4·105 | −13·682 | −1·406 | +0·720 | −10·263 | 45·187 | |
| 4 | E | α | 53·150 | +4·091 | −13·745 | +1·166 | +1·185 | − 7·303 | 45·847 | |
| 5 | E | 60° | 52·850 | +4·094 | −13·807 | +0·916 | +1·503 | − 7·294 | 45·556 | 45·446 |
| 6 | W | | 55·900 | +4·089 | −13·867 | −1·544 | +0·614 | −10·708 | 45·192 | |
| 7 | W | | 55·000 | +4·090 | −13·926 | −1·354 | +1·249 | − 9·941 | 45·059 | |
| 8 | E | α (i) | 53·475 | +4·109 | −13·982 | +1·270 | +2·307 | − 6·296 | 47·179 | |
| 9 | W | 30° | 54·450 | +4·115 | −14·034 | −1·565 | +0·381 | −11·103 | 43·347 | 45·482 |
| 10 | E | | 54·350 | +4·106 | −14·088 | +0·514 | +1·460 | − 8·008 | 46·342 | |
| 11 | W | | 55·275 | +4·106 | −14·138 | −0·786 | +0·635 | −10·183 | 45·092 | |
| 12 | E | α (i) | 54·050 | +4·121 | −14·189 | +0·708 | +0·148 | − 9·212 | 44·838 | |
| 13 | W | 50° | 55·975 | +4·139 | −14·236 | −1·040 | +0·296 | −10·841 | 45·134 | 44·943 |
| 14 | E | | 53·600 | +4·144 | −14·282 | +0·019 | +1·228 | − 8·891 | 44·709 | |
| 15 | W | | 56·650 | +4·124 | −14·324 | −1·695 | +0·106 | −11·789 | 44·861 | |
| 16 | E | α (i) | 53·800 | +4·116 | −14·365 | +0·630 | +1·418 | − 8·201 | 45·599 | |
| 17 | W | 70° | 55·425 | +4·125 | −14·406 | −1·915 | +1·101 | −11·095 | 44·330 | 44·777 |
| 18 | E | | 51·775 | +4·137 | −14·444 | +1·539 | +1·312 | − 7·456 | 44·319 | |

Mean 4° 27′ 45″·6937

Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | W | | 53″·875 | +4″·153 | −14″·479 | −0″·268 | +0″·550 | −10″·044 | 43″·831 | |
| 20 | E | α | 55·000 | +4·133 | −14·511 | +0·664 | +1·164 | − 8·550 | 46·450 | 45″·126 |
| 21 | W | 20° | 53·200 | +4·138 | −14·546 | −0·978 | +1·693 | − 9·693 | 43·507 | |
| 22 | E | | 56·500 | +4·128 | −14·577 | +0·411 | +0·254 | − 9·784 | 46·716 | |
| 23 | W | | 52·275 | +4·116 | −14·604 | +0·330 | +0·339 | − 9·819 | 42·456 | |
| 24 | E | α | 55·150 | +4·124 | −14·630 | +0·190 | +0·254 | −10·062 | 45·088 | |
| 25 | W | 40° | 52·350 | +4·116 | −14·654 | −0·195 | +0·212 | −10·521 | 41·829 | 43·881 |
| 26 | E | | 56·400 | +4·135 | −14·678 | −0·214 | +0·508 | −10·249 | 46·151 | |
| 27 | W | | 54·575 | +4·111 | −14·699 | −1·221 | +1·291 | −10·518 | 44·057 | |
| 28 | E | α | 55·025 | +4·086 | −14·718 | +1·570 | +1·418 | − 7·644 | 47·381 | |
| 29 | W | 60° | 53·850 | +4·092 | −14·734 | −1·275 | +0·550 | −11·367 | 42·483 | 45·145 |
| 30 | E | | 55·775 | +4·082 | −14·748 | +0·260 | +1·291 | − 9·115 | 46·660 | |
| 31 | W | | 54·475 | +4·067 | −14·759 | −1·399 | +0·508 | −11·583 | 42·892 | |
| Jan. 1 | E | α (i) | 54·700 | +4·052 | −14·772 | +1·285 | −0·000 | − 9·435 | 45·265 | |
| 2 | W | 30° | 53·875 | +4·071 | −14·780 | −1·984 | +0·698 | −11·995 | 41·880 | 44·015 |
| 3 | E | | 54·025 | +4·085 | −14·786 | +1·915 | +0·783 | − 8·003 | 46·022 | |
| 4 | W | | 53·800 | +4·074 | −14·791 | +0·318 | −0·106 | −10·505 | 43·295 | |
| 5 | E | α (i) | 57·350 | +4·085 | −14·793 | −0·146 | −0·550 | −11·404 | 45·946 | |
| 6 | W | 50° | 54·400 | +4·079 | −14·794 | −0·246 | +0·360 | −10·601 | 43·799 | 44·884 |
| 7 | E | | 57·150 | +4·073 | −14·792 | −0·381 | +0·444 | −10·656 | 46·494 | |
| 8 | W | | 55·125 | +4·070 | −14·788 | −0·753 | −0·042 | −11·513 | 43·612 | |
| 9 | E | α (i) | 59·000 | +4·072 | −14·782 | −2·711 | +0·254 | −13·167 | 45·833 | |
| 10 | W | 70° | 54·300 | +4·053 | −14·775 | −1·460 | +0·317 | −11·865 | 42·435 | 44·391 |
| 11 | E | | 55·000 | +4·056 | −14·765 | +1·140 | +0·254 | − 9·315 | 45·685 | |

Mean 4° 27′ 44″·5737

Mean Result of both Faces..... 4° 27′ 45″·1337

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## No. 5 (307) 43 ARIETIS $\sigma$. South 9° 41′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | #'s Place. | Collimatn | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | $\sigma$ 30° | 30″·050 | +9″·005 | +11″·431 | +0″·144 | −0″·466 | +20″·114 | 50″·164 | 48″·776 |
| 25 | W | | 28·050 | +9·059 | +11·426 | −0·109 | −0·593 | +19·783 | 47·833 | |
| 26 | E | | 31·100 | +9·087 | +11·419 | −0·465 | −0·656 | +19·385 | 50·485 | |
| 27 | W | | 23·550 | +9·095 | +11·411 | +2·354 | +0·212 | +23·072 | 46·622 | |
| 28 | E | $\sigma$ 40° | 25·525 | +9·045 | +11·402 | +2·931 | +0·444 | +23·822 | 49·347 | 47·492 |
| 30 | W | | 26·600 | +9·062 | +11·384 | −2·748 | +0·995 | +18·693 | 45·293 | |
| Dec. 1 | E | | 24·250 | +9·055 | +11·371 | +2·066 | +0·698 | +23·190 | 47·440 | |
| 2 | W | | 29·225 | +8·998 | +11·360 | −1·824 | +0·127 | +18·661 | 47·886 | |
| 3 | E | $\sigma$ 60° | 29·250 | +8·978 | +11·346 | −1·406 | −0·741 | +18·177 | 47·427 | 47·984 |
| 4 | W | | 27·175 | +8·947 | +11·330 | +1·166 | −0·868 | +20·575 | 47·750 | |
| 5 | W | | 27·825 | +8·954 | +11·315 | +0·916 | −0·825 | +20·360 | 48·185 | |
| 6 | E | | 30·175 | +8·941 | +11·298 | −1·544 | −0·296 | +18·399 | 48·574 | |
| 7 | E | $\sigma$ (i) 30° | 29·450 | +8·945 | +11·282 | −1·354 | +0·021 | +18·894 | 48·344 | 48·403 |
| 8 | W | | 28·550 | +8·988 | +11·263 | +1·270 | −1·143 | +20·378 | 48·928 | |
| 9 | E | | 30·450 | +8·999 | +11·241 | −1·565 | −0·995 | +17·680 | 48·130 | |
| 10 | W | | 28·700 | +8·978 | +11·222 | +0·514 | −1·206 | +19·508 | 48·208 | |
| 11 | E | $\sigma$ (i) 50° | 28·750 | +8·980 | +11·200 | −0·786 | −0·190 | +19·204 | 47·954 | 47·437 |
| 12 | W | | 25·275 | +9·014 | +11·179 | +0·708 | +0·762 | +21·663 | 46·938 | |
| 13 | E | | 29·475 | +9·053 | +11·156 | −1·040 | −0·296 | +18·873 | 48·348 | |
| 14 | W | | 27·500 | +9·062 | +11·132 | +0·019 | −1·206 | +19·007 | 46·507 | |
| 15 | E | $\sigma$ (i) 70° | 29·025 | +9·016 | +11·107 | −1·695 | +0·508 | +18·936 | 47·961 | 48·210 |
| 16 | W | | 27·975 | +9·001 | +11·080 | +0·630 | −0·720 | +19·991 | 47·966 | |
| 17 | E | | 31·950 | +9·022 | +11·054 | −1·915 | −1·164 | +16·997 | 48·947 | |
| 18 | W | | 27·475 | +9·047 | +11·027 | +1·539 | −1·122 | +20·491 | 47·966 | |

Mean 9° 41′ 48″·0503

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | #'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | $\sigma$ 20° | 26″·075 | +9″·083 | +10″·998 | −0″·268 | +0″·423 | +20″·236 | 46″·311 | 48″·339 |
| 20 | W | | 30·075 | +9·039 | +10·967 | +0·664 | −0·571 | +20·099 | 50·174 | |
| 21 | E | | 28·375 | +9·052 | +10·940 | −0·978 | −1·228 | +17·786 | 46·161 | |
| 22 | W | | 30·425 | +9·027 | +10·910 | +0·411 | −0·063 | +20·285 | 50·710 | |
| 23 | E | $\sigma$ 40° | 24·700 | +9·002 | +10·878 | +0·330 | +0·360 | +20·570 | 45·270 | 47·638 |
| 24 | W | | 29·100 | +9·022 | +10·846 | +0·190 | −0·063 | +19·995 | 49·095 | |
| 25 | E | | 25·250 | +9·001 | +10·813 | −0·195 | +0·212 | +19·831 | 45·081 | |
| 26 | W | | 31·500 | +9·040 | +10·780 | −0·214 | 0·000 | +19·606 | 51·106 | |
| 27 | E | $\sigma$ 60° | 28·000 | +8·991 | +10·746 | −1·221 | −0·783 | +17·733 | 45·733 | 48·747 |
| 28 | W | | 30·700 | +8·937 | +10·712 | +1·570 | −0·571 | +20·648 | 51·348 | |
| 29 | E | | 29·000 | +8·949 | +10·675 | −1·275 | −0·127 | +18·222 | 47·222 | |
| 30 | W | | 32·000 | +8·928 | +10·638 | +0·260 | −1·143 | +18·683 | 50·683 | |
| 31 | E | $\sigma$ (i) 30° | 27·175 | +8·894 | +10·600 | −1·399 | +0·571 | +18·666 | 45·841 | 47·989 |
| Jan. 1 | W | | 29·725 | +8·863 | +10·567 | +1·285 | 0·000 | +20·715 | 50·440 | |
| 2 | E | | 28·525 | +8·906 | +10·528 | −1·984 | −0·741 | +16·709 | 45·234 | |
| 3 | W | | 29·925 | +8·935 | +10·489 | +1·915 | −0·825 | +20·514 | 50·439 | |
| 4 | E | $\sigma$ (i) 50° | 26·600 | +8·909 | +10·449 | +0·318 | +0·275 | +19·951 | 46·551 | 48·327 |
| 5 | W | | 29·850 | +8·934 | +10·409 | −0·146 | +0·741 | +19·938 | 49·788 | |
| 6 | E | | 28·175 | +8·920 | +10·368 | −0·246 | −0·233 | +18·809 | 46·984 | |
| 7 | W | | 31·575 | +8·908 | +10·326 | −0·381 | −0·444 | +18·409 | 49·984 | |
| 8 | E | $\sigma$ (i) 70° | 28·550 | +8·902 | +10·284 | −0·753 | +0·339 | +18·772 | 47·322 | 48·799 |
| 9 | W | | 33·300 | +8·904 | +10·241 | −2·711 | +0·212 | +16·646 | 49·946 | |
| 10 | E | | 29·975 | +8·864 | +10·198 | −1·460 | −0·169 | +17·433 | 47·408 | |
| 11 | W | | 30·525 | +8·871 | +10·154 | +1·140 | −0·169 | +19·996 | 50·521 | |

Mean 9° 41′ 48″·3065

Mean Result of both Faces..... 9° 41′ 48″·1784



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## No. 6 (314) 46 Arietis $\rho^3$. South 6° 43′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | #'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | α 20° | 48″·375 | +6″·223 | +11″·753 | −0″·144 | −0″·466 | +17″·366 | 65″·741 | 66″·502 |
| 25 | E | | 50·850 | +6·261 | +11·764 | +0·109 | −0·889 | +17·245 | 68·095 | |
| 26 | W | | 47·575 | +6·281 | +11·774 | +0·465 | −1·228 | +17·292 | 64·867 | |
| 27 | E | | 51·250 | +6·287 | +11·783 | −2·354 | +0·339 | +16·055 | 67·305 | |
| 28 | W | α 40° | 50·475 | +6·250 | +11·790 | −2·931 | +0·444 | +15·553 | 66·028 | 66·077 |
| 30 | E | | 44·975 | +6·263 | +11·805 | +2·748 | +1·016 | +21·832 | 66·807 | |
| Dec. 1 | W | | 47·425 | +6·259 | +11·809 | −2·066 | +2·455 | +18·457 | 65·882 | |
| 2 | E | | 45·225 | +6·219 | +11·814 | +1·824 | +0·508 | +20·365 | 65·590 | |
| 3 | W | α 60° | 47·550 | +6·204 | +11·816 | +1·406 | −0·254 | +19·172 | 66·722 | 66·622 |
| 4 | E | | 50·175 | +6·183 | +11·816 | −1·166 | −0·847 | +15·986 | 66·161 | |
| 5 | E | | 49·675 | +6·190 | +11·817 | −0·916 | −0·212 | +16·879 | 66·554 | |
| 6 | W | | 48·000 | +6·178 | +11·816 | +1·544 | −0·487 | +19·051 | 67·051 | |
| 7 | W | α (1) 30° | 47·250 | +6·183 | +11·815 | +1·354 | +0·762 | +20·114 | 67·364 | 66·181 |
| 8 | E | | 50·600 | +6·213 | +11·811 | −1·270 | −1·143 | +15·611 | 66·211 | |
| 9 | W | | 47·750 | +6·219 | +11·805 | +1·565 | −0·974 | +18·615 | 66·365 | |
| 10 | E | | 48·375 | +6·202 | +11·801 | −0·514 | −1·079 | +16·410 | 64·785 | |
| 11 | W | α (1) 50° | 46·775 | +6·207 | +11·795 | +0·786 | +0·254 | +19·042 | 65·817 | 66·580 |
| 12 | E | | 48·275 | +6·231 | +11·788 | −0·708 | +0·762 | +18·073 | 66·348 | |
| 13 | W | | 48·950 | +6·257 | +11·780 | +1·040 | −0·042 | +19·035 | 67·985 | |
| 14 | E | | 49·025 | +6·261 | +11·771 | −0·019 | −0·868 | +17·145 | 66·170 | |
| 15 | W | α (1) 70° | 45·650 | +6·230 | +11·760 | +1·695 | +0·762 | +20·447 | 66·097 | 66·879 |
| 16 | E | | 51·300 | +6·219 | +11·747 | −0·630 | −0·889 | +16·447 | 67·747 | |
| 17 | W | | 48·550 | +6·236 | +11·736 | +1·915 | −1·228 | +18·659 | 67·209 | |
| 18 | E | | 51·150 | +6·253 | +11·722 | −1·539 | −1·122 | +15·314 | 66·464 | |

Mean 6° 44′ 6″·4735

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | #'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | α 20° | 49″·350 | +6″·277 | +11″·706 | +0″·268 | +0″·783 | +19″·034 | 68″·384 | 66″·730 |
| 20 | E | | 49·100 | +6·246 | +11·689 | −0·664 | −0·508 | +16·763 | 65·863 | |
| 21 | W | | 49·725 | +6·257 | +11·675 | +0·978 | −0·720 | +18·190 | 67·915 | |
| 22 | E | | 47·925 | +6·239 | +11·659 | −0·411 | −0·656 | +16·831 | 64·756 | |
| 23 | W | α 40° | 50·425 | +6·221 | +11·640 | −0·330 | +0·339 | +17·870 | 68·295 | 66·542 |
| 24 | E | | 46·000 | +6·237 | +11·620 | −0·190 | +0·825 | +18·492 | 64·492 | |
| 25 | W | | 50·700 | +6·220 | +11·599 | +0·195 | +0·275 | +18·289 | 68·989 | |
| 26 | E | | 46·500 | +6·246 | +11·579 | +0·214 | −0·148 | +17·891 | 64·391 | |
| 27 | W | α 60° | 49·375 | +6·215 | +11·557 | +1·221 | −0·042 | +18·951 | 68·326 | 66·811 |
| 28 | E | | 50·075 | +6·178 | +11·535 | −1·570 | −1·228 | +14·915 | 64·990 | |
| 29 | W | | 50·350 | +6·185 | +11·509 | +1·275 | −0·317 | +18·652 | 69·002 | |
| 30 | E | | 48·675 | +6·171 | +11·484 | −0·260 | −1·143 | +16·252 | 64·927 | |
| 31 | W | α (1) 30° | 48·850 | +6·147 | +11·457 | +1·399 | +0·508 | +19·511 | 68·361 | 66·949 |
| Jan. 1 | E | | 48·700 | +6·126 | +11·436 | −1·285 | 0·000 | +16·277 | 64·977 | |
| 2 | W | | 50·350 | +6·156 | +11·408 | +1·984 | −0·444 | +19·104 | 69·454 | |
| 3 | E | | 49·850 | +6·176 | +11·379 | −1·915 | −0·487 | +15·153 | 65·003 | |
| 4 | W | α (1) 50° | 50·325 | +6·157 | +11·349 | −0·318 | +0·444 | +17·632 | 67·957 | 66·044 |
| 5 | E | | 46·925 | +6·175 | +11·319 | +0·146 | +0·423 | +18·063 | 64·988 | |
| 6 | W | | 49·950 | +6·165 | +11·288 | +0·246 | −0·190 | +17·509 | 67·459 | |
| 7 | E | | 46·425 | +6·156 | +11·255 | +0·381 | −0·444 | +17·348 | 63·773 | |
| 8 | W | α (1) 70° | 48·650 | +6·153 | +11·222 | +0·753 | +0·317 | +18·445 | 67·095 | 65·984 |
| 9 | E | | 44·450 | +6·153 | +11·188 | +2·711 | −0·042 | +20·010 | 64·460 | |
| 10 | W | | 49·500 | +6·126 | +11·153 | +1·460 | −0·190 | +18·549 | 68·049 | |
| 11 | E | | 48·625 | +6·132 | +11·117 | −1·140 | −0·402 | +15·707 | 64·332 | |

Mean 6° 44′ 6″·5100

Mean Result of both Faces..... 6° 44′ 6″·4918

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## G. T. STATION KALIANPUR.

### No. 7 (326) 49 ARIETIS. North 1° 42′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 42″·925 | +1″·576 | −12″·513 | −0″·144 | +0″·212 | −10″·869 | 32″·056 | |
| 25 | W | α | 43·425 | +1·586 | −12·574 | +0·109 | +1·101 | − 9·778 | 33·647 | 32″·500 |
| 26 | E | 20° | 39·250 | +1·591 | −12·634 | +0·465 | +2·117 | − 8·461 | 30·789 | |
| 27 | W | | 45·925 | +1·593 | −12·692 | −2·354 | +1·037 | −12·416 | 33·509 | |
| 28 | E | | 45·675 | +1·583 | −12·749 | −2·931 | −0·423 | −14·520 | 31·155 | |
| 30 | W | α | 43·325 | +1·587 | −12·861 | +2·748 | −0·571 | − 9·097 | 34·228 | 31·833 |
| Dec. 1 | E | 40° | 44·650 | +1·586 | −12·913 | −2·066 | −1·037 | −14·430 | 30·220 | |
| 2 | W | | 40·450 | +1·575 | −12·966 | +1·824 | +0·847 | − 8·720 | 31·730 | |
| 3 | E | | 40·800 | +1·572 | −13·016 | +1·406 | +0·698 | − 9·340 | 31·460 | |
| 4 | W | α | 43·200 | +1·566 | −13·064 | −1·166 | +1·228 | −11·436 | 31·764 | 31·705 |
| 5 | W | 60° | 42·650 | +1·568 | −13·112 | −0·916 | +1·185 | −11·275 | 31·375 | |
| 6 | E | | 41·000 | +1·565 | −13·158 | +1·544 | +1·270 | − 8·779 | 32·221 | |
| 7 | E | | 42·175 | +1·566 | −13·204 | +1·354 | +0·423 | − 9·861 | 32·314 | |
| 8 | W | α (1) | 42·025 | +1·574 | −13·246 | −1·270 | +2·138 | −10·804 | 31·221 | 31·936 |
| 9 | E | 30° | 42·400 | +1·575 | −13·285 | +1·565 | +0·339 | − 9·806 | 32·594 | |
| 10 | W | | 42·400 | +1·571 | −13·326 | −0·514 | +1·482 | −10·787 | 31·613 | |
| 11 | E | | 41·750 | +1·572 | −13·364 | +0·786 | +0·169 | −10·837 | 30·913 | |
| 12 | W | α (1) | 43·225 | +1·579 | −13·402 | −0·708 | +0·148 | −12·383 | 30·842 | 31·552 |
| 13 | E | 50° | 43·200 | +1·585 | −13·437 | +1·040 | +0·042 | −10·770 | 32·430 | |
| 14 | W | | 42·975 | +1·586 | −13·472 | −0·019 | +0·952 | −10·953 | 32·022 | |
| 15 | E | | 39·825 | +1·578 | −13·503 | +1·695 | −0·381 | −10·611 | 29·214 | |
| 16 | W | α (1) | 42·025 | +1·575 | −13·533 | −0·630 | +1·460 | −11·128 | 30·897 | 31·154 |
| 17 | E | 70° | 40·950 | +1·580 | −13·563 | +1·915 | +1·228 | − 8·840 | 32·110 | |
| 18 | W | | 45·050 | +1·584 | −13·591 | −1·539 | +0·889 | −12·657 | 32·393 | |

Mean 1° 42′ 31″·7800

#### Face B to the fixed Microscopes. A D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | E | | 43″·200 | +1″·590 | −13″·616 | +0″·268 | +0″·148 | −11″·610 | 31″·590 | |
| 20 | W | α | 41·475 | +1·582 | −13·639 | −0·664 | +0·635 | −12·086 | 29·389 | 30″·667 |
| 21 | E | 20° | 42·000 | +1·586 | −13·664 | +0·978 | +1·206 | − 9·894 | 32·106 | |
| 22 | W | | 41·000 | +1·581 | −13·687 | −0·411 | +1·101 | −11·416 | 29·584 | |
| 23 | E | | 44·425 | +1·576 | −13·706 | −0·330 | +0·317 | −12·143 | 32·282 | |
| 24 | W | α | 42·100 | +1·581 | −13·723 | −0·190 | −0·847 | −13·179 | 28·921 | 31·264 |
| 25 | E | 40° | 45·675 | +1·576 | −13·740 | +0·195 | +0·423 | −11·546 | 34·129 | |
| 26 | W | | 40·775 | +1·582 | −13·756 | +0·214 | +0·910 | −11·050 | 29·725 | |
| 27 | E | | 44·250 | +1·575 | −13·771 | +1·221 | +0·720 | −10·255 | 33·995 | |
| 28 | W | α | 41·050 | +1·565 | −13·783 | −1·570 | +1·714 | −12·074 | 28·976 | 31·560 |
| 29 | E | 60° | 43·800 | +1·567 | −13·792 | +1·275 | +0·571 | −10·379 | 33·421 | |
| 30 | W | | 41·200 | +1·563 | −13·800 | −0·260 | +1·143 | −11·354 | 29·846 | |
| 31 | E | | 43·975 | +1·557 | −13·806 | +1·399 | +0·063 | −10·787 | 33·188 | |
| Jan. 1 | W | α (1) | 42·975 | +1·552 | −13·821 | −1·285 | −0·000 | −13·554 | 29·421 | 31·673 |
| 2 | E | 30° | 44·650 | +1·560 | −13·824 | +1·984 | +0·423 | − 9·857 | 34·793 | |
| 3 | W | | 43·000 | +1·565 | −13·826 | −1·915 | +0·466 | −13·710 | 29·290 | |
| 4 | E | | 45·775 | +1·560 | −13·826 | −0·318 | −0·127 | −12·711 | 33·064 | |
| 5 | W | α (1) | 42·800 | +1·565 | −13·825 | +0·146 | +0·339 | −11·775 | 31·025 | 31·795 |
| 6 | E | 50° | 44·675 | +1·562 | −13·823 | +0·246 | +0·085 | −11·930 | 32·745 | |
| 7 | W | | 42·200 | +1·560 | −13·818 | +0·381 | +0·021 | −11·856 | 30·344 | |
| 8 | E | | 45·625 | +1·559 | −13·811 | +0·753 | +0·021 | −11·478 | 34·147 | |
| 9 | W | α (1) | 39·950 | +1·559 | −13·804 | +2·711 | +0·360 | − 9·174 | 30·776 | 32·013 |
| 10 | E | 70° | 43·125 | +1·552 | −13·794 | +1·460 | +0·593 | −10·189 | 32·936 | |
| 11 | W | | 42·925 | +1·554 | −13·783 | −1·140 | +0·635 | −12·734 | 30·191 | |

Mean 1° 42′ 31″·4953

**Mean Result of both Faces..... 1° 42′ 31″·6377**

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## G. T. STATION KALIANPUR.

### No. 8 (342) 53 Arietis. South 6° 51′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 8″·900 | +6″·338 | +11″·660 | −0″·144 | +0″·212 | +18″·066 | 26″·966 | |
| 25 | E | α | 12·750 | +6·379 | +11·668 | +0·109 | −1·122 | +17·034 | 29·784 | 27″·782 |
| 26 | W | 20° | 8·950 | +6·399 | +11·677 | +0·465 | −1·185 | +17·356 | 26·306 | |
| 27 | E | | 11·850 | +6·406 | +11·683 | −2·354 | +0·487 | +16·222 | 28·072 | |
| 28 | W | | 13·125 | +6·365 | +11·688 | −2·931 | +0·487 | +15·609 | 28·734 | |
| 30 | E | α | 7·225 | +6·379 | +11·699 | +2·748 | +1·291 | +22·117 | 29·342 | 27·520 |
| Dec. 1 | W | 40° | 8·000 | +6·378 | +11·702 | −2·066 | +1·101 | +17·115 | 25·115 | |
| 2 | E | | 8·125 | +6·335 | +11·705 | +1·824 | −1·101 | +18·763 | 26·888 | |
| 3 | W | | 10·375 | +6·318 | +11·705 | +1·406 | −0·529 | +18·900 | 29·275 | |
| 4 | E | α | 13·375 | +6·299 | +11·704 | −1·166 | −1·228 | +15·609 | 28·984 | 29·422 |
| 5 | E | 60° | 14·475 | +6·308 | +11·704 | −0·916 | −1·587 | +15·509 | 29·984 | |
| 6 | W | | 10·925 | +6·292 | +11·701 | +1·544 | −1·016 | +18·521 | 29·446 | |
| 7 | W | | 11·425 | +6·299 | +11·699 | +1·354 | −1·164 | +18·188 | 29·613 | |
| 8 | E | α (1) | 12·950 | +6·333 | +11·694 | −1·270 | −1·185 | +15·572 | 28·522 | 29·481 |
| 9 | W | 30° | 12·225 | +6·333 | +11·687 | +1·565 | −0·339 | +19·246 | 31·471 | |
| 10 | E | | 12·275 | +6·313 | +11·682 | −0·514 | −1·439 | +16·042 | 28·317 | |
| 11 | W | | 9·500 | +6·323 | +11·674 | +0·786 | −0·085 | +18·698 | 28·198 | |
| 12 | E | α (1) | 9·550 | +6·349 | +11·667 | −0·708 | +0·635 | +17·943 | 27·493 | 28·985 |
| 13 | W | 50° | 10·925 | +6·376 | +11·658 | +1·040 | −0·042 | +19·032 | 29·957 | |
| 14 | E | | 13·600 | +6·375 | +11·649 | −0·019 | −1·312 | +16·693 | 30·293 | |
| 15 | W | | 9·000 | +6·343 | +11·637 | +1·695 | +0·635 | +20·310 | 29·310 | |
| 16 | E | α (1) | 12·675 | +6·333 | +11·624 | −0·630 | −0·000 | +17·327 | 30·002 | 29·729 |
| 17 | W | 70° | 11·700 | +6·352 | +11·612 | +1·915 | −1·185 | +18·694 | 30·394 | |
| 18 | E | | 14·175 | +6·370 | +11·599 | −1·539 | −1·397 | +15·033 | 29·208 | |

Mean 6° 51′ 28″·8198

#### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 11″·525 | +6″·395 | +11″·583 | +0″·268 | +0″·720 | +18″·966 | 30″·491 | |
| 20 | E | α | 10·350 | +6·363 | +11·566 | −0·664 | −0·000 | +17·265 | 27·615 | 29″·378 |
| 21 | W | 20° | 13·875 | +6·377 | +11·552 | +0·978 | −1·714 | +17·193 | 31·068 | |
| 22 | E | | 11·300 | +6·356 | +11·536 | −0·411 | −0·444 | +17·037 | 28·337 | |
| 23 | W | | 12·425 | +6·337 | +11·516 | −0·330 | +1·079 | +18·602 | 31·027 | |
| 24 | E | α | 8·725 | +6·357 | +11·497 | −0·190 | +0·698 | +18·362 | 27·087 | 29·353 |
| 25 | W | 40° | 14·700 | +6·335 | +11·477 | +0·195 | −0·698 | +17·309 | 32·009 | |
| 26 | E | | 10·275 | +6·359 | +11·457 | +0·214 | −1·016 | +17·014 | 27·289 | |
| 27 | W | | 12·300 | +6·332 | +11·436 | +1·221 | +0·169 | +19·158 | 31·458 | |
| 28 | E | α | 11·825 | +6·295 | +11·415 | −1·570 | −0·550 | +15·590 | 27·415 | 29·617 |
| 29 | W | 60° | 13·050 | +6·300 | +11·390 | +1·275 | −0·635 | +18·330 | 31·380 | |
| 30 | E | | 11·775 | +6·287 | +11·365 | −0·260 | −0·952 | +16·440 | 28·215 | |
| 31 | W | | 11·775 | +6·261 | +11·340 | +1·399 | +0·487 | +19·487 | 31·262 | |
| Jan. 1 | E | α (1) | 11·100 | +6·243 | +11·323 | −1·285 | +0·233 | +16·514 | 27·614 | 29·761 |
| 2 | W | 30° | 12·975 | +6·275 | +11·296 | +1·984 | −0·466 | +19·089 | 32·064 | |
| 3 | E | | 12·925 | +6·293 | +11·268 | −1·915 | −0·466 | +15·180 | 28·105 | |
| 4 | W | | 12·925 | +6·272 | +11·240 | −0·318 | +0·042 | +17·236 | 30·161 | |
| 5 | E | α (1) | 10·025 | +6·292 | +11·211 | +0·146 | +0·063 | +17·712 | 27·737 | 28·786 |
| 6 | W | 50° | 12·350 | +6·279 | +11·182 | +0·246 | +0·127 | +17·834 | 30·184 | |
| 7 | E | | 9·175 | +6·271 | +11·151 | +0·381 | +0·085 | +17·888 | 27·063 | |
| 8 | W | | 12·700 | +6·268 | +11·119 | +0·753 | +0·063 | +18·203 | 30·903 | |
| 9 | E | α (1) | 8·425 | +6·267 | +11·087 | +2·711 | −0·042 | +20·023 | 28·448 | 29·467 |
| 10 | W | 70° | 12·900 | +6·240 | +11·054 | +1·460 | −0·571 | +18·183 | 31·083 | |
| 11 | E | | 11·900 | +6·248 | +11·020 | −1·140 | −0·593 | +15·535 | 27·435 | |

Mean 6° 51′ 29″·3937

Mean Result of both Faces..... 6° 51′ 29″·1068

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## No. 9 (351) 56 ARIETIS *i*. North 2° 31′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | a 20° | 65″·750 | +2″·335 | −12″·374 | −0″·144 | +0″·127 | −10″·056 | 55″·694 | 56″·232 |
| 25 | W | | 66·350 | +2·351 | −12·439 | +0·109 | +1·291 | − 8·638 | 57·662 | |
| 26 | E | | 64·100 | +2·358 | −12·504 | +0·465 | +1·228 | − 8·453 | 55·647 | |
| 27 | W | | 68·650 | +2·361 | −12·565 | −2·354 | −0·169 | −12·727 | 55·923 | |
| 28 | E | a 40° | 71·275 | +2·346 | −12·627 | −2·931 | −0·466 | −13·678 | 57·597 | 57·984 |
| 30 | W | | 68·800 | +2·351 | −12·748 | +2·748 | −1·524 | − 9·173 | 59·627 | |
| Dec. 1 | E | | 70·450 | +2·351 | −12·805 | −2·066 | −0·720 | −13·240 | 57·210 | |
| 2 | W | | 65·950 | +2·335 | −12·862 | +1·824 | +0·254 | − 8·449 | 57·501 | |
| 3 | E | a 60° | 66·750 | +2·328 | −12·917 | +1·406 | +0·275 | − 8·908 | 57·842 | 57·907 |
| 4 | W | | 68·275 | +2·321 | −12·970 | −1·166 | +0·868 | −10·947 | 57·328 | |
| 5 | W | | 68·225 | +2·325 | −13·023 | −0·916 | +0·995 | −10·619 | 57·606 | |
| 6 | E | | 67·425 | +2·319 | −13·073 | +1·544 | +0·635 | − 8·575 | 58·850 | |
| 7 | E | a (1) 30° | 66·150 | +2·322 | −13·124 | +1·354 | +0·995 | − 8·453 | 57·697 | 58·282 |
| 8 | W | | 68·100 | +2·334 | −13·171 | −1·270 | +0·910 | −11·197 | 56·903 | |
| 9 | E | | 68·300 | +2·334 | −13·216 | +1·565 | +0·825 | − 8·492 | 59·808 | |
| 10 | W | | 68·750 | +2·326 | −13·262 | −0·514 | +1·418 | −10·032 | 58·718 | |
| 11 | E | a (1) 50° | 68·250 | +2·330 | −13·305 | +0·786 | −0·698 | −10·887 | 57·363 | 57·691 |
| 12 | W | | 70·025 | +2·340 | −13·349 | −0·708 | −0·974 | −12·681 | 57·344 | |
| 13 | E | | 67·575 | +2·350 | −13·389 | +1·040 | −0·042 | −10·041 | 57·534 | |
| 14 | W | | 68·350 | +2·349 | −13·429 | −0·019 | +1·270 | − 9·829 | 58·521 | |
| 15 | E | a (1) 70° | 66·700 | +2·337 | −13·466 | +1·695 | −0·614 | −10·048 | 56·652 | 56·716 |
| 16 | W | | 67·925 | +2·334 | −13·502 | −0·630 | +0·042 | −11·756 | 56·169 | |
| 17 | E | | 65·625 | +2·341 | −13·538 | +1·915 | +1·206 | − 8·076 | 57·549 | |
| 18 | W | | 68·450 | +2·348 | −13·571 | −1·539 | +0·804 | −11·958 | 56·492 | |

Mean 2° 31′ 57″·4687

### Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | W | a 20° | 69″·925 | +2″·357 | −13″·602 | +0″·268 | −0″·847 | −11″·824 | 58″·101 | 57″·096 |
| 20 | E | | 66·475 | +2·345 | −13·631 | −0·664 | +0·190 | −11·760 | 54·715 | |
| 21 | W | | 68·125 | +2·351 | −13·662 | +0·978 | +1·270 | − 9·063 | 59·062 | |
| 22 | E | | 68·350 | +2·343 | −13·691 | −0·411 | −0·085 | −11·844 | 56·506 | |
| 23 | W | a 40° | 70·700 | +2·335 | −13·716 | −0·330 | −1·376 | −13·087 | 57·613 | 57·224 |
| 24 | E | | 67·000 | +2·343 | −13·740 | −0·190 | −0·614 | −12·201 | 54·799 | |
| 25 | W | | 70·200 | +2·335 | −13·763 | +0·195 | +1·058 | −10·175 | 60·025 | |
| 26 | E | | 67·200 | +2·343 | −13·785 | +0·214 | +0·487 | −10·741 | 56·459 | |
| 27 | W | a 60° | 69·150 | +2·334 | −13·805 | +1·221 | −0·571 | −10·821 | 58·329 | 57·290 |
| 28 | E | | 67·750 | +2·321 | −13·824 | −1·570 | +0·550 | −12·523 | 55·227 | |
| 29 | W | | 68·675 | +2·322 | −13·839 | +1·275 | +0·889 | − 9·353 | 59·322 | |
| 30 | E | | 67·125 | +2·317 | −13·854 | −0·260 | +0·952 | −10·845 | 56·280 | |
| 31 | W | a (1) 30° | 69·875 | +2·308 | −13·866 | +1·399 | −0·529 | −10·688 | 59·187 | 57·537 |
| Jan. 1 | E | | 68·200 | +2·301 | −13·891 | −1·285 | −0·233 | −13·108 | 55·092 | |
| 2 | W | | 68·650 | +2·313 | −13·901 | +1·984 | +0·762 | − 8·842 | 59·808 | |
| 3 | E | | 68·675 | +2·320 | −13·910 | −1·915 | +0·889 | −12·616 | 56·059 | |
| 4 | W | a (1) 50° | 71·900 | +2·311 | −13·916 | −0·318 | −0·360 | −12·283 | 59·617 | 58·029 |
| 5 | E | | 67·950 | +2·319 | −13·922 | +0·146 | +0·042 | −11·415 | 56·535 | |
| 6 | W | | 70·625 | +2·314 | −13·926 | +0·246 | −0·106 | −11·472 | 59·153 | |
| 7 | E | | 67·750 | +2·311 | −13·927 | +0·381 | +0·296 | −10·939 | 56·811 | |
| 8 | W | a (1) 70° | 71·100 | +2·310 | −13·928 | +0·753 | −0·000 | −10·865 | 60·235 | 58·166 |
| 9 | E | | 65·700 | +2·309 | −13·926 | +2·711 | −0·000 | − 8·906 | 56·794 | |
| 10 | W | | 69·750 | +2·300 | −13·924 | +1·460 | +0·423 | − 9·741 | 60·009 | |
| 11 | E | | 68·000 | +2·303 | −13·919 | −1·140 | +0·381 | −12·375 | 55·625 | |

Mean 2° 31 57″·5570

Mean Result of both Faces ..... 2° 31′ 57″·5129

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## G. T. STATION KALIANPUR.

### No. 10 (359) Tauri. North 4° 20′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 59″·725 | +4″·011 | −12″·307 | +0″·144 | +1″·143 | − 7″·009 | 52″·716 | |
| 25 | E | α 20° | 56·575 | +4·039 | −12·382 | −0·109 | +1·058 | − 7·394 | 49·181 | 50″·982 |
| 26 | W | | 59·525 | +4·051 | −12·457 | −0·465 | +1·397 | − 7·474 | 52·051 | |
| 27 | E | | 54·700 | +4·057 | −12·529 | +2·354 | +1·397 | − 4·721 | 49·979 | |
| 28 | W | | 56·250 | +4·028 | −12·601 | +2·931 | −0·423 | − 6·065 | 50·185 | |
| 30 | E | α 40° | 62·600 | +4·038 | −12·742 | −2·748 | −0·952 | −12·404 | 50·196 | 50·423 |
| Dec. 1 | W | | 56·750 | +4·039 | −12·810 | +2·066 | +1·270 | − 5·435 | 51·315 | |
| 2 | E | | 59·925 | +4·011 | −12·877 | −1·824 | +0·762 | − 9·928 | 49·997 | |
| 3 | W | | 58·850 | +3·999 | −12·942 | −1·406 | +0·868 | − 9·481 | 49·369 | |
| 4 | E | α 60° | 55·575 | +3·988 | −13·006 | +1·166 | +0·868 | − 6·984 | 48·591 | 49·026 |
| 5 | E | | 56·150 | +3·996 | −13·069 | +0·916 | +1·016 | − 7·141 | 49·009 | |
| 6 | W | | 58·875 | +3·982 | −13·130 | −1·544 | +0·952 | − 9·740 | 49·135 | |
| 7 | W | | 58·425 | +3·988 | −13·191 | −1·354 | +0·952 | − 9·605 | 48·820 | |
| 8 | E | α (i) 30° | 56·800 | +4·011 | −13·257 | +1·270 | +1·968 | − 6·008 | 50·792 | 49·664 |
| 9 | W | | 59·050 | +4·008 | −13·308 | −1·565 | +0·593 | −10·272 | 48·778 | |
| 10 | E | | 58·125 | +3·993 | −13·361 | +0·514 | +0·995 | − 7·859 | 50·266 | |
| 11 | W | | 58·975 | +4·003 | −13·415 | −0·786 | −0·085 | −10·283 | 48·692 | |
| 12 | E | α (i) 50° | 58·575 | +4·020 | −13·439 | +0·708 | −0·190 | − 8·901 | 49·674 | 49·273 |
| 13 | W | | 59·850 | +4·037 | −13·520 | −1·040 | +0·127 | −10·396 | 49·454 | |
| 14 | E | | 57·500 | +4·033 | −13·570 | +0·019 | +1·291 | − 8·227 | 49·273 | |
| 15 | W | | 61·050 | +4·013 | −13·618 | −1·695 | −0·042 | −11·342 | 49·708 | |
| 16 | E | α (i) 70° | 57·375 | +4·008 | −13·664 | +0·630 | +1·460 | − 7·566 | 49·809 | 49·788 |
| 17 | W | | 60·625 | +4·022 | −13·711 | −1·915 | +1·037 | −10·567 | 50·058 | |
| 18 | E | | 56·700 | +4·033 | −13·755 | +1·539 | +1·058 | − 7·125 | 49·575 | |

Mean 4° 20′ 49″·8593

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | W | | 57″·900 | +4″·049 | −13″·796 | −0″·268 | +0″·021 | − 9″·994 | 47″·906 | |
| 20 | E | α 20° | 56·975 | +4·028 | −13·835 | +0·664 | +1·016 | − 8·127 | 48·848 | 48″·477 |
| 21 | W | | 56·650 | +4·039 | −13·877 | −0·978 | +1·228 | − 9·588 | 47·062 | |
| 22 | E | | 59·000 | +4·024 | −13·916 | +0·411 | +0·571 | − 8·910 | 50·090 | |
| 23 | W | | 56·450 | +4·011 | −13·952 | +0·330 | −0·296 | − 9·907 | 46·543 | |
| 24 | E | α 40° | 60·825 | +4·027 | −13·986 | +0·190 | −0·085 | − 9·854 | 50·971 | 48·714 |
| 25 | W | | 55·850 | +4·010 | −14·019 | −0·195 | +1·376 | − 8·828 | 47·022 | |
| 26 | E | | 60·075 | +4·023 | −14·051 | −0·214 | +0·487 | − 9·755 | 50·320 | |
| 27 | W | | 58·075 | +4·009 | −14·082 | −1·221 | +0·508 | −10·786 | 47·289 | |
| 28 | E | α 60° | 58·350 | +3·987 | −14·111 | +1·570 | +0·952 | − 7·602 | 50·748 | 48·621 |
| 29 | W | | 57·400 | +3·989 | −14·137 | −1·275 | +0·889 | −10·534 | 46·866 | |
| 30 | E | | 58·125 | +3·981 | −14·161 | +0·260 | +1·376 | − 8·544 | 49·581 | |
| 31 | W | | 57·925 | +3·964 | −14·184 | −1·399 | −0·317 | −11·936 | 45·989 | |
| Jan. 1 | E | α (i) 30° | 59·700 | +3·954 | −14·222 | +1·285 | +0·212 | − 8·771 | 50·929 | 48·649 |
| 2 | W | | 57·300 | +3·975 | −14·242 | −1·984 | +0·783 | −11·468 | 45·832 | |
| 3 | E | | 59·125 | +3·985 | −14·260 | +1·915 | +1·079 | − 7·281 | 51·844 | |
| 4 | W | | 58·650 | +3·970 | −14·276 | +0·318 | −0·466 | −10·454 | 48·196 | |
| 5 | E | α (i) 50° | 62·100 | +3·984 | −14·291 | −0·146 | −0·000 | −10·453 | 51·647 | 49·936 |
| 6 | W | | 58·600 | +3·975 | −14·305 | −0·246 | +0·021 | −10·555 | 48·045 | |
| 7 | E | | 62·200 | +3·970 | −14·316 | −0·381 | +0·381 | −10·346 | 51·854 | |
| 8 | W | | 59·400 | +3·969 | −14·325 | −0·753 | +0·804 | −10·305 | 49·095 | |
| 9 | E | α (i) 70° | 63·725 | +3·966 | −14·333 | −2·711 | +0·381 | −12·697 | 51·028 | 49·549 |
| 10 | W | | 58·700 | +3·950 | −14·340 | −1·460 | +0·762 | −11·088 | 47·612 | |
| 11 | E | | 59·475 | +3·957 | −14·344 | +1·140 | +0·233 | − 9·014 | 50·461 | |

Mean 4° 20′ 48″·9910

Mean Result of both Faces..... 4° 20′ 49″·4252

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## No. 11 (369) 64 ARIETIS *g*. North 0° 2′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | | 20″·525 | +0″·037 | −11″·960 | −0″·144 | +0″·550 | −11″·517 | 9″·008 | |
| 25 | W | α 20° | 20·950 | +0·037 | −12·008 | +0·109 | +0·847 | −11·015 | 9·935 | 8″·470 |
| 26 | E | | 17·425 | +0·037 | −12·055 | +0·465 | +1·439 | −10·114 | 7·311 | |
| 27 | W | | 21·875 | +0·037 | −12·101 | −2·354 | +0·169 | −14·249 | 7·626 | |
| 28 | E | | 24·575 | +0·037 | −12·146 | −2·931 | −0·444 | −15·484 | 9·091 | |
| 30 | W | α 40° | 23·000 | +0·037 | −12·235 | +2·748 | −1·079 | −10·529 | 12·471 | 10·569 |
| Dec. 1 | E | | 23·925 | +0·037 | −12·276 | −2·066 | −0·190 | −14·495 | 9·430 | |
| 2 | W | | 21·700 | +0·037 | −12·318 | +1·824 | +0·042 | −10·415 | 11·285 | |
| 3 | E | | 20·475 | +0·036 | −12·358 | +1·406 | +0·698 | −10·218 | 10·257 | |
| 4 | W | α 60° | 24·075 | +0·036 | −12·396 | −1·166 | +0·889 | −12·637 | 11·438 | 10·748 |
| 5 | W | | 23·200 | +0·036 | −12·434 | −0·916 | +0·783 | −12·531 | 10·669 | |
| 6 | E | | 20·925 | +0·036 | −12·470 | +1·544 | +0·593 | −10·297 | 10·628 | |
| 7 | E | | 21·325 | +0·036 | −12·506 | +1·354 | +0·063 | −11·053 | 10·272 | |
| 8 | W | α (1) 30° | 23·125 | +0·037 | −12·539 | −1·270 | +2·328 | −11·444 | 11·681 | 10·908 |
| 9 | E | | 21·775 | +0·037 | −12·570 | +1·565 | +0·106 | −10·862 | 10·913 | |
| 10 | W | | 23·150 | +0·036 | −12·603 | −0·514 | +0·698 | −12·383 | 10·767 | |
| 11 | E | | 23·050 | +0·036 | −12·633 | +0·786 | −0·974 | −12·785 | 10·265 | |
| 12 | W | α (1) 50° | 26·100 | +0·037 | −12·663 | −0·708 | −0·148 | −13·482 | 12·618 | 11·364 |
| 13 | E | | 22·200 | +0·037 | −12·691 | +1·040 | +0·021 | −11·593 | 10·607 | |
| 14 | W | | 24·625 | +0·037 | −12·718 | −0·019 | +0·042 | −12·658 | 11·967 | |
| 15 | E | | 19·575 | +0·037 | −12·743 | +1·695 | −0·106 | −11·117 | 8·458 | |
| 16 | W | α (1) 70° | 24·575 | +0·037 | −12·767 | −0·630 | +1·545 | −11·815 | 12·760 | 11·042 |
| 17 | E | | 21·050 | +0·037 | −12·791 | +1·915 | +0·550 | −10·289 | 10·761 | |
| 18 | W | | 25·700 | +0·037 | −12·813 | −1·539 | +0·804 | −13·511 | 12·189 | |

Mean 0° 2′ 10″·5168

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | | 22″·725 | +0″·037 | −12″·833 | +0″·268 | +0″·042 | −12″·486 | 10″·239 | |
| 20 | W | α 20° | 23·525 | +0·037 | −12·851 | −0·664 | +0·106 | −13·372 | 10·153 | 10″·524 |
| 21 | E | | 21·900 | +0·037 | −12·872 | +0·978 | +1·185 | −10·672 | 11·228 | |
| 22 | W | | 23·825 | +0·037 | −12·890 | −0·411 | −0·085 | −13·349 | 10·476 | |
| 23 | E | | 24·250 | +0·037 | −12·905 | −0·330 | +0·381 | −12·817 | 11·433 | |
| 24 | W | α 40° | 23·125 | +0·037 | −12·919 | −0·190 | +0·063 | −13·009 | 10·116 | 11·089 |
| 25 | E | | 24·350 | +0·037 | −12·933 | +0·195 | +0·698 | −12·003 | 12·347 | |
| 26 | W | | 22·625 | +0·037 | −12·946 | +0·214 | +0·529 | −12·166 | 10·459 | |
| 27 | E | | 22·775 | +0·037 | −12·958 | +1·221 | +0·635 | −11·065 | 11·710 | |
| 28 | W | α 60° | 23·200 | +0·036 | −12·968 | −1·570 | +1·016 | −13·486 | 9·714 | 11·259 |
| 29 | E | | 22·750 | +0·036 | −12·976 | +1·275 | +0·931 | −10·734 | 12·016 | |
| 30 | W | | 23·425 | +0·036 | −12·983 | −0·260 | +1·376 | −11·831 | 11·594 | |
| 31 | E | | 25·025 | +0·036 | −12·988 | +1·399 | −0·910 | −12·463 | 12·562 | |
| Jan. 1 | W | α (1) 30° | 24·000 | +0·036 | −13·009 | −1·285 | −0·190 | −14·448 | 9·552 | 11·158 |
| 2 | E | | 23·700 | +0·036 | −13·012 | +1·984 | +0·804 | −10·188 | 13·512 | |
| 3 | W | | 23·475 | +0·036 | −13·014 | −1·915 | +0·423 | −14·470 | 9·005 | |
| 4 | E | | 25·325 | +0·036 | −13·015 | −0·318 | −0·254 | −13·551 | 11·774 | |
| 5 | W | α (1) 50° | 23·700 | +0·036 | −13·014 | +0·146 | −0·635 | −13·467 | 10·233 | 11·293 |
| 6 | E | | 25·025 | +0·036 | −13·013 | +0·246 | +0·529 | −12·202 | 12·823 | |
| 7 | W | | 22·700 | +0·036 | −13·009 | +0·381 | +0·233 | −12·359 | 10·341 | |
| 8 | E | | 24·050 | +0·036 | −13·005 | +0·753 | +0·466 | −11·750 | 12·300 | |
| 9 | W | α (1) 70° | 20·375 | +0·036 | −12·999 | +2·711 | +0·042 | −10·210 | 10·165 | 11·205 |
| 10 | E | | 23·600 | +0·036 | −12·992 | +1·460 | +0·360 | −11·136 | 12·464 | |
| 11 | W | | 24·000 | +0·036 | −12·984 | −1·140 | −0·021 | −14·109 | 9·891 | |

Mean 0° 2′ 11″·0880

Mean Result of both Faces ..... 0° 2′ 10″·8024

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## G. T. STATION KALIANPUR.

### No. 12 (392) 11 Tauri. North 0° 41′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 35″·050 | +0″·638 | −11″·634 | +0″·144 | +0″·571 | −10″·281 | 24″·769 | |
| 25 | E | α | 33·700 | +0·643 | −11·683 | −0·109 | 0·000 | −11·149 | 22·551 | 23″·961 |
| 26 | W | 20° | 34·475 | +0·645 | −11·732 | −0·465 | +2·138 | − 9·414 | 25·061 | |
| 27 | E | | 32·200 | +0·646 | −11·779 | +2·354 | +0·042 | − 8·737 | 23·463 | |
| 28 | W | | 34·325 | +0·641 | −11·825 | +2·931 | +0·212 | − 8·041 | 26·284 | |
| 30 | E | α | 37·425 | +0·643 | −11·917 | −2·748 | −0·931 | −14·953 | 22·472 | |
| Dec. 1 | W | 40° | 41·100 | +0·643 | −11·961 | +2·066 | −0·698 | − 9·950 | 31·150 | 25·043 |
| 2 | E | | 32·100 | +0·639 | −12·005 | −1·824 | +1·355 | −11·835 | 20·265 | |
| 3 | W | | 35·750 | +0·636 | −12·046 | −1·406 | +0·952 | −11·864 | 23·886 | |
| 4 | E | α | 31·250 | +0·635 | −12·087 | +1·166 | +0·698 | − 9·588 | 21·662 | |
| 5 | E | 60° | 31·150 | +0·637 | −12·127 | +0·916 | +0·720 | − 9·854 | 21·296 | 22·676 |
| 6 | W | | 36·450 | +0·634 | −12·166 | −1·544 | +0·487 | −12·589 | 23·861 | |
| 7 | W | | 34·800 | +0·635 | −12·205 | −1·354 | +0·550 | −12·374 | 22·426 | |
| 8 | E | α (1) | 31·700 | +0·639 | −12·241 | +1·270 | +2·222 | − 8·110 | 23·590 | |
| 9 | W | 30° | 36·400 | +0·638 | −12·275 | −1·565 | +0·275 | −12·927 | 23·473 | 23·367 |
| 10 | E | | 34·125 | +0·635 | −12·312 | +0·514 | +1·016 | −10·147 | 23·978 | |
| 11 | W | | 37·175 | +0·637 | −12·345 | −0·786 | −0·296 | −12·790 | 24·385 | |
| 12 | E | α (1) | 33·925 | +0·640 | −12·379 | +0·708 | +0·381 | −10·650 | 23·275 | |
| 13 | W | 50° | 37·700 | +0·643 | −12·410 | −1·040 | +0·127 | −12·680 | 25·020 | 23·679 |
| 14 | E | | 32·950 | +0·641 | −12·442 | +0·019 | +0·868 | −10·914 | 22·036 | |
| 15 | W | | 40·250 | +0·638 | −12·471 | −1·695 | +0·296 | −13·232 | 27·018 | |
| 16 | E | α (1) | 32·350 | +0·638 | −12·498 | +0·630 | +1·714 | − 9·516 | 22·834 | |
| 17 | W | 70° | 37·025 | +0·640 | −12·527 | −1·915 | +1·164 | −12·638 | 24·387 | 24·163 |
| 18 | E | | 32·150 | +0·642 | −12·554 | +1·539 | +0·635 | − 9·738 | 22·412 | |

Mean 0° 41′ 23″·8148

#### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 35″·625 | +0″·645 | −12″·578 | −0″·268 | +0″·720 | −11″·481 | 24″·144 | |
| 20 | E | α | 33·275 | +0·641 | −12·601 | +0·664 | +0·952 | −10·344 | 22·931 | 23″·429 |
| 21 | W | 20° | 35·575 | +0·644 | −12·627 | −0·978 | +0·614 | −12·347 | 23·228 | |
| 22 | E | | 35·075 | +0·641 | −12·650 | +0·411 | −0·063 | −11·661 | 23·414 | |
| 23 | W | | 34·825 | +0·638 | −12·671 | +0·330 | +1·122 | −10·581 | 24·244 | |
| 24 | E | α | 36·800 | +0·642 | −12·690 | +0·190 | +1·312 | −10·546 | 26·254 | |
| 25 | W | 40° | 35·125 | +0·638 | −12·709 | −0·195 | +0·190 | −12·076 | 23·049 | 24·405 |
| 26 | E | | 35·950 | +0·640 | −12·728 | −0·214 | +0·423 | −11·879 | 24·071 | |
| 27 | W | | 35·775 | +0·638 | −12·746 | −1·221 | +1·037 | −12·292 | 23·483 | |
| 28 | E | α | 33·575 | +0·635 | −12·762 | +1·570 | +2·244 | − 8·313 | 25·262 | |
| 29 | W | 60° | 34·400 | +0·635 | −12·775 | −1·275 | +0·825 | −12·590 | 21·810 | 23·432 |
| 30 | E | | 33·775 | +0·634 | −12·788 | +0·260 | +1·291 | −10·603 | 23·172 | |
| 31 | W | | 34·800 | +0·631 | −12·799 | −1·399 | +0·106 | −13·461 | 21·339 | |
| Jan. 1 | E | α (1) | 33·675 | +0·630 | −12·832 | +1·285 | +0·360 | −10·557 | 23·118 | |
| 2 | W | 30° | 35·825 | +0·633 | −12·842 | −1·984 | +0·804 | −13·389 | 22·436 | 22·779 |
| 3 | E | | 33·125 | +0·635 | −12·850 | +1·915 | +1·397 | − 8·903 | 24·222 | |
| 4 | W | | 34·200 | +0·632 | −12·858 | +0·318 | +0·529 | −11·379 | 22·821 | |
| 5 | E | α (1) | 37·775 | +0·634 | −12·864 | −0·146 | +0·423 | −11·953 | 25·822 | |
| 6 | W | 50° | 35·500 | +0·633 | −12·870 | −0·246 | +0·995 | −11·488 | 24·012 | 24·199 |
| 7 | E | | 36·550 | +0·632 | −12·873 | −0·381 | +0·212 | −12·410 | 24·140 | |
| 8 | W | | 36·950 | +0·632 | −12·876 | −0·753 | −0·339 | −13·336 | 23·614 | |
| 9 | E | α (1) | 39·375 | +0·631 | −12·877 | −2·711 | 0·000 | −14·957 | 24·418 | |
| 10 | W | 70° | 35·250 | +0·629 | −12·878 | −1·460 | +0·127 | −13·582 | 21·668 | 23·719 |
| 11 | E | | 36·050 | +0·630 | −12·876 | +1·140 | +0·233 | −10·873 | 25·177 | |

Mean 0° 41′ 23″·6605

Mean Result of both Faces..... 0° 41′ 23″·7377

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No. 13 (404) 18 PLEIADUM *m*. North 0° 12′ +

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✻'s Place. | Collimatn | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | a 90° | 64″·525 | +0″·201 | −11″·514 | −0″·144 | +0″·995 | −10″·462 | 54″·063 | 54″·085 |
| 25 | W | | 65·250 | +0·203 | −11·559 | +0·109 | +0·042 | −11·205 | 54·045 | |
| 26 | E | | 62·775 | +0·203 | −11·604 | +0·465 | +2·349 | − 8·587 | 54·188 | |
| 28 | E | a 80° | 69·775 | +0·202 | −11·690 | −2·931 | 0·000 | −14·419 | 55·356 | 55·917 |
| 30 | W | | 65·875 | +0·203 | −11·775 | +2·748 | −0·868 | − 9·692 | 56·183 | |
| Dec. 1 | E | | 71·175 | +0·203 | −11·815 | −2·066 | −1·355 | −15·033 | 56·142 | |
| 2 | W | | 64·675 | +0·201 | −11·855 | +1·824 | +1·143 | − 8·687 | 55·988 | |
| 3 | E | a 60° | 64·325 | +0·201 | −11·893 | +1·406 | +0·974 | − 9·312 | 55·013 | 54·500 |
| 4 | W | | 66·425 | +0·200 | −11·930 | −1·166 | +0·487 | −12·409 | 54·016 | |
| 5 | W | | 66·000 | +0·201 | −11·968 | −0·916 | +1·312 | −11·371 | 54·629 | |
| 6 | E | | 63·775 | +0·200 | −12·003 | +1·544 | +0·825 | − 9·434 | 54·341 | |
| 7 | E | a (5) 30° | 65·550 | +0·200 | −12·039 | +1·354 | +0·571 | − 9·914 | 55·636 | 55·242 |
| 8 | W | | 66·525 | +0·202 | −12·072 | −1·270 | +2·117 | −11·023 | 55·502 | |
| 9 | E | | 65·450 | +0·201 | −12·103 | +1·565 | +0·100 | −10·237 | 55·213 | |
| 10 | W | | 66·325 | +0·200 | −12·136 | −0·514 | +0·741 | −11·709 | 54·616 | |
| 11 | E | a (5) 50° | 65·375 | +0·201 | −12·166 | +0·786 | +0·550 | −10·629 | 54·746 | 55·213 |
| 12 | W | | 68·875 | +0·202 | −12·198 | −0·708 | +0·085 | −12·619 | 56·256 | |
| 13 | E | | 65·325 | +0·203 | −12·226 | +1·040 | −0·021 | −11·004 | 54·321 | |
| 14 | W | | 66·350 | +0·202 | −12·255 | −0·019 | +1·249 | −10·823 | 55·527 | |
| 15 | E | a (5) 70° | 62·850 | +0·201 | −12·281 | +1·695 | +1·418 | − 8·967 | 53·883 | 55·673 |
| 16 | W | | 69·425 | +0·201 | −12·306 | −0·630 | +1·566 | −11·169 | 58·256 | |
| 17 | E | | 64·325 | +0·202 | −12·333 | +1·915 | +1·228 | − 8·988 | 55·337 | |
| 18 | W | | 68·550 | +0·202 | −12·357 | −1·539 | +0·360 | −13·334 | 55·216 | |

Mean 0° 12′ 55″·1050

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | a 90° | 67″·800 | +0″·203 | −12″·379 | +0″·268 | +0″·593 | −11″·315 | 56″·485 | 55″·758 |
| 20 | W | | 67·325 | +0·202 | −12·399 | −0·664 | +1·672 | −11·189 | 56·136 | |
| 21 | E | | 65·775 | +0·203 | −12·423 | +0·978 | +0·656 | −10·586 | 55·189 | |
| 22 | W | | 67·175 | +0·202 | −12·444 | −0·411 | +0·698 | −11·955 | 55·220 | |
| 23 | E | a 80° | 69·750 | +0·201 | −12·462 | −0·330 | −0·063 | −12·654 | 57·096 | 55·822 |
| 24 | W | | 67·300 | +0·202 | −12·480 | −0·190 | +0·868 | −11·600 | 55·700 | |
| 25 | E | | 68·500 | +0·201 | −12·497 | +0·195 | +0·021 | −12·080 | 56·420 | |
| 26 | W | | 65·575 | +0·202 | −12·514 | +0·214 | +0·593 | −11·505 | 54·070 | |
| 27 | E | a 60° | 68·050 | +0·201 | −12·530 | +1·221 | +1·164 | − 9·944 | 58·106 | 55·878 |
| 28 | W | | 66·250 | +0·200 | −12·540 | −1·570 | +1·926 | −11·984 | 54·266 | |
| 29 | E | | 67·450 | +0·200 | −12·556 | +1·275 | +0·423 | −10·658 | 56·792 | |
| 30 | W | | 65·725 | +0·200 | −12·568 | −0·260 | +1·249 | −11·379 | 54·346 | |
| 31 | E | a (5) 30° | 68·775 | +0·199 | −12·578 | +1·399 | +0·931 | −10·049 | 58·726 | 56·529 |
| Jan. 1 | W | | 68·300 | +0·199 | −12·610 | −1·285 | +0·720 | −12·976 | 55·324 | |
| 2 | E | | 67·125 | +0·200 | −12·618 | +1·984 | +1·122 | − 9·312 | 57·813 | |
| 3 | W | | 66·775 | +0·200 | −12·626 | −1·915 | +1·820 | −12·521 | 54·254 | |
| 4 | E | a (5) 50° | 69·025 | +0·199 | −12·632 | −0·318 | +0·804 | −11·947 | 57·078 | 55·259 |
| 5 | W | | 65·825 | +0·200 | −12·637 | +0·146 | −0·254 | −12·545 | 53·280 | |
| 6 | E | | 68·650 | +0·199 | −12·642 | +0·246 | +0·508 | −11·689 | 56·961 | |
| 7 | W | | 65·550 | +0·199 | −12·645 | +0·381 | +0·233 | −11·832 | 53·718 | |
| 8 | E | a (5) 70° | 67·900 | +0·199 | −12·647 | +0·753 | +0·106 | −11·589 | 56·311 | 55·272 |
| 9 | W | | 63·625 | +0·199 | −12·647 | +2·711 | +0·360 | − 9·377 | 54·248 | |
| 10 | E | | 67·150 | +0·198 | −12·647 | +1·460 | +0·550 | −10·439 | 56·711 | |
| 11 | W | | 67·300 | +0·199 | −12·646 | −1·140 | +0·106 | −13·481 | 53·819 | |

Mean 0° 12′ 55″·7530

Mean Result of both Faces..... 0° 12′ 55″·4290





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## G. T. STATION KALIANPUR.

### No. 14 (423) PLEIADUM. North 0° 58′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 36″·925 | +0″·900 | −11″·412 | +0″·144 | +1″·228 | − 9″·140 | 27″·785 | |
| 25 | E | α | 34·925 | +0·907 | −11·461 | −0·109 | +1·312 | − 9·351 | 25·574 | 27″·309 |
| 26 | W | 20° | 40·475 | +0·909 | −11·510 | −0·465 | +1·439 | − 9·627 | 30·848 | |
| 27 | E | | 33·575 | +0·911 | −11·556 | +2·354 | −0·254 | − 8·545 | 25·030 | |
| 28 | W | | 35·425 | +0·903 | −11·603 | +2·931 | 0·000 | − 7·769 | 27·656 | |
| 30 | E | α | 40·650 | +0·906 | −11·695 | −2·748 | −0·910 | −14·447 | 26·203 | 25·734 |
| Dec. 1 | W | 40° | 35·275 | +0·907 | −11·739 | +2·066 | −0·508 | − 9·274 | 26·001 | |
| 2 | E | | 34·850 | +0·900 | −11·783 | −1·824 | +0·931 | −11·776 | 23·074 | |
| 3 | W | | 39·300 | +0·897 | −11·825 | −1·406 | +0·931 | −11·403 | 27·897 | |
| 4 | E | α | 34·900 | +0·895 | −11·866 | +1·166 | +0·889 | − 8·916 | 25·984 | 26·752 |
| 5 | E | 60° | 34·000 | +0·898 | −11·907 | +0·916 | +1·820 | − 8·273 | 25·727 | |
| 6 | W | | 39·150 | +0·893 | −11·946 | −1·544 | +0·847 | −11·750 | 27·400 | |
| 7 | W | | 37·750 | +0·895 | −11·987 | −1·354 | +0·614 | −11·832 | 25·918 | |
| 8 | E | α (1) | 35·875 | +0·901 | −12·024 | +1·270 | +2·371 | − 7·482 | 28·393 | 26·962 |
| 9 | W | 30° | 39·275 | +0·899 | −12·059 | −1·565 | +0·085 | −12·640 | 26·635 | |
| 10 | E | | 36·700 | +0·895 | −12·096 | +0·514 | +0·889 | − 9·798 | 26·902 | |
| 11 | W | | 38·325 | +0·898 | −12·130 | −0·786 | +0·741 | −11·277 | 27·048 | |
| 12 | E | α (1) | 37·775 | +0·903 | −12·166 | +0·708 | +0·106 | −10·449 | 27·326 | 27·160 |
| 13 | W | 50° | 39·700 | +0·906 | −12·199 | −1·040 | +0·804 | −11·529 | 28·171 | |
| 14 | E | | 36·175 | +0·904 | −12·231 | +0·019 | +1·228 | −10·080 | 26·095 | |
| 15 | W | | 41·525 | +0·900 | −12·262 | −1·695 | +1·482 | −11·575 | 29·950 | |
| 16 | E | α (1) | 34·825 | +0·899 | −12·291 | +0·630 | +1·609 | − 9·153 | 25·672 | 26·775 |
| 17 | W | 70° | 38·575 | +0·903 | −12·322 | −1·915 | +1·609 | −11·725 | 26·850 | |
| 18 | E | | 33·750 | +0·905 | −12·350 | +1·539 | +0·783 | − 9·123 | 24·627 | |

Mean 0° 58′ 26″·7820

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 37″·925 | +0″·909 | −12″·377 | −0″·268 | +0″·360 | −11″·376 | 26″·549 | |
| 20 | E | α | 35·250 | +0·904 | −12·402 | +0·664 | +2·138 | − 8·696 | 26·554 | 26″·426 |
| 21 | W | 20° | 37·100 | +0·907 | −12·430 | −0·978 | +0·889 | −11·612 | 25·488 | |
| 22 | E | | 37·575 | +0·903 | −12·455 | +0·411 | +0·677 | −10·464 | 27·111 | |
| 23 | W | | 36·850 | +0·900 | −12·478 | +0·330 | 0·000 | −11·248 | 24·602 | |
| 24 | E | α | 38·750 | +0·905 | −12·500 | +0·190 | +0·720 | −10·685 | 28·065 | 26·624 |
| 25 | W | 40° | 36·275 | +0·900 | −12·521 | −0·195 | +0·423 | −11·393 | 24·882 | |
| 26 | E | | 39·975 | +0·902 | −12·543 | −0·214 | +0·825 | −11·030 | 28·945 | |
| 27 | W | | 36·325 | +0·900 | −12·563 | −1·221 | +1·503 | −11·381 | 24·944 | |
| 28 | E | α | 35·450 | +0·895 | −12·582 | +1·570 | +1·905 | − 8·212 | 27·238 | 26·002 |
| 29 | W | 60° | 36·075 | +0·895 | −12·598 | −1·275 | +0·995 | −11·983 | 24·092 | |
| 30 | E | | 38·050 | +0·894 | −12·614 | +0·260 | +1·143 | −10·317 | 27·733 | |
| 31 | W | | 36·750 | +0·889 | −12·628 | −1·399 | +1·630 | −11·508 | 25·242 | |
| Jan. 1 | E | α (1) | 37·750 | +0·888 | −12·666 | +1·285 | +0·868 | − 9·625 | 28·125 | 26·354 |
| 2 | W | 30° | 37·125 | +0·893 | −12·679 | −1·984 | +1·524 | −12·246 | 24·879 | |
| 3 | E | | 35·125 | +0·895 | −12·691 | +1·915 | +1·926 | − 7·955 | 27·170 | |
| 4 | W | | 36·650 | +0·891 | −12·702 | +0·318 | +0·381 | −11·112 | 25·538 | |
| 5 | E | α (1) | 39·825 | +0·895 | −12·711 | −0·146 | −0·381 | −12·343 | 27·482 | 26·391 |
| 6 | W | 50° | 37·525 | +0·892 | −12·720 | −0·246 | +0·233 | −11·841 | 25·684 | |
| 7 | E | | 38·800 | +0·892 | −12·727 | −0·381 | +0·275 | −11·941 | 26·859 | |
| 8 | W | | 38·975 | +0·891 | −12·734 | −0·753 | +0·635 | −11·961 | 27·014 | |
| 9 | E | α (1) | 42·550 | +0·890 | −12·738 | −2·711 | +0·021 | −14·538 | 28·012 | 27·242 |
| 10 | W | 70° | 38·475 | +0·886 | −12·743 | −1·460 | +0·698 | −12·619 | 25·856 | |
| 11 | E | | 38·675 | +0·889 | −12·746 | +1·140 | +0·127 | −10·590 | 28·085 | |

Mean 0° 58′ 26″·5065

**Mean Result of both Faces..... 0° 58′ 26″·6443**

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## G. T. STATION KALIANPUR.

### No. 15 (441) TAURI. South 6° 22′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | |
| Nov. 25 | W | α 20° | 28·925 | +5·942 | +11·026 | −0·109 | −1·270 | +15·589 | 44·514 | 46″·400 |
| 26 | E | | 31·700 | +5·959 | +11·026 | −0·465 | +0·233 | +16·753 | 48·453 | |
| 27 | W | | 23·800 | +5·964 | +11·024 | +2·354 | +1·037 | +20·379 | 44·179 | |
| 28 | E | α 40° | 28·100 | +5·914 | +11·022 | +2·931 | 0·000 | +19·867 | 47·967 | 45·541 |
| 30 | W | | 28·800 | +5·937 | +11·019 | −2·748 | +1·228 | +15·436 | 44·236 | |
| Dec. 1 | E | | 24·875 | +5·939 | +11·015 | +2·066 | +0·847 | +19·867 | 44·742 | |
| 2 | W | | 31·275 | +5·899 | +11·012 | −1·824 | −1·143 | +13·944 | 45·219 | |
| 3 | E | α 60° | 32·225 | +5·874 | +11·006 | −1·406 | −0·910 | +14·564 | 46·789 | 46·938 |
| 4 | W | | 29·000 | +5·863 | +11·000 | +1·166 | −0·889 | +17·140 | 46·140 | |
| 5 | W | | 31·500 | +5·881 | +10·995 | +0·916 | −2·201 | +15·591 | 47·091 | |
| 6 | E | | 33·325 | +5·853 | +10·988 | −1·544 | −0·889 | +14·408 | 47·733 | |
| 7 | E | α (1) 30° | 33·050 | +5·868 | +10·982 | −1·354 | −1·101 | +14·395 | 47·445 | 47·305 |
| 8 | W | | 29·875 | +5·905 | +10·973 | +1·270 | −1·312 | +16·836 | 46·711 | |
| 9 | E | | 32·750 | +5·894 | +10·963 | −1·565 | −1·249 | +14·043 | 46·793 | |
| 10 | W | | 32·375 | +5·865 | +10·956 | +0·514 | −1·439 | +15·896 | 48·271 | |
| 11 | E | α (1) 50° | 30·700 | +5·885 | +10·945 | −0·786 | −0·593 | +15·451 | 46·151 | 46·278 |
| 12 | W | | 26·450 | +5·912 | +10·937 | +0·708 | +0·423 | +17·980 | 44·430 | |
| 13 | E | | 32·150 | +5·937 | +10·926 | −1·040 | −0·698 | +15·125 | 47·275 | |
| 14 | W | | 31·675 | +5·916 | +10·915 | +0·019 | −1·270 | +15·580 | 47·255 | |
| 15 | E | α (1) 70° | 33·100 | +5·899 | +10·903 | −1·695 | −0·677 | +14·430 | 47·530 | 46·663 |
| 16 | W | | 30·625 | +5·896 | +10·890 | +0·630 | −1·418 | +15·998 | 46·623 | |
| 17 | E | | 34·550 | +5·921 | +10·878 | −1·915 | −2·392 | +12·492 | 47·042 | |
| 18 | W | | 28·375 | +5·926 | +10·865 | +1·539 | −1·249 | +17·081 | 45·456 | |

Mean 6° 22′ 46″·5208

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | |
| Dec. 19 | E | α 20° | 28·075 | +5·953 | +10·850 | −0·268 | +0·593 | +17·128 | 45·203 | 46″·283 |
| 20 | W | | 31·300 | +5·918 | +10·835 | +0·664 | −1·672 | +15·745 | 47·045 | |
| 21 | E | | 30·375 | +5·943 | +10·823 | −0·978 | −0·487 | +15·301 | 45·676 | |
| 22 | W | | 31·575 | +5·917 | +10·809 | +0·411 | −1·503 | +15·634 | 47·209 | |
| 23 | E | α 40° | 27·625 | +5·902 | +10·792 | +0·330 | −0·275 | +16·749 | 44·374 | 46·449 |
| 24 | W | | 31·175 | +5·928 | +10·776 | +0·190 | −0·360 | +16·534 | 47·709 | |
| 25 | E | | 29·675 | +5·900 | +10·760 | −0·195 | −1·101 | +15·364 | 45·039 | |
| 26 | W | | 33·075 | +5·915 | +10·744 | −0·214 | −0·847 | +15·598 | 48·673 | |
| 27 | E | α 60° | 30·950 | +5·895 | +10·727 | −1·221 | −1·122 | +14·279 | 45·229 | 46·888 |
| 28 | W | | 31·925 | +5·866 | +10·710 | +1·570 | −1·206 | +16·940 | 48·865 | |
| 29 | E | | 30·175 | +5·863 | +10·691 | −1·275 | −1·016 | +14·263 | 44·438 | |
| 30 | W | | 33·525 | +5·855 | +10·672 | +0·260 | −1·291 | +15·496 | 49·021 | |
| 31 | E | α (1) 30° | 29·650 | +5·817 | +10·652 | −1·399 | −0·550 | +14·520 | 44·170 | 46·196 |
| Jan. 1 | W | | 29·450 | +5·816 | +10·657 | +1·285 | −0·720 | +17·038 | 46·488 | |
| 2 | E | | 31·625 | +5·855 | +10·637 | −1·984 | −0·635 | +13·873 | 45·498 | |
| 3 | W | | 33·000 | +5·867 | +10·617 | +1·915 | −2·773 | +15·626 | 48·626 | |
| 4 | E | α (1) 50° | 29·275 | +5·842 | +10·596 | +0·318 | −0·254 | +16·502 | 45·777 | 46·750 |
| 5 | W | | 31·175 | +5·861 | +10·575 | −0·146 | +0·275 | +16·565 | 47·740 | |
| 6 | E | | 29·825 | +5·844 | +10·554 | −0·246 | −0·233 | +15·919 | 45·744 | |
| 7 | W | | 32·100 | +5·848 | +10·531 | −0·381 | −0·360 | +15·638 | 47·738 | |
| 8 | E | α (1) 70° | 30·525 | +5·836 | +10·509 | −0·753 | −1·058 | +14·534 | 45·059 | 47·219 |
| 9 | W | | 37·150 | +5·828 | +10·486 | −2·711 | −0·571 | +13·032 | 50·182 | |
| 10 | E | | 31·500 | +5·810 | +10·462 | −1·460 | −0·783 | +14·029 | 45·529 | |
| 11 | W | | 31·800 | +5·826 | +10·439 | +1·140 | −1·101 | +16·304 | 48·104 | |

Mean 6° 22′ 46″·6308

**Mean Result of both Faces.....6° 22′ 46″·5758**

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## G. T. STATION KALIANPUR.

### No. 16 (454) Tauri. South 7° 12′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | #'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 18″·825 | +6″·680 | +10″·895 | −0″·144 | −0″·571 | +16″·860 | 35″·685 | |
| 25 | E | α | 21·575 | +6·726 | +10·888 | +0·109 | −0·677 | +17·046 | 38·621 | 37″·831 |
| 26 | W | 20° | 19·700 | +6·745 | +10·880 | +0·465 | −0·042 | +18·048 | 37·748 | |
| 27 | E | | 22·250 | +6·747 | +10·871 | −2·354 | +1·757 | +17·021 | 39·271 | |
| 28 | W | | 21·975 | +6·691 | +10·862 | −2·931 | +0·804 | +15·426 | 37·401 | |
| 30 | E | α | 18·175 | +6·719 | +10·845 | +2·748 | +1·397 | +21·709 | 39·884 | 37·602 |
| Dec. 1 | W | 40° | 17·325 | +6·720 | +10·834 | −2·066 | +3·281 | +18·769 | 36·094 | |
| 2 | E | | 18·000 | +6·677 | +10·824 | +1·824 | −0·296 | +19·029 | 37·029 | |
| 3 | W | | 19·550 | +6·647 | +10·812 | +1·406 | −0·487 | +18·378 | 37·928 | |
| 4 | E | α | 23·050 | +6·635 | +10·799 | −1·166 | −0·402 | +15·866 | 38·916 | 38·484 |
| 5 | E | 60° | 24·225 | +6·656 | +10·787 | −0·916 | −1·905 | +14·622 | 38·847 | |
| 6 | W | | 20·000 | +6·625 | +10·774 | +1·544 | −0·698 | +18·245 | 38·245 | |
| 7 | W | | 19·150 | +6·642 | +10·761 | +1·354 | −0·063 | +18·694 | 37·844 | |
| 8 | E | α (1) | 21·875 | +6·685 | +10·746 | −1·270 | −0·698 | +15·463 | 37·338 | |
| 9 | W | 30° | 21·500 | +6·673 | +10·730 | +1·565 | −1·143 | +17·825 | 39·325 | 37·927 |
| 10 | E | | 21·775 | +6·640 | +10·716 | −0·514 | −1·418 | +15·424 | 37·199 | |
| 11 | W | | 17·700 | +6·660 | +10·700 | +0·786 | +1·016 | +19·162 | 36·862 | |
| 12 | E | α (1) | 20·025 | +6·691 | +10·685 | −0·708 | +0·804 | +17·472 | 37·497 | |
| 13 | W | 50° | 19·425 | +6·719 | +10·668 | +1·040 | +0·487 | +18·914 | 38·339 | 37·977 |
| 14 | E | | 23·175 | +6·692 | +10·651 | −0·019 | −1·291 | +16·033 | 39·208 | |
| 15 | W | | 19·000 | +6·679 | +10·633 | +1·695 | +0·148 | +19·155 | 38·155 | |
| 16 | E | α (1) | 22·750 | +6·675 | +10·615 | −0·630 | −1·249 | +15·411 | 38·161 | |
| 17 | W | 70° | 20·950 | +6·705 | +10·597 | +1·915 | −1·016 | +18·201 | 39·151 | 38·498 |
| 18 | E | | 23·900 | +6·706 | +10·579 | −1·539 | −1·122 | +14·624 | 38·524 | |

Mean 7° 12′ 38″·0532

#### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | #'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 20″·600 | +6″·738 | +10″·559 | +0″·268 | +0″·804 | +18″·369 | 38″·969 | |
| 20 | E | α | 20·250 | +6·697 | +10·538 | −0·664 | −0·042 | +16·529 | 36·779 | 38″·101 |
| 21 | W | 20° | 22·375 | +6·725 | +10·521 | +0·978 | −0·423 | +17·801 | 40·176 | |
| 22 | E | | 21·025 | +6·697 | +10·501 | −0·411 | −1·333 | +15·454 | 36·479 | |
| 23 | W | | 22·250 | +6·682 | +10·480 | −0·330 | +0·360 | +17·192 | 39·442 | |
| 24 | E | α | 18·825 | +6·709 | +10·459 | −0·190 | +0·021 | +16·999 | 35·824 | 37·999 |
| 25 | W | 40° | 24·325 | +6·680 | +10·438 | +0·195 | −0·720 | +16·593 | 40·918 | |
| 26 | E | | 19·350 | +6·698 | +10·417 | +0·214 | −0·868 | +16·461 | 35·811 | |
| 27 | W | | 21·400 | +6·672 | +10·396 | +1·221 | +0·233 | +18·522 | 39·922 | |
| 28 | E | α | 21·300 | +6·638 | +10·375 | −1·570 | +0·550 | +15·993 | 37·293 | 38·424 |
| 29 | W | 60° | 22·800 | +6·635 | +10·351 | +1·275 | −0·635 | +17·626 | 40·426 | |
| 30 | E | | 20·800 | +6·626 | +10·328 | −0·260 | −1·439 | +15·255 | 36·055 | |
| 31 | W | | 22·575 | +6·579 | +10·305 | +1·399 | +0·656 | +18·939 | 41·514 | |
| Jan. 1 | E | α (1) | 19·500 | +6·582 | +10·307 | −1·285 | +0·466 | +16·070 | 35·570 | 38·188 |
| 2 | W | 30° | 22·600 | +6·629 | +10·283 | +1·984 | −0·381 | +18·515 | 41·115 | |
| 3 | E | | 22·000 | +6·642 | +10·259 | −1·915 | −2·434 | +12·552 | 34·552 | |
| 4 | W | | 23·050 | +6·615 | +10·235 | −0·318 | −0·296 | +16·236 | 39·286 | |
| 5 | E | α (1) | 18·450 | +6·634 | +10·210 | +0·146 | +0·720 | +17·710 | 36·160 | |
| 6 | W | 50° | 22·850 | +6·615 | +10·186 | +0·246 | −0·550 | +16·497 | 39·347 | 37·787 |
| 7 | E | | 19·425 | +6·623 | +10·160 | +0·381 | −0·333 | +16·931 | 36·356 | |
| 8 | W | | 22·050 | +6·604 | +10·134 | +0·753 | −0·889 | +16·602 | 38·652 | |
| 9 | E | α (1) | 17·650 | +6·595 | +10·109 | +2·711 | −0·698 | +18·717 | 36·367 | |
| 10 | W | 70° | 21·725 | +6·577 | +10·083 | +1·460 | −0·444 | +17·676 | 39·401 | 37·468 |
| 11 | E | | 21·000 | +6·595 | +10·056 | −1·140 | −1·058 | +14·453 | 35·453 | |

Mean 7° 12′ 37″·9945

Mean Result of both Faces..... 7° 12′ 38″·0239

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## G. T. STATION KALIANPUR.

### No. 17 (468) 48 TAURI. South 9° 6′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | α 20° | 62″·275 | +8″·483 | +10″·762 | +0″·144 | −0″·635 | +18″·754 | 81″·029 | 81″·521 |
| 25 | W | | 60·550 | +8·540 | +10·741 | −0·109 | −0·868 | +18·304 | 78·854 | |
| 26 | E | | 65·000 | +8·564 | +10·719 | −0·465 | −0·656 | +18·162 | 83·162 | |
| 27 | W | | 61·425 | +8·563 | +10·696 | +2·354 | 0·000 | +21·613 | 83·038 | |
| 29 | E | α 40° | 59·900 | +8·425 | +10·651 | +2·881 | 0·000 | +21·957 | 81·857 | 81·146 |
| 30 | W | | 63·875 | +8·530 | +10·627 | −2·748 | +0·254 | +16·663 | 80·538 | |
| Dec. 1 | E | | 58·425 | +8·530 | +10·602 | +2·066 | +2·519 | +23·717 | 82·142 | |
| 2 | W | | 62·900 | +8·478 | +10·578 | −1·824 | −0·085 | +17·147 | 80·047 | |
| 3 | E | α 60° | 64·275 | +8·437 | +10·553 | −1·406 | −0·508 | +17·076 | 81·351 | 81·734 |
| 4 | W | | 63·150 | +8·423 | +10·526 | +1·166 | −0·381 | +19·734 | 82·884 | |
| 5 | W | | 63·475 | +8·450 | +10·501 | +0·916 | −1·355 | +18·512 | 81·987 | |
| 6 | E | | 64·325 | +8·411 | +10·473 | −1·544 | −0·952 | +16·388 | 80·713 | |
| 7 | E | α (1) 30° | 63·925 | +8·434 | +10·447 | −1·354 | −0·063 | +17·464 | 81·389 | 81·745 |
| 8 | W | | 62·750 | +8·488 | +10·419 | +1·270 | −1·270 | +18·907 | 81·657 | |
| 9 | E | | 64·900 | +8·473 | +10·390 | −1·565 | −1·228 | +16·070 | 80·970 | |
| 10 | W | | 65·200 | +8·432 | +10·363 | +0·514 | −1·545 | +17·764 | 82·964 | |
| 11 | E | α (1) 50° | 61·600 | +8·455 | +10·333 | −0·786 | +0·487 | +18·489 | 80·089 | 80·189 |
| 12 | W | | 59·100 | +8·493 | +10·306 | +0·708 | +0·317 | +19·824 | 78·924 | |
| 13 | E | | 62·850 | +8·529 | +10·276 | −1·040 | −0·148 | +17·617 | 80·467 | |
| 14 | W | | 64·150 | +8·491 | +10·247 | +0·019 | −1·630 | +17·127 | 81·277 | |
| 15 | E | α (1) 70° | 63·600 | +8·481 | +10·216 | −1·695 | +0·254 | +17·256 | 80·856 | 81·519 |
| 16 | W | | 62·925 | +8·479 | +10·186 | +0·630 | −0·677 | +18·618 | 81·543 | |
| 17 | E | | 65·825 | +8·517 | +10·156 | −0·915 | −0·593 | +17·165 | 82·990 | |
| 18 | W | | 61·675 | +8·512 | +10·126 | +1·539 | −1·164 | +19·013 | 80·688 | |

Mean 9° 7′ 21″·3090

#### Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | α 20° | 60″·425 | +8″·554 | +10″·094 | −0″·268 | +0″·825 | +19″·205 | 79″·630 | 81″·243 |
| 20 | W | | 64·600 | +8·501 | +10·062 | +0·664 | −0·656 | +18·571 | 83·171 | |
| 21 | E | | 61·550 | +8·537 | +10·032 | −0·978 | −0·720 | +16·871 | 78·421 | |
| 22 | W | | 65·575 | +8·502 | +10·002 | +0·411 | −0·741 | +18·174 | 83·749 | |
| 23 | E | α 40° | 60·275 | +8·486 | + 9·969 | +0·330 | −0·423 | +18·362 | 78·637 | 80·471 |
| 24 | W | | 63·800 | +8·518 | + 9·937 | +0·190 | −0·614 | +18·031 | 81·831 | |
| 25 | E | | 60·550 | +8·484 | + 9·905 | −0·195 | −0·635 | +17·559 | 78·109 | |
| 26 | W | | 65·900 | +8·508 | + 9·874 | −0·214 | −0·762 | +17·406 | 83·306 | |
| 27 | E | α 60° | 60·525 | +8·470 | + 9·842 | −1·221 | −0·085 | +17·006 | 77·531 | 81·024 |
| 28 | W | | 65·550 | +8·427 | + 9·810 | +1·570 | −0·466 | +19·341 | 84·891 | |
| 29 | E | | 62·375 | +8·422 | + 9·777 | −1·275 | −0·974 | +15·950 | 78·325 | |
| 30 | W | | 66·350 | +8·412 | + 9·744 | +0·260 | −1·418 | +16·998 | 83·348 | |
| 31 | E | α (1) 30° | 62·075 | +8·347 | + 9·710 | −1·399 | −0·656 | +16·002 | 78·077 | 80·360 |
| Jan. 1 | W | | 62·525 | +8·357 | + 9·706 | +1·285 | −0·169 | +19·179 | 81·704 | |
| 2 | E | | 62·925 | +8·419 | + 9·673 | −1·984 | −0·212 | +15·896 | 78·821 | |
| 3 | W | | 64·775 | +8·434 | + 9·640 | +1·915 | −1·926 | +18·063 | 82·838 | |
| 4 | E | α (1) 50° | 62·425 | +8·401 | + 9·606 | +0·318 | −0·360 | +17·965 | 80·390 | 81·173 |
| 5 | W | | 64·600 | +8·422 | + 9·573 | −0·146 | +0·720 | +18·569 | 83·169 | |
| 6 | E | | 62·300 | +8·399 | + 9·540 | −0·246 | −1·079 | +16·614 | 78·914 | |
| 7 | W | | 64·975 | +8·414 | + 9·506 | −0·381 | −0·296 | +17·243 | 82·218 | |
| 8 | E | α (1) 70° | 62·900 | +8·383 | + 9·472 | −0·753 | −0·360 | +16·742 | 79·642 | 81·339 |
| 9 | W | | 68·075 | +8·372 | + 9·438 | −2·711 | −0·317 | +14·782 | 82·857 | |
| 10 | E | | 63·400 | +8·352 | + 9·405 | −1·460 | −0·444 | +15·853 | 79·253 | |
| 11 | W | | 65·100 | +8·375 | + 9·371 | +1·140 | −0·381 | +18·505 | 83·605 | |

Mean 9° 7′ 20″·9350

Mean Result of both Faces..... 9° 7′ 21″·1220

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## G. T. STATION KALIANPUR.

### No. 18 (478) 54 Tauri γ. South 8° 52′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | α 20° | 36″·775 | +8″·258 | +10″·700 | −0″·144 | −0″·762 | +18″·052 | 54″·827 | 55″·413 |
| 25 | E | | 38·225 | +8·312 | +10·679 | +0·109 | −1·355 | +17·745 | 55·970 | |
| 26 | W | | 36·000 | +8·335 | +10·658 | +0·465 | −0·804 | +18·654 | 54·654 | |
| 27 | E | | 39·650 | +8·332 | +10·635 | −2·354 | −0·063 | +16·550 | 56·200 | |
| 29 | W | α 40° | 37·175 | +8·200 | +10·590 | −2·881 | −0·339 | +15·570 | 52·745 | 53·978 |
| 30 | E | | 33·850 | +8·302 | +10·567 | +2·748 | +0·254 | +21·871 | 55·721 | |
| Dec. 1 | W | | 35·200 | +8·301 | +10·542 | −2·066 | +2·413 | +19·190 | 54·390 | |
| 2 | E | | 32·675 | +8·251 | +10·519 | +1·824 | −0·212 | +20·382 | 53·057 | |
| 3 | W | α 60° | 34·800 | +8·211 | +10·493 | +1·406 | −0·402 | +19·708 | 54·508 | 54·492 |
| 4 | E | | 37·325 | +8·197 | +10·467 | −1·166 | −0·381 | +17·117 | 54·442 | |
| 5 | E | | 37·950 | +8·225 | +10·442 | −0·916 | −0·889 | +16·862 | 54·812 | |
| 6 | W | | 34·950 | +8·186 | +10·415 | +1·544 | −0·889 | +19·256 | 54·206 | |
| 7 | W | α (i) 30° | 34·775 | +8·209 | +10·390 | +1·354 | −0·762 | +19·191 | 53·966 | 54·150 |
| 8 | E | | 38·075 | +8·261 | +10·362 | −1·270 | −1·164 | +16·189 | 54·264 | |
| 9 | W | | 35·850 | +8·248 | +10·334 | +1·565 | −1·905 | +18·242 | 54·092 | |
| 10 | E | | 37·800 | +8·207 | +10·307 | −0·514 | −1·524 | +16·476 | 54·276 | |
| 11 | W | α (i) 50° | 34·025 | +8·228 | +10·278 | +0·786 | +0·550 | +19·842 | 53·867 | 54·765 |
| 12 | E | | 36·450 | +8·266 | +10·251 | +0·708 | +0·339 | +19·564 | 56·014 | |
| 13 | W | | 34·500 | +8·301 | +10·222 | +1·040 | −0·021 | +19·542 | 54·042 | |
| 14 | E | | 38·350 | +8·262 | +10·194 | −0·019 | −1·651 | +16·786 | 55·136 | |
| 15 | W | α (i) 70° | 33·875 | +8·256 | +10·164 | +1·695 | +0·127 | +20·242 | 54·117 | 54·958 |
| 16 | E | | 38·725 | +8·254 | +10·134 | −0·630 | −0·720 | +17·038 | 55·763 | |
| 17 | W | | 35·850 | +8·292 | +10·105 | +1·915 | −0·931 | +19·381 | 55·231 | |
| 18 | E | | 38·750 | +8·283 | +10·075 | −1·539 | −0·847 | +15·972 | 54·722 | |

Mean 8° 52′ 54″·6260

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | α 20° | 36″·975 | +8″·326 | +10″·044 | +0″·268 | +0″·825 | +19″·463 | 56″·438 | 54″·444 |
| 20 | E | | 36·050 | +8·274 | +10·013 | −0·664 | −1·355 | +16·268 | 52·318 | |
| 21 | W | | 37·600 | +8·309 | + 9·984 | +0·978 | −0·466 | +18·805 | 56·405 | |
| 22 | E | | 35·475 | +8·274 | + 9·954 | −0·411 | −0·677 | +17·140 | 52·615 | |
| 23 | W | α 40° | 37·475 | +8·261 | + 9·923 | −0·330 | −0·656 | +17·198 | 54·673 | 53·533 |
| 24 | E | | 33·550 | +8·291 | + 9·891 | −0·190 | 0·000 | +17·992 | 51·542 | |
| 25 | W | | 37·225 | +8·260 | + 9·860 | +0·195 | +0·042 | +18·357 | 55·582 | |
| 26 | E | | 34·450 | +8·283 | + 9·830 | +0·214 | −0·444 | +17·883 | 52·333 | |
| 27 | W | α 60° | 37·150 | +8·243 | + 9·799 | +1·221 | −0·444 | +18·819 | 55·969 | 53·926 |
| 28 | E | | 37·700 | +8·201 | + 9·768 | −1·570 | −1·376 | +15·023 | 52·723 | |
| 29 | W | | 36·500 | +8·196 | + 9·736 | +1·275 | −0·444 | +18·763 | 55·263 | |
| 30 | E | | 34·900 | +8·187 | + 9·703 | −0·260 | −0·783 | +16·847 | 51·747 | |
| 31 | W | α (i) 30° | 38·450 | +8·121 | + 9·671 | +1·399 | −1·101 | +18·090 | 56·540 | 53·423 |
| Jan. 1 | E | | 35·900 | +8·133 | + 9·669 | −1·285 | −0·868 | +15·649 | 51·549 | |
| 2 | W | | 35·125 | +8·195 | + 9·637 | +1·984 | −0·042 | +19·774 | 54·899 | |
| 3 | E | | 36·200 | +8·210 | + 9·605 | −1·915 | −1·397 | +14·503 | 50·703 | |
| 4 | W | α (i) 50° | 37·300 | +8·178 | + 9·572 | −0·318 | −0·148 | +17·284 | 54·584 | 53·759 |
| 5 | E | | 34·875 | +8·197 | + 9·540 | +0·146 | +0·614 | +18·497 | 53·372 | |
| 6 | W | | 36·975 | +8·175 | + 9·508 | +0·246 | −0·381 | +17·548 | 54·523 | |
| 7 | E | | 34·125 | +8·193 | + 9·476 | +0·381 | +0·381 | +18·431 | 52·556 | |
| 8 | W | α (i) 70° | 36·150 | +8·158 | + 9·443 | +0·753 | +0·021 | +18·375 | 54·525 | 53·368 |
| 9 | E | | 32·225 | +8·148 | + 9·410 | +2·711 | −0·042 | +20·227 | 52·452 | |
| 10 | W | | 37·025 | +8·130 | + 9·378 | +1·460 | −0·804 | +18·164 | 55·189 | |
| 11 | E | | 35·075 | +8·153 | + 9·345 | −1·140 | −0·127 | +16·231 | 51·306 | |

Mean 8° 52′ 53″·7422

Mean Result of both Faces..... 8° 52′ 54″·1841

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## G. T. STATION KALIANPUR.

No. 19 (492) 64 TAURI $\delta^2$. South 7° 2′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | α 20° | 44″·200 | +6″·537 | +10″·609 | +0″·144 | −1″·143 | +16″·147 | 60″·347 | 58″·639 |
| 25 | W | | 42·100 | +6·578 | +10·598 | −0·109 | −1·312 | +15·755 | 57·855 | |
| 26 | E | | 44·450 | +6·597 | +10·587 | −0·465 | −0·847 | +15·872 | 60·322 | |
| 27 | W | | 36·025 | +6·593 | +10·574 | +2·354 | +0·487 | +20·008 | 56·033 | |
| 29 | E | α 40° | 39·700 | +6·489 | +10·550 | +2·881 | −0·042 | +19·878 | 59·578 | 58·188 |
| 30 | W | | 42·725 | +6·570 | +10·536 | −2·748 | +0·952 | +15·310 | 58·035 | |
| Dec. 1 | E | | 35·675 | +6·569 | +10·522 | +2·066 | +3·154 | +22·311 | 57·986 | |
| 2 | W | | 42·150 | +6·530 | +10·509 | −1·824 | −0·212 | +15·003 | 57·153 | |
| 3 | E | α 60° | 44·675 | +6·497 | +10·494 | −1·406 | −0·423 | +15·162 | 59·837 | 60·424 |
| 4 | W | | 43·100 | +6·487 | +10·478 | +1·166 | −0·402 | +17·729 | 60·829 | |
| 5 | W | | 43·325 | +6·509 | +10·463 | +0·916 | −0·508 | +17·380 | 60·705 | |
| 6 | E | | 45·175 | +6·479 | +10·447 | −1·544 | −0·233 | +15·149 | 60·324 | |
| 7 | E | α (1) 30° | 44·025 | +6·497 | +10·431 | −1·354 | −0·825 | +14·749 | 58·774 | 59·642 |
| 8 | W | | 44·375 | +6·538 | +10·414 | +1·270 | −1·439 | +16·783 | 61·158 | |
| 9 | E | | 44·250 | +6·528 | +10·395 | −1·565 | −1·079 | +14·279 | 58·529 | |
| 10 | W | | 44·050 | +6·496 | +10·379 | +0·514 | −1·333 | +16·056 | 60·106 | |
| 11 | E | α (1) 50° | 43·050 | +6·511 | +10·361 | −0·786 | +0·677 | +16·763 | 59·813 | 59·209 |
| 12 | W | | 39·325 | +6·541 | +10·344 | +0·708 | +0·402 | +17·995 | 57·320 | |
| 13 | E | | 44·800 | +6·569 | +10·325 | −1·040 | −0·000 | +15·854 | 60·654 | |
| 14 | W | | 44·050 | +6·536 | +10·306 | +0·019 | −1·863 | +14·998 | 59·048 | |
| 15 | E | α (1) 70° | 44·700 | +6·535 | +10·287 | −1·695 | −0·021 | +15·106 | 59·806 | 59·314 |
| 16 | W | | 43·700 | +6·534 | +10·267 | +0·630 | −2·328 | +15·103 | 58·803 | |
| 17 | E | | 45·600 | +6·564 | +10·248 | −1·915 | −0·974 | +13·923 | 59·523 | |
| 18 | W | | 41·650 | +6·555 | +10·228 | +1·539 | −0·847 | +17·475 | 59·125 | |

Mean 7° 2′ 59″·2360

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | E | α 20° | 41″·575 | +6″·589 | +10″·207 | −0″·268 | −0″·381 | +16″·147 | 57″·722 | 59″·283 |
| 20 | W | | 44·450 | +6·547 | +10·185 | +0·664 | −1·376 | +16·020 | 60·470 | |
| 21 | E | | 41·975 | +6·575 | +10·167 | −0·978 | −0·444 | +15·320 | 57·295 | |
| 22 | W | | 44·750 | +6·548 | +10·147 | +0·411 | −0·212 | +16·894 | 61·644 | |
| 23 | E | α 40° | 40·925 | +6·539 | +10·125 | +0·330 | −0·635 | +16·359 | 57·284 | 59·658 |
| 24 | W | | 43·950 | +6·561 | +10·103 | +0·190 | +0·148 | +17·002 | 60·952 | |
| 25 | E | | 40·300 | +6·538 | +10·082 | −0·195 | +0·825 | +17·250 | 57·550 | |
| 26 | W | | 46·950 | +6·557 | +10·061 | −0·214 | −0·508 | +15·896 | 62·846 | |
| 27 | E | α 60° | 42·550 | +6·523 | +10·039 | −1·221 | −0·466 | +14·875 | 57·425 | 59·478 |
| 28 | W | | 45·800 | +6·490 | +10·018 | +1·570 | −1·418 | +16·660 | 62·460 | |
| 29 | E | | 41·150 | +6·486 | + 9·995 | −1·275 | −0·000 | +15·206 | 56·356 | |
| 30 | W | | 45·425 | +6·479 | + 9·972 | +0·260 | −0·466 | +16·245 | 61·670 | |
| 31 | E | α (1) 30° | 42·100 | +6·425 | + 9·949 | −1·399 | −0·974 | +14·001 | 56·101 | 59·182 |
| Jan. 1 | W | | 42·750 | +6·436 | + 9·957 | +1·285 | −0·317 | +17·361 | 60·111 | |
| 2 | E | | 43·825 | +6·487 | + 9·934 | −1·984 | −0·106 | +14·331 | 58·156 | |
| 3 | W | | 45·325 | +6·498 | + 9·911 | +1·915 | −1·291 | +17·033 | 62·358 | |
| 4 | E | α (1) 50° | 42·150 | +6·473 | + 9·887 | +0·318 | −0·296 | +16·382 | 58·532 | 59·434 |
| 5 | W | | 43·875 | +6·488 | + 9·864 | −0·146 | +0·677 | +16·883 | 60·758 | |
| 6 | E | | 42·450 | +6·470 | + 9·840 | −0·246 | −0·042 | +16·022 | 58·472 | |
| 7 | W | | 43·800 | +6·486 | + 9·816 | −0·381 | +0·254 | +16·175 | 59·975 | |
| 8 | E | α (1) 70° | 42·375 | +6·456 | + 9·792 | −0·753 | +0·317 | +15·812 | 58·187 | 59·668 |
| 9 | W | | 48·625 | +6·448 | + 9·767 | −2·711 | −0·254 | +13·250 | 61·875 | |
| 10 | E | | 44·050 | +6·435 | + 9·743 | −1·460 | −0·741 | +13·977 | 58·027 | |
| 11 | W | | 43·400 | +6·453 | + 9·718 | +1·140 | −0·127 | +17·184 | 60·584 | |

Mean 7° 2′ 59″·4505

Mean Result of both Faces ..... 7° 2′ 59″·3433

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## G. T. STATION KALIANPUR.

### No. 20 (510) 77 Tauri θ′. South 8° 30′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 42″·475 | +7″·918 | +10″·551 | −0″·144 | −0″·804 | +17″·521 | 59″·996 | |
| 25 | E | α | 43·075 | +7·967 | +10·529 | +0·109 | −1·312 | +17·293 | 60·368 | 59″·771 |
| 26 | W | 20° | 41·400 | +7·989 | +10·508 | +0·465 | −0·656 | +18·306 | 59·706 | |
| 27 | E | | 42·225 | +7·983 | +10·484 | −2·354 | +0·677 | +16·790 | 59·015 | |
| 28 | W | | 44·025 | +7·916 | +10·461 | −2·931 | +0·169 | +15·615 | 59·640 | |
| 29 | W | α | 42·650 | +7·858 | +10·439 | −2·881 | 0·000 | +15·416 | 58·066 | |
| 30 | E | 40° | 38·000 | +7·956 | +10·415 | +2·748 | +1·070 | +22·189 | 60·189 | 59·092 |
| Dec. 1 | W | | 39·100 | +7·954 | +10·390 | −2·066 | +3·323 | +19·601 | 58·701 | |
| 2 | E | | 37·375 | +7·909 | +10·366 | +1·824 | +1·101 | +21·200 | 58·575 | |
| 3 | W | | 39·275 | +7·868 | +10·341 | +1·406 | −0·212 | +19·403 | 58·678 | |
| 4 | E | α | 42·175 | +7·856 | +10·315 | −1·166 | −0·360 | +16·645 | 58·820 | |
| 5 | E | 60° | 42·400 | +7·883 | +10·289 | −0·916 | −0·466 | +16·790 | 59·190 | 59·307 |
| 6 | W | | 41·100 | +7·846 | +10·263 | +1·544 | −0·212 | +19·441 | 60·541 | |
| 7 | W | | 40·125 | +7·869 | +10·237 | +1·354 | −0·847 | +18·613 | 58·738 | |
| 8 | E | α (1) | 42·500 | +7·919 | +10·210 | −1·270 | −1·397 | +15·462 | 57·962 | |
| 9 | W | 30° | 40·600 | +7·907 | +10·181 | +1·565 | −0·233 | +19·420 | 60·020 | 59·048 |
| 10 | E | | 42·875 | +7·868 | +10·154 | −0·514 | −0·910 | +16·598 | 59·473 | |
| 11 | W | | 38·475 | +7·885 | +10·126 | +0·786 | +0·127 | +18·924 | 57·399 | |
| 12 | E | α (1) | 40·400 | +7·921 | +10·099 | −0·708 | +0·402 | +17·714 | 58·114 | |
| 13 | W | 50° | 39·725 | +7·954 | +10·071 | +1·040 | −0·106 | +18·959 | 58·684 | 58·231 |
| 14 | E | | 42·675 | +7·913 | +10·043 | −0·019 | −1·884 | +16·053 | 58·728 | |
| 15 | W | | 39·400 | +7·916 | +10·014 | +1·695 | −0·614 | +19·011 | 58·411 | |
| 16 | E | α (1) | 42·875 | +7·915 | + 9·984 | −0·630 | −2·201 | +15·068 | 57·943 | |
| 17 | W | 70° | 40·800 | +7·952 | + 9·956 | +1·915 | −1·206 | +18·617 | 59·417 | 58·411 |
| 18 | E | | 43·050 | +7·937 | + 9·927 | −1·539 | −1·503 | +14·822 | 57·872 | |

Mean 8° 30′ 58″·9767

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 40″·650 | +7″·980 | + 9″·896 | +0″·268 | +0″·233 | +18″·377 | 59″·027 | |
| 20 | E | α | 40·650 | +7·928 | + 9·865 | −0·664 | −1·016 | +16·113 | 56·763 | 58″·252 |
| 21 | W | 20° | 41·400 | +7·962 | + 9·838 | +0·978 | −0·042 | +18·736 | 60·136 | |
| 22 | E | | 39·900 | +7·930 | + 9·809 | −0·411 | −0·148 | +17·180 | 57·080 | |
| 23 | W | | 42·400 | +7·920 | + 9·778 | −0·330 | −0·635 | +16·733 | 59·133 | |
| 24 | E | α | 39·175 | +7·946 | + 9·748 | −0·190 | −0·571 | +16·933 | 56·108 | |
| 25 | W | 40° | 40·500 | +7·920 | + 9·718 | +0·195 | +0·741 | +18·574 | 59·074 | 57·913 |
| 26 | E | | 40·125 | +7·943 | + 9·688 | +0·214 | −0·635 | +17·210 | 57·335 | |
| 27 | W | | 42·250 | +7·900 | + 9·658 | +1·221 | −0·847 | +17·932 | 60·182 | |
| 28 | E | α | 41·975 | +7·859 | + 9·629 | −1·570 | −0·614 | +15·304 | 57·279 | |
| 29 | W | 60° | 41·750 | +7·854 | + 9·598 | +1·275 | +0·021 | +18·748 | 60·498 | 58·814 |
| 30 | E | | 40·525 | +7·847 | + 9·567 | −0·260 | −0·381 | +16·773 | 57·298 | |
| 31 | W | | 42·525 | +7·778 | + 9·536 | +1·399 | −0·847 | +17·866 | 60·391 | |
| Jan. 1 | E | α (1) | 40·625 | +7·795 | + 9·536 | −1·285 | −0·339 | +15·707 | 56·332 | |
| 2 | W | 30° | 41·050 | +7·857 | + 9·506 | +1·984 | −0·063 | +19·284 | 60·334 | 58·237 |
| 3 | E | | 42·025 | +7·870 | + 9·475 | −1·915 | −1·566 | +13·864 | 55·889 | |
| 4 | W | | 42·775 | +7·841 | + 9·444 | −0·318 | −0·402 | +16·565 | 59·340 | |
| 5 | E | α (1) | 38·825 | +7·857 | + 9·413 | +0·146 | +0·868 | +18·284 | 57·109 | |
| 6 | W | 50° | 43·525 | +7·836 | + 9·383 | +0·246 | −0·783 | +16·682 | 60·207 | 58·377 |
| 7 | E | | 39·450 | +7·859 | + 9·352 | +0·381 | −0·190 | +17·402 | 56·852 | |
| 8 | W | | 42·400 | +7·818 | + 9·321 | +0·753 | −0·085 | +17·807 | 60·207 | |
| 9 | E | α (1) | 35·925 | +7·808 | + 9·290 | +2·711 | +0·169 | +19·978 | 55·903 | |
| 10 | W | 70° | 43·200 | +7·795 | + 9·259 | +1·460 | −0·868 | +17·646 | 60·846 | 58·107 |
| 11 | E | | 39·950 | +7·816 | + 9·228 | −1·140 | −0·381 | +15·523 | 55·473 | |

Mean 8° 30′ 58″·2833

Mean Result of both Faces..... 8° 30′ 58″·6300

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## No. 21 (523) 86 TAURI ρ. South 9° 36′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 36″·900 | +8″·961 | +10″·484 | +0″·144 | −0″·804 | +18″·785 | 55″·685 | |
| 25 | W | a 20° | 34·900 | +9·015 | +10·453 | −0·109 | −1·312 | +18·047 | 52·947 | 55″·031 |
| 26 | E | | 38·275 | +9·040 | +10·423 | −0·465 | −0·593 | +18·405 | 56·680 | |
| 27 | W | | 32·000 | +9·030 | +10·391 | +2·354 | +1·037 | +22·812 | 54·812 | |
| 29 | E | | 34·450 | +8·890 | +10·328 | +2·881 | −0·063 | +22·036 | 56·486 | |
| 30 | W | a 40° | 35·125 | +9·002 | +10·296 | −2·748 | +1·312 | +17·862 | 52·987 | |
| Dec. 1 | E | | 31·175 | +8·999 | +10·263 | +2·066 | +2·117 | +23·445 | 54·620 | 54·594 |
| 2 | W | | 35·825 | +8·949 | +10·230 | −1·824 | +1·101 | +18·456 | 54·281 | |
| 3 | E | | 38·125 | +8·901 | +10·196 | −1·406 | −0·190 | +17·501 | 55·626 | |
| 4 | W | a 60° | 35·425 | +8·889 | +10·162 | +1·166 | −0·317 | +19·900 | 55·325 | |
| 5 | W | | 36·150 | +8·919 | +10·128 | +0·916 | −0·063 | +19·900 | 56·050 | 55·645 |
| 6 | E | | 39·000 | +8·878 | +10·093 | −1·544 | −0·847 | +16·580 | 55·580 | |
| 7 | E | | 37·775 | +8·905 | +10·059 | −1·354 | +0·021 | +17·631 | 55·406 | |
| 8 | W | a (1) 30° | 36·075 | +8·961 | +10·024 | +1·270 | −0·275 | +19·980 | 56·055 | |
| 9 | E | | 38·925 | +8·949 | + 9·987 | −1·565 | −0·508 | +16·863 | 55·788 | 55·980 |
| 10 | W | | 38·250 | +8·904 | + 9·953 | +0·514 | −0·952 | +18·419 | 56·669 | |
| 11 | E | | 36·300 | +8·922 | + 9·916 | −0·786 | +0·995 | +19·047 | 55·347 | |
| 12 | W | a (1) 50° | 32·875 | +8·962 | + 9·882 | +0·708 | +0·317 | +19·869 | 52·744 | |
| 13 | E | | 37·800 | +9·000 | + 9·845 | −1·040 | −0·085 | +17·720 | 55·520 | 54·529 |
| 14 | W | | 37·250 | +8·950 | + 9·809 | +0·019 | −1·524 | +17·254 | 54·504 | |
| 15 | E | | 37·975 | +8·958 | + 9·772 | −1·695 | −0·825 | +16·210 | 54·185 | |
| 16 | W | a (1) 70° | 35·375 | +8·959 | + 9·735 | +0·630 | −0·825 | +18·499 | 53·874 | |
| 17 | E | | 39·725 | +9·001 | + 9·699 | −1·915 | −1·164 | +15·621 | 55·346 | 54·414 |
| 18 | W | | 35·550 | +8·980 | + 9·663 | +1·539 | −1·482 | +18·700 | 54·250 | |

Mean 9° 36′ 55″·0322

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | E | | 34″·175 | +9″·029 | + 9″·625 | −0″·268 | +0″·783 | +19″·169 | 53″·344 | |
| 20 | W | a 20° | 37·975 | +8·970 | + 9·587 | +0·664 | −0·804 | +18·417 | 56·392 | 54″·847 |
| 21 | E | | 35·050 | +9·008 | + 9·552 | −0·978 | +0·783 | +18·365 | 53·415 | |
| 22 | W | | 38·375 | +8·973 | + 9·516 | +0·411 | −1·037 | +17·863 | 56·238 | |
| 23 | E | | 34·075 | +8·964 | + 9·478 | +0·330 | −1·122 | +17·650 | 51·725 | |
| 24 | W | a 40° | 37·025 | +8·991 | + 9·441 | +0·190 | −0·762 | +17·860 | 54·885 | |
| 25 | E | | 33·950 | +8·964 | + 9·404 | −0·195 | +0·444 | +18·617 | 52·567 | 53·986 |
| 26 | W | | 38·875 | +8·991 | + 9·368 | −0·214 | −0·254 | +17·891 | 56·766 | |
| 27 | E | | 36·675 | +8·939 | + 9·331 | −1·221 | −1·249 | +15·800 | 52·475 | |
| 28 | W | a 60° | 37·725 | +8·893 | + 9·295 | +1·570 | −0·423 | +19·335 | 57·060 | |
| 29 | E | | 35·775 | +8·886 | + 9·258 | −1·275 | 0·000 | +16·869 | 52·644 | 54·748 |
| 30 | W | | 39·150 | +8·879 | + 9·220 | +0·260 | −0·698 | +17·661 | 56·811 | |
| 31 | E | | 35·050 | +8·797 | + 9·183 | −1·399 | −0·550 | +16·031 | 51·081 | |
| Jan. 1 | W | a (1) 30° | 36·675 | +8·820 | + 9·181 | +1·285 | −0·360 | +18·926 | 55·601 | |
| 2 | E | | 36·150 | +8·892 | + 9·144 | −1·984 | −0·254 | +15·798 | 51·948 | 53·705 |
| 3 | W | | 38·125 | +8·907 | + 9·107 | +1·915 | −1·863 | +18·066 | 56·191 | |
| 4 | E | | 36·375 | +8·875 | + 9·071 | +0·318 | 0·000 | +18·264 | 54·639 | |
| 5 | W | a (1) 50° | 38·100 | +8·891 | + 9·034 | −0·146 | +0·762 | +18·541 | 56·641 | |
| 6 | E | | 35·325 | +8·867 | + 8·998 | −0·246 | −0·042 | +17·577 | 52·902 | 54·885 |
| 7 | W | | 37·075 | +8·897 | + 8·962 | −0·381 | +0·804 | +18·282 | 55·357 | |
| 8 | E | | 36·450 | +8·845 | + 8·925 | −0·753 | −0·085 | +16·932 | 53·382 | |
| 9 | W | a (1) 70° | 41·550 | +8·834 | + 8·889 | −2·711 | +0·402 | +15·414 | 56·964 | |
| 10 | E | | 37·375 | +8·821 | + 8·854 | −1·460 | −0·571 | +15·644 | 53·019 | 54·937 |
| 11 | W | | 38·000 | +8·846 | + 8·818 | +1·140 | −0·423 | +18·381 | 56·381 | |

Mean 9° 36′ 54″·5180

Mean Result of both Faces..... 9° 36′ 54″·7751



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## G. T. STATION KALIANPUR.

### No. 22 (541) Tauri. North 4° 10′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 56″·075 | +3″·872 | — 9″·790 | +0″·144 | +0″·995 | — 4″·779 | 51″·296 | |
| 25 | E | a | 53·975 | +3·895 | — 9·842 | —0·109 | +0·974 | — 5·082 | 48·893 | 50″·249 |
| 26 | W | 20° | 56·800 | +3·905 | — 9·896 | —0·465 | +0·847 | — 5·609 | 51·191 | |
| 27 | E | | 54·725 | +3·900 | — 9·947 | +2·354 | —1·418 | — 5·111 | 49·614 | |
| 29 | W | | 54·675 | +3·840 | —10·052 | +2·881 | —0·042 | — 3·373 | 51·302 | |
| 30 | E | a | 60·100 | +3·889 | —10·104 | —2·748 | —1·291 | —10·254 | 49·846 | 50·604 |
| Dec. 1 | W | 40° | 57·475 | +3·887 | —10·156 | +2·066 | —1·990 | — 6·193 | 51·282 | |
| 2 | E | | 58·150 | +3·866 | —10·207 | —1·824 | 0·000 | — 8·165 | 49·985 | |
| 3 | W | | 56·375 | +3·845 | —10·257 | —1·406 | +0·825 | — 6·993 | 49·382 | |
| 4 | E | a | 55·100 | +3·840 | —10·308 | +1·166 | +1·524 | — 3·778 | 51·322 | 49·888 |
| 5 | E | 60° | 55·025 | +3·853 | —10·358 | +0·916 | +0·148 | — 5·441 | 49·584 | |
| 6 | W | | 56·450 | +3·835 | —10·408 | —1·544 | +0·931 | — 7·186 | 49·264 | |
| 7 | W | | 56·950 | +3·847 | —10·458 | —1·354 | —0·042 | — 8·007 | 48·943 | |
| 8 | E | a (1) | 55·425 | +3·871 | —10·507 | +1·270 | +0·317 | — 5·049 | 50·376 | |
| 9 | W | 30° | 57·350 | +3·866 | —10·554 | —1·565 | +0·423 | — 7·830 | 49·520 | 50·104 |
| 10 | E | | 57·100 | +3·847 | —10·603 | +0·514 | +0·720 | — 5·522 | 51·578 | |
| 11 | W | | 57·000 | +3·854 | —10·650 | —0·786 | —0·974 | — 8·556 | 48·444 | |
| 12 | E | a (1) | 56·650 | +3·871 | —10·699 | +0·708 | —0·825 | — 6·945 | 49·705 | |
| 13 | W | 50° | 57·275 | +3·887 | —10·746 | —1·040 | —0·042 | — 7·941 | 49·334 | 49·477 |
| 14 | E | | 55·850 | +3·864 | —10·792 | +0·019 | +1·482 | — 5·427 | 50·423 | |
| 15 | W | | 58·175 | +3·871 | —10·838 | —1·695 | +0·339 | — 8·323 | 49·852 | |
| 16 | E | a (1) | 54·925 | +3·871 | —10·883 | +0·630 | +0·466 | — 5·916 | 49·009 | |
| 17 | W | 70° | 59·175 | +3·890 | —10·929 | —1·915 | +0·868 | — 8·086 | 51·089 | 50·135 |
| 18 | E | | 54·875 | +3·878 | —10·974 | +1·539 | +1·270 | — 4·287 | 50·588 | |

Mean 4° 10′ 50″·0762

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 57″·050 | +3″·900 | —11″·018 | —0″·268 | —0″·762 | — 8″·148 | 48″·902 | |
| 20 | E | a | 56·525 | +3·874 | —11·061 | +0·664 | +0·783 | — 5·740 | 50·785 | 49″·595 |
| 21 | W | 20° | 55·875 | +3·891 | —11·106 | —0·978 | —0·741 | — 8·934 | 46·941 | |
| 22 | E | | 57·325 | +3·876 | —11·150 | +0·411 | +1·291 | — 5·572 | 51·753 | |
| 23 | W | | 54·325 | +3·874 | —11·191 | +0·330 | +0·677 | — 6·310 | 48·015 | |
| 24 | E | a | 57·625 | +3·884 | —11·233 | +0·190 | —0·254 | — 7·413 | 50·212 | 49·235 |
| 25 | W | 40° | 55·025 | +3·874 | —11·274 | —0·195 | —0·487 | — 8·082 | 46·943 | |
| 26 | E | | 59·475 | +3·886 | —11·316 | —0·214 | —0·063 | — 7·707 | 51·768 | |
| 27 | W | | 56·150 | +3·861 | —11·356 | —1·221 | +0·698 | — 8·018 | 48·132 | |
| 28 | E | a | 57·400 | +3·841 | —11·396 | +1·570 | +0·698 | — 5·287 | 52·113 | 49·664 |
| 29 | W | 60° | 55·425 | +3·838 | —11·434 | —1·275 | +0·212 | — 8·659 | 46·766 | |
| 30 | E | | 58·175 | +3·835 | —11·472 | +0·260 | +0·847 | — 6·530 | 51·645 | |
| 31 | W | | 54·875 | +3·798 | —11·509 | —1·399 | —0·127 | — 9·237 | 45·638 | |
| Jan. 1 | E | a (1) | 57·950 | +3·810 | —11·587 | +1·285 | +0·085 | — 6·407 | 51·543 | |
| 2 | W | 30° | 57·125 | +3·842 | —11·623 | —1·984 | +0·021 | — 9·744 | 47·381 | 49·376 |
| 3 | E | | 56·975 | +3·848 | —11·658 | +1·915 | +1·863 | — 4·032 | 52·943 | |
| 4 | W | | 55·850 | +3·835 | —11·693 | +0·318 | +0·550 | — 6·990 | 48·860 | |
| 5 | E | a (1) | 60·250 | +3·841 | —11·727 | —0·146 | —0·423 | — 8·455 | 51·795 | |
| 6 | W | 50° | 57·225 | +3·831 | —11·760 | —0·246 | —0·381 | — 8·556 | 48·669 | 50·173 |
| 7 | E | | 60·350 | +3·845 | —11·792 | —0·381 | —0·656 | — 8·984 | 51·366 | |
| 8 | W | | 58·150 | +3·821 | —11·824 | —0·753 | —0·402 | — 9·158 | 48·992 | |
| 9 | E | a (1) | 62·575 | +3·816 | —11·854 | —2·711 | +0·254 | —10·495 | 52·080 | |
| 10 | W | 70° | 57·375 | +3·811 | —11·884 | —1·460 | 0·000 | — 9·533 | 47·842 | 50·072 |
| 11 | E | | 57·925 | +3·822 | —11·914 | +1·140 | +0·402 | — 6·550 | 51·375 | |

Mean 4° 10′ 49″·6858

Mean Result of both Faces..... 4° 10′ 49″·8810

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No. 23 (555) 96 TAURI *K*. South 8° 29′+

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 25 | W | α 20° | 39″·200 | +7″·956 | +10″·123 | −0″·109 | −0″·571 | +17″·399 | 56″·599 | 55″·919 |
| 26 | E | | 38·525 | +7·978 | +10·094 | −0·465 | −0·910 | +16·697 | 55·222 | |
| 27 | W | | 34·350 | +7·962 | +10·063 | +2·354 | +1·905 | +22·284 | 56·634 | |
| 29 | E | α 40° | 35·725 | +7·843 | +10·003 | +2·881 | +0·550 | +21·277 | 57·002 | 55·538 |
| 30 | W | | 38·525 | +7·943 | + 9·973 | −2·748 | +1·122 | +16·290 | 54·815 | |
| Dec. 1 | E | | 33·475 | +7·938 | + 9·941 | +2·066 | +2·603 | +22·548 | 56·023 | |
| 2 | W | | 38·325 | +7·898 | + 9·911 | −1·824 | 0·000 | +15·985 | 54·310 | |
| 3 | E | α 60° | 39·475 | +7·851 | + 9·879 | −1·406 | −0·847 | +15·477 | 54·952 | 56·346 |
| 4 | W | | 37·675 | +7·842 | + 9·847 | +1·166 | −0·783 | +18·072 | 55·747 | |
| 5 | W | | 40·300 | +7·871 | + 9·815 | +0·916 | −0·402 | +18·200 | 58·500 | |
| 6 | E | | 40·600 | +7·835 | + 9·782 | −1·544 | −0·487 | +15·586 | 56·186 | |
| 7 | E | α (1) 30° | 39·800 | +7·860 | + 9·751 | −1·354 | −0·085 | +16·172 | 55·972 | 56·255 |
| 8 | W | | 37·650 | +7·909 | + 9·717 | +1·270 | −0·952 | +17·944 | 55·594 | |
| 9 | E | | 41·000 | +7·900 | + 9·683 | −1·565 | −0·190 | +15·828 | 56·828 | |
| 10 | W | | 39·425 | +7·861 | + 9·651 | +0·514 | −0·825 | +17·201 | 56·626 | |
| 11 | E | α (1) 50° | 38·925 | +7·871 | + 9·618 | −0·786 | +0·635 | +17·338 | 56·263 | 55·040 |
| 12 | W | | 32·900 | +7·906 | + 9·586 | +0·708 | +1·566 | +19·766 | 52·666 | |
| 13 | E | | 40·450 | +7·940 | + 9·552 | −1·040 | +0·021 | +16·473 | 56·923 | |
| 14 | W | | 38·425 | +7·888 | + 9·519 | +0·019 | −1·545 | +15·881 | 54·306 | |
| 15 | E | α (1) 70° | 39·625 | +7·910 | + 9·486 | −1·695 | +0·931 | +16·632 | 56·257 | 56·033 |
| 16 | W | | 39·200 | +7·912 | + 9·452 | +0·630 | −0·762 | +17·232 | 56·432 | |
| 17 | E | | 41·225 | +7·950 | + 9·419 | −1·915 | −1·291 | +14·163 | 55·388 | |
| 18 | W | | 38·500 | +7·920 | + 9·386 | +1·539 | −1·291 | +17·554 | 56·054 | |

Mean 8° 29′ 55″·8552

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | α 20° | 35″·675 | +7″·967 | + 9″·351 | −0″·268 | +1″·587 | +18″·637 | 54″·312 | 55″·644 |
| 20 | W | | 40·700 | +7·912 | + 9·317 | +0·664 | −0·974 | +16·919 | 57·619 | |
| 21 | E | | 37·075 | +7·947 | + 9·286 | −0·978 | −0·021 | +16·234 | 53·309 | |
| 22 | W | | 40·050 | +7·917 | + 9·253 | +0·411 | −0·296 | +17·285 | 57·335 | |
| 23 | E | α 40° | 36·675 | +7·916 | + 9·219 | +0·330 | +0·783 | +18·248 | 54·923 | 55·318 |
| 24 | W | | 38·075 | +7·934 | + 9·186 | +0·190 | +0·825 | +18·135 | 56·210 | |
| 25 | E | | 34·750 | +7·917 | + 9·153 | −0·195 | +1·122 | +17·997 | 52·747 | |
| 26 | W | | 40·500 | +7·942 | + 9·120 | −0·214 | +0·042 | +16·890 | 57·390 | |
| 27 | E | α 60° | 38·975 | +7·886 | + 9·088 | −1·221 | +0·275 | +16·028 | 55·003 | 56·379 |
| 28 | W | | 40·550 | +7·845 | + 9·056 | +1·570 | +0·212 | +18·683 | 59·233 | |
| 29 | E | | 38·250 | +7·839 | + 9·023 | −1·275 | +0·021 | +15·608 | 53·858 | |
| 30 | W | | 40·950 | +7·834 | + 8·990 | +0·260 | −0·614 | +16·470 | 57·420 | |
| 31 | E | α (1) 30° | 37·550 | +7·751 | + 8·957 | −1·399 | +0·339 | +15·648 | 53·198 | 55·961 |
| Jan. 1 | W | | 39·275 | +7·782 | + 8·961 | +1·285 | +0·487 | +18·515 | 57·790 | |
| 2 | E | | 40·600 | +7·852 | + 8·929 | −1·984 | −0·085 | +14·712 | 55·312 | |
| 3 | W | | 39·650 | +7·863 | + 8·897 | +1·915 | −0·783 | +17·892 | 57·542 | |
| 4 | E | α (1) 50° | 37·275 | +7·837 | + 8·865 | +0·318 | 0·000 | +17·020 | 54·295 | 55·969 |
| 5 | W | | 39·225 | +7·846 | + 8·833 | −0·146 | +0·423 | +16·956 | 56·181 | |
| 6 | E | | 39·850 | +7·826 | + 8·802 | −0·246 | +0·339 | +16·721 | 56·571 | |
| 7 | W | | 40·600 | +7·862 | + 8·770 | −0·381 | −0·021 | +16·230 | 56·830 | |
| 8 | E | α (1) 70° | 37·625 | +7·803 | + 8·739 | −0·753 | +1·312 | +17·101 | 54·726 | 55·833 |
| 9 | W | | 43·225 | +7·794 | + 8·707 | −2·711 | −0·085 | +13·705 | 56·930 | |
| 10 | E | | 38·875 | +7·788 | + 8·677 | −1·460 | 0·000 | +15·005 | 53·880 | |
| 11 | W | | 40·350 | +7·810 | + 8·645 | +1·140 | −0·148 | +17·447 | 57·797 | |

Mean 8° 29′ 55″·8507

Mean Result of both Faces..... 8° 29′ 55″·8530





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## G. T. STATION KALIANPUR.

No. 24 (575) 98 Tauri *k*. North 0° 40′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 25 | E | | 48″·875 | +0″·633 | — 9″·415 | —0″·109 | +0″·931 | — 7″·960 | 40″·915 | |
| 26 | W | α 20° | 51·750 | +0·635 | — 9·440 | —0·465 | +1·058 | — 8·212 | 43·538 | 42″·545 |
| 27 | E | | 49·975 | +0·634 | — 9·463 | +2·354 | —1·312 | — 7·787 | 42·188 | |
| 29 | W | | 51·700 | +0·624 | — 9·511 | +2·881 | —0·423 | — 6·429 | 45·271 | |
| 30 | E | α 40° | 54·050 | +0·632 | — 9·535 | —2·748 | —0·783 | —12·434 | 41·616 | 42·941 |
| Dec. 1 | W | | 51·875 | +0·632 | — 9·559 | +2·066 | —1·968 | — 8·829 | 43·046 | |
| 2 | E | | 52·650 | +0·629 | — 9·583 | —1·824 | —0·042 | —10·820 | 41·830 | |
| 3 | W | | 54·000 | +0·625 | — 9·605 | —1·406 | +0·910 | — 9·476 | 44·524 | |
| 4 | E | α 60° | 49·150 | +0·624 | — 9·628 | +1·166 | +1·079 | — 6·759 | 42·391 | 42·761 |
| 5 | E | | 49·250 | +0·627 | — 9·652 | +0·916 | +0·910 | — 7·199 | 42·051 | |
| 6 | W | | 52·250 | +0·624 | — 9·674 | —1·544 | +0·423 | —10·171 | 42·079 | |
| 7 | W | | 52·650 | +0·626 | — 9·697 | —1·354 | +0·042 | —10·383 | 42·267 | |
| 8 | E | α (1) 30° | 48·500 | +0·630 | — 9·719 | +1·270 | +1·714 | — 6·105 | 42·395 | 42·687 |
| 9 | W | | 53·225 | +0·629 | — 9·741 | —1·565 | +0·063 | —10·614 | 42·611 | |
| 10 | E | | 50·425 | +0·626 | — 9·764 | +0·514 | +1·672 | — 6·952 | 43·473 | |
| 11 | W | | 53·300 | +0·627 | — 9·785 | —0·786 | —0·720 | —10·664 | 42·636 | |
| 12 | E | α (1) 50° | 51·825 | +0·629 | — 9·808 | +0·708 | —1·587 | —10·058 | 41·767 | 43·004 |
| 13 | W | | 54·900 | +0·632 | — 9·830 | —1·040 | —0·021 | —10·259 | 44·641 | |
| 14 | E | | 51·075 | +0·628 | — 9·851 | +0·019 | +1·101 | — 8·103 | 42·972 | |
| 15 | W | | 53·525 | +0·630 | — 9·873 | —1·695 | —0·317 | —11·255 | 42·270 | |
| 16 | E | α (1) 70° | 48·900 | +0·630 | — 9·893 | +0·630 | +1·037 | — 7·596 | 41·304 | 43·128 |
| 17 | W | | 56·075 | +0·633 | — 9·915 | —1·915 | +0·931 | —10·266 | 45·809 | |
| 18 | E | | 50·050 | +0·630 | — 9·936 | +1·539 | +0·847 | — 6·920 | 43·130 | |

Mean 0° 40′ 42″·8443

### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | | 53″·900 | +0″·634 | — 9″·956 | —0″·268 | —1″·524 | —11″·114 | 42″·786 | |
| 20 | E | α 20° | 50·300 | +0·630 | — 9·976 | +0·664 | +0·889 | — 7·793 | 42·507 | 42″·766 |
| 21 | W | | 52·450 | +0·633 | — 9·998 | —0·978 | +0·360 | — 9·983 | 42·467 | |
| 22 | E | | 52·050 | +0·630 | —10·019 | +0·411 | +0·233 | — 8·745 | 43·305 | |
| 23 | W | | 50·975 | +0·630 | —10·039 | +0·330 | —1·101 | —10·180 | 40·795 | |
| 24 | E | α 40° | 53·875 | +0·632 | —10·059 | +0·190 | —0·698 | — 9·935 | 43·940 | 42·369 |
| 25 | W | | 51·350 | +0·630 | —10·078 | —0·195 | —1·143 | —10·786 | 40·564 | |
| 26 | E | | 53·625 | +0·632 | —10·099 | —0·214 | +0·233 | — 9·448 | 44·177 | |
| 27 | W | | 52·000 | +0·628 | —10·118 | —1·221 | —0·423 | —11·134 | 40·866 | |
| 28 | E | α 60° | 51·475 | +0·625 | —10·138 | +1·570 | +0·106 | — 7·837 | 43·638 | 42·088 |
| 29 | W | | 51·450 | +0·624 | —10·156 | —1·275 | —0·233 | —11·040 | 40·410 | |
| 30 | E | | 51·925 | +0·624 | —10·175 | +0·260 | +0·804 | — 8·487 | 43·438 | |
| 31 | W | | 50·750 | +0·617 | —10·192 | —1·399 | —0·317 | —11·291 | 39·459 | |
| Jan. 1 | E | α (1) 30° | 52·250 | +0·619 | —10·254 | +1·285 | —0·571 | — 8·921 | 43·329 | 42·165 |
| 2 | W | | 51·350 | +0·625 | —10·272 | —1·984 | +0·466 | —11·165 | 40·185 | |
| 3 | E | | 53·075 | +0·626 | —10·289 | +1·915 | +0·360 | — 7·388 | 45·687 | |
| 4 | W | | 52·150 | +0·624 | —10·306 | +0·318 | —0·762 | —10·126 | 42·024 | |
| 5 | E | α (1) 50° | 54·550 | +0·625 | —10·323 | —0·146 | —0·529 | —10·373 | 44·177 | 43·022 |
| 6 | W | | 52·350 | +0·623 | —10·340 | —0·246 | —0·614 | —10·577 | 41·773 | |
| 7 | E | | 54·225 | +0·626 | —10·356 | —0·381 | 0·000 | —10·111 | 44·114 | |
| 8 | W | | 52·525 | +0·621 | —10·371 | —0·753 | —1·143 | —11·646 | 40·879 | |
| 9 | E | α (1) 70° | 57·225 | +0·620 | —10·386 | —2·711 | —0·021 | —12·498 | 44·727 | 42·764 |
| 10 | W | | 52·325 | +0·620 | —10·402 | —1·460 | —0·148 | —11·390 | 40·935 | |
| 11 | E | | 53·275 | +0·622 | —10·416 | +1·140 | —0·106 | — 8·760 | 44·515 | |

Mean 0° 40′ 42″·5290

Mean Result of both Faces..... 0° 40′ 42″·6867

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No. 25 (589) 11 Orionis $\gamma'$. South 8° 56′+

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 25 | W | a 20° | 16″·325 | +8″·379 | + 9″·833 | −0″·109 | −0″·783 | +17″·320 | 33″·645 | 34″·979 |
| 26 | E | | 19·125 | +8·398 | + 9·796 | −0·465 | −1·101 | +16·628 | 35·753 | |
| 27 | W | | 12·850 | +8·385 | + 9·756 | +2·354 | +1·418 | +21·913 | 34·763 | |
| 29 | E | a 40° | 15·625 | +8·261 | + 9·680 | +2·881 | −0·042 | +20·780 | 36·405 | 34·156 |
| 30 | W | | 16·400 | +8·366 | + 9·641 | −2·748 | +0·995 | +16·254 | 32·654 | |
| Dec. 1 | E | | 12·075 | +8·355 | + 9·602 | +2·066 | +2·244 | +22·267 | 34·342 | |
| 2 | W | | 16·400 | +8·320 | + 9·563 | −1·824 | +0·762 | +16·821 | 33·221 | |
| 3 | E | a 60° | 19·000 | +8·269 | + 9·523 | −1·406 | −0·910 | +15·476 | 34·476 | 34·946 |
| 4 | W | | 17·300 | +8·264 | + 9·483 | +1·166 | −0·804 | +18·109 | 35·409 | |
| 5 | W | | 16·900 | +8·296 | + 9·444 | +0·916 | −0·720 | +17·936 | 34·836 | |
| 6 | E | | 19·575 | +8·263 | + 9·404 | −1·544 | −0·635 | +15·488 | 35·063 | |
| 7 | E | a (1) 30° | 19·000 | +8·278 | + 9·365 | −1·354 | +0·487 | +16·776 | 35·776 | 35·188 |
| 8 | W | | 16·100 | +8·329 | + 9·324 | +1·270 | −1·101 | +17·822 | 33·922 | |
| 9 | E | | 20·375 | +8·325 | + 9·283 | −1·565 | −0·381 | +15·662 | 36·037 | |
| 10 | W | | 18·475 | +8·285 | + 9·244 | +0·514 | −1·503 | +16·540 | 35·015 | |
| 11 | E | a (1) 50° | 16·800 | +8·291 | + 9·203 | −0·786 | +1·185 | +17·893 | 34·693 | 34·605 |
| 12 | W | | 13·875 | +8·326 | + 9·164 | +0·708 | +1·418 | +19·616 | 33·491 | |
| 13 | E | | 19·600 | +8·364 | + 9·124 | −1·040 | −0·021 | +16·427 | 36·027 | |
| 14 | W | | 17·400 | +8·318 | + 9·084 | +0·019 | −0·614 | +16·807 | 34·207 | |
| 15 | E | a (1) 70° | 18·325 | +8·336 | + 9·044 | −1·695 | +0·593 | +16·278 | 34·603 | 35·276 |
| 16 | W | | 16·600 | +8·325 | + 9·003 | +0·630 | −0·529 | +17·429 | 34·029 | |
| 17 | E | | 21·025 | +8·370 | + 8·964 | −1·915 | −0·593 | +14·826 | 35·851 | |
| 18 | W | | 18·725 | +8·340 | + 8·925 | +1·539 | −0·910 | +17·894 | 36·619 | |

Mean 8° 56′ 34″·8583

## Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | a 20° | 15″·500 | +8″·393 | + 8″·884 | −0″·268 | +1″·397 | +18″·406 | 33″·906 | 34″·986 |
| 20 | W | | 19·725 | +8·342 | + 8·844 | +0·664 | +0·063 | +17·913 | 37·638 | |
| 21 | E | | 16·925 | +8·375 | + 8·807 | −0·978 | −0·317 | +15·887 | 32·812 | |
| 22 | W | | 18·825 | +8·343 | + 8·769 | +0·411 | −0·762 | +16·761 | 35·586 | |
| 23 | E | a 40° | 13·825 | +8·338 | + 8·729 | +0·330 | +1·079 | +18·476 | 32·301 | 34·618 |
| 24 | W | | 17·200 | +8·357 | + 8·691 | +0·190 | +1·545 | +18·783 | 25·983 | |
| 25 | E | | 16·025 | +8·343 | + 8·652 | −0·195 | +0·360 | +17·160 | 33·185 | |
| 26 | W | | 20·550 | +8·367 | + 8·615 | −0·214 | −0·317 | +16·451 | 37·001 | |
| 27 | E | a 60° | 17·725 | +8·308 | + 8·577 | −1·221 | +0·466 | +16·130 | 33·855 | 34·956 |
| 28 | W | | 18·900 | +8·271 | + 8·540 | +1·570 | 0·000 | +18·381 | 37·281 | |
| 29 | E | | 16·800 | +8·260 | + 8·502 | −1·275 | +0·402 | +15·889 | 32·689 | |
| 30 | W | | 19·300 | +8·248 | + 8·465 | +0·260 | −0·275 | +16·698 | 35·998 | |
| 31 | E | a (1) 30° | 16·325 | +8·165 | + 8·427 | −1·399 | +0·698 | +15·891 | 32·216 | 34·746 |
| Jan. 1 | W | | 16·975 | +8·196 | + 8·432 | +1·285 | +0·593 | +18·506 | 35·481 | |
| 2 | E | | 19·500 | +8·276 | + 8·396 | −1·984 | −0·550 | +14·138 | 33·638 | |
| 3 | W | | 19·175 | +8·283 | + 8·360 | +1·915 | −0·085 | +18·473 | 37·648 | |
| 4 | E | a (1) 50° | 17·125 | +8·255 | + 8·324 | +0·318 | +0·656 | +17·553 | 34·678 | 35·633 |
| 5 | W | | 19·975 | +8·270 | + 8·288 | −0·146 | +0·804 | +17·216 | 37·191 | |
| 6 | E | | 17·325 | +8·247 | + 8·254 | −0·246 | +0·063 | +16·318 | 33·643 | |
| 7 | W | | 20·900 | +8·281 | + 8·219 | −0·381 | 0·000 | +16·119 | 37·919 | |
| 8 | E | a (1) 70° | 18·250 | +8·222 | + 8·184 | −0·753 | +0·402 | +16·055 | 34·305 | 35·317 |
| 9 | W | | 22·675 | +8·206 | + 8·149 | −2·711 | +0·317 | +13·961 | 36·636 | |
| 10 | E | | 18·850 | +8·198 | + 8·116 | −1·460 | −0·085 | +14·769 | 33·619 | |
| 11 | W | | 19·625 | +8·221 | + 8·082 | +1·140 | −0·360 | +17·083 | 36·708 | |

Mean 8° 56′ 35″·0427

Mean Result of both Faces ..... 8° 56′ 34″·9505







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## G. T. STATION KALIANPUR.

No. 26 (604) 15 Orionis $y^2$. South 8° 43′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Nov. 25 | E | 20° α | 39·200 | +8·178 | + 9·704 | +0·109 | −0·741 | +17·250 | 56·450 | 57·491 |
| 26 | W | | 38·900 | +8·195 | + 9·666 | +0·465 | −0·275 | +18·051 | 56·951 | |
| 27 | E | | 41·975 | +8·183 | + 9·626 | −2·354 | +2·180 | +17·635 | 59·610 | |
| 29 | W | 40° α | 38·200 | +8·063 | + 9·548 | −2·881 | +0·296 | +15·026 | 53·226 | 54·441 |
| 30 | E | | 34·250 | +8·165 | + 9·508 | +2·748 | +1·249 | +21·670 | 55·920 | |
| Dec. 1 | W | | 36·225 | +8·154 | + 9·469 | −2·066 | +0·804 | +16·361 | 52·586 | |
| 2 | E | | 35·175 | +8·120 | + 9·429 | +1·824 | +1·482 | +20·855 | 56·030 | |
| 3 | W | 60° α | 35·275 | +8·070 | + 9·389 | +1·406 | −0·212 | +18·653 | 53·928 | 55·045 |
| 4 | E | | 38·975 | +8·067 | + 9·349 | −1·166 | −0·063 | +16·187 | 55·162 | |
| 5 | E | | 40·450 | +8·099 | + 9·309 | −0·916 | −0·508 | +15·984 | 56·434 | |
| 6 | W | | 36·175 | +8·069 | + 9·268 | +1·544 | −0·402 | +18·479 | 54·654 | |
| 7 | W | 30° α (1) | 35·650 | +8·080 | + 9·228 | +1·354 | +0·995 | +19·657 | 55·307 | 54·827 |
| 8 | E | | 39·700 | +8·129 | + 9·188 | −1·270 | −0·317 | +15·730 | 55·430 | |
| 9 | W | | 36·350 | +8·128 | + 9·146 | +1·565 | −0·931 | +17·908 | 54·258 | |
| 10 | E | | 38·775 | +8·089 | + 9·106 | −0·514 | −1·143 | +15·538 | 54·313 | |
| 11 | W | 50° α (1) | 35·425 | +8·093 | + 9·066 | +0·786 | +1·291 | +19·236 | 54·661 | 54·426 |
| 12 | E | | 36·875 | +8·126 | + 9·026 | −0·708 | +0·825 | +17·269 | 54·144 | |
| 13 | W | | 35·075 | +8·165 | + 8·986 | +1·040 | −0·444 | +17·747 | 52·822 | |
| 14 | E | | 40·025 | +8·122 | + 8·945 | −0·019 | −0·995 | +16·053 | 56·078 | |
| 15 | W | 70° α (1) | 35·500 | +8·138 | + 8·905 | +1·695 | +1·460 | +20·198 | 55·698 | 54·451 |
| 16 | E | | 39·700 | +8·123 | + 8·865 | −0·630 | −0·423 | +15·935 | 55·635 | |
| 17 | W | | 35·725 | +8·168 | + 8·826 | +1·915 | −0·487 | +18·422 | 54·147 | |
| 18 | E | | 39·975 | +8·139 | + 8·786 | −1·539 | −1·037 | +14·349 | 54·324 | |

Mean 8° 43′ 55″·1135

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Dec. 19 | W | 20° α | 37·375 | +8·192 | + 8·746 | +0·268 | +2·201 | +19·407 | 56·782 | 55·058 |
| 20 | E | | 38·000 | +8·145 | + 8·706 | −0·664 | −0·275 | +15·912 | 53·912 | |
| 21 | W | | 38·150 | +8·176 | + 8·669 | +0·978 | 0·000 | +17·823 | 55·973 | |
| 22 | E | | 37·625 | +8·144 | + 8·630 | −0·411 | −0·423 | +15·940 | 53·565 | |
| 23 | W | 40° α | 38·200 | +8·138 | + 8·591 | −0·330 | +0·974 | +17·373 | 55·573 | 54·277 |
| 24 | E | | 35·050 | +8·157 | + 8·553 | −0·190 | +1·587 | +18·107 | 53·157 | |
| 25 | W | | 38·150 | +8·145 | + 8·515 | +0·195 | +0·550 | +17·405 | 55·555 | |
| 26 | E | | 36·450 | +8·167 | + 8·477 | +0·214 | −0·487 | +16·371 | 52·821 | |
| 27 | W | 60° α | 39·250 | +8·109 | + 8·440 | +1·221 | +0·106 | +17·876 | 57·126 | 55·181 |
| 28 | E | | 38·300 | +8·076 | + 8·403 | −1·570 | 0·000 | +14·909 | 53·209 | |
| 29 | W | | 38·950 | +8·063 | + 8·366 | +1·275 | +0·317 | +18·021 | 56·971 | |
| 30 | E | | 37·300 | +8·050 | + 8·328 | −0·260 | 0·000 | +16·118 | 53·418 | |
| 31 | W | 30° α (1) | 38·500 | +7·970 | + 8·292 | +1·399 | +0·402 | +18·063 | 56·563 | 54·046 |
| Jan. 1 | E | | 36·175 | +7·999 | + 8·298 | −1·285 | +0·042 | +15·054 | 51·229 | |
| 2 | W | | 39·325 | +8·079 | + 8·263 | +1·984 | −0·762 | +17·564 | 56·889 | |
| 3 | E | | 37·275 | +8·085 | + 8·227 | −1·915 | −0·169 | +14·228 | 51·503 | |
| 4 | W | 50° α (1) | 39·975 | +8·058 | + 8·192 | −0·318 | +0·190 | +16·122 | 56·097 | 54·324 |
| 5 | E | | 35·950 | +8·075 | + 8·157 | +0·146 | +0·825 | +17·203 | 53·153 | |
| 6 | W | | 39·275 | +8·050 | + 8·123 | +0·246 | 0·000 | +16·419 | 55·694 | |
| 7 | E | | 35·800 | +8·082 | + 8·088 | +0·381 | 0·000 | +16·551 | 52·351 | |
| 8 | W | 70° α (1) | 38·700 | +8·027 | + 8·054 | +0·753 | −0·254 | +16·580 | 55·280 | 53·706 |
| 9 | E | | 33·625 | +8·009 | + 8·020 | +2·711 | +0·339 | +19·079 | 52·704 | |
| 10 | W | | 37·925 | +8·000 | + 7·987 | +1·460 | −0·339 | +17·108 | 55·033 | |
| 11 | E | | 37·775 | +8·023 | + 7·954 | −1·140 | −0·804 | +14·033 | 51·808 | |

Mean 8° 43′ 54″·4320

Mean Result of both Faces..... 8° 43′ 54″·7728

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No. 27 (642) 112 Tauri $\beta$. North 4° 20′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | *'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | | 51″·750 | +4″·023 | — 8″·005 | —0″·144 | +0″·275 | — 3″·851 | 47″·899 | |
| 25 | W | | 52·350 | +4·051 | — 8·038 | +0·109 | +0·656 | — 3·222 | 49·128 | 47″·635 |
| 26 | E | 20° α | 48·775 | +4·057 | — 8·072 | +0·465 | +1·587 | — 1·963 | 46·812 | |
| 27 | W | | 53·700 | +4·053 | — 8·105 | —2·354 | —0·593 | — 6·999 | 46·701 | |
| 29 | E | | 55·575 | +3·994 | — 8·173 | —2·881 | —0·275 | — 7·335 | 48·240 | |
| 30 | W | | 51·900 | +4·044 | — 8·208 | +2·748 | —0·910 | — 2·326 | 49·574 | 48·507 |
| Dec. 1 | E | 40° α | 53·200 | +4·036 | — 8·242 | —2·066 | +0·423 | — 5·849 | 47·351 | |
| 2 | W | | 50·700 | +4·023 | — 8·278 | +1·824 | +0·593 | — 1·838 | 48·862 | |
| 3 | E | | 48·950 | +3·997 | — 8·312 | +1·406 | +0·677 | — 2·232 | 46·718 | |
| 5 | W | 60° α | 51·100 | +4·015 | — 8·383 | —0·916 | +1·376 | — 3·908 | 47·192 | 47·421 |
| 6 | E | | 50·925 | +4·002 | — 8·418 | +1·544 | +0·529 | — 2·343 | 48·582 | |
| 7 | E | | 49·750 | +4·002 | — 8·455 | +1·354 | +0·233 | — 2·866 | 46·884 | |
| 8 | W | 30° α (1) | 49·125 | +4·026 | — 8·491 | —1·270 | +1·778 | — 3·957 | 45·168 | |
| 9 | E | | 50·175 | +4·028 | — 8·526 | +1·565 | +0·847 | — 2·086 | 48·089 | 46·307 |
| 10 | W | | 49·075 | +4·010 | — 8·563 | —0·514 | +1·079 | — 3·988 | 45·087 | |
| 11 | E | | 51·975 | +4·010 | — 8·599 | +0·786 | —0·063 | — 3·866 | 48·109 | |
| 12 | W | 50° α (1) | 51·175 | +4·025 | — 8·637 | —0·708 | —0·169 | — 5·489 | 45·686 | |
| 13 | E | | 52·025 | +4·045 | — 8·674 | +1·040 | +0·127 | — 3·462 | 48·563 | 47·287 |
| 14 | W | | 50·075 | +4·028 | — 8·711 | —0·019 | +1·418 | — 3·284 | 46·791 | |
| 15 | E | | 47·400 | +4·034 | — 8·748 | +1·695 | +0·190 | — 2·829 | 44·571 | |
| 16 | W | 70° α (1) | 51·700 | +4·019 | — 8·785 | —0·630 | +1·545 | — 3·851 | 47·849 | |
| 17 | E | | 51·175 | +4·044 | — 8·823 | +1·915 | 0·000 | — 2·864 | 48·311 | 46·897 |
| 18 | W | | 52·250 | +4·031 | — 8·861 | —1·539 | +0·974 | — 5·395 | 46·855 | |

Mean 4° 20′ 47″·3423

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | *'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | | 53″·225 | +4″·059 | — 8″·898 | +0″·268 | —1″·757 | — 6″·328 | 46″·897 | |
| 20 | W | | 49·525 | +4·038 | — 8·935 | —0·664 | +1·143 | — 4·418 | 45·107 | 46″·340 |
| 21 | E | 20° α | 53·075 | +4·052 | — 8·975 | +0·978 | —0·233 | — 4·178 | 48·897 | |
| 22 | W | | 49·275 | +4·036 | — 9·013 | —0·411 | +0·571 | — 4·817 | 44·458 | |
| 23 | E | | 53·725 | +4·032 | — 9·051 | —0·330 | —0·783 | — 6·132 | 47·593 | |
| 24 | W | | 49·200 | +4·040 | — 9·089 | —0·190 | —0·085 | — 5·324 | 43·876 | |
| 25 | E | 40° α | 53·275 | +4·037 | — 9·128 | +0·195 | —0·466 | — 5·362 | 47·913 | 46·027 |
| 26 | W | | 48·975 | +4·047 | — 9·167 | +0·214 | +0·656 | — 4·250 | 44·725 | |
| 27 | E | | 51·725 | +4·018 | — 9·205 | +1·221 | +0·635 | — 3·331 | 48·394 | |
| 28 | W | | 50·975 | +4·004 | — 9·244 | —1·570 | +0·423 | — 6·387 | 44·588 | |
| 29 | E | 60° α | 53·175 | +3·995 | — 9·282 | +1·275 | +0·254 | — 3·758 | 49·417 | 45·964 |
| 30 | W | | 46·500 | +3·986 | — 9·320 | —0·260 | +0·550 | — 5·044 | 41·456 | |
| 31 | E | | 51·325 | +3·948 | — 9·358 | +1·399 | +0·339 | — 3·672 | 47·653 | |
| Jan. 1 | W | 30° α (1) | 50·825 | +3·962 | — 9·448 | —1·285 | +0·042 | — 6·729 | 44·096 | |
| 2 | E | | 50·175 | +4·005 | — 9·486 | +1·984 | +1·058 | — 2·439 | 47·736 | 45·954 |
| 3 | W | | 51·850 | +4·005 | — 9·524 | —1·915 | —0·085 | — 7·519 | 44·331 | |
| 4 | E | | 52·375 | +3·992 | — 9·562 | —0·318 | +0·063 | — 5·825 | 46·550 | |
| 5 | W | 50° α (1) | 52·100 | +4·003 | — 9·599 | +0·146 | —0·571 | — 6·021 | 46·079 | |
| 6 | E | | 53·425 | +3·989 | — 9·638 | +0·246 | —0·212 | — 5·615 | 47·810 | 46·256 |
| 7 | W | | 49·875 | +4·004 | — 9·675 | +0·381 | 0·000 | — 5·290 | 44·585 | |
| 8 | E | | 54·275 | +3·978 | — 9·711 | +0·753 | —0·190 | — 5·170 | 49·105 | |
| 9 | W | 70° α (1) | 48·550 | +3·966 | — 9·748 | +2·711 | 0·000 | — 3·071 | 45·479 | |
| 10 | E | | 52·500 | +3·960 | — 9·785 | +1·460 | +0·444 | — 3·921 | 48·579 | 47·156 |
| 11 | W | | 52·050 | +3·971 | — 9·821 | —1·140 | +0·402 | — 6·588 | 45·462 | |

Mean 4° 20′ 46″·2828

Mean Result of both Faces..... 4° 20′ 46″·8126





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## G. T. STATION KALIANPUR.

### No. 28 (670) 35 Orionis *u*. South 9° 55′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 34″·975 | +9″·258 | + 9″·306 | −0″·144 | −0″·741 | +17″·679 | 52″·654 | |
| 25 | E | α 20° | 39·300 | +9·324 | + 9·250 | +0·109 | −0·487 | +18·196 | 57·496 | 54″·029 |
| 26 | W | | 34·450 | +9·335 | + 9·194 | +0·465 | −1·651 | +17·343 | 51·793 | |
| 27 | E | | 37·150 | +9·329 | + 9·137 | −2·354 | +0·910 | +17·022 | 54·172 | |
| 29 | W | | 37·350 | +9·195 | + 9·024 | −2·881 | +0·148 | +15·486 | 52·836 | |
| 30 | E | α 40° | 33·850 | +9·310 | + 8·968 | +2·748 | +0·720 | +21·746 | 55·596 | 53″·174 |
| Dec. 1 | W | | 33·125 | +9·289 | + 8·911 | −2·066 | +2·074 | +18·208 | 51·333 | |
| 2 | E | | 33·500 | +9·261 | + 8·855 | +1·824 | −0·508 | +19·432 | 52·932 | |
| 3 | W | | 34·650 | +9·201 | + 8·798 | +1·406 | −0·952 | +18·453 | 53·103 | |
| 4 | E | α 60° | 38·150 | +9·206 | + 8·741 | −1·166 | −1·482 | +15·299 | 53·449 | 53″·894 |
| 5 | E | | 39·325 | +9·246 | + 8·685 | −0·916 | −1·482 | +15·533 | 54·858 | |
| 6 | W | | 35·875 | +9·221 | + 8·627 | +1·544 | −1·101 | +18·291 | 54·166 | |
| 7 | W | | 34·075 | +9·213 | + 8·572 | +1·354 | −0·550 | +18·589 | 52·664 | |
| 8 | E | α (1) 30° | 35·825 | +9·269 | + 8·515 | −1·270 | −1·101 | +15·413 | 51·238 | 53″·268 |
| 9 | W | | 35·125 | +9·276 | + 8·458 | +1·565 | −0·656 | +18·643 | 53·768 | |
| 10 | E | | 39·275 | +9·235 | + 8·402 | −0·514 | −0·995 | +16·128 | 55·403 | |
| 11 | W | | 33·725 | +9·232 | + 8·346 | +0·786 | +0·783 | +19·147 | 52·872 | |
| 12 | E | α (1) 50° | 34·600 | +9·266 | + 8·291 | −0·708 | +1·524 | +18·373 | 52·973 | 53″·697 |
| 13 | W | | 34·725 | +9·313 | + 8·235 | +1·040 | +0·550 | +19·138 | 53·863 | |
| 14 | E | | 38·550 | +9·279 | + 8·180 | −0·019 | −0·910 | +16·530 | 55·080 | |
| 15 | W | | 34·675 | +9·290 | + 8·125 | +1·695 | −0·063 | +19·047 | 53·722 | |
| 16 | E | α (1) 70° | 38·000 | +9·247 | + 8·070 | −0·630 | −0·614 | +16·073 | 54·073 | 53″·762 |
| 17 | W | | 33·425 | +9·307 | + 8·016 | +1·915 | −0·042 | +19·196 | 52·621 | |
| 18 | E | | 38·950 | +9·277 | + 7·963 | −1·539 | −0·021 | +15·680 | 54·630 | |

Mean 9° 55′ 53″·6373

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | W | | 35″·450 | +9″·344 | + 7″·908 | +0″·268 | +1″·947 | +19″·467 | 54″·917 | |
| 20 | E | α 20° | 35·675 | +9·303 | + 7·855 | −0·664 | +0·085 | +16·579 | 52·254 | 53″·532 |
| 21 | W | | 36·725 | +9·331 | + 7·803 | +0·978 | +0·042 | +18·154 | 54·879 | |
| 22 | E | | 36·650 | +9·294 | + 7·751 | −0·411 | −1·206 | +15·428 | 52·078 | |
| 23 | W | | 35·675 | +9·281 | + 7·699 | −0·330 | +1·990 | +18·640 | 54·315 | |
| 24 | E | α 40° | 32·325 | +9·301 | + 7·647 | −0·190 | +1·418 | +18·176 | 50·501 | 52″·793 |
| 25 | W | | 37·050 | +9·295 | + 7·596 | +0·195 | +0·931 | +18·017 | 55·067 | |
| 26 | E | | 34·425 | +9·317 | + 7·546 | +0·214 | −0·212 | +16·865 | 51·290 | |
| 27 | W | | 37·925 | +9·250 | + 7·496 | +1·221 | +0·825 | +18·792 | 56·717 | |
| 28 | E | α 60° | 36·625 | +9·223 | + 7·448 | −1·570 | +0·275 | +15·376 | 52·001 | 54″·419 |
| 29 | W | | 39·225 | +9·199 | + 7·398 | +1·275 | +0·317 | +18·189 | 57·414 | |
| 30 | E | | 35·725 | +9·173 | + 7·350 | −0·260 | −0·444 | +15·819 | 51·544 | |
| 31 | W | | 37·875 | +9·090 | + 7·302 | +1·399 | 0·000 | +17·791 | 55·666 | |
| Jan. 1 | E | α (1) 30° | 36·075 | +9·119 | + 7·302 | −1·285 | +0·931 | +16·067 | 52·142 | 53″·703 |
| 2 | W | | 37·175 | +9·224 | + 7·255 | +1·984 | −0·804 | +17·659 | 54·834 | |
| 3 | E | | 37·675 | +9·220 | + 7·209 | −1·915 | −0·021 | +14·493 | 52·168 | |
| 4 | W | | 37·975 | +9·189 | + 7·163 | −0·318 | −0·190 | +15·844 | 53·819 | |
| 5 | E | α (1) 50° | 35·650 | +9·220 | + 7·118 | +0·146 | +0·868 | +17·352 | 53·002 | 53″·445 |
| 6 | W | | 38·225 | +9·186 | + 7·074 | +0·246 | 0·000 | +16·506 | 54·731 | |
| 7 | E | | 35·725 | +9·217 | + 7·030 | +0·381 | −0·127 | +16·501 | 52·226 | |
| 8 | W | | 37·300 | +9·159 | + 6·986 | +0·753 | +0·868 | +17·766 | 55·066 | |
| 9 | E | α (1) 70° | 33·700 | +9·128 | + 6·943 | +2·711 | +0·085 | +18·867 | 52·567 | 53″·944 |
| 10 | W | | 38·025 | +9·114 | + 6·901 | +1·460 | −0·233 | +17·242 | 55·267 | |
| 11 | E | | 37·825 | +9·139 | + 6·860 | −1·140 | +0·190 | +15·049 | 52·874 | |

Mean 9° 55′ 53″·6393

Mean Result of both Faces..... 9° 55′ 53″·6383

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## G. T. STATION KALIANPUR.

No. 29 (688) 125 TAURI. North 1° 40′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 58″·775 | +1″·554 | — 7″·760 | —0″·144 | +1″·143 | — 5″·207 | 53″·568 | |
| 25 | W | α | 58·400 | +1·565 | — 7·769 | +0·109 | +1·228 | — 4·867 | 53·533 | 52″·292 |
| 26 | E | 20° | 56·150 | +1·567 | — 7·781 | +0·465 | +0·931 | — 4·818 | 51·332 | |
| 27 | W | | 60·475 | +1·566 | — 7·790 | —2·354 | —1·164 | — 9·742 | 50·733 | |
| 28 | E | | 61·350 | +1·553 | — 7·801 | —2·931 | —0·190 | — 9·369 | 51·981 | |
| 30 | W | α | 59·250 | +1·563 | — 7·824 | +2·748 | —0·360 | — 3·873 | 55·377 | 52·076 |
| Dec. 1 | E | 40° | 61·350 | +1·559 | — 7·837 | —2·066 | —1·820 | —10·164 | 51·186 | |
| 2 | W | | 54·125 | +1·555 | — 7·849 | +1·824 | +0·106 | — 4·364 | 49·761 | |
| 3 | E | | 56·850 | +1·545 | — 7·861 | +1·406 | +0·910 | — 4·000 | 52·850 | |
| 4 | W | α | 58·675 | +1·546 | — 7·874 | —1·166 | +0·635 | — 6·859 | 51·816 | 52·793 |
| 5 | W | 60° | 59·125 | +1·553 | — 7·887 | —0·916 | +0·762 | — 6·488 | 52·637 | |
| 6 | E | | 57·725 | +1·549 | — 7·900 | +1·544 | +0·952 | — 3·855 | 53·870 | |
| 7 | E | | 58·350 | +1·547 | — 7·914 | +1·354 | —0·423 | — 5·436 | 52·914 | |
| 8 | W | α (1) | 57·350 | +1·556 | — 7·928 | —1·270 | +0·508 | — 7·134 | 50·216 | |
| 9 | E | 30° | 57·700 | +1·558 | — 7·941 | +1·565 | +0·635 | — 4·183 | 53·517 | 51·941 |
| 10 | W | | 56·575 | +1·551 | — 7·956 | —0·514 | +1·460 | — 5·459 | 51·116 | |
| 11 | E | | 58·825 | +1·550 | — 7·971 | +0·786 | —0·720 | — 6·355 | 52·470 | |
| 12 | W | α (1) | 59·550 | +1·555 | — 7·987 | —0·708 | —1·545 | — 8·685 | 50·865 | |
| 13 | E | 50° | 57·075 | +1·564 | — 8·003 | +1·040 | 0·000 | — 5·399 | 51·676 | 51·612 |
| 14 | W | | 57·875 | +1·558 | — 8·018 | —0·019 | +0·042 | — 6·437 | 51·438 | |
| 15 | E | | 55·025 | +1·560 | — 8·034 | +1·695 | —0·423 | — 5·202 | 49·823 | |
| 16 | W | α (1) | 57·650 | +1·552 | — 8·051 | —0·630 | +0·042 | — 7·087 | 50·563 | |
| 17 | E | 70° | 56·475 | +1·562 | — 8·068 | +1·915 | +0·063 | — 4·528 | 51·947 | 50·720 |
| 18 | W | | 58·975 | +1·557 | — 8·086 | —1·539 | —0·360 | — 8·428 | 50·547 | |

Mean 1° 40′ 51″·9057

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | E | | 59″·175 | +1″·569 | — 8″·102 | +0″·268 | —1″·609 | — 7″·874 | 51″·301 | |
| 20 | W | α | 57·525 | +1·562 | — 8·120 | —0·664 | —0·804 | — 8·026 | 49·499 | 50″·871 |
| 21 | E | 20° | 57·750 | +1·567 | — 8·139 | +0·978 | +0·402 | — 5·192 | 52·558 | |
| 22 | W | | 56·075 | +1·560 | — 8·158 | —0·411 | +1·058 | — 5·951 | 50·124 | |
| 23 | E | | 61·250 | +1·558 | — 8·177 | —0·330 | —1·482 | — 8·431 | 52·819 | |
| 24 | W | α | 56·775 | +1·561 | — 8·196 | —0·190 | —1·863 | — 8·688 | 48·087 | 50·964 |
| 25 | E | 40° | 60·150 | +1·561 | — 8·215 | +0·195 | —0·762 | — 7·221 | 52·929 | |
| 26 | W | | 56·775 | +1·564 | — 8·235 | +0·214 | —0·296 | — 6·753 | 50·022 | |
| 27 | E | | 59·125 | +1·553 | — 8·256 | +1·221 | —0·868 | — 6·350 | 52·775 | |
| 28 | W | α | 57·275 | +1·549 | — 8·277 | —1·570 | —0·317 | — 8·615 | 48·660 | 51·165 |
| 29 | E | 60° | 59·725 | +1·544 | — 8·297 | +1·275 | —0·381 | — 5·859 | 53·866 | |
| 30 | W | | 55·825 | +1·540 | — 8·317 | —0·260 | +0·571 | — 6·466 | 49·359 | |
| 31 | E | | 60·675 | +1·526 | — 8·338 | +1·399 | 0·000 | — 5·413 | 55·262 | |
| Jan. 1 | W | α (1) | 58·550 | +1·531 | — 8·412 | —1·285 | —1·058 | — 9·224 | 49·326 | |
| 2 | E | 30° | 59·100 | +1·549 | — 8·434 | +1·984 | +0·635 | — 4·266 | 54·834 | 52·407 |
| 3 | W | | 58·625 | +1·548 | — 8·455 | —1·915 | +0·402 | — 8·420 | 50·205 | |
| 4 | E | | 59·700 | +1·543 | — 8·476 | —0·318 | +0·169 | — 7·082 | 52·618 | |
| 5 | W | α (1) | 58·675 | +1·548 | — 8·498 | +0·146 | —0·804 | — 7·608 | 51·067 | |
| 6 | E | 50° | 59·900 | +1·542 | — 8·521 | +0·246 | —0·063 | — 6·796 | 53·104 | 52·136 |
| 7 | W | | 58·475 | +1·547 | — 8·543 | +0·381 | —0·106 | — 6·721 | 51·754 | |
| 8 | E | | 60·200 | +1·538 | — 8·564 | +0·753 | —0·741 | — 7·014 | 53·186 | |
| 9 | W | α (1) | 54·950 | +1·532 | — 8·586 | +2·711 | —0·085 | — 4·428 | 50·522 | |
| 10 | E | 70° | 59·400 | +1·530 | — 8·609 | +1·460 | +0·254 | — 5·365 | 54·035 | 52·170 |
| 11 | W | | 59·175 | +1·534 | — 8·631 | —1·140 | 0·000 | — 8·237 | 50·938 | |

Mean 1° 40′ 51″·6188

Mean Result of both Faces..... 1° 40′ 51″·7623

Q 2

## G. T. STATION KALIANPUR.

### No. 30 (704) 129 Tauri. South 8° 21′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 25 | E | α 20° | 41″·975 | +7″·831 | + 8″·748 | +0″·109 | −1″·122 | +15″·566 | 57″·541 | 56″·884 |
| 26 | W | | 40·650 | +7·837 | + 8·696 | +0·465 | −0·635 | +16·363 | 57·013 | |
| 27 | E | | 41·125 | +7·835 | + 8·642 | −2·354 | +0·720 | +14·843 | 55·968 | |
| 28 | W | α 40° | 43·150 | +7·771 | + 8·589 | −2·931 | +0·169 | +13·598 | 56·748 | 56·460 |
| 30 | E | | 38·250 | +7·819 | + 8·484 | +2·748 | +0·423 | +19·474 | 57·724 | |
| Dec. 1 | W | | 40·075 | +7·798 | + 8·432 | −2·066 | +1·609 | +15·773 | 55·848 | |
| 2 | E | | 37·175 | +7·780 | + 8·380 | +1·824 | +0·360 | +18·344 | 55·519 | |
| 3 | W | α 60° | 39·600 | +7·727 | + 8·327 | +1·406 | −1·143 | +16·317 | 55·917 | 56·753 |
| 4 | E | | 42·675 | +7·735 | + 8·275 | −1·166 | −0·847 | +13·997 | 56·672 | |
| 5 | E | | 43·300 | +7·771 | + 8·223 | −0·916 | −0·762 | +14·316 | 57·616 | |
| 6 | W | | 40·250 | +7·754 | + 8·170 | +1·544 | −0·910 | +16·558 | 56·808 | |
| 7 | W | α (1) 30° | 40·000 | +7·737 | + 8·119 | +1·354 | +0·847 | +18·057 | 58·057 | 56·802 |
| 8 | E | | 42·475 | +7·784 | + 8·067 | −1·270 | −0·910 | +13·671 | 56·146 | |
| 9 | W | | 39·550 | +7·795 | + 8·015 | +1·565 | −0·656 | +16·719 | 56·269 | |
| 10 | E | | 42·900 | +7·761 | + 7·964 | −0·514 | −1·376 | +13·835 | 56·735 | |
| 11 | W | α (1) 50° | 38·900 | +7·756 | + 7·913 | +0·786 | +0·635 | +17·090 | 55·990 | 55·957 |
| 12 | E | | 38·925 | +7·782 | + 7·863 | −0·708 | +1·101 | +16·038 | 54·963 | |
| 13 | W | | 37·375 | +7·824 | + 7·813 | +1·040 | +0·275 | +16·952 | 54·327 | |
| 14 | E | | 43·850 | +7·802 | + 7·763 | −0·019 | −0·847 | +14·699 | 58·549 | |
| 15 | W | α (1) 70° | 38·425 | +7·807 | + 7·714 | +1·695 | +0·677 | +17·893 | 56·318 | 56·218 |
| 16 | E | | 40·950 | +7·760 | + 7·664 | −0·630 | +0·677 | +15·471 | 56·421 | |
| 17 | W | | 38·100 | +7·814 | + 7·616 | +1·915 | −0·423 | +16·922 | 55·022 | |
| 18 | E | | 44·475 | +7·790 | + 7·568 | −1·539 | −1·185 | +12·634 | 57·109 | |

Mean 8° 21′ 56″·5123

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | α 20° | 39″·100 | +7″·849 | + 7″·519 | +0″·268 | +1″·418 | +17″·054 | 56″·154 | 55″·836 |
| 20 | E | | 40·400 | +7·820 | + 7·472 | −0·664 | +1·143 | +15·771 | 56·171 | |
| 21 | W | | 40·300 | +7·841 | + 7·426 | +0·978 | −0·550 | +15·695 | 55·995 | |
| 22 | E | | 41·175 | +7·809 | + 7·380 | −0·411 | −0·931 | +13·847 | 55·022 | |
| 23 | W | α 40° | 39·900 | +7·796 | + 7·334 | −0·330 | +1·651 | +16·451 | 56·351 | 55·735 |
| 24 | E | | 37·300 | +7·812 | + 7·289 | −0·190 | +1·270 | +16·181 | 53·481 | |
| 25 | W | | 42·650 | +7·811 | + 7·244 | +0·195 | +0·169 | +15·419 | 58·069 | |
| 26 | E | | 39·775 | +7·827 | + 7·200 | +0·214 | +0·021 | +15·262 | 55·037 | |
| 27 | W | α 60° | 41·725 | +7·771 | + 7·157 | +1·221 | +0·889 | +17·038 | 58·763 | 56·937 |
| 28 | E | | 40·875 | +7·753 | + 7·114 | −1·570 | +0·762 | +14·059 | 54·934 | |
| 29 | W | | 42·950 | +7·729 | + 7·072 | +1·275 | 0·000 | +16·076 | 59·026 | |
| 30 | E | | 41·275 | +7·702 | + 7·029 | −0·260 | −0·720 | +13·751 | 55·026 | |
| 31 | W | α (1) 30° | 42·725 | +7·636 | + 6·988 | +1·399 | +0·127 | +16·150 | 58·875 | 56·290 |
| Jan. 1 | E | | 39·225 | +7·659 | + 6·991 | −1·285 | +1·397 | +14·762 | 53·987 | |
| 2 | W | | 42·550 | +7·752 | + 6·951 | +1·984 | −0·974 | +15·713 | 58·263 | |
| 3 | E | | 41·250 | +7·745 | + 6·912 | −1·915 | +0·042 | +12·784 | 54·034 | |
| 4 | W | α (1) 50° | 43·900 | +7·719 | + 6·872 | −0·318 | +0·063 | +14·336 | 58·236 | 56·864 |
| 5 | E | | 41·325 | +7·749 | + 6·834 | +0·146 | −0·169 | +14·560 | 55·885 | |
| 6 | W | | 42·875 | +7·719 | + 6·797 | +0·246 | +0·360 | +15·122 | 57·997 | |
| 7 | E | | 40·350 | +7·742 | + 6·760 | +0·381 | +0·106 | +14·989 | 55·339 | |
| 8 | W | α (1) 70° | 42·800 | +7·696 | + 6·723 | +0·753 | +0·042 | +15·214 | 58·014 | 56·201 |
| 9 | E | | 37·600 | +7·665 | + 6·687 | +2·711 | +0·423 | +17·486 | 55·086 | |
| 10 | W | | 42·775 | +7·651 | + 6·652 | +1·460 | −0·656 | +15·107 | 57·882 | |
| 11 | E | | 40·650 | +7·672 | + 6·618 | −1·140 | +0·021 | +13·171 | 53·821 | |

Mean 8° 21′ 56″·3105

Mean Result of both Faces.....8° 21′ 56″·4114

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## G. T. STATION KALIANPUR.

### No. 31 (722) 136 TAURI *C*. North 3° 26′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | 20° *a* | 55″·950 | +3″·186 | — 6″·969 | —0″·144 | +0″·360 | — 3″·567 | 52″·383 | 52″·325 |
| 25 | W | | 56·225 | +3·211 | — 6·981 | +0·109 | +0·783 | — 2·878 | 53·347 | |
| 26 | E | | 53·775 | +3·213 | — 6·995 | +0·465 | +0·614 | — 2·703 | 51·072 | |
| 27 | W | | 59·325 | +3·213 | — 7·008 | —2·354 | —0·677 | — 6·826 | 52·499 | |
| 28 | E | 40° *a* | 57·800 | +3·187 | — 7·022 | —2·931 | —0·106 | — 6·872 | 50·928 | 52·095 |
| 30 | W | | 57·300 | +3·206 | — 7·052 | +2·748 | —0·614 | — 1·712 | 55·588 | |
| Dec. 1 | E | | 59·800 | +3·197 | — 7·068 | —2·066 | —2·709 | — 8·646 | 51·154 | |
| 2 | W | | 53·625 | +3·191 | — 7·084 | +1·824 | —0·847 | — 2·916 | 50·709 | |
| 3 | E | 60° *a* | 53·400 | +3·169 | — 7·100 | +1·406 | +0·508 | — 2·017 | 51·383 | 52·109 |
| 4 | W | | 55·225 | +3·173 | — 7·117 | —1·166 | +0·995 | — 4·115 | 51·110 | |
| 5 | W | | 57·150 | +3·188 | — 7·135 | —0·916 | +0·931 | — 3·932 | 53·218 | |
| 6 | E | | 54·350 | +3·181 | — 7·153 | +1·544 | +0·804 | — 1·624 | 52·726 | |
| 7 | E | 30° *a* (1) | 55·000 | +3·173 | — 7·172 | +1·354 | —0·063 | — 2·708 | 52·292 | 52·717 |
| 8 | W | | 56·425 | +3·192 | — 7·191 | —1·270 | +0·508 | — 4·761 | 51·664 | |
| 9 | E | | 56·100 | +3·197 | — 7·210 | +1·565 | +0·656 | — 1·792 | 54·308 | |
| 10 | W | | 56·400 | +3·184 | — 7·230 | —0·514 | +0·762 | — 3·798 | 52·602 | |
| 11 | E | 50° *a* (1) | 55·725 | +3·181 | — 7·250 | +0·786 | —1·482 | — 4·765 | 50·960 | 51·628 |
| 12 | W | | 57·425 | +3·191 | — 7·272 | —0·708 | —1·609 | — 6·398 | 51·027 | |
| 13 | E | | 55·750 | +3·209 | — 7·294 | +1·040 | —1·101 | — 4·146 | 51·604 | |
| 14 | W | | 55·975 | +3·201 | — 7·316 | —0·019 | +1·079 | — 3·055 | 52·920 | |
| 15 | E | 70° *a* (1) | 53·125 | +3·202 | — 7·338 | +1·695 | —0·063 | — 2·504 | 50·621 | 52·290 |
| 16 | W | | 57·050 | +3·181 | — 7·361 | —0·630 | —0·635 | — 5·445 | 51·605 | |
| 17 | E | | 55·900 | +3·204 | — 7·385 | +1·915 | +0·360 | — 1·906 | 53·994 | |
| 18 | W | | 57·550 | +3·194 | — 7·409 | —1·539 | +1·143 | — 4·611 | 52·939 | |

Mean 3° 26′ 52″·1940

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 19 | E | 20° *a* | 58″·375 | +3″·219 | — 7″·433 | +0″·268 | —1″·460 | — 5″·406 | 52″·969 | 52″·309 |
| 20 | W | | 55·575 | +3·208 | — 7·458 | —0·664 | —1·037 | — 5·951 | 49·624 | |
| 21 | E | | 57·325 | +3·216 | — 7·485 | +0·978 | +0·381 | — 2·910 | 54·415 | |
| 22 | W | | 56·650 | +3·203 | — 7·511 | —0·411 | +0·296 | — 4·423 | 52·227 | |
| 23 | E | 40° *a* | 58·825 | +3·197 | — 7·537 | —0·330 | —1·884 | — 6·554 | 52·271 | 51·920 |
| 24 | W | | 55·425 | +3·204 | — 7·564 | —0·190 | —1·058 | — 5·608 | 49·817 | |
| 25 | E | | 58·800 | +3·204 | — 7·592 | +0·195 | —0·381 | — 4·574 | 54·226 | |
| 26 | W | | 55·750 | +3·210 | — 7·620 | +0·214 | —0·190 | — 4·386 | 51·364 | |
| 27 | E | 60° *a* | 58·375 | +3·187 | — 7·648 | +1·221 | —1·355 | — 4·595 | 53·780 | 52·219 |
| 28 | W | | 56·650 | +3·181 | — 7·677 | —1·570 | —0·825 | — 6·891 | 49·759 | |
| 29 | E | | 58·000 | +3·170 | — 7·706 | +1·275 | —0·339 | — 3·600 | 54·400 | |
| 30 | W | | 55·075 | +3·158 | — 7·735 | —0·260 | +0·698 | — 4·139 | 50·936 | |
| 31 | E | 30° *a* (1) | 58·875 | +3·131 | — 7·765 | +1·399 | —0·444 | — 3·679 | 55·196 | 52·189 |
| Jan. 1 | W | | 56·200 | +3·141 | — 7·852 | —1·285 | —1·249 | — 7·245 | 48·955 | |
| 2 | E | | 56·875 | +3·180 | — 7·883 | +1·984 | +0·931 | — 1·788 | 55·087 | |
| 3 | W | | 56·550 | +3·176 | — 7·913 | —1·915 | —0·381 | — 7·033 | 49·517 | |
| 4 | E | 50° *a* (1) | 59·525 | +3·166 | — 7·944 | —0·318 | —0·085 | — 5·181 | 54·344 | 52·716 |
| 5 | W | | 56·850 | +3·179 | — 7·975 | +0·146 | —0·042 | — 4·692 | 52·158 | |
| 6 | E | | 58·300 | +3·166 | — 8·007 | +0·246 | —0·677 | — 5·272 | 53·028 | |
| 7 | W | | 55·900 | +3·175 | — 8·038 | +0·381 | —0·085 | — 4·567 | 51·333 | |
| 8 | E | 70° *a* (1) | 59·975 | +3·156 | — 8·070 | +0·753 | —0·106 | — 4·267 | 55·708 | 52·843 |
| 9 | W | | 52·475 | +3·143 | — 8·101 | +2·711 | 0·000 | — 2·247 | 50·228 | |
| 10 | E | | 58·650 | +3·137 | — 8·134 | +1·460 | +0·550 | — 2·987 | 55·663 | |
| 11 | W | | 55·975 | +3·146 | — 8·166 | —1·140 | —0·042 | — 6·202 | 49·773 | |

Mean 3° 26′ 52″·3660

Mean Result of both Faces..... 3° 26′ 52″·2800

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## G. T. STATION KALIANPUR.

### No. 32 (737) 139 Tauri. North 1° 48′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | 20° α | 32″·100 | +1″·670 | — 7″·005 | +0″·144 | +0″·762 | — 4″·429 | 27″·671 | 28″·096 |
| 25 | E | | 31·025 | +1·683 | — 7·005 | —0·109 | +0·614 | — 4·817 | 26·208 | |
| 26 | W | | 32·875 | +1·684 | — 7·007 | —0·465 | +1·672 | — 4·116 | 28·759 | |
| 27 | E | | 33·750 | +1·684 | — 7·007 | +2·354 | —1·037 | — 4·006 | 29·744 | |
| 28 | W | 40° α | 31·925 | +1·670 | — 7·009 | +2·931 | 0·000 | — 2·408 | 29·517 | 27·761 |
| 30 | E | | 33·800 | +1·680 | — 7·015 | —2·748 | —0·677 | — 8·760 | 25·040 | |
| Dec. 1 | W | | 34·300 | +1·675 | — 7·018 | +2·066 | —2·138 | — 5·415 | 28·885 | |
| 2 | E | | 35·325 | +1·672 | — 7·022 | —1·824 | —0·550 | — 7·724 | 27·601 | |
| 3 | W | 60° α | 33·425 | +1·661 | — 7·026 | —1·406 | +0·762 | — 6·009 | 27·416 | 26·892 |
| 4 | E | | 29·625 | +1·663 | — 7·031 | +1·166 | +1·143 | — 3·059 | 26·566 | |
| 5 | E | | 29·375 | +1·671 | — 7·036 | +0·916 | +0·847 | — 3·602 | 25·773 | |
| 6 | W | | 34·750 | +1·668 | — 7·041 | —1·544 | —0·021 | — 6·938 | 27·812 | |
| 7 | W | 30° α (1) | 32·075 | +1·663 | — 7·048 | —1·354 | +0·847 | — 5·892 | 26·183 | 26·748 |
| 8 | E | | 30·975 | +1·673 | — 7·055 | +1·270 | +0·571 | — 3·541 | 27·434 | |
| 9 | W | | 32·825 | +1·676 | — 7·061 | —1·565 | +0·021 | — 6·929 | 25·896 | |
| 10 | E | | 31·075 | +1·669 | — 7·069 | +0·514 | +1·291 | — 3·595 | 27·480 | |
| 11 | W | 50° α (1) | 35·525 | +1·667 | — 7·078 | —0·786 | —1·037 | — 7·234 | 28·291 | 27·356 |
| 12 | E | | 32·375 | +1·673 | — 7·087 | +0·708 | —1·016 | — 5·722 | 26·653 | |
| 13 | W | | 34·575 | +1·682 | — 7·097 | —1·040 | —0·804 | — 7·259 | 27·316 | |
| 14 | E | | 31·725 | +1·678 | — 7·106 | +0·019 | +0·847 | — 4·562 | 27·163 | |
| 15 | W | 70° α (1) | 33·325 | +1·679 | — 7·117 | —1·695 | +0·656 | — 6·477 | 26·848 | 26·740 |
| 16 | E | | 31·100 | +1·667 | — 7·128 | +0·630 | +0·148 | — 4·683 | 26·417 | |
| 17 | W | | 35·350 | +1·679 | — 7·140 | —1·915 | 0·000 | — 7·376 | 27·974 | |
| 18 | E | | 28·750 | +1·674 | — 7·152 | +1·539 | +0·910 | — 3·029 | 25·721 | |

Mean 1° 48′ 27″·2655

#### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 19 | W | 20° α | 33″·650 | +1″·687 | — 7″·164 | —0″·268 | —1″·503 | — 7″·248 | 26″·402 | 26″·288 |
| 20 | E | | 32·300 | +1·682 | — 7·177 | +0·664 | —0·571 | — 5·402 | 26·898 | |
| 21 | W | | 31·175 | +1·686 | — 7·192 | —0·978 | +0·021 | — 6·463 | 24·712 | |
| 22 | E | | 32·000 | +1·679 | — 7·206 | +0·411 | +0·254 | — 4·862 | 27·138 | |
| 23 | W | 40° α | 32·550 | +1·676 | — 7·221 | +0·330 | —1·376 | — 6·591 | 25·959 | 26·623 |
| 24 | E | | 34·275 | +1·679 | — 7·237 | +0·190 | —0·571 | — 5·939 | 28·336 | |
| 25 | W | | 31·025 | +1·679 | — 7·252 | —0·195 | —0·402 | — 6·170 | 24·855 | |
| 26 | E | | 33·375 | +1·683 | — 7·269 | —0·214 | —0·233 | — 6·033 | 27·342 | |
| 27 | W | 60° α | 33·450 | +1·670 | — 7·286 | —1·221 | —0·720 | — 7·557 | 25·893 | 26·681 |
| 28 | E | | 33·500 | +1·667 | — 7·304 | +1·570 | —0·254 | — 4·321 | 29·179 | |
| 29 | W | | 31·375 | +1·661 | — 7·322 | —1·275 | —0·635 | — 7·571 | 23·804 | |
| 30 | E | | 32·575 | +1·655 | — 7·340 | +0·260 | +0·698 | — 4·727 | 27·848 | |
| 31 | W | 30° α (1) | 33·250 | +1·641 | — 7·359 | —1·399 | —0·529 | — 7·646 | 25·604 | 27·279 |
| Jan. 1 | E | | 34·625 | +1·646 | — 7·435 | +1·285 | —1·228 | — 5·732 | 28·893 | |
| 2 | W | | 32·975 | +1·667 | — 7·455 | —1·984 | +0·910 | — 6·862 | 26·113 | |
| 3 | E | | 32·400 | +1·665 | — 7·475 | +1·915 | 0·000 | — 3·895 | 28·505 | |
| 4 | W | 50° α (1) | 31·925 | +1·659 | — 7·495 | +0·318 | —0·021 | — 5·539 | 26·386 | 26·607 |
| 5 | E | | 33·550 | +1·666 | — 7·515 | —0·146 | —0·952 | — 6·947 | 26·603 | |
| 6 | W | | 32·325 | +1·659 | — 7·537 | —0·246 | —0·339 | — 6·463 | 25·862 | |
| 7 | E | | 33·850 | +1·664 | — 7·558 | —0·381 | 0·000 | — 6·275 | 27·575 | |
| 8 | W | 70° α (1) | 32·800 | +1·654 | — 7·580 | —0·753 | —0·656 | — 7·335 | 25·465 | 27·060 |
| 9 | E | | 37·700 | +1·647 | — 7·602 | —2·711 | +0·444 | — 8·222 | 29·478 | |
| 10 | W | | 31·250 | +1·644 | — 7·625 | —1·460 | +0·720 | — 6·721 | 24·529 | |
| 11 | E | | 33·625 | +1·648 | — 7·647 | +1·140 | 0·000 | — 4·859 | 28·766 | |

Mean 1° 48′ 26″·7563

Mean Result of both Faces..... 1° 48′ 27″·0109

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No. 1 (253) TRIANGULI *c*. North 10° 53′+

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 65″·975 | +10″·143 | −13″·411 | +0″·314 | +1″·305 | −1″·649 | 64″·326 | |
| 25 | E | 20° *a* | 68·900 | +10·149 | −13·501 | +0·263 | −1·397 | −4·486 | 64·414 | 64″·721 |
| 26 | W | | 66·925 | +10·104 | −13·579 | +0·385 | +0·202 | −2·888 | 64·037 | |
| 27 | E | | 68·675 | +10·098 | −13·654 | +1·154 | −0·165 | −2·567 | 66·108 | |
| 28 | W | | 65·375 | +10·093 | −13·728 | +2·200 | +1·048 | −0·387 | 64·988 | |
| 29 | E | 40° *a* | 74·650 | +10·046 | −13·803 | −1·431 | +0·018 | −5·170 | 69·480 | 67·964 |
| 30 | W | | 69·775 | +10·031 | −13·873 | +1·670 | −0·202 | −2·374 | 67·401 | |
| Dec. 1 | E | | 76·175 | +10·036 | −13·941 | −1·786 | −0·496 | −6·187 | 69·988 | |
| 2 | W | | 70·225 | +10·046 | −14·009 | −3·333 | +0·368 | −6·928 | 63·297 | |
| 3 | E | 60° *a* | 66·350 | + 9·955 | −14·074 | +4·239 | 0·000 | +0·120 | 66·470 | 67·049 |
| 4 | W | | 77·050 | + 9·978 | −14·136 | −3·721 | −0·037 | −7·916 | 69·134 | |
| 5 | E | | 68·900 | +10·018 | −14·197 | +3·671 | +0·901 | +0·393 | 69·293 | |
| 6 | W | | 68·600 | +10·094 | −14·256 | +0·096 | +1·489 | −2·577 | 66·023 | |
| 7 | E | 30° *a* (1) | 73·250 | +10·128 | −14·314 | −0·516 | −0·698 | −5·400 | 67·850 | 67·437 |
| 8 | W | | 69·125 | +10·137 | −14·368 | +0·789 | +1·342 | −2·100 | 67·025 | |
| 9 | E | | 73·175 | +10·122 | −14·418 | −0·105 | +0·074 | −4·327 | 68·848 | |
| 10 | W | | 70·075 | +10·105 | −14·470 | +0·705 | +0·772 | −2·888 | 67·187 | |
| 11 | E | 50° *a* (1) | 75·100 | +10·086 | −14·519 | −0·076 | −0·349 | −4·858 | 70·242 | 69·014 |
| 12 | W | | 71·550 | +10·074 | −14·567 | +0·404 | +0·845 | −3·244 | 68·306 | |
| 13 | E | | 74·700 | +10·050 | −14·610 | +0·033 | +0·147 | −4·380 | 70·320 | |
| 14 | W | | 71·950 | +10·128 | −14·653 | +1·580 | +2·205 | −0·740 | 71·210 | |
| 15 | E | 70° *a* (1) | 74·800 | +10·123 | −14·693 | −1·404 | +1·066 | −4·908 | 69·892 | 68·582 |
| 16 | W | | 62·550 | +10·124 | −14·730 | +1·536 | +1·470 | −1·600 | 60·950 | |
| 17 | E | | 76·975 | +10·085 | −14·767 | −1·340 | +1·323 | −4·699 | 72·276 | |

Mean 10° 54′ 7″·4612

## Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | | 65″·175 | +10″·071 | −14″·801 | −0″·238 | +1″·783 | −3″·185 | 61″·990 | |
| 19 | E | 20° *a* | 65·850 | +10·083 | −14·831 | +1·953 | +0·882 | −1·913 | 63·937 | 61″·958 |
| 20 | W | | 63·550 | +10·168 | −14·859 | +0·284 | +0·809 | −3·598 | 59·952 | |
| 21 | E | | 64·650 | +10·163 | −14·889 | +0·008 | +2·022 | −2·696 | 61·954 | |
| 22 | W | | 66·700 | +10·139 | −14·916 | −0·461 | +2·408 | −2·830 | 63·870 | |
| 23 | E | 40° *a* | 68·375 | +10·045 | −14·938 | +1·405 | −0·349 | −3·837 | 64·538 | 64·425 |
| 24 | W | | 70·325 | +10·007 | −14·958 | −0·306 | −0·827 | −6·084 | 64·241 | |
| 25 | E | | 70·000 | +10·009 | −14·976 | +0·956 | −0·937 | −4·948 | 65·052 | |
| 26 | W | | 68·150 | + 9·995 | −14·994 | −0·161 | +0·386 | −4·774 | 63·376 | |
| 27 | E | 60° *a* | 71·475 | +10·036 | −15·009 | +1·229 | +0·423 | −3·321 | 68·154 | 65·634 |
| 28 | W | | 69·050 | +10·017 | −15·022 | +0·038 | +0·607 | −4·360 | 64·690 | |
| 29 | E | | 71·600 | + 9·990 | −15·031 | +0·345 | −0·588 | −5·284 | 66·316 | |
| 30 | W | | 68·850 | + 9·936 | −15·038 | −0·459 | +0·937 | −4·624 | 64·226 | |
| 31 | E | 30° *a* (1) | 70·825 | + 9·868 | −15·042 | +1·173 | −1·195 | −5·196 | 65·629 | 65·449 |
| Jan. 1 | W | | 67·775 | + 9·902 | −15·045 | +0·779 | +0·625 | −3·739 | 64·036 | |
| 2 | E | | 70·475 | + 9·911 | −15·045 | +0·360 | +2·205 | −2·569 | 67·906 | |
| 3 | W | | 72·200 | + 9·920 | −15·044 | −2·764 | +1·158 | −6·730 | 65·470 | |
| 4 | E | 50° *a* (1) | 64·350 | + 9·943 | −15·041 | +4·375 | +0·055 | −0·668 | 63·682 | 64·753 |
| 5 | W | | 72·750 | + 9·966 | −15·035 | −3·705 | +1·286 | −7·488 | 65·262 | |
| 6 | E | | 65·925 | + 9·997 | −15·027 | +3·903 | −0·202 | −1·329 | 64·596 | |
| 7 | W | | 71·175 | + 9·976 | −15·017 | −3·180 | +2·426 | −5·795 | 65·380 | |
| 8 | E | 70° *a* (1) | 66·800 | +10·009 | −15·004 | +2·519 | −0·533 | −3·009 | 63·791 | |
| 9 | W | | 68·225 | + 9·956 | −14·990 | +0·705 | +1·066 | −3·263 | 64·962 | 65·043 |
| 10 | E | | 69·475 | + 9·984 | −14·974 | −0·486 | +0·368 | −5·108 | 64·367 | |
| 11 | W | | 68·625 | + 9·981 | −14·955 | +0·976 | +3·051 | −0·947 | 67·678 | |

Mean 10° 54′ 4″·5437

Mean Result of both Faces ..... 10° 54′ 6″·0025

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## G. T. STATION DAMARGIDA.

No. 2 (262) 29 Arietis ω. South 3° 43′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 21″·325 | +3″·427 | +11″·426 | +0″·314 | −0″·368 | +14″·799 | 36″·124 | |
| 25 | W | 20° α | 24·425 | +3·429 | +11·422 | +0·263 | +0·404 | +15·518 | 39·943 | 37″·661 |
| 26 | E | | 20·100 | +3·415 | +11·418 | +0·385 | +0·055 | +15·273 | 35·373 | |
| 27 | W | | 23·300 | +3·412 | +11·411 | +1·154 | −0·074 | +15·903 | 39·203 | |
| 28 | E | | 20·800 | +3·410 | +11·403 | +2·200 | −0·937 | +16·076 | 36·876 | |
| 29 | W | 40° α | 29·700 | +3·394 | +11·397 | −1·431 | +0·018 | +13·378 | 43·078 | 41·093 |
| 30 | E | | 23·775 | +3·389 | +11·387 | +1·670 | −0·129 | +16·317 | 40·092 | |
| Dec. 1 | W | | 31·125 | +3·391 | +11·376 | −1·786 | +0·221 | +13·202 | 44·327 | |
| 2 | E | | 24·975 | +3·394 | +11·365 | −3·333 | −0·331 | +11·095 | 36·070 | |
| 3 | W | 60° α | 19·800 | +3·364 | +11·352 | +4·239 | −0·717 | +18·238 | 38·038 | 37·086 |
| 4 | E | | 23·300 | +3·371 | +11·337 | −3·721 | +0·441 | +11·428 | 34·728 | |
| 5 | W | | 22·175 | +3·385 | +11·323 | +3·671 | −1·048 | +17·331 | 39·506 | |
| 6 | E | | 23·650 | +3·410 | +11·306 | +0·096 | −1·268 | +13·544 | 37·194 | |
| 7 | W | 30° α (1) | 25·800 | +3·422 | +11·290 | −0·516 | +0·533 | +14·729 | 40·529 | 39·409 |
| 8 | E | | 23·025 | +3·425 | +11·271 | +0·789 | −0·790 | +14·695 | 37·720 | |
| 9 | W | | 29·300 | +3·420 | +11·249 | −0·105 | −1·672 | +12·892 | 42·192 | |
| 10 | E | | 25·850 | +3·414 | +11·230 | +0·705 | −0·919 | +14·430 | 40·280 | |
| 11 | W | 50° α (1) | 30·325 | +3·408 | +11·208 | −0·076 | +0·992 | +15·532 | 45·857 | 42·695 |
| 12 | E | | 27·475 | +3·404 | +11·187 | +0·404 | −0·018 | +14·977 | 42·452 | |
| 13 | W | | 27·800 | +3·396 | +11·163 | +0·033 | −0·202 | +14·390 | 42·190 | |
| 14 | E | | 25·975 | +3·422 | +11·139 | +1·580 | −2·352 | +13·789 | 39·764 | |
| 15 | W | 70° α (1) | 31·200 | +3·420 | +11·113 | −1·404 | −0·423 | +12·706 | 43·906 | 41·126 |
| 16 | E | | 23·600 | +3·420 | +11·085 | +1·536 | −0·827 | +15·214 | 38·814 | |
| 17 | W | | 29·500 | +3·407 | +11·059 | −1·340 | −0·607 | +12·519 | 42·019 | |

Mean 3° 43′ 38″·1783

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 21″·100 | +3″·403 | +11″·031 | −0″·238 | −1″·672 | +12″·524 | 33″·624 | |
| 19 | W | 20° α | 21·550 | +3·408 | +11·000 | +1·953 | −0·349 | +16·012 | 37·562 | 35″·105 |
| 20 | E | | 19·925 | +3·436 | +10·968 | +0·284 | −1·029 | +13·659 | 33·584 | |
| 21 | W | | 23·325 | +3·434 | +10·940 | +0·008 | −2·058 | +12·324 | 35·649 | |
| 22 | E | | 22·625 | +3·425 | +10·909 | −0·461 | −1·819 | +12·054 | 34·619 | |
| 23 | W | 40° α | 22·850 | +3·395 | +10·875 | +1·405 | +0·551 | +16·226 | 39·076 | 37·162 |
| 24 | E | | 21·450 | +3·381 | +10·841 | −0·306 | +0·680 | +14·596 | 36·046 | |
| 25 | W | | 23·375 | +3·382 | +10·806 | +0·956 | +0·386 | +15·530 | 38·905 | |
| 26 | E | | 21·300 | +3·377 | +10·772 | −0·161 | −0·349 | +13·639 | 34·939 | |
| 27 | W | 60° α | 26·525 | +3·391 | +10·736 | +1·229 | −0·276 | +15·080 | 41·605 | 37·959 |
| 28 | E | | 21·000 | +3·384 | +10·700 | +0·038 | +0·018 | +14·140 | 35·140 | |
| 29 | W | | 25·475 | +3·375 | +10·661 | +0·345 | +0·294 | +14·675 | 40·150 | |
| 30 | E | | 22·600 | +3·357 | +10·622 | −0·459 | +0·257 | +13·777 | 36·377 | |
| 31 | W | 30° α (1) | 24·100 | +3·334 | +10·581 | +1·173 | −0·184 | +14·904 | 39·004 | 37·216 |
| Jan. 1 | E | | 21·100 | +3·345 | +10·539 | +0·779 | −1·103 | +13·560 | 34·660 | |
| 2 | W | | 26·125 | +3·348 | +10·498 | +0·360 | −1·507 | +12·699 | 38·824 | |
| 3 | E | | 26·975 | +3·352 | +10·456 | −2·764 | +0·239 | +11·283 | 38·258 | |
| 4 | W | 50° α (1) | 19·325 | +3·360 | +10·414 | +4·375 | −1·066 | +17·083 | 36·408 | 37·140 |
| 5 | E | | 27·525 | +3·368 | +10·370 | −3·705 | −1·581 | + 8·452 | 35·977 | |
| 6 | W | | 21·225 | +3·379 | +10·327 | +3·903 | −0·919 | +16·690 | 37·915 | |
| 7 | E | | 27·850 | +3·372 | +10·282 | −3·180 | −2·389 | + 8·085 | 35·935 | |
| 8 | W | 70° α (1) | 21·525 | +3·382 | +10·236 | +2·519 | −0·680 | +15·457 | 36·982 | |
| 9 | E | | 23·175 | +3·364 | +10·190 | +0·705 | −0·368 | +13·891 | 37·066 | 37·089 |
| 10 | W | | 25·200 | +3·374 | +10·143 | −0·486 | −0·827 | +12·204 | 37·404 | |
| 11 | E | | 26·025 | +3·373 | +10·096 | +0·976 | −2·518 | +11·927 | 37·952 | |

Mean 3° 43′ 36″·9452

Mean Result of both Faces..... 3° 43′ 37″·5618

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## No. 3 (277) 33 ARIETIS. North 8° 19′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 14″·175 | +7″·705 | −12″·926 | +0″·314 | +0″·184 | − 4″·723 | 9″·452 | |
| 25 | E | 20° α | 18·075 | +7·709 | −12·991 | +0·263 | +0·092 | − 4·927 | 13·148 | 11″·444 |
| 26 | W | | 14·325 | +7·678 | −13·055 | +0·385 | +0·698 | − 4·294 | 10·031 | |
| 27 | E | | 17·475 | +7·669 | −13·116 | +1·154 | −0·037 | − 4·330 | 13·145 | |
| 28 | W | | 13·500 | +7·667 | −13·176 | +2·200 | +1·452 | − 1·857 | 11·643 | |
| 29 | E | 40° α | 23·900 | +7·630 | −13·238 | −1·431 | −0·018 | − 7·057 | 16·843 | 15·082 |
| 30 | W | | 16·275 | +7·620 | −13·295 | +1·670 | +0·055 | − 3·950 | 12·325 | |
| Dec. 1 | E | | 27·025 | +7·626 | −13·350 | −1·786 | 0·000 | − 7·510 | 19·515 | |
| 2 | W | | 19·075 | +7·631 | −13·405 | −3·333 | +0·368 | − 8·739 | 10·336 | |
| 3 | E | 60° α | 14·250 | +7·564 | −13·457 | +4·239 | +1·250 | − 0·404 | 13·846 | 12·527 |
| 4 | W | | 20·600 | +7·578 | −13·507 | −3·721 | +0·184 | − 9·466 | 11·134 | |
| 5 | E | | 16·475 | +7·613 | −13·557 | +3·671 | +0·588 | − 1·685 | 14·790 | |
| 6 | W | | 17·300 | +7·666 | −13·604 | +0·096 | +0·882 | − 4·960 | 12·340 | |
| 7 | E | 30° α (1) | 18·250 | +7·693 | −13·651 | −0·516 | −0·515 | − 6·989 | 11·261 | 13·137 |
| 8 | W | | 16·525 | +7·699 | −13·693 | +0·789 | +0·221 | − 4·984 | 11·541 | |
| 9 | E | | 21·825 | +7·690 | −13·733 | −0·105 | +1·728 | − 4·420 | 17·405 | |
| 10 | W | | 22·650 | +7·677 | −13·775 | +0·705 | +1·728 | − 3·665 | 18·985 | |
| 11 | E | 50° α (1) | 24·400 | +7·662 | −13·813 | −0·076 | −0·055 | − 6·282 | 18·118 | 17·076 |
| 12 | W | | 21·000 | +7·652 | −13·851 | +0·404 | −1·305 | − 7·100 | 13·900 | |
| 13 | E | | 23·425 | +7·637 | −13·885 | +0·033 | +0·092 | − 6·123 | 17·302 | |
| 14 | W | | 17·225 | +7·691 | −13·919 | +1·580 | +2·205 | − 2·443 | 14·782 | |
| 15 | E | 70° α (1) | 26·200 | +7·688 | −13·949 | −1·404 | +0·478 | − 7·187 | 19·013 | 15·404 |
| 16 | W | | 11·000 | +7·688 | −13·978 | +1·536 | +0·257 | − 4·497 | 6·503 | |
| 17 | E | | 28·525 | +7·659 | −14·006 | −1·340 | +0·478 | − 7·209 | 21·316 | |

Mean 8° 19′ 14″·1117

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | | 14″·725 | +7″·648 | −14″·033 | −0″·238 | +1″·691 | − 4″·932 | 9″·793 | |
| 19 | E | 20° α | 12·050 | +7·663 | −14·055 | +1·953 | +0·037 | − 4·402 | 7·648 | 8″·180 |
| 20 | W | | 11·350 | +7·724 | −14·076 | +0·284 | +0·919 | − 5·149 | 6·201 | |
| 21 | E | | 13·850 | +7·718 | −14·099 | +0·008 | +1·599 | − 4·774 | 9·076 | |
| 22 | W | | 14·675 | +7·700 | −14·119 | −0·461 | +1·966 | − 4·914 | 9·761 | |
| 23 | E | 40° α | 17·950 | +7·633 | −14·134 | +1·405 | −0·331 | − 5·427 | 12·423 | 11·303 |
| 24 | W | | 18·000 | +7·603 | −14·148 | −0·306 | −0·901 | − 7·752 | 10·248 | |
| 25 | W | | 18·475 | +7·602 | −14·162 | +0·956 | −0·092 | − 5·696 | 12·779 | |
| 26 | W | | 16·700 | +7·593 | −14·174 | −0·161 | +0·312 | − 6·430 | 10·270 | |
| 27 | E | 60° α | 20·075 | +7·623 | −14·184 | +1·229 | 0·000 | − 5·332 | 14·743 | 12·377 |
| 28 | W | | 15·650 | +7·607 | −14·192 | +0·038 | +0·404 | − 6·143 | 9·507 | |
| 29 | E | | 21·825 | +7·586 | −14·197 | +0·345 | −0·570 | − 6·836 | 14·989 | |
| 30 | W | | 17·875 | +7·547 | −14·200 | −0·459 | +0·037 | − 7·075 | 10·800 | |
| 31 | E | 30° α (1) | 22·950 | +7·497 | −14·201 | +1·173 | +0·184 | − 5·347 | 17·603 | 13·324 |
| Jan. 1 | W | | 14·325 | +7·519 | −14·201 | +0·779 | +1·636 | − 4·267 | 10·058 | |
| 2 | E | | 19·825 | +7·526 | −14·199 | +0·360 | +1·323 | − 4·990 | 14·835 | |
| 3 | W | | 19·550 | +7·537 | −14·195 | −2·764 | +0·074 | − 9·348 | 10·202 | |
| 4 | E | 50° α (1) | 13·225 | +7·556 | −14·189 | +4·375 | +0·772 | − 1·486 | 11·739 | 11·564 |
| 5 | W | | 19·725 | +7·575 | −14·182 | −3·705 | +1·562 | − 8·750 | 10·975 | |
| 6 | E | | 15·275 | +7·599 | −14·173 | +3·903 | +0·735 | − 1·936 | 13·339 | |
| 7 | W | | 19·500 | +7·586 | −14·161 | −3·180 | +1·286 | − 8·469 | 11·031 | |
| 8 | E | 70° α (1) | 15·125 | +7·606 | −14·148 | +2·519 | −0·276 | − 4·299 | 10·826 | |
| 9 | W | | 15·750 | +7·565 | −14·133 | +0·705 | +0·625 | − 5·238 | 10·512 | 11·238 |
| 10 | E | | 17·675 | +7·587 | −14·117 | −0·486 | +1·158 | − 5·858 | 11·817 | |
| 11 | W | | 15·250 | +7·585 | −14·098 | +0·976 | +2·205 | − 3·332 | 11·918 | |

Mean 8° 19′ 11″·3310

Mean Result of both Faces..... 8° 19′ 12″·7214

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No. 4 (298) 39 ARIETIS *b*. North 10° 31′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | 20° *a* | 46″·475 | +9″·792 | −13″·035 | −0″·314 | −0″·312 | − 3″·869 | 42″·606 | 40″·839 |
| 25 | W | | 41·675 | +9·797 | −13·113 | −0·263 | +0·129 | − 3·450 | 38·225 | |
| 26 | E | | 46·450 | +9·761 | −13·190 | −0·385 | +1·709 | − 2·105 | 44·345 | |
| 27 | W | | 42·850 | +9·746 | −13·264 | −1·154 | 0·000 | − 4·672 | 38·178 | |
| 28 | E | 40° *a* | 47·075 | +9·743 | −13·337 | −2·200 | +1·286 | − 4·508 | 42·567 | 43·866 |
| 29 | W | | 43·300 | +9·697 | −13·411 | +1·431 | +0·459 | − 1·824 | 41·476 | |
| 30 | E | | 50·525 | +9·685 | −13·481 | −1·670 | +0·294 | − 5·172 | 45·353 | |
| Dec. 1 | W | | 48·375 | +9·695 | −13·549 | +1·786 | −0·239 | − 2·307 | 46·068 | |
| 2 | E | 60° *a* | 42·400 | +9·698 | −13·617 | +3·333 | +0·790 | + 0·204 | 42·604 | 43·053 |
| 3 | W | | 47·575 | +9·614 | −13·682 | −4·239 | +1·746 | − 6·561 | 41·014 | |
| 4 | E | | 48·050 | +9·629 | −13·745 | +3·721 | +0·625 | − 0·230 | 47·820 | |
| 5 | W | | 47·875 | +9·678 | −13·807 | −3·671 | +0·698 | − 7·102 | 40·773 | |
| 6 | E | 30° *a* (1) | 49·350 | +9·742 | −13·867 | −0·096 | +1·084 | − 3·137 | 46·213 | 44·805 |
| 7 | W | | 45·625 | +9·777 | −13·926 | +0·516 | +1·029 | − 2·604 | 43·021 | |
| 8 | E | | 50·850 | +9·784 | −13·982 | −0·789 | +1·011 | − 3·976 | 46·874 | |
| 9 | W | | 47·250 | +9·774 | −14·034 | +0·105 | +0·018 | − 4·137 | 43·113 | |
| 10 | E | 50° *a* (1) | 46·800 | +9·758 | −14·088 | −0·705 | +1·746 | − 3·289 | 43·511 | 44·311 |
| 11 | W | | 47·225 | +9·740 | −14·138 | +0·076 | +0·331 | − 3·991 | 43·234 | |
| 12 | E | | 50·450 | +9·725 | −14·189 | −0·404 | +0·037 | − 4·831 | 45·619 | |
| 13 | W | | 49·475 | +9·709 | −14·236 | −0·033 | −0·037 | − 4·597 | 44·878 | |
| 14 | E | 70° *a* (1) | 52·825 | +9·773 | −14·282 | −1·580 | +2·555 | − 3·534 | 49·291 | 45·568 |
| 15 | W | | 41·375 | +9·771 | −14·324 | +1·404 | +1·948 | − 1·201 | 40·174 | |
| 16 | E | | 51·975 | +9·770 | −14·365 | −1·536 | +1·286 | − 4·845 | 47·130 | |
| 17 | W | | 48·000 | +9·732 | −14·406 | +1·340 | +1·011 | − 2·323 | 45·677 | |

Mean 10° 31′ 43″·7403

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | 20° *a* | 41″·900 | +9″·718 | −14″·444 | +0″·238 | +2″·077 | − 2″·411 | 39″·489 | 38″·230 |
| 19 | W | | 42·225 | +9·741 | −14·479 | −1·953 | +1·838 | − 4·853 | 37·372 | |
| 20 | E | | 40·775 | +9·816 | −14·511 | −0·284 | +1·893 | − 3·086 | 37·689 | |
| 21 | W | | 41·225 | +9·807 | −14·546 | −0·008 | +1·893 | − 2·854 | 38·371 | |
| 22 | E | 40° *a* | 44·925 | +9·785 | −14·577 | +0·461 | +1·360 | − 2·971 | 41·954 | 40·674 |
| 23 | W | | 47·075 | +9·703 | −14·604 | −1·405 | −0·294 | − 6·600 | 40·475 | |
| 24 | E | | 46·075 | +9·664 | −14·630 | +0·306 | −2·003 | − 6·663 | 39·412 | |
| 25 | W | | 46·675 | +9·660 | −14·654 | −0·956 | +0·129 | − 5·821 | 40·854 | |
| 26 | E | 60° *a* | 49·050 | +9·651 | −14·678 | +0·161 | −0·184 | − 5·050 | 44·000 | 41·327 |
| 27 | W | | 44·950 | +9·688 | −14·699 | −1·229 | +0·386 | − 5·854 | 39·096 | |
| 28 | E | | 48·300 | +9·666 | −14·718 | −0·038 | +0·441 | − 4·649 | 43·651 | |
| 29 | W | | 44·000 | +9·640 | −14·734 | −0·345 | 0·000 | − 5·439 | 38·561 | |
| 30 | E | 30° *a* (1) | 46·050 | +9·592 | −14·748 | +0·459 | +1·397 | − 3·300 | 42·750 | 41·455 |
| 31 | W | | 45·825 | +9·528 | −14·759 | −1·173 | +0·257 | − 6·147 | 39·678 | |
| Jan. 1 | E | | 47·900 | +9·554 | −14·772 | −0·779 | +1·746 | − 4·251 | 43·649 | |
| 2 | W | | 43·225 | +9·563 | −14·780 | −0·360 | +2·095 | − 3·482 | 39·743 | |
| 3 | E | 50° *a* (1) | 42·300 | +9·580 | −14·786 | +2·764 | +0·919 | − 1·523 | 40·777 | 41·013 |
| 4 | W | | 48·525 | +9·605 | −14·791 | −4·375 | +1·783 | − 7·778 | 40·747 | |
| 5 | E | | 41·375 | +9·631 | −14·793 | +3·705 | +2·518 | + 1·061 | 42·436 | |
| 6 | W | | 47·400 | +9·661 | −14·794 | −3·903 | +1·728 | − 7·308 | 40·092 | |
| 7 | E | 70° *a* (1) | 41·700 | +9·647 | −14·792 | +3·180 | +1·250 | − 0·715 | 40·985 | 41·418 |
| 8 | W | | 47·700 | +9·668 | −14·788 | −2·519 | +0·349 | − 7·290 | 40·410 | |
| 9 | E | | 46·775 | +9·617 | −14·782 | −0·705 | +1·066 | − 4·804 | 41·971 | |
| 10 | W | | 44·275 | +9·645 | −14·775 | +0·486 | +1·819 | − 2·825 | 41·450 | |
| 11 | E | | 46·100 | +9·643 | −14·765 | −0·976 | +2·757 | − 3·341 | 42·759 | |

Mean 10° 31′ 40″·6862

Mean Result of both Faces ..... 10° 31′ 42″·2133

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No. 5 (307) 43 ARIETIS. South 3° 37′ +

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 39″·050 | +3″·340 | +11″·431 | −0″·314 | +0″·184 | +14″·641 | 53″·691 | |
| 25 | E | 20° α | 35·450 | +3·342 | +11·426 | −0·263 | 0·000 | +14·505 | 49·955 | 52″·052 |
| 26 | W | | 40·025 | +3·330 | +11·419 | −0·385 | −0·735 | +13·629 | 53·654 | |
| 27 | E | | 37·325 | +3·324 | +11·411 | −1·154 | 0·000 | +13·581 | 50·906 | |
| 28 | W | | 39·950 | +3·323 | +11·402 | −2·200 | +0·459 | +12·984 | 52·934 | |
| 29 | E | 40° α | 36·675 | +3·308 | +11·394 | +1·431 | 0·000 | +16·133 | 52·808 | 54·766 |
| 30 | W | | 43·225 | +3·304 | +11·384 | −1·670 | +0·349 | +13·367 | 56·592 | |
| Dec. 1 | E | | 40·375 | +3·308 | +11·371 | +1·786 | −0·110 | +16·355 | 56·730 | |
| 2 | W | | 35·450 | +3·308 | +11·360 | +3·333 | −0·625 | +17·376 | 52·826 | |
| 3 | E | 60° α | 40·675 | +3·280 | +11·346 | −4·239 | −0·974 | + 9·413 | 50·088 | 53·602 |
| 4 | W | | 38·125 | +3·284 | +11·330 | +3·721 | −0·276 | +18·059 | 56·184 | |
| 5 | E | | 45·175 | +3·301 | +11·315 | −3·671 | −0·809 | +10·136 | 55·311 | |
| 6 | W | | 45·575 | +3·323 | +11·298 | −0·096 | −0·165 | +14·360 | 59·935 | |
| 7 | E | 30° α (1) | 40·025 | +3·335 | +11·282 | +0·516 | −0·276 | +14·857 | 54·882 | 56·876 |
| 8 | W | | 43·675 | +3·337 | +11·263 | −0·789 | −0·312 | +13·499 | 57·174 | |
| 9 | E | | 39·875 | +3·334 | +11·241 | +0·105 | +0·956 | +15·636 | 55·511 | |
| 10 | W | | 42·200 | +3·329 | +11·222 | −0·705 | −0·110 | +13·736 | 55·936 | |
| 11 | E | 50° α (1) | 41·875 | +3·322 | +11·200 | +0·076 | −0·055 | +14·543 | 56·418 | 56·789 |
| 12 | W | | 42·525 | +3·317 | +11·179 | −0·404 | −0·368 | +13·724 | 56·249 | |
| 13 | E | | 43·400 | +3·312 | +11·156 | −0·033 | +0·717 | +15·152 | 58·552 | |
| 14 | W | | 40·825 | +3·333 | +11·132 | −1·580 | −1·930 | +10·955 | 51·780 | |
| 15 | E | 70° α (1) | 35·575 | +3·333 | +11·107 | +1·404 | −1·838 | +14·006 | 49·581 | 54·646 |
| 16 | W | | 49·675 | +3·332 | +11·080 | −1·536 | −0·864 | +12·012 | 61·687 | |
| 17 | E | | 40·725 | +3·319 | +11·054 | +1·340 | −0·901 | +14·812 | 55·537 | |

Mean 3° 37′ 54″·7885

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 38″·350 | +3″·315 | +11″·027 | +0″·238 | −0″·368 | +14″·212 | 52″·562 | |
| 19 | E | 20° α | 39·525 | +3·323 | +10·998 | −1·953 | −0·956 | +11·412 | 50·937 | 51″·059 |
| 20 | W | | 37·450 | +3·348 | +10·967 | −0·284 | −1·213 | +12·818 | 50·268 | |
| 21 | E | | 37·700 | +3·345 | +10·940 | −0·008 | −1·507 | +12·770 | 50·470 | |
| 22 | W | | 40·750 | +3·338 | +10·910 | +0·461 | −0·643 | +14·066 | 54·816 | |
| 23 | E | 40° α | 38·975 | +3·310 | +10·878 | −1·405 | +0·588 | +13·371 | 52·346 | 53·256 |
| 24 | W | | 39·025 | +3·297 | +10·846 | +0·306 | −0·147 | +14·302 | 53·327 | |
| 25 | E | | 38·925 | +3·295 | +10·813 | −0·956 | +0·459 | +13·611 | 52·536 | |
| 26 | W | | 41·200 | +3·292 | +10·780 | +0·161 | +0·680 | +14·913 | 56·113 | |
| 27 | E | 60° α | 36·375 | +3·304 | +10·746 | −1·229 | −0·037 | +12·784 | 49·159 | 52·778 |
| 28 | W | | 41·925 | +3·297 | +10·712 | −0·038 | −0·074 | +13·897 | 55·822 | |
| 29 | E | | 35·850 | +3·288 | +10·675 | −0·345 | +0·551 | +14·169 | 50·019 | |
| 30 | W | | 40·475 | +3·272 | +10·638 | +0·459 | −1·231 | +13·138 | 53·613 | |
| 31 | E | 30° α (1) | 37·475 | +3·250 | +10·600 | −1·173 | +0·368 | +13·045 | 50·520 | 51·952 |
| Jan. 1 | W | | 41·800 | +3·259 | +10·567 | −0·779 | −0·588 | +12·459 | 54·259 | |
| 2 | E | | 37·750 | +3·262 | +10·528 | −0·360 | −1·764 | +11·666 | 49·416 | |
| 3 | W | | 36·000 | +3·268 | +10·489 | +2·764 | −0·698 | +15·823 | 51·823 | |
| 4 | E | 50° α (1) | 45·350 | +3·277 | +10·449 | −4·375 | −1·158 | + 8·193 | 53·543 | 52·243 |
| 5 | W | | 35·675 | +3·286 | +10·409 | +3·705 | −1·342 | +16·058 | 51·733 | |
| 6 | E | | 42·975 | +3·296 | +10·368 | −3·903 | −0·864 | + 8·897 | 51·872 | |
| 7 | W | | 36·850 | +3·292 | +10·326 | +3·180 | −0·845 | +15·953 | 52·803 | |
| 8 | E | 70° α (1) | 41·250 | +3·298 | +10·284 | −2·519 | +0·110 | +11·173 | 52·423 | |
| 9 | W | | 41·550 | +3·281 | +10·241 | −0·705 | +0·184 | +13·001 | 54·551 | 52·448 |
| 10 | E | | 38·650 | +3·290 | +10·198 | +0·486 | −0·790 | +13·184 | 51·834 | |
| 11 | W | | 40·650 | +3·290 | +10·154 | −0·976 | −2·169 | +10·299 | 50·949 | |

Mean 3° 37′ 52″·2893

Mean Result of both Faces..... 3° 37′ 53″·5389



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## G. T. STATION DAMARGIDA.

No. 6 (314) 46 ARIETIS $\rho^3$. South 0° 39′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 56″·050 | +0″·613 | +11″·753 | +0″·314 | +0″·312 | +12″·992 | 69″·042 | |
| 25 | W | 20° α | 59·500 | +0·613 | +11·764 | +0·263 | −1·268 | +11·372 | 70·872 | 70″·237 |
| 26 | E | | 56·350 | +0·611 | +11·774 | +0·385 | −0·809 | +11·961 | 68·311 | |
| 27 | W | | 59·175 | +0·610 | +11·783 | +1·154 | 0·000 | +13·547 | 72·722 | |
| 28 | E | | 54·300 | +0·610 | +11·790 | +2·200 | 0·000 | +14·600 | 68·900 | |
| 29 | W | 40° α | 61·575 | +0·607 | +11·799 | −1·431 | −0·037 | +10·938 | 72·513 | 72·825 |
| 30 | E | | 59·725 | +0·606 | +11·805 | +1·670 | +0·662 | +14·743 | 74·468 | |
| Dec. 1 | W | | 64·750 | +0·607 | +11·809 | −1·786 | +0·037 | +10·667 | 75·417 | |
| 2 | E | | 60·800 | +0·607 | +11·814 | −3·333 | −0·221 | + 8·867 | 69·667 | |
| 3 | W | 60° α | 53·975 | +0·602 | +11·816 | +4·239 | −0·551 | +16·106 | 70·081 | 70·906 |
| 4 | E | | 61·200 | +0·603 | +11·816 | −3·721 | +0·055 | + 8·753 | 69·953 | |
| 5 | W | | 58·600 | +0·606 | +11·817 | +3·671 | −0·772 | +15·322 | 73·922 | |
| 6 | E | | 59·150 | +0·610 | +11·816 | +0·096 | −0·018 | +12·504 | 71·654 | |
| 7 | W | 30° α (1) | 57·725 | +0·612 | +11·815 | −0·516 | −0·037 | +11·874 | 69·599 | 72·072 |
| 8 | E | | 59·250 | +0·612 | +11·811 | +0·789 | +0·257 | +13·469 | 72·719 | |
| 9 | W | | 61·800 | +0·612 | +11·805 | −0·105 | +0·202 | +12·514 | 74·314 | |
| 10 | E | | 61·600 | +0·611 | +11·801 | +0·705 | −0·018 | +13·099 | 74·699 | |
| 11 | W | 50° α (1) | 61·300 | +0·610 | +11·795 | −0·076 | −0·331 | +11·998 | 73·298 | 73·922 |
| 12 | E | | 62·175 | +0·609 | +11·788 | +0·404 | +0·018 | +12·819 | 74·994 | |
| 13 | W | | 60·275 | +0·608 | +11·780 | +0·033 | 0·000 | +12·421 | 72·696 | |
| 14 | E | | 55·275 | +0·612 | +11·771 | +1·580 | −1·250 | +12·713 | 67·988 | |
| 15 | W | 70° α (1) | 66·475 | +0·611 | +11·760 | −1·404 | −2·003 | + 8·964 | 75·439 | 73·701 |
| 16 | E | | 61·275 | +0·611 | +11·747 | +1·536 | −0·202 | +13·692 | 74·967 | |
| 17 | W | | 66·250 | +0·609 | +11·736 | −1·340 | −0·845 | +10·160 | 76·410 | |

Mean 0° 40′ 12″·2772

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 57″·525 | +0″·608 | +11″·722 | −0″·238 | +0″·055 | +12″·147 | 69″·672 | |
| 19 | W | 20° α | 55·400 | +0·610 | +11·706 | +1·953 | +0·239 | +14·508 | 69·908 | 68″·862 |
| 20 | E | | 57·350 | +0·614 | +11·689 | +0·284 | −0·974 | +11·613 | 68·963 | |
| 21 | W | | 56·225 | +0·614 | +11·675 | +0·008 | −1·617 | +10·680 | 66·905 | |
| 22 | E | | 56·750 | +0·612 | +11·659 | −0·461 | +0·276 | +12·086 | 68·836 | |
| 23 | W | 40° α | 56·000 | +0·607 | +11·640 | +1·405 | +0·570 | +14·222 | 70·222 | 69·678 |
| 24 | E | | 57·425 | +0·605 | +11·620 | −0·306 | −1·268 | +10·651 | 68·076 | |
| 25 | W | | 57·500 | +0·605 | +11·599 | +0·956 | +0·919 | +14·079 | 71·579 | |
| 26 | E | | 56·300 | +0·604 | +11·579 | −0·161 | +0·092 | +12·114 | 68·414 | |
| 27 | W | 60° α | 58·475 | +0·606 | +11·557 | +1·229 | +0·680 | +14·072 | 72·517 | 70·405 |
| 28 | E | | 56·550 | +0·605 | +11·535 | +0·038 | 0·000 | +12·178 | 68·728 | |
| 29 | W | | 59·025 | +0·603 | +11·509 | +0·345 | +0·478 | +12·935 | 71·960 | |
| 30 | E | | 57·650 | +0·600 | +11·484 | −0·459 | −0·937 | +10·688 | 68·338 | |
| 31 | W | 30° α (1) | 57·050 | +0·596 | +11·457 | +1·173 | +0·349 | +13·575 | 70·625 | 69·564 |
| Jan. 1 | E | | 56·125 | +0·598 | +11·436 | +0·779 | −0·643 | +12·170 | 68·295 | |
| 2 | W | | 59·825 | +0·598 | +11·408 | +0·360 | −1·195 | +11·171 | 70·996 | |
| 3 | E | | 61·025 | +0·600 | +11·379 | −2·764 | +0·662 | + 9·877 | 70·902 | |
| 4 | W | 50° α (1) | 52·650 | +0·601 | +11·349 | +4·375 | −0·074 | +16·251 | 68·901 | 69·873 |
| 5 | E | | 62·550 | +0·603 | +11·319 | −3·705 | −1·048 | + 7·169 | 69·719 | |
| 6 | W | | 54·375 | +0·605 | +11·288 | +3·903 | −0·202 | +15·594 | 69·969 | |
| 7 | E | | 63·800 | +0·604 | +11·255 | −3·180 | −0·754 | + 7·925 | 71·725 | |
| 8 | W | 70° α (1) | 55·825 | +0·605 | +11·222 | +2·519 | +0·349 | +14·695 | 70·520 | |
| 9 | E | | 57·250 | +0·602 | +11·188 | +0·705 | −0·239 | +12·256 | 69·506 | 70·315 |
| 10 | W | | 58·950 | +0·604 | +11·153 | −0·486 | −1·305 | + 9·966 | 68·916 | |
| 11 | E | | 60·775 | +0·604 | +11·117 | +0·976 | −1·966 | +10·731 | 71·506 | |

Mean 0° 40′ 10″·7828

Mean Result of both Faces..... 0° 40′ 11″·5300

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## G. T. STATION DAMARGIDA.

### No. 7 (326) 49 ARIETIS. North 7° 46′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Nov. 24 | W | | 29·050 | +7·197 | −12·513 | +0·314 | −0·735 | − 5·737 | 23·313 | |
| 25 | E | a 20° | 33·800 | +7·199 | −12·574 | +0·263 | +1·121 | − 3·991 | 29·809 | 27·091 |
| 26 | W | | 29·575 | +7·177 | −12·634 | +0·385 | +1·617 | − 3·455 | 26·120 | |
| 27 | E | | 33·500 | +7·161 | −12·692 | +1·154 | 0·000 | − 4·377 | 29·123 | |
| 28 | W | | 28·650 | +7·160 | −12·749 | +2·200 | +1·581 | − 1·808 | 26·842 | |
| 29 | E | a 40° | 36·725 | +7·126 | −12·806 | −1·431 | +0·625 | − 6·486 | 30·239 | 29·726 |
| 30 | W | | 30·875 | +7·119 | −12·861 | +1·670 | +0·037 | − 4·035 | 26·840 | |
| Dec. 1 | E | | 42·150 | +7·129 | −12·913 | −1·786 | +0·404 | − 7·166 | 34·984 | |
| 2 | W | | 35·900 | +7·127 | −12·966 | −3·333 | +0·184 | − 8·988 | 26·912 | |
| 3 | E | a 60° | 30·925 | +7·067 | −13·016 | +4·239 | +1·124 | − 0·586 | 30·339 | 28·349 |
| 4 | W | | 35·275 | +7·075 | −13·064 | −3·721 | +0·331 | − 9·379 | 25·896 | |
| 5 | E | | 31·325 | +7·116 | −13·112 | +3·671 | +1·250 | − 1·075 | 30·250 | |
| 6 | W | | 29·975 | +7·158 | −13·158 | +0·096 | +1·176 | − 4·728 | 25·247 | |
| 7 | E | a (1) 30° | 34·925 | +7·185 | −13·204 | −0·516 | +0·055 | − 6·480 | 28·445 | 28·175 |
| 8 | W | | 32·550 | +7·189 | −13·246 | +0·789 | +0·110 | − 5·158 | 27·392 | |
| 9 | E | | 37·050 | +7·185 | −13·285 | −0·105 | +0·772 | − 5·433 | 31·617 | |
| 10 | W | | 33·750 | +7·172 | −13·326 | +0·705 | −0·037 | − 5·486 | 28·264 | |
| 11 | E | a (1) 50° | 39·400 | +7·159 | −13·364 | −0·076 | +0·386 | − 5·895 | 33·505 | 31·077 |
| 12 | W | | 35·550 | +7·146 | −13·402 | +0·404 | 0·000 | − 5·852 | 29·698 | |
| 13 | E | | 39·125 | +7·138 | −13·437 | +0·033 | −0·018 | − 6·284 | 32·841 | |
| 14 | W | | 27·550 | +7·180 | −13·472 | +1·580 | +1·801 | − 2·911 | 24·639 | |
| 15 | E | a (1) 70° | 40·350 | +7·179 | −13·503 | −1·404 | +1·985 | − 5·743 | 34·607 | 30·188 |
| 16 | W | | 32·025 | +7·177 | −13·533 | +1·536 | +1·121 | − 3·699 | 28·326 | |
| 17 | E | | 40·250 | +7·151 | −13·563 | −1·340 | +0·680 | − 7·072 | 33·178 | |

Mean 7° 46′ 29″·1010

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Dec. 18 | W | | 30·000 | +7·140 | −13·591 | −0·238 | +2·242 | − 4·447 | 25·553 | |
| 19 | E | a 20° | 30·300 | +7·163 | −13·616 | +1·953 | +0·625 | − 3·875 | 26·425 | 25·450 |
| 20 | W | | 28·775 | +7·214 | −13·639 | +0·284 | +1·856 | − 4·285 | 24·490 | |
| 21 | E | | 30·200 | +7·205 | −13·664 | +0·008 | +1·581 | − 4·870 | 25·330 | |
| 22 | W | | 31·650 | +7·190 | −13·687 | −0·461 | +0·110 | − 6·848 | 24·802 | |
| 23 | E | a 40° | 33·800 | +7·134 | −13·706 | +1·405 | +0·037 | − 5·130 | 28·670 | 26·726 |
| 24 | W | | 33·500 | +7·104 | −13·723 | −0·306 | −1·415 | − 8·340 | 25·160 | |
| 25 | E | | 34·250 | +7·098 | −13·740 | +0·956 | −0·294 | − 5·980 | 28·270 | |
| 26 | W | | 32·725 | +7·094 | −13·756 | −0·161 | −0·092 | − 6·915 | 25·810 | |
| 27 | E | a 60° | 35·375 | +7·119 | −13·771 | +1·229 | −0·368 | − 5·791 | 29·584 | 27·648 |
| 28 | W | | 30·875 | +7·101 | −13·783 | +0·038 | +0·404 | − 6·240 | 24·635 | |
| 29 | E | | 37·150 | +7·082 | −13·792 | +0·345 | −0·221 | − 6·586 | 30·564 | |
| 30 | W | | 33·750 | +7·049 | −13·800 | −0·459 | +0·551 | − 6·659 | 27·091 | |
| 31 | E | a (1) 30° | 34·750 | +7·002 | −13·806 | +1·173 | +0·312 | − 5·319 | 29·431 | 28·255 |
| Jan. 1 | W | | 30·450 | +7·019 | −13·821 | +0·779 | +1·103 | − 4·920 | 25·530 | |
| 2 | E | | 35·825 | +7·026 | −13·824 | +0·360 | +1·581 | − 4·857 | 30·968 | |
| 3 | W | | 35·600 | +7·042 | −13·826 | −2·764 | −0·698 | −10·246 | 25·354 | |
| 4 | E | a (1) 50° | 29·025 | +7·062 | −13·826 | +4·375 | +0·533 | − 1·856 | 27·169 | 27·329 |
| 5 | W | | 36·400 | +7·082 | −13·825 | −3·705 | +1·415 | − 9·033 | 27·367 | |
| 6 | E | | 31·175 | +7·105 | −13·823 | +3·903 | +1·066 | − 1·749 | 29·426 | |
| 7 | W | | 35·025 | +7·098 | −13·818 | −3·180 | +0·901 | − 8·999 | 26·026 | |
| 8 | E | a (1) 70° | 31·450 | +7·108 | −13·811 | +2·519 | −0·074 | − 4·258 | 27·192 | 27·532 |
| 9 | W | | 32·025 | +7·071 | −13·804 | +0·705 | +0·698 | − 5·330 | 26·695 | |
| 10 | E | | 34·975 | +7·092 | −13·794 | −0·486 | +1·342 | − 5·846 | 29·129 | |
| 11 | W | | 31·500 | +7·091 | −13·783 | +0·976 | +2·205 | − 3·511 | 27·989 | |

Mean 7° 46′ 27″·1567

Mean Result of both Faces..... 7° 46′ 28″·1289

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## G. T. STATION DAMARGIDA.

No. 8 (342) 53 ARIETIS. South 0° 47′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 19″·000 | +0″·726 | +11″·660 | +0″·314 | +0″·754 | +13″·454 | 32″·454 | |
| 25 | W | α | 22·175 | +0·726 | +11·668 | +0·263 | −0·368 | +12·289 | 34·464 | 33″·761 |
| 26 | E | 20° | 19·750 | +0·724 | +11·677 | +0·385 | −0·294 | +12·492 | 32·242 | |
| 27 | W | | 22·325 | +0·722 | +11·683 | +1·154 | 0·000 | +13·559 | 35·884 | |
| 28 | E | | 18·125 | +0·722 | +11·688 | +2·200 | −1·305 | +13·305 | 31·430 | |
| 29 | W | α | 25·675 | +0·719 | +11·695 | −1·431 | −0·459 | +10·524 | 36·199 | 34·705 |
| 30 | E | 40° | 19·225 | +0·718 | +11·699 | +1·670 | −0·294 | +13·793 | 33·018 | |
| Dec. 1 | W | | 27·775 | +0·719 | +11·702 | −1·786 | −0·239 | +10·396 | 38·171 | |
| 2 | E | | 23·575 | +0·719 | +11·705 | −3·333 | 0·000 | + 9·091 | 32·666 | |
| 3 | W | α | 16·675 | +0·713 | +11·705 | +4·239 | −1·103 | +15·554 | 32·229 | 33·800 |
| 4 | E | 60° | 25·350 | +0·714 | +11·704 | −3·721 | −0·092 | + 8·605 | 33·955 | |
| 5 | W | | 21·450 | +0·718 | +11·704 | +3·671 | −1·195 | +14·898 | 36·348 | |
| 6 | E | | 21·925 | +0·722 | +11·701 | +0·096 | −0·882 | +11·637 | 33·562 | |
| 7 | W | α (1) | 20·325 | +0·725 | +11·699 | −0·516 | +0·368 | +12·276 | 32·601 | 34·169 |
| 8 | E | 30° | 21·325 | +0·725 | +11·694 | +0·789 | −0·992 | +12·216 | 33·541 | |
| 9 | W | | 25·475 | +0·725 | +11·687 | −0·105 | −0·809 | +11·498 | 36·973 | |
| 10 | E | | 26·625 | +0·724 | +11·682 | +0·705 | −0·515 | +12·596 | 39·221 | |
| 11 | W | α (1) | 24·300 | +0·722 | +11·674 | −0·076 | −0·037 | +12·283 | 36·583 | |
| 12 | E | 50° | 22·600 | +0·721 | +11·667 | +0·404 | −0·478 | +12·314 | 34·914 | 37·510 |
| 13 | W | | 25·900 | +0·720 | +11·658 | +0·033 | +1·011 | +13·422 | 39·322 | |
| 14 | E | | 20·900 | +0·724 | +11·649 | +1·580 | −2·205 | +11·748 | 32·648 | |
| 15 | W | α (1) | 29·800 | +0·724 | +11·637 | −1·404 | −1·397 | + 9·560 | 39·360 | |
| 16 | E | 70° | 23·625 | +0·724 | +11·624 | +1·536 | −1·838 | +12·046 | 35·671 | 37·084 |
| 17 | W | | 29·700 | +0·721 | +11·612 | −1·340 | −0·037 | +10·956 | 40·656 | |

Mean 0° 47′ 35″·1715

### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 19″·450 | +0″·720 | +11″·599 | −0″·238 | −2″·297 | + 9″·784 | 29″·234 | |
| 19 | W | α | 18·450 | +0·723 | +11·583 | +1·953 | −1·764 | +12·495 | 30·945 | 30″·036 |
| 20 | E | 20° | 18·550 | +0·728 | +11·566 | +0·284 | −0·974 | +11·604 | 30·154 | |
| 21 | W | | 18·975 | +0·727 | +11·552 | +0·008 | −1·452 | +10·835 | 29·810 | |
| 22 | E | | 21·375 | +0·725 | +11·536 | −0·461 | −1·084 | +10·716 | 32·091 | |
| 23 | W | α | 20·375 | +0·720 | +11·516 | +1·405 | −0·607 | +13·034 | 33·409 | 32·786 |
| 24 | E | 40° | 19·900 | +0·717 | +11·497 | −0·306 | +1·378 | +13·286 | 33·186 | |
| 25 | W | | 19·675 | +0·716 | +11·477 | +0·956 | −0·368 | +12·781 | 32·456 | |
| 26 | E | | 17·625 | +0·716 | +11·457 | −0·161 | +0·386 | +12·398 | 30·023 | |
| 27 | W | α | 20·425 | +0·718 | +11·436 | +1·229 | −0·386 | +12·997 | 33·422 | 32·106 |
| 28 | E | 60° | 18·375 | +0·716 | +11·415 | +0·038 | −0·349 | +11·820 | 30·195 | |
| 29 | W | | 21·600 | +0·714 | +11·390 | +0·345 | +0·735 | +13·184 | 34·784 | |
| 30 | E | | 20·325 | +0·711 | +11·365 | −0·459 | −0·312 | +11·305 | 31·630 | |
| 31 | W | α (1) | 21·525 | +0·706 | +11·340 | +1·173 | −0·349 | +12·870 | 34·395 | 32·489 |
| Jan. 1 | E | 30° | 19·425 | +0·708 | +11·323 | +0·779 | −1·048 | +11·762 | 31·187 | |
| 2 | W | | 22·125 | +0·709 | +11·296 | +0·360 | −1·746 | +10·619 | 32·744 | |
| 3 | E | | 23·125 | +0·711 | +11·268 | −2·764 | −0·257 | + 8·958 | 32·083 | |
| 4 | W | α (1) | 14·925 | +0·713 | +11·240 | +4·375 | −1·544 | +14·784 | 29·709 | |
| 5 | E | 50° | 25·050 | +0·715 | +11·211 | −3·705 | −1·470 | + 6·751 | 31·801 | 31·542 |
| 6 | W | | 18·150 | +0·717 | +11·182 | +3·903 | −1·378 | +14·424 | 32·574 | |
| 7 | E | | 26·000 | +0·716 | +11·151 | −3·180 | −0·845 | + 7·842 | 33·842 | |
| 8 | W | α (1) | 18·675 | +0·717 | +11·119 | +2·519 | +0·018 | +14·373 | 33·048 | |
| 9 | E | 70° | 20·150 | +0·713 | +11·087 | +0·705 | −0·533 | +11·972 | 32·122 | 32·741 |
| 10 | W | | 22·025 | +0·716 | +11·054 | −0·486 | −0·882 | +10·402 | 32·427 | |
| 11 | E | | 21·725 | +0·716 | +11·020 | +0·976 | −2·169 | +10·543 | 32·268 | |

Mean 0° 47′ 31″·9500

**Mean Result of both Faces.....0° 47′ 33″·5608**

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## G. T. STATION DAMARGIDA.

No. 9 (351) 56 ARIETIS *i*. North 8° 35′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 54″·125 | + 7″·972 | −12″·374 | +0″·314 | −0″·607 | −4″·695 | 49″·430 | |
| 25 | E | 20° *a* | 59·950 | + 7·975 | −12·439 | +0·263 | +0·018 | −4·183 | 55·767 | 53″·058 |
| 26 | W | | 54·825 | + 7·954 | −12·504 | +0·385 | −1·048 | −5·213 | 49·612 | |
| 27 | E | | 60·500 | + 7·931 | −12·565 | +1·154 | +0·404 | −3·076 | 57·424 | |
| 28 | W | | 56·025 | + 7·931 | −12·627 | +2·200 | −0·368 | −2·864 | 53·161 | |
| 29 | E | 40° *a* | 62·025 | + 7·893 | −12·689 | −1·431 | +0·257 | −5·970 | 56·055 | 55·781 |
| 30 | W | | 57·850 | + 7·887 | −12·748 | +1·670 | +0·110 | −3·081 | 54·769 | |
| Dec. 1 | E | | 65·700 | + 7·900 | −12·805 | −1·786 | +0·129 | −6·562 | 59·138 | |
| 2 | W | | 60·350 | + 7·895 | −12·862 | −3·333 | +0·037 | −8·263 | 52·087 | |
| 3 | E | 60° *a* | 55·725 | + 7·830 | −12·917 | +4·239 | +0·956 | +0·108 | 55·833 | 54·864 |
| 4 | W | | 63·000 | + 7·836 | −12·970 | −3·721 | 0·000 | −8·855 | 54·145 | |
| 5 | E | | 58·250 | + 7·885 | −13·023 | +3·671 | +0·607 | −0·860 | 57·390 | |
| 6 | W | | 57·475 | + 7·928 | −13·073 | +0·096 | +0·992 | −4·057 | 53·418 | |
| 7 | E | 30° *a* (1) | 59·250 | + 7·960 | −13·124 | −0·516 | −0·257 | −5·937 | 53·313 | 55·110 |
| 8 | W | | 58·675 | + 7·963 | −13·171 | +0·789 | +0·625 | −3·794 | 54·881 | |
| 9 | E | | 63·325 | + 7·960 | −13·216 | −0·105 | +0·864 | −4·497 | 58·828 | |
| 10 | W | | 60·050 | + 7·946 | −13·262 | +0·705 | +2·279 | −2·332 | 57·718 | |
| 11 | E | 50° *a* (1) | 65·625 | + 7·932 | −13·305 | −0·076 | +0·037 | −5·412 | 60·213 | 59·163 |
| 12 | W | | 62·900 | + 7·916 | −13·349 | +0·404 | +1·581 | −3·448 | 59·452 | |
| 13 | E | | 64·200 | + 7·910 | −13·389 | +0·033 | +0·515 | −4·931 | 59·269 | |
| 14 | W | | 55·650 | + 7·952 | −13·429 | +1·580 | +2·205 | −1·692 | 53·958 | |
| 15 | E | 70° *a* (1) | 66·875 | + 7·952 | −13·466 | −1·404 | +1·378 | −5·540 | 61·335 | 57·542 |
| 16 | W | | 56·925 | + 7·949 | −13·502 | +1·536 | +1·801 | −2·216 | 54·709 | |
| 17 | E | | 66·975 | + 7·920 | −13·538 | −1·340 | +0·147 | −6·811 | 60·164 | |

Mean 8° 35′ 55″·9197

### Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 54″·625 | + 7″·907 | −13″·571 | −0″·238 | +1″·691 | −4″·211 | 50″·414 | |
| 19 | E | 20° *a* | 56·550 | + 7·937 | −13·602 | +1·953 | +1·783 | −1·929 | 54·621 | 50″·670 |
| 20 | W | | 52·200 | + 7·991 | −13·631 | +0·284 | +0·515 | −4·841 | 47·359 | |
| 21 | E | | 53·700 | + 7·980 | −13·662 | +0·008 | +2·261 | −3·413 | 50·287 | |
| 22 | W | | 56·450 | + 7·964 | −13·691 | −0·461 | +0·864 | −5·324 | 51·126 | |
| 23 | E | 40° *a* | 59·000 | + 7·904 | −13·716 | +1·405 | +0·110 | −4·297 | 54·703 | 53·377 |
| 24 | W | | 59·600 | + 7·870 | −13·740 | −0·306 | −1·268 | −7·444 | 52·156 | |
| 25 | E | | 60·100 | + 7·862 | −13·763 | +0·956 | +0·368 | −4·577 | 55·523 | |
| 26 | W | | 57·225 | + 7·860 | −13·785 | −0·161 | +0·294 | −5·792 | 51·433 | |
| 27 | E | 60° *a* | 61·250 | + 7·886 | −13·805 | +1·229 | +0·037 | −4·653 | 56·597 | 54·115 |
| 28 | W | | 57·725 | + 7·864 | −13·824 | +0·038 | +0·037 | −5·885 | 51·840 | |
| 29 | E | | 62·700 | + 7·843 | −13·839 | +0·345 | −0·459 | −6·110 | 56·590 | |
| 30 | W | | 58·125 | + 7·809 | −13·854 | −0·459 | +0·312 | −6·192 | 51·933 | |
| 31 | E | 30° *a* (1) | 60·675 | + 7·757 | −13·866 | +1·173 | +0·717 | −4·219 | 56·456 | 54·413 |
| Jan. 1 | W | | 55·625 | + 7·773 | −13·891 | +0·779 | +1·121 | −4·218 | 51·407 | |
| 2 | E | | 61·850 | + 7·781 | −13·901 | +0·360 | +1·764 | −3·996 | 57·854 | |
| 3 | W | | 60·775 | + 7·803 | −13·910 | −2·764 | +0·129 | −8·742 | 52·033 | |
| 4 | E | 50° *a* (1) | 55·525 | + 7·826 | −13·916 | +4·375 | +1·966 | +0·251 | 55·776 | 54·428 |
| 5 | W | | 61·850 | + 7·849 | −13·922 | −3·705 | +1·728 | −8·050 | 53·800 | |
| 6 | E | | 56·375 | + 7·875 | −13·926 | +3·903 | +1·875 | −0·273 | 56·102 | |
| 7 | W | | 61·475 | + 7·869 | −13·927 | −3·180 | +0·992 | −8·246 | 53·229 | |
| 8 | E | 70° *a* (1) | 57·450 | + 7·876 | −13·928 | +2·519 | −0·331 | −3·864 | 53·586 | |
| 9 | W | | 58·400 | + 7·835 | −13·926 | +0·705 | 0·000 | −5·386 | 53·014 | 54·227 |
| 10 | E | | 61·575 | + 7·859 | −13·924 | −0·486 | +1·029 | −5·522 | 56·053 | |
| 11 | W | | 57·650 | + 7·858 | −13·919 | +0·976 | +2·095 | −2·990 | 54·660 | |

Mean 8° 35′ 53″·5383

Mean Result of both Faces ..... 8° 35′ 54″·7290

2 T

## G. T. STATION DAMARGIDA.

### No. 10 (359) Tauri. North 10° 24′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 49″·775 | +9″·691 | −12″·307 | −0″·314 | +0″·423 | − 2″·507 | 47″·268 | |
| 25 | W | α 20° | 45·825 | +9·693 | −12·382 | −0·263 | +0·845 | − 2·107 | 43·718 | 44″·833 |
| 26 | E | | 49·075 | +9·670 | −12·457 | −0·385 | −0·901 | − 4·073 | 45·002 | |
| 27 | W | | 46·725 | +9·639 | −12·529 | −1·154 | +0·662 | − 3·382 | 43·343 | |
| 28 | E | | 51·400 | +9·640 | −12·601 | −2·200 | +0·165 | − 4·996 | 46·404 | |
| 29 | W | α 40° | 46·575 | +9·593 | −12·673 | +1·431 | +0·239 | − 1·410 | 45·165 | 47·262 |
| 30 | E | | 55·900 | +9·587 | −12·742 | −1·670 | −0·018 | − 4·843 | 51·057 | |
| Dec. 1 | W | | 46·500 | +9·605 | −12·810 | +1·786 | +1·342 | − 0·077 | 46·423 | |
| 2 | E | | 46·200 | +9·596 | −12·877 | +3·333 | +0·754 | + 0·806 | 47·006 | |
| 3 | W | α 60° | 51·675 | +9·519 | −12·942 | −4·239 | +1·452 | − 6·210 | 45·465 | 47·177 |
| 4 | E | | 50·550 | +9·523 | −13·006 | +3·721 | +0·772 | + 1·010 | 51·560 | |
| 5 | W | | 50·875 | +9·587 | −13·069 | −3·671 | +0·956 | − 6·197 | 44·678 | |
| 6 | E | | 49·825 | +9·636 | −13·130 | −0·096 | +1·581 | − 2·009 | 47·816 | |
| 7 | W | α (1) 30° | 48·050 | +9·675 | −13·191 | +0·516 | +0·331 | − 2·669 | 45·381 | 46·997 |
| 8 | E | | 50·925 | +9·677 | −13·257 | −0·789 | +0·725 | − 3·644 | 47·281 | |
| 9 | W | | 49·475 | +9·677 | −13·308 | +0·105 | +1·562 | − 1·964 | 47·511 | |
| 10 | E | | 53·350 | +9·660 | −13·361 | −0·705 | +2·040 | − 2·366 | 50·984 | |
| 11 | W | α (1) 50° | 50·900 | +9·643 | −13·415 | +0·076 | −0·074 | − 3·770 | 47·130 | 50·408 |
| 12 | E | | 56·125 | +9·621 | −13·469 | −0·404 | +1·617 | − 2·635 | 53·490 | |
| 13 | W | | 53·450 | +9·617 | −13·520 | −0·033 | +0·515 | − 3·421 | 50·029 | |
| 14 | E | | 54·350 | +9·663 | −13·570 | −1·580 | +2·334 | − 3·153 | 51·197 | |
| 15 | W | α (1) 70° | 42·500 | +9·665 | −13·618 | +1·404 | +1·930 | − 0·619 | 41·881 | 49·048 |
| 16 | E | | 56·850 | +9·660 | −13·664 | −1·536 | +2·775 | − 2·765 | 54·085 | |
| 17 | W | | 50·525 | +9·625 | −13·711 | +1·340 | +1·250 | − 1·496 | 49·029 | |

Mean 10° 24′ 47″·6208

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 50″·525 | +9″·609 | −13″·755 | +0″·238 | +1″·985 | − 1″·923 | 48″·602 | |
| 19 | W | α 20° | 50·600 | +9·650 | −13·796 | −1·953 | +1·893 | − 4·206 | 46·394 | 46″·101 |
| 20 | E | | 48·100 | +9·712 | −13·835 | −0·284 | +1·581 | − 2·826 | 45·274 | |
| 21 | W | | 45·950 | +9·697 | −13·877 | −0·008 | +2·371 | − 1·817 | 44·133 | |
| 22 | E | | 47·950 | +9·679 | −13·916 | +0·461 | +1·672 | − 2·104 | 45·846 | |
| 23 | W | α 40° | 50·875 | +9·610 | −13·952 | −1·405 | −0·368 | − 6·115 | 44·760 | 45·371 |
| 24 | E | | 50·850 | +9·568 | −13·986 | +0·306 | −1·323 | − 5·435 | 45·415 | |
| 25 | W | | 50·350 | +9·555 | −14·019 | −0·956 | +0·533 | − 4·887 | 45·463 | |
| 26 | E | | 52·450 | +9·555 | −14·051 | +0·161 | −0·055 | − 4·390 | 48·060 | |
| 27 | W | α 60° | 49·550 | +9·584 | −14·082 | −1·229 | −0·698 | − 6·425 | 43·125 | 45·927 |
| 28 | E | | 53·375 | +9·557 | −14·111 | −0·038 | +0·037 | − 4·555 | 48·820 | |
| 29 | W | | 49·425 | +9·531 | −14·137 | −0·345 | −0·772 | − 5·723 | 43·702 | |
| 30 | E | | 50·550 | +9·492 | −14·161 | +0·459 | +0·515 | − 3·695 | 46·855 | |
| 31 | W | α (1) 30° | 49·625 | +9·429 | −14·184 | −1·173 | +1·048 | − 4·880 | 44·745 | 46·096 |
| Jan. 1 | E | | 51·650 | +9·446 | −14·222 | −0·779 | +0·882 | − 4·673 | 46·977 | |
| 2 | W | | 47·975 | +9·455 | −14·242 | −0·360 | +2·977 | − 2·170 | 45·805 | |
| 3 | E | | 47·400 | +9·485 | −14·260 | +2·764 | +0·312 | − 1·699 | 45·701 | |
| 4 | W | α (1) 50° | 54·025 | +9·514 | −14·276 | −4·375 | +2·242 | − 6·895 | 47·130 | 46·593 |
| 5 | E | | 46·450 | +9·544 | −14·291 | +3·705 | +2·352 | + 1·310 | 47·760 | |
| 6 | W | | 52·575 | +9·576 | −14·305 | −3·903 | +1·838 | − 6·794 | 45·781 | |
| 7 | E | | 45·525 | +9·571 | −14·316 | +3·180 | +1·599 | + 0·034 | 45·559 | |
| 8 | W | α (1) 70° | 52·625 | +9·575 | −14·325 | −2·519 | −0·368 | − 7·637 | 44·988 | |
| 9 | E | | 50·525 | +9·526 | −14·333 | −0·705 | −0·055 | − 5·567 | 44·958 | 45·422 |
| 10 | W | | 49·075 | +9·555 | −14·340 | +0·486 | +1·231 | − 3·068 | 46·007 | |
| 11 | E | | 49·325 | +9·554 | −14·344 | −0·976 | +1·966 | − 3·800 | 45·525 | |

Mean 10° 24′ 45″·9183

Mean Result of both Faces ..... 10° 24′ 46″·7696

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No. 11 (369) 64 ARIETIS *g*. North 6° 6′+

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 10″·375 | +5″·639 | −11″·960 | +0″·314 | +0″·625 | − 5″·382 | 4″·993 | |
| 25 | E | | 14·400 | +5·640 | −12·008 | +0·263 | +1·709 | − 4·396 | 10·004 | 6″·959 |
| 26 | W | 20° *a* | 10·275 | +5·628 | −12·055 | +0·385 | −1·066 | − 7·108 | 3·167 | |
| 27 | E | | 14·200 | +5·609 | −12·101 | +1·154 | +0·809 | − 4·529 | 9·671 | |
| 28 | W | | 9·750 | +5·610 | −12·146 | +2·200 | +1·231 | − 3·105 | 6·645 | |
| 29 | E | | 15·950 | +5·582 | −12·192 | −1·431 | +0·165 | − 7·876 | 8·074 | |
| 30 | W | 40° *a* | 11·100 | +5·579 | −12·235 | +1·670 | 0·000 | − 4·986 | 6·114 | 8·046 |
| Dec. 1 | E | | 18·225 | +5·590 | −12·276 | −1·786 | +1·599 | − 6·873 | 11·352 | |
| 2 | W | | 14·750 | +5·584 | −12·318 | −3·333 | +0·717 | − 9·350 | 5·400 | |
| 3 | E | | 9·775 | +5·539 | −12·358 | +4·239 | +1·213 | − 1·367 | 8·408 | |
| 4 | W | 60° *a* | 15·475 | +5·541 | −12·396 | −3·721 | +0·478 | −10·098 | 5·377 | 6·814 |
| 5 | E | | 10·225 | +5·579 | −12·434 | +3·671 | +1·029 | − 2·155 | 8·070 | |
| 6 | W | | 12·125 | +5·607 | −12·478 | +0·096 | +0·882 | − 5·885 | 6·240 | |
| 7 | E | | 15·175 | +5·630 | −12·506 | −0·516 | +0·607 | − 6·785 | 8·390 | |
| 8 | W | 30° *a* (i) | 13·825 | +5·631 | −12·539 | +0·789 | +0·331 | − 5·788 | 8·037 | 8·525 |
| 9 | E | | 17·225 | +5·631 | −12·570 | −0·105 | +1·250 | − 5·794 | 11·431 | |
| 10 | W | | 12·950 | +5·621 | −12·603 | +0·705 | +1·434 | − 4·843 | 8·107 | |
| 11 | E | | 21·325 | +5·612 | −12·633 | −0·076 | +0·165 | − 6·932 | 14·393 | |
| 12 | W | 50° *a* (i) | 15·950 | +5·599 | −12·663 | +0·404 | +0·092 | − 6·568 | 9·382 | 10·965 |
| 13 | E | | 19·000 | +5·597 | −12·691 | +0·033 | +0·037 | − 7·024 | 11·976 | |
| 14 | W | | 8·025 | +5·623 | −12·718 | +1·580 | +1·728 | − 3·787 | 4·238 | |
| 15 | E | | 19·150 | +5·624 | −12·743 | −1·404 | +1·911 | − 6·612 | 12·538 | |
| 16 | W | 70° *a* (i) | 11·925 | +5·621 | −12·767 | +1·536 | +2·261 | − 3·349 | 8·576 | 9·186 |
| 17 | E | | 18·450 | +5·601 | −12·791 | −1·340 | +1·470 | − 7·060 | 11·390 | |

Mean 6° 6′ 8″·4158

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | | 12″·125 | +5″·591 | −12″·813 | −0″·238 | +1″·103 | − 6″·357 | 5″·768 | |
| 19 | E | | 10·525 | +5·616 | −12·833 | +1·953 | +0·533 | − 4·731 | 5·794 | 4″·718 |
| 20 | W | 20° *a* | 9·375 | +5·652 | −12·851 | +0·284 | +1·672 | − 5·243 | 4·132 | |
| 21 | E | | 8·525 | +5·642 | −12·872 | +0·008 | +1·875 | − 5·347 | 3·178 | |
| 22 | W | | 11·400 | +5·632 | −12·890 | −0·461 | +0·864 | − 6·855 | 4·545 | |
| 23 | E | | 13·350 | +5·593 | −12·905 | +1·405 | −0·312 | − 6·219 | 7·131 | |
| 24 | W | 40° *a* | 13·550 | +5·568 | −12·919 | −0·306 | −1·048 | − 8·705 | 4·845 | 6·381 |
| 25 | E | | 15·125 | +5·560 | −12·933 | +0·956 | +0·294 | − 6·123 | 9·002 | |
| 26 | W | | 11·800 | +5·560 | −12·946 | −0·161 | −0·037 | − 7·584 | 4·216 | |
| 27 | E | | 14·525 | +5·577 | −12·958 | +1·229 | −0·368 | − 6·520 | 8·005 | |
| 28 | W | 60° *a* | 10·725 | +5·561 | −12·968 | +0·038 | +0·018 | − 7·351 | 3·374 | 5·870 |
| 29 | E | | 16·000 | +5·546 | −12·976 | +0·345 | −1·029 | − 8·114 | 7·886 | |
| 30 | W | | 13·025 | +5·523 | −12·983 | −0·459 | +0·551 | − 7·368 | 5·657 | |
| 31 | E | | 14·425 | +5·487 | −12·988 | +1·173 | +0·368 | − 5·960 | 8·465 | |
| Jan. 1 | W | 30° *a* (i) | 10·550 | +5·496 | −13·009 | +0·779 | +0·368 | − 6·366 | 4·184 | 7·328 |
| 2 | E | | 16·025 | +5·502 | −13·012 | +0·360 | +2·132 | − 5·018 | 11·007 | |
| 3 | W | | 15·975 | +5·520 | −13·014 | −2·764 | +0·294 | − 9·964 | 6·011 | |
| 4 | E | | 9·875 | +5·537 | −13·015 | +4·375 | +1·985 | − 1·118 | 8·757 | |
| 5 | W | 50° *a* (i) | 17·350 | +5·555 | −13·014 | −3·705 | +1·819 | − 9·345 | 8·005 | 7·633 |
| 6 | E | | 10·725 | +5·574 | −13·013 | +3·903 | +0·570 | − 2·966 | 7·759 | |
| 7 | W | | 16·200 | +5·572 | −13·009 | −3·180 | +1·084 | − 9·533 | 6·667 | |
| 8 | E | | 10·750 | +5·573 | −13·005 | +2·519 | +0·074 | − 4·839 | 5·911 | |
| 9 | W | 70° *a* (i) | 12·800 | +5·544 | −12·999 | +0·705 | −0·404 | − 7·154 | 5·646 | 6·808 |
| 10 | E | | 15·425 | +5·561 | −12·992 | −0·486 | +0·974 | − 6·943 | 8·482 | |
| 11 | W | | 12·050 | +5·561 | −12·984 | +0·976 | +1·342 | − 5·105 | 6·945 | |

Mean 6° 6′ 6″·4563

Mean Result of both Faces..... 6° 6′ 7″·4361



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## G. T. STATION DAMARGIDA.

### No. 12 (392) 11 Tauri. North 6° 45′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | 20° α | 27″·650 | +6″·251 | —11″·634 | —0″·314 | —0″·165 | — 5″·862 | 21″·788 | 20″·159 |
| 25 | W | | 24·100 | +6·251 | —11·683 | —0·263 | +0·662 | — 5·033 | 19·067 | |
| 26 | E | | 27·325 | +6·242 | —11·732 | —0·385 | —0·147 | — 6·022 | 21·303 | |
| 27 | W | | 24·425 | +6·215 | —11·779 | —1·154 | +0·772 | — 5·946 | 18·479 | |
| 28 | E | 40° α | 27·000 | +6·217 | —11·825 | —2·200 | +1·434 | — 6·374 | 20·626 | 20·843 |
| 29 | W | | 21·150 | +6·186 | —11·872 | +1·431 | +1·856 | — 2·399 | 18·751 | |
| 30 | E | | 28·775 | +6·185 | —11·917 | —1·670 | +0·459 | — 6·943 | 21·832 | |
| Dec. 1 | W | | 24·575 | +6·200 | —11·961 | +1·786 | +1·562 | — 2·413 | 22·162 | |
| 2 | E | 60° α | 22·075 | +6·189 | —12·005 | +3·333 | +0·845 | — 1·638 | 20·437 | 21·118 |
| 3 | W | | 28·125 | +6·142 | —12·046 | —4·239 | +0·754 | — 9·389 | 18·736 | |
| 4 | E | | 27·875 | +6·140 | —12·087 | +3·721 | +1·158 | — 1·068 | 26·807 | |
| 5 | W | | 26·850 | +6·188 | —12·127 | —3·671 | +1·250 | — 8·360 | 18·490 | |
| 6 | E | 30° α (2) | 31·200 | +6·213 | —12·166 | —0·096 | +1·489 | — 4·560 | 26·640 | 23·261 |
| 7 | W | | 26·125 | +6·241 | —12·205 | +0·516 | +0·790 | — 4·658 | 21·467 | |
| 8 | E | | 30·575 | +6·240 | —12·241 | —0·789 | +0·643 | — 6·147 | 24·428 | |
| 9 | W | | 25·150 | +6·243 | —12·275 | +0·105 | +1·286 | — 4·641 | 20·509 | |
| 10 | E | 50° α (2) | 31·275 | +6·232 | —12·312 | —0·705 | +1·305 | — 5·480 | 25·795 | 25·380 |
| 11 | W | | 28·525 | +6·222 | —12·345 | +0·076 | +1·654 | — 4·393 | 24·132 | |
| 12 | E | | 32·250 | +6·205 | —12·379 | —0·404 | +0·184 | — 6·394 | 25·856 | |
| 13 | W | | 30·775 | +6·208 | —12·410 | —0·033 | +1·195 | — 5·040 | 25·735 | |
| 14 | E | 70° α (2) | 36·500 | +6·230 | —12·442 | —1·580 | +1·783 | — 6·009 | 30·491 | 26·110 |
| 15 | W | | 21·925 | +6·233 | —12·471 | +1·404 | +2·536 | — 2·298 | 19·627 | |
| 16 | E | | 34·100 | +6·228 | —12·498 | —1·536 | +2·352 | — 5·454 | 28·646 | |
| 17 | W | | 29·500 | +6·206 | —12·527 | +1·340 | +1·158 | — 3·823 | 25·677 | |

Mean 6° 45′ 22″·8118

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | 20° α | 26″·200 | +6″·195 | —12″·554 | +0″·238 | +1″·176 | — 4″·945 | 21″·255 | 21″·436 |
| 19 | W | | 25·375 | +6·229 | —12·578 | —1·953 | +0·515 | — 7·787 | 17·588 | |
| 20 | E | | 26·350 | +6·264 | —12·601 | —0·284 | +1·636 | — 4·985 | 21·365 | |
| 21 | W | | 29·750 | +6·252 | —12·627 | —0·008 | +2·169 | — 4·214 | 25·536 | |
| 22 | E | 40° α | 26·175 | +6·242 | —12·650 | +0·461 | +0·992 | — 4·955 | 21·220 | 20·169 |
| 23 | W | | 26·550 | +6·202 | —12·671 | —1·405 | —0·496 | — 8·370 | 18·180 | |
| 24 | E | | 29·175 | +6·173 | —12·690 | +0·306 | —0·680 | — 6·891 | 22·284 | |
| 25 | W | | 26·000 | +6·161 | —12·709 | —0·956 | +0·496 | — 7·008 | 18·992 | |
| 26 | E | 60° α | 29·200 | +6·164 | —12·728 | +0·161 | +0·294 | — 6·109 | 23·091 | 20·205 |
| 27 | W | | 24·475 | +6·181 | —12·746 | —1·229 | +0·276 | — 7·518 | 16·957 | |
| 28 | E | | 30·625 | +6·161 | —12·762 | —0·038 | +0·074 | — 6·565 | 24·060 | |
| 29 | W | | 23·925 | +6·145 | —12·775 | —0·345 | —0·239 | — 7·214 | 16·711 | |
| 30 | E | 30° α (2) | 28·025 | +6·122 | —12·788 | +0·459 | +0·754 | — 5·453 | 22·572 | 20·248 |
| 31 | W | | 25·800 | +6·082 | —12·799 | —1·173 | +1·286 | — 6·604 | 19·196 | |
| Jan. 1 | E | | 28·425 | +6·089 | —12·832 | —0·779 | +0·441 | — 7·081 | 21·344 | |
| 2 | W | | 22·800 | +6·096 | —12·842 | —0·360 | +2·187 | — 4·919 | 17·881 | |
| 3 | E | 50° α (2) | 23·575 | +6·120 | —12·850 | +2·764 | +0·827 | — 3·139 | 20·436 | 19·467 |
| 4 | W | | 28·500 | +6·141 | —12·858 | —4·375 | +2·224 | — 8·868 | 19·632 | |
| 5 | E | | 21·725 | +6·162 | —12·864 | +3·705 | +1·231 | — 1·766 | 19·959 | |
| 6 | W | | 27·550 | +6·183 | —12·870 | —3·903 | +0·882 | — 9·708 | 17·842 | |
| 7 | E | 70° α (2) | 21·900 | +6·184 | —12·873 | +3·180 | +0·698 | — 2·811 | 19·089 | 19·334 |
| 8 | W | | 28·650 | +6·180 | —12·876 | —2·519 | —0·074 | — 9·289 | 19·361 | |
| 9 | E | | 27·675 | +6·148 | —12·877 | —0·705 | —0·184 | — 7·618 | 20·057 | |
| 10 | W | | 24·275 | +6·167 | —12·878 | +0·486 | +0·790 | — 5·435 | 18·840 | |
| 11 | E | | 26·175 | +6·168 | —12·876 | —0·976 | +1·066 | — 6·618 | 19·557 | |

Mean 6° 45′ 20″·1432

Mean Result of both Faces ..... 6° 45′ 21″·4775

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No. 13 (404) 18 PLEIADUM *m*. North 6° 16′ +

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | 20° *a* | 54″·250 | +5″·807 | −11″·514 | +0″·314 | −0″·992 | − 6″·385 | 47″·865 | 50″·662 |
| 25 | E | | 58·175 | +5·808 | −11·559 | +0·263 | +0·625 | − 4·863 | 53·312 | |
| 26 | W | | 54·475 | +5·800 | −11·604 | +0·385 | +0·018 | − 5·401 | 49·074 | |
| 27 | E | | 56·450 | +5·776 | −11·647 | +1·154 | +0·662 | − 4·055 | 52·395 | |
| 28 | W | 40° *a* | 52·975 | +5·778 | −11·690 | +2·200 | +1·397 | − 2·315 | 50·660 | 55·252 |
| 29 | E | | 65·475 | +5·749 | −11·734 | −1·431 | +1·691 | − 5·725 | 59·750 | |
| 30 | W | | 57·625 | +5·748 | −11·775 | +1·670 | −0·074 | − 4·431 | 53·194 | |
| Dec. 1 | E | | 63·700 | +5·761 | −11·815 | −1·786 | +1·544 | − 6·296 | 57·404 | |
| 2 | W | 60° *a* | 58·325 | +5·751 | −11·855 | −3·333 | +0·441 | − 8·996 | 49·329 | 52·383 |
| 3 | E | | 53·225 | +5·709 | −11·893 | +4·239 | +0·901 | − 1·044 | 52·181 | |
| 4 | W | | 58·400 | +5·706 | −11·930 | −3·721 | +1·360 | − 8·585 | 49·815 | |
| 5 | E | | 59·100 | +5·750 | −11·968 | +3·671 | +1·654 | − 0·893 | 58·207 | |
| 6 | W | 30° *a* (i) | 55·975 | +5·774 | −12·003 | +0·096 | +1·489 | − 4·644 | 51·331 | 54·372 |
| 7 | E | | 62·600 | +5·800 | −12·039 | −0·516 | +0·919 | − 5·836 | 56·764 | |
| 8 | W | | 54·950 | +5·800 | −12·072 | +0·789 | +1·470 | − 4·013 | 50·937 | |
| 9 | E | | 63·850 | +5·801 | −12·103 | −0·105 | +1·011 | − 5·396 | 58·454 | |
| 10 | W | 50° *a* (i) | 59·275 | +5·792 | −12·136 | +0·705 | −0·386 | − 6·025 | 53·250 | 56·408 |
| 11 | E | | 63·975 | +5·782 | −12·166 | −0·076 | +1·801 | − 4·659 | 59·316 | |
| 12 | W | | 60·900 | +5·766 | −12·198 | +0·404 | +0·055 | − 5·973 | 54·927 | |
| 13 | E | | 64·525 | +5·770 | −12·226 | +0·033 | +0·037 | − 6·386 | 58·139 | |
| 14 | W | 70° *a* (i) | 54·600 | +5·790 | −12·255 | +1·580 | +2·242 | − 2·643 | 51·957 | 55·532 |
| 15 | E | | 65·625 | +5·791 | −12·281 | −1·404 | +2·683 | − 5·211 | 60·414 | |
| 16 | W | | 56·125 | +5·788 | −12·306 | +1·536 | +2·591 | − 2·391 | 53·734 | |
| 17 | E | | 63·450 | +5·767 | −12·333 | −1·340 | +0·478 | − 7·428 | 56·022 | |

Mean 6° 16′ 54″·1015

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | 20° *a* | 55″·800 | +5″·757 | −12″·357 | −0″·238 | +1″·893 | − 4″·945 | 50″·855 | 49″·820 |
| 19 | E | | 53·525 | +5·788 | −12·379 | +1·953 | +1·378 | − 3·260 | 50·265 | |
| 20 | W | | 53·000 | +5·823 | −12·399 | +0·284 | +2·205 | − 4·087 | 48·913 | |
| 21 | E | | 53·425 | +5·810 | −12·423 | +0·008 | +2·426 | − 4·179 | 49·246 | |
| 22 | W | 40° *a* | 54·975 | +5·800 | −12·444 | −0·461 | +1·103 | − 6·002 | 48·973 | 50·418 |
| 23 | E | | 57·250 | +5·763 | −12·462 | +1·405 | −0·386 | − 5·680 | 51·570 | |
| 24 | W | | 56·200 | +5·737 | −12·480 | −0·306 | −0·717 | − 7·766 | 48·434 | |
| 25 | E | | 58·200 | +5·725 | −12·497 | +0·956 | +0·312 | − 5·504 | 52·696 | |
| 26 | W | 60° *a* | 54·975 | +5·729 | −12·514 | +0·161 | −0·386 | − 7·010 | 47·965 | 50·482 |
| 28 | W | | 54·225 | +5·725 | −12·540 | +0·038 | −0·478 | − 7·255 | 46·970 | |
| 29 | E | | 60·475 | +5·710 | −12·556 | +0·345 | −0·478 | − 6·979 | 53·496 | |
| 30 | W | 30° *a* (i) | 56·050 | +5·689 | −12·568 | −0·459 | +0·368 | − 6·970 | 49·080 | 51·066 |
| 31 | E | | 57·875 | +5·654 | −12·578 | +1·173 | +1·231 | − 4·520 | 53·355 | |
| Jan. 1 | W | | 54·125 | +5·661 | −12·610 | +0·779 | +0·331 | − 5·839 | 48·286 | |
| 2 | E | | 57·800 | +5·665 | −12·618 | +0·360 | +2·334 | − 4·259 | 53·541 | |
| 3 | W | 50° *a* (i) | 58·600 | +5·687 | −12·626 | −2·764 | +0·607 | − 9·096 | 49·504 | 50·820 |
| 4 | E | | 52·725 | +5·708 | −12·632 | +4·375 | +2·371 | − 0·178 | 52·547 | |
| 5 | W | | 58·925 | +5·727 | −12·637 | −3·705 | +1·084 | − 9·531 | 49·394 | |
| 6 | E | | 53·725 | +5·746 | −12·642 | +3·903 | +1·103 | − 1·890 | 51·835 | |
| 7 | W | 70° *a* (i) | 59·550 | +5·747 | −12·645 | −3·180 | +0·937 | − 9·141 | 50·409 | 50·661 |
| 8 | E | | 54·900 | +5·742 | −12·647 | +2·519 | 0·000 | − 4·386 | 50·514 | |
| 9 | W | | 55·850 | +5·715 | −12·647 | +0·705 | +0·551 | − 5·676 | 50·174 | |
| 10 | E | | 58·100 | +5·733 | −12·647 | −0·486 | +0·717 | − 6·683 | 51·417 | |
| 11 | W | | 55·250 | +5·733 | −12·646 | +0·976 | +1·176 | − 4·761 | 50·489 | |

Mean 6° 16′ 50″·5445

Mean Result of both Faces..... 6° 16′ 52″·3230





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## G. T. STATION DAMARGIDA.

### No. 14 (423) Pleiadum. North 7° 2′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 29″·650 | +6″·514 | −11″·412 | −0″·314 | +0″·018 | − 5″·194 | 24″·456 | |
| 25 | W | α 20° | 27·125 | +6·514 | −11·461 | −0·263 | +1·323 | − 3·887 | 23·238 | 23″·662 |
| 26 | E | | 31·100 | +6·508 | −11·510 | −0·385 | −0·018 | − 5·405 | 25·695 | |
| 27 | W | | 26·825 | +6·480 | −11·556 | −1·154 | +0·662 | − 5·568 | 21·257 | |
| 28 | E | | 30·900 | +6·483 | −11·603 | −2·200 | +1·452 | − 5·868 | 25·032 | |
| 29 | W | α 40° | 26·250 | +6·451 | −11·650 | +1·431 | +0·055 | − 3·713 | 22·537 | 25·010 |
| 30 | E | | 35·800 | +6·450 | −11·695 | −1·670 | +0·037 | − 6·878 | 28·922 | |
| Dec. 1 | W | | 25·550 | +6·464 | −11·739 | +1·786 | +1·489 | − 2·000 | 23·550 | |
| 2 | E | | 25·725 | +6·453 | −11·783 | +3·333 | +0·459 | − 1·538 | 24·187 | |
| 3 | W | α 60° | 31·350 | +6·408 | −11·825 | −4·239 | +0·901 | − 8·755 | 22·595 | 24·945 |
| 4 | E | | 31·525 | +6·401 | −11·866 | +3·721 | +0·809 | − 0·935 | 30·590 | |
| 5 | W | | 30·875 | +6·450 | −11·907 | −3·671 | +0·662 | − 8·466 | 22·409 | |
| 6 | E | | 34·825 | +6·479 | −11·946 | −0·096 | +1·544 | − 4·019 | 30·806 | |
| 7 | W | α (1) 30° | 27·100 | +6·509 | −11·987 | +0·516 | +0·901 | − 4·061 | 23·039 | 25·738 |
| 8 | E | | 31·800 | +6·508 | −12·024 | −0·789 | +1·176 | − 5·129 | 26·671 | |
| 9 | W | | 26·375 | +6·507 | −12·059 | +0·105 | +1·507 | − 3·940 | 22·435 | |
| 10 | E | | 30·350 | +6·499 | −12·096 | −0·705 | +0·129 | − 6·173 | 24·177 | |
| 11 | W | α (1) 50° | 30·725 | +6·487 | −12·130 | +0·076 | +1·672 | − 3·895 | 26·830 | 26·464 |
| 12 | E | | 34·475 | +6·470 | −12·166 | −0·404 | +0·349 | − 5·751 | 28·724 | |
| 13 | W | | 31·750 | +6·476 | −12·199 | −0·033 | +0·129 | − 5·627 | 26·123 | |
| 14 | E | | 40·650 | +6·498 | −12·231 | −1·580 | +2·518 | − 4·795 | 35·855 | |
| 15 | W | α (1) 70° | 21·375 | +6·497 | −12·262 | +1·404 | +2·316 | − 2·045 | 19·330 | 27·875 |
| 16 | E | | 36·650 | +6·494 | −12·291 | −1·536 | +2·169 | − 5·164 | 31·486 | |
| 17 | W | | 28·125 | +6·471 | −12·322 | +1·340 | +1·213 | − 3·298 | 24·827 | |

Mean 7° 2′ 25″·6157

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 28″·025 | +6″·458 | −12″·350 | +0″·238 | +1″·581 | − 4″·073 | 23″·952 | |
| 19 | W | α 20° | 24·950 | +6·495 | −12·377 | −1·953 | +1·893 | − 5·942 | 19·008 | 21″·573 |
| 20 | E | | 25·650 | +6·535 | −12·402 | −0·284 | +2·040 | − 4·111 | 21·539 | |
| 21 | W | | 25·450 | +6·518 | −12·430 | −0·008 | +2·261 | − 3·659 | 21·791 | |
| 22 | E | | 29·875 | +6·509 | −12·455 | +0·461 | +0·037 | − 5·448 | 24·427 | |
| 23 | W | α 40° | 30·675 | +6·466 | −12·478 | −1·405 | −0·037 | − 7·454 | 23·221 | 23·756 |
| 24 | E | | 31·425 | +6·437 | −12·500 | +0·306 | −0·864 | − 6·621 | 24·804 | |
| 25 | W | | 29·825 | +6·424 | −12·521 | −0·956 | −0·202 | − 7·255 | 22·570 | |
| 26 | E | | 32·350 | +6·430 | −12·543 | +0·161 | −0·717 | − 6·669 | 25·681 | |
| 27 | W | α 60° | 27·650 | +6·445 | −12·563 | −1·229 | −0·184 | − 7·531 | 20·119 | 22·475 |
| 28 | E | | 32·075 | +6·423 | −12·582 | −0·038 | +0·092 | − 6·105 | 25·970 | |
| 29 | W | | 25·475 | +6·406 | −12·598 | −0·345 | −0·809 | − 7·346 | 18·129 | |
| 30 | E | | 31·725 | +6·382 | −12·614 | +0·459 | −0·331 | − 6·104 | 25·621 | |
| 31 | W | α (1) 30° | 29·025 | +6·346 | −12·628 | −1·173 | +1·103 | − 6·352 | 22·673 | 23·280 |
| Jan. 1 | E | | 31·100 | +6·356 | −12·666 | −0·779 | +0·221 | − 6·868 | 24·232 | |
| 2 | W | | 26·025 | +6·356 | −12·679 | −0·360 | +1·250 | − 5·433 | 20·592 | |
| 3 | E | | 26·625 | +6·381 | −12·691 | +2·764 | +0·643 | − 2·903 | 23·722 | |
| 4 | W | α (1) 50° | 32·125 | +6·406 | −12·702 | −4·375 | +2·169 | − 8·502 | 23·623 | 23·304 |
| 5 | E | | 25·575 | +6·427 | −12·711 | +3·705 | +0·956 | − 1·623 | 23·952 | |
| 6 | W | | 31·450 | +6·447 | −12·720 | −3·903 | +0·643 | − 9·533 | 21·917 | |
| 7 | E | | 24·975 | +6·449 | −12·727 | +3·180 | +0·772 | − 2·326 | 22·649 | |
| 8 | W | α (1) 70° | 31·050 | +6·442 | −12·734 | −2·519 | +0·276 | − 8·535 | 22·515 | |
| 9 | E | | 30·125 | +6·414 | −12·738 | −0·705 | +0·662 | − 6·367 | 23·758 | 22·913 |
| 10 | W | | 27·675 | +6·434 | −12·743 | +0·486 | 0·000 | − 5·823 | 21·852 | |
| 11 | E | | 29·675 | +6·434 | −12·746 | −0·976 | +2·132 | − 5·156 | 24·519 | |

Mean 7° 2′ 22″·8835

Mean Result of both Faces ..... 7° 2′ 24″·2496

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## No. 15 (441) TAURI. South 0° 18′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 40″·250 | +0″·287 | +11″·026 | −0″·314 | −0″·570 | +10″·429 | 50″·679 | |
| 25 | E | α 20° | 39·150 | +0·287 | +11·026 | −0·263 | −0·312 | +10·738 | 49·888 | 50″·540 |
| 26 | W | | 41·075 | +0·286 | +11·026 | −0·385 | −0·772 | +10·155 | 51·230 | |
| 27 | E | | 40·225 | +0·285 | +11·024 | −1·154 | −0·018 | +10·137 | 50·362 | |
| 28 | W | | 42·975 | +0·285 | +11·022 | −2·200 | −1·139 | + 7·968 | 50·943 | |
| 29 | E | α 40° | 38·875 | +0·284 | +11·021 | +1·431 | −0·607 | +12·129 | 51·004 | 53·022 |
| 30 | W | | 47·625 | +0·284 | +11·019 | −1·670 | −1·801 | + 7·832 | 55·457 | |
| Dec. 1 | E | | 42·975 | +0·284 | +11·015 | +1·786 | −1·378 | +11·707 | 54·682 | |
| 2 | W | | 38·500 | +0·284 | +11·012 | +3·333 | −0·312 | +14·317 | 52·817 | |
| 3 | E | α 60° | 44·500 | +0·282 | +11·006 | −4·239 | −0·129 | + 6·920 | 51·420 | 52·789 |
| 4 | W | | 39·050 | +0·282 | +11·000 | +3·721 | −0·496 | +14·507 | 53·557 | |
| 5 | E | | 46·250 | +0·284 | +10·995 | −3·671 | −0·496 | + 7·112 | 53·362 | |
| 6 | W | | 45·200 | +0·285 | +10·988 | −0·096 | −1·562 | + 9·615 | 54·815 | |
| 7 | E | α (1) 30° | 43·400 | +0·287 | +10·982 | +0·516 | −0·662 | +11·123 | 54·523 | 53·399 |
| 8 | W | | 41·800 | +0·287 | +10·973 | −0·789 | −1·360 | + 9·111 | 50·911 | |
| 9 | E | | 43·075 | +0·286 | +10·963 | +0·105 | −1·084 | +10·270 | 53·345 | |
| 10 | W | | 43·850 | +0·286 | +10·956 | −0·705 | −2·150 | + 8·387 | 52·237 | |
| 11 | E | α (1) 50° | 42·925 | +0·286 | +10·945 | +0·076 | −0·698 | +10·609 | 53·534 | 54·697 |
| 12 | W | | 46·400 | +0·285 | +10·937 | −0·404 | −0·717 | +10·101 | 56·501 | |
| 13 | E | | 46·475 | +0·285 | +10·926 | −0·033 | −1·139 | +10·039 | 56·514 | |
| 14 | W | | 46·400 | +0·286 | +10·915 | −1·580 | −1·966 | + 7·655 | 54·055 | |
| 15 | E | α (1) 70° | 38·450 | +0·286 | +10·903 | +1·404 | −1·489 | +11·104 | 49·554 | 53·730 |
| 16 | W | | 48·550 | +0·286 | +10·890 | −1·536 | −0·919 | + 8·721 | 57·271 | |
| 17 | E | | 43·100 | +0·285 | +10·878 | +1·340 | −1·562 | +10·941 | 54·041 | |

Mean 0° 18′ 53″·0295

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | | 40″·175 | +0″·284 | +10″·865 | +0″·238 | −0″·992 | +10″·395 | 50″·570 | |
| 19 | E | α 20° | 40·900 | +0·286 | +10·850 | −1·953 | −1·452 | + 7·731 | 48·631 | 49″·653 |
| 20 | W | | 37·950 | +0·288 | +10·835 | −0·284 | −1·029 | + 9·810 | 47·760 | |
| 21 | E | | 41·800 | +0·287 | +10·823 | −0·008 | −1·250 | + 9·852 | 51·652 | |
| 22 | W | | 42·900 | +0·286 | +10·809 | +0·461 | −0·607 | +10·949 | 53·849 | |
| 23 | E | α 40° | 42·500 | +0·285 | +10·792 | −1·405 | +0·037 | + 9·709 | 52·209 | 52·308 |
| 24 | W | | 40·050 | +0·283 | +10·776 | +0·306 | +0·790 | +12·155 | 52·205 | |
| 25 | E | | 40·975 | +0·283 | +10·760 | −0·956 | −0·092 | + 9·995 | 50·970 | |
| 26 | W | | 43·150 | +0·283 | +10·744 | +0·161 | −0·551 | +10·637 | 53·787 | |
| 27 | E | α 60° | 39·625 | +0·284 | +10·727 | −1·229 | +0·092 | + 9·874 | 49·499 | 51·605 |
| 28 | W | | 42·025 | +0·283 | +10·710 | −0·038 | +0·018 | +10·973 | 52·998 | |
| 29 | E | | 39·600 | +0·282 | +10·691 | −0·345 | −0·092 | +10·536 | 50·136 | |
| 30 | W | | 41·150 | +0·281 | +10·672 | +0·459 | −0·404 | +11·008 | 52·158 | |
| 31 | E | α (1) 30° | 40·850 | +0·280 | +10·652 | −1·173 | −1·507 | + 8·252 | 49·102 | 51·207 |
| Jan. 1 | W | | 44·050 | +0·280 | +10·657 | −0·779 | −0·717 | + 9·441 | 53·491 | |
| 2 | E | | 41·025 | +0·280 | +10·637 | −0·360 | −1·507 | + 9·050 | 50·075 | |
| 3 | W | | 39·450 | +0·281 | +10·617 | +2·764 | −0·937 | +12·725 | 52·175 | |
| 4 | E | α (1) 50° | 45·475 | +0·282 | +10·596 | −4·375 | −1·856 | + 4·647 | 50·122 | 51·102 |
| 5 | W | | 39·350 | +0·283 | +10·575 | +3·705 | −0·735 | +13·828 | 53·178 | |
| 6 | E | | 44·000 | +0·284 | +10·554 | −3·903 | −2·003 | + 4·932 | 48·932 | |
| 7 | W | | 37·725 | +0·284 | +10·531 | +3·180 | −0·276 | +13·719 | 51·444 | |
| 8 | E | α (1) 70° | 44·525 | +0·283 | +10·509 | −2·519 | −0·202 | + 8·071 | 52·596 | |
| 9 | W | | 41·750 | +0·282 | +10·486 | −0·705 | −0·827 | + 9·236 | 50·986 | 51·761 |
| 10 | E | | 41·400 | +0·283 | +10·462 | +0·486 | −0·459 | +10·772 | 52·172 | |
| 11 | W | | 43·550 | +0·283 | +10·439 | −0·976 | −2·316 | + 7·430 | 50·982 | |

Mean 0° 18′ 51″·2727

**Mean Result of both Faces..... 0° 18′ 52″·1511**

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## G. T. STATION DAMARGIDA.

### No. 16 (454) Tauri. South 1° 8′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 28″·325 | +1″·051 | +10″·895 | +0″·314 | −0″·368 | +11″·892 | 40″·217 | |
| 25 | W | α | 31·575 | +1·051 | +10·888 | +0·263 | +0·588 | +12·790 | 44·365 | 42″·403 |
| 26 | E | 20° | 28·925 | +1·050 | +10·880 | +0·385 | +0·110 | +12·425 | 41·350 | |
| 27 | W | | 30·625 | +1·046 | +10·871 | +1·154 | −0·018 | +13·053 | 43·678 | |
| 28 | E | | 26·850 | +1·047 | +10·862 | +2·200 | −0·754 | +13·355 | 40·205 | |
| 29 | W | α | 33·700 | +1·041 | +10·854 | −1·431 | −0·404 | +10·060 | 43·760 | |
| 30 | E | 40° | 28·750 | +1·041 | +10·845 | +1·670 | −1·286 | +12·270 | 41·020 | 43·135 |
| Dec. 1 | W | | 37·500 | +1·043 | +10·834 | −1·786 | −0·037 | +10·054 | 47·554 | |
| 2 | E | | 33·725 | +1·041 | +10·824 | −3·333 | −0·147 | + 8·385 | 42·110 | |
| 3 | W | α | 27·975 | +1·036 | +10·812 | +4·239 | −0·018 | +16·069 | 44·044 | |
| 4 | E | 60° | 34·700 | +1·033 | +10·799 | −3·721 | 0·000 | + 8·111 | 42·811 | 43·897 |
| 5 | W | | 31·675 | +1·041 | +10·787 | +3·671 | −0·551 | +14·948 | 46·623 | |
| 6 | E | | 28·025 | +1·046 | +10·774 | +0·096 | −0·018 | +11·898 | 39·923 | |
| 7 | W | α (1) | 35·075 | +1·051 | +10·761 | −0·516 | −0·165 | +11·131 | 46·206 | |
| 8 | E | 30° | 30·275 | +1·051 | +10·746 | +0·789 | −1·268 | +11·318 | 41·593 | 42·863 |
| 9 | W | | 32·625 | +1·050 | +10·730 | −0·105 | −0·570 | +11·105 | 43·730 | |
| 10 | E | | 32·775 | +1·049 | +10·716 | +0·705 | −1·084 | +11·386 | 44·161 | |
| 11 | W | α (1) | 35·800 | +1·047 | +10·700 | −0·076 | −0·221 | +11·450 | 47·250 | |
| 12 | E | 50° | 34·050 | +1·045 | +10·685 | +0·404 | −0·055 | +12·079 | 46·129 | 46·427 |
| 13 | W | | 35·850 | +1·046 | +10·668 | +0·033 | +0·570 | +12·317 | 48·167 | |
| 14 | E | | 28·775 | +1·050 | +10·651 | +1·580 | −0·772 | +12·509 | 41·284 | |
| 15 | W | α (1) | 38·325 | +1·048 | +10·633 | −1·404 | −0·937 | + 9·340 | 47·665 | |
| 16 | E | 70° | 33·150 | +1·048 | +10·615 | +1·536 | +0·221 | +13·420 | 46·570 | 45·486 |
| 17 | W | | 37·575 | +1·045 | +10·597 | −1·340 | −1·452 | + 8·850 | 46·425 | |

Mean 1° 8′ 44″·0352

#### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 29″·300 | +1″·042 | +10″·579 | −0″·238 | −1″·084 | +10″·299 | 39″·599 | |
| 19 | W | α | 30·250 | +1·048 | +10·559 | +1·953 | −0·588 | +12·972 | 43·222 | 41″·256 |
| 20 | E | 20° | 29·375 | +1·056 | +10·538 | +0·284 | −1·434 | +10·444 | 39·819 | |
| 21 | W | | 31·925 | +1·052 | +10·521 | +0·008 | −1·121 | +10·460 | 42·385 | |
| 22 | E | | 30·675 | +1·051 | +10·501 | −0·461 | −1·654 | + 9·437 | 40·112 | |
| 23 | W | α | 30·900 | +1·044 | +10·480 | +1·405 | 0·000 | +12·929 | 43·829 | |
| 24 | E | 40° | 29·775 | +1·039 | +10·459 | −0·306 | +0·533 | +11·725 | 41·500 | 42·328 |
| 25 | W | | 31·475 | +1·037 | +10·438 | +0·956 | −0·037 | +12·394 | 43·869 | |
| 26 | E | | 27·400 | +1·039 | +10·417 | −0·161 | −0·827 | +10·468 | 37·868 | |
| 27 | W | α | 32·700 | +1·041 | +10·396 | +1·229 | −0·092 | +12·574 | 45·274 | |
| 28 | E | 60° | 27·725 | +1·037 | +10·375 | +0·038 | −0·018 | +11·432 | 39·157 | 41·748 |
| 29 | W | | 33·000 | +1·034 | +10·351 | +0·345 | −0·037 | +11·693 | 44·693 | |
| 30 | E | | 29·125 | +1·030 | +10·328 | −0·459 | −0·441 | +10·958 | 40·083 | |
| 31 | W | α (1) | 31·075 | +1·026 | +10·305 | +1·173 | −0·570 | +11·934 | 43·009 | |
| Jan. 1 | E | 30° | 29·825 | +1·028 | +10·307 | +0·779 | −0·992 | +11·122 | 40·947 | 41·660 |
| 2 | W | | 32·275 | +1·026 | +10·283 | +0·360 | −1·342 | +10·327 | 42·602 | |
| 3 | E | | 33·800 | +1·030 | +10·259 | −2·764 | −0·625 | + 7·900 | 41·700 | |
| 4 | W | α (1) | 26·925 | +1·035 | +10·235 | +4·375 | +0·037 | +15·682 | 42·607 | |
| 5 | E | 50° | 35·125 | +1·038 | +10·210 | −3·705 | −0·735 | + 6·808 | 41·933 | 41·982 |
| 6 | W | | 28·375 | +1·041 | +10·186 | +3·903 | −1·819 | +13·311 | 41·686 | |
| 7 | E | | 36·525 | +1·042 | +10·160 | −3·180 | −0·570 | + 7·452 | 43·977 | |
| 8 | W | α (1) | 29·625 | +1·039 | +10·134 | +2·519 | −0·184 | +13·508 | 43·133 | |
| 9 | E | 70° | 30·650 | +1·037 | +10·109 | +0·705 | −0·607 | +11·244 | 41·894 | 42·794 |
| 10 | W | | 32·400 | +1·040 | +10·083 | −0·486 | −0·827 | + 9·810 | 42·210 | |
| 11 | E | | 32·975 | +1·039 | +10·056 | +0·976 | −2·169 | + 9·902 | 42·877 | |

Mean 1° 8′ 41″·9613

Mean Result of both Faces..... 1° 8′ 42″·9983

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## No. 17 (468) 48 TAURI. South 3° 3′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 14″·250 | +2″·811 | +10″·762 | −0″·314 | +0″·555 | +13″·814 | 28″·064 | |
| 25 | E | | 12·150 | +2·811 | +10·741 | −0·263 | +0·018 | +13·307 | 25·457 | |
| 26 | W | 20° α | 17·750 | +2·812 | +10·719 | −0·385 | +0·018 | +13·164 | 30·914 | 27″·214 |
| 27 | E | | 12·925 | +2·800 | +10·696 | −1·154 | −0·845 | +11·497 | 24·422 | |
| 28 | W | | 18·050 | +2·802 | +10·673 | −2·200 | −1·213 | +10·062 | 28·112 | |
| 29 | E | | 9·775 | +2·788 | +10·651 | +1·431 | −0·662 | +14·208 | 23·983 | |
| 30 | W | 40° α | 21·525 | +2·788 | +10·627 | −1·670 | −0·515 | +11·230 | 32·755 | 28·830 |
| Dec. 1 | E | | 15·400 | +2·793 | +10·602 | +1·786 | −0·110 | +15·071 | 30·471 | |
| 2 | W | | 9·750 | +2·788 | +10·578 | +3·333 | −0·533 | +16·166 | 25·916 | |
| 3 | E | 60° α | 15·625 | +2·774 | +10·553 | −4·239 | −1·286 | + 7·802 | 23·427 | 26·667 |
| 4 | W | | 14·750 | +2·765 | +10·526 | +3·721 | −0·037 | +16·975 | 31·725 | |
| 5 | E | | 16·350 | +2·786 | +10·501 | −3·671 | −0·368 | + 9·248 | 25·598 | |
| 6 | W | | 21·050 | +2·801 | +10·473 | −0·096 | 0·000 | +13·178 | 34·228 | |
| 7 | E | 30° α (1) | 15·625 | +2·815 | +10·447 | +0·516 | −0·698 | +13·080 | 28·705 | 28·958 |
| 8 | W | | 15·075 | +2·815 | +10·419 | −0·789 | −0·772 | +11·673 | 26·748 | |
| 9 | E | | 14·575 | +2·809 | +10·390 | +0·105 | −1·728 | +11·576 | 26·151 | |
| 10 | W | | 18·500 | +2·810 | +10·363 | −0·705 | −1·158 | +11·310 | 29·810 | |
| 11 | E | 50° α (1) | 18·250 | +2·804 | +10·333 | +0·076 | −1·268 | +11·945 | 30·195 | 31·160 |
| 12 | W | | 19·050 | +2·796 | +10·306 | −0·404 | −1·084 | +11·614 | 30·664 | |
| 13 | E | | 21·000 | +2·802 | +10·276 | −0·033 | −0·074 | +12·971 | 33·971 | |
| 14 | W | | 23·175 | +2·810 | +10·247 | −1·580 | −1·103 | +10·374 | 33·549 | |
| 15 | E | 70° α (1) | 13·275 | +2·806 | +10·216 | +1·404 | −1·930 | +12·496 | 25·771 | 29·423 |
| 16 | W | | 22·625 | +2·806 | +10·186 | −1·536 | −0·368 | +11·088 | 33·713 | |
| 17 | E | | 14·800 | +2·797 | +10·156 | +1·340 | −4·434 | + 9·859 | 24·659 | |

Mean 3° 3′ 28″·7087

### Face B to the Fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 13″·225 | +2″·790 | +10″·126 | +0″·238 | −1″·764 | +11″·390 | 24″·615 | |
| 19 | E | | 11·875 | +2·807 | +10·094 | −1·953 | −0·643 | +10·305 | 22·180 | |
| 20 | W | 20° α | 13·700 | +2·828 | +10·062 | −0·284 | −2·058 | +10·548 | 24·248 | 24″·327 |
| 21 | E | | 13·000 | +2·816 | +10·032 | −0·008 | +0·423 | +13·263 | 26·263 | |
| 22 | W | | 14·525 | +2·814 | +10·002 | +0·461 | −2·169 | +11·108 | 25·633 | |
| 23 | E | | 13·475 | +2·794 | + 9·969 | −1·405 | 0·000 | +11·358 | 24·833 | |
| 24 | W | 40° α | 12·275 | +2·782 | + 9·937 | +0·306 | +0·257 | +13·282 | 25·557 | 25·032 |
| 25 | E | | 12·525 | +2·776 | + 9·905 | −0·956 | −0·147 | +11·578 | 24·103 | |
| 26 | W | | 15·550 | +2·781 | + 9·874 | +0·161 | −0·754 | +12·062 | 27·612 | |
| 28 | W | 60° α | 16·175 | +2·775 | + 9·810 | −0·038 | −0·992 | +11·555 | 27·730 | 25·973 |
| 29 | E | | 11·100 | +2·768 | + 9·777 | −0·345 | +0·974 | +13·174 | 24·274 | |
| 30 | W | | 14·350 | +2·756 | + 9·744 | +0·459 | −0·037 | +12·922 | 27·272 | |
| 31 | E | 30° α (1) | 12·300 | +2·748 | + 9·710 | −1·173 | −0·018 | +11·267 | 23·567 | 25·170 |
| Jan. 1 | W | | 15·750 | +2·755 | + 9·706 | −0·779 | −2·058 | + 9·624 | 25·374 | |
| 2 | E | | 12·775 | +2·746 | + 9·673 | −0·360 | −0·368 | +11·691 | 24·466 | |
| 3 | W | | 12·000 | +2·757 | + 9·640 | +2·764 | −0·165 | +14·996 | 26·996 | |
| 4 | E | 50° α (1) | 19·550 | +2·772 | + 9·606 | −4·375 | +0·790 | + 8·793 | 28·343 | 26·893 |
| 5 | W | | 11·625 | +2·780 | + 9·573 | +3·705 | −0·717 | +15·341 | 26·966 | |
| 6 | E | | 17·100 | +2·786 | + 9·540 | −3·903 | −0·257 | + 8·166 | 25·266 | |
| 7 | W | | 11·875 | +2·789 | + 9·506 | +3·180 | −0·717 | +14·758 | 26·633 | |
| 8 | E | 70° α (1) | 16·950 | +2·782 | + 9·472 | −2·519 | −0·827 | + 8·908 | 25·858 | |
| 9 | W | | 14·875 | +2·777 | + 9·438 | −0·705 | −0·937 | +10·573 | 25·448 | 25·808 |
| 10 | E | | 13·550 | +2·784 | + 9·405 | +0·486 | −0·662 | +12·013 | 25·563 | |
| 11 | W | | 16·425 | +2·783 | + 9·371 | −0·976 | −1·966 | + 9·212 | 25·637 | |

Mean 3° 3′ 25″·5338

Mean Result of both Faces ..... 3° 3′ 27″·1213

2 X

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## G. T. STATION DAMARGIDA.

### No. 18 (478) 54 Tauri γ. South 2° 48′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 42″·175 | +2″·589 | +10″·700 | +0″·314 | +0″·147 | +13″·750 | 55″·925 | |
| 25 | W | α | 47·100 | +2·588 | +10·679 | +0·263 | −0·165 | +13·365 | 60·465 | 57″·953 |
| 26 | E | 20° | 42·000 | +2·589 | +10·658 | +0·385 | −1·011 | +12·621 | 54·621 | |
| 27 | W | | 46·875 | +2·579 | +10·635 | +1·154 | −0·441 | +13·927 | 60·802 | |
| 28 | E | | 40·650 | +2·580 | +10·612 | +2·200 | +0·165 | +15·557 | 56·207 | |
| 29 | W | α | 48·950 | +2·568 | +10·590 | −1·431 | −1·378 | +10·349 | 59·299 | 59·653 |
| 30 | E | 40° | 45·000 | +2·568 | +10·567 | +1·670 | −0·551 | +14·254 | 59·254 | |
| Dec. 1 | W | | 52·725 | +2·572 | +10·542 | −1·786 | −0·202 | +11·126 | 63·851 | |
| 2 | E | | 47·400 | +2·567 | +10·519 | −3·333 | −0·551 | + 9·202 | 56·602 | |
| 3 | W | α | 41·750 | +2·556 | +10·493 | +4·239 | −1·011 | +16·277 | 58·027 | 58·698 |
| 4 | E | 60° | 46·575 | +2·546 | +10·467 | −3·721 | −0·129 | + 9·163 | 55·738 | |
| 5 | W | | 48·075 | +2·566 | +10·442 | +3·671 | −0·331 | +16·348 | 64·423 | |
| 6 | E | | 45·450 | +2·579 | +10·415 | +0·096 | −1·213 | +11·877 | 57·327 | |
| 7 | W | α (1) | 49·550 | +2·593 | +10·390 | −0·516 | −0·717 | +11·750 | 61·300 | 59·499 |
| 8 | E | 30° | 44·225 | +2·593 | +10·362 | +0·789 | −0·937 | +12·807 | 57·032 | |
| 9 | W | | 50·750 | +2·587 | +10·334 | −0·105 | −1·231 | +11·585 | 62·335 | |
| 10 | E | | 48·325 | +2·588 | +10·307 | +0·705 | −1·397 | +12·203 | 60·528 | |
| 11 | W | α (1) | 49·225 | +2·582 | +10·278 | −0·076 | −0·680 | +12·104 | 61·329 | 61·495 |
| 12 | E | 50° | 49·975 | +2·575 | +10·251 | +0·404 | −1·636 | +11·594 | 61·569 | |
| 13 | W | | 51·500 | +2·581 | +10·222 | +0·033 | −1·783 | +11·053 | 62·553 | |
| 14 | E | | 42·300 | +2·589 | +10·194 | +1·580 | −2·352 | +12·011 | 54·311 | |
| 15 | W | α (1) | 53·150 | +2·584 | +10·164 | −1·404 | −1·452 | + 9·892 | 63·042 | 59·884 |
| 16 | E | 70° | 45·625 | +2·584 | +10·134 | +1·536 | −0·441 | +13·813 | 59·438 | |
| 17 | W | | 52·725 | +2·576 | +10·105 | −1·340 | −1·323 | +10·018 | 62·743 | |

Mean 2° 48′ 59″·5303

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 48″·150 | +2″·569 | +10″·075 | −0″·238 | −0″·901 | +11″·505 | 59″·655 | |
| 19 | W | α | 43·500 | +2·585 | +10·044 | +1·953 | +0·221 | +14·803 | 58·303 | 57″·801 |
| 20 | E | 20° | 42·775 | +2·606 | +10·013 | +0·284 | −0·992 | +11·911 | 54·686 | |
| 21 | W | | 45·350 | +2·594 | + 9·984 | +0·008 | +0·625 | +13·211 | 58·561 | |
| 22 | E | | 46·225 | +2·592 | + 9·954 | −0·461 | −0·331 | +11·754 | 57·979 | |
| 23 | W | α | 44·800 | +2·573 | + 9·923 | +1·405 | +0·368 | +14·269 | 59·069 | 58·001 |
| 24 | E | 40° | 44·900 | +2·562 | + 9·891 | −0·306 | −0·018 | +12·129 | 57·029 | |
| 25 | W | | 44·700 | +2·556 | + 9·860 | +0·956 | −0·147 | +13·225 | 57·925 | |
| 26 | E | | 42·575 | +2·562 | + 9·830 | −0·161 | −0·588 | +11·643 | 54·218 | |
| 27 | W | α | 48·375 | +2·566 | + 9·799 | +1·229 | 0·000 | +13·594 | 61·969 | 58·435 |
| 28 | E | 60° | 44·350 | +2·556 | + 9·768 | +0·038 | −0·368 | +11·994 | 56·344 | |
| 29 | W | | 46·850 | +2·549 | + 9·736 | +0·345 | +1·728 | +14·358 | 61·208 | |
| 30 | E | | 44·375 | +2·538 | + 9·703 | −0·459 | 0·000 | +11·782 | 56·157 | |
| 31 | W | α (1) | 46·500 | +2·532 | + 9·671 | +1·173 | +0·312 | +13·688 | 60·188 | 57·814 |
| Jan. 1 | E | 30° | 43·075 | +2·539 | + 9·669 | +0·779 | −1·966 | +11·021 | 54·096 | |
| 2 | W | | 48·675 | +2·529 | + 9·637 | +0·360 | −0·386 | +12·140 | 60·815 | |
| 3 | E | | 49·425 | +2·539 | + 9·605 | −2·764 | +0·129 | + 9·509 | 58·934 | |
| 4 | W | α (1) | 41·625 | +2·554 | + 9·572 | +4·375 | +0·827 | +17·328 | 58·953 | 58·658 |
| 5 | E | 50° | 49·625 | +2·560 | + 9·540 | −3·705 | −0·459 | + 7·936 | 57·561 | |
| 6 | W | | 43·500 | +2·566 | + 9·508 | +3·903 | −0·394 | +15·683 | 59·183 | |
| 7 | E | | 50·525 | +2·569 | + 9·476 | −3·180 | −0·809 | + 8·056 | 58·581 | |
| 8 | W | α (1) | 44·625 | +2·562 | + 9·443 | +2·519 | −0·533 | +13·991 | 58·616 | |
| 9 | E | 70° | 46·050 | +2·558 | + 9·410 | +0·705 | −1·084 | +11·589 | 57·639 | 58·436 |
| 10 | W | | 48·125 | +2·565 | + 9·378 | −0·486 | −0·478 | +10·979 | 59·104 | |
| 11 | E | | 46·825 | +2·564 | + 9·345 | +0·976 | −1·893 | +10·992 | 57·817 | |

Mean 2° 48′ 58″·1908

Mean Result of both Faces ..... 2° 48′ 58″·8606

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No. 19 (492) 64 Tauri $\delta^2$. South 0° 58′+

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 53″·675 | +0″·903 | +10″·609 | −0″·314 | +0″·349 | +11″·547 | 65″·222 | |
| 25 | E | α 20° | 51·650 | +0·903 | +10·598 | −0·263 | −0·018 | +11·220 | 62·870 | 64″·297 |
| 26 | W | | 55·525 | +0·903 | +10·587 | −0·385 | −0·717 | +10·388 | 65·913 | |
| 27 | E | | 52·475 | +0·900 | +10·574 | −1·154 | +0·386 | +10·706 | 63·181 | |
| 28 | W | | 55·625 | +0·900 | +10·561 | −2·200 | +1·415 | +10·676 | 66·301 | |
| 29 | E | α 40° | 50·600 | +0·896 | +10·550 | +1·431 | −1·231 | +11·646 | 62·246 | 66·569 |
| 30 | W | | 59·200 | +0·896 | +10·536 | −1·670 | +0·459 | +10·221 | 69·421 | |
| Dec. 1 | E | | 55·600 | +0·897 | +10·522 | +1·786 | −0·496 | +12·709 | 68·309 | |
| 2 | W | | 52·575 | +0·896 | +10·509 | +3·333 | +0·037 | +14·775 | 67·350 | |
| 3 | E | α 60° | 56·875 | +0·892 | +10·494 | −4·239 | −0·423 | + 6·724 | 63·599 | 67·031 |
| 4 | W | | 55·800 | +0·888 | +10·478 | +3·721 | −0·459 | +14·628 | 70·428 | |
| 5 | E | | 58·950 | +0·895 | +10·463 | −3·671 | +0·110 | + 7·797 | 66·747 | |
| 6 | W | | 59·350 | +0·900 | +10·447 | −0·096 | −1·213 | +10·038 | 69·388 | |
| 7 | E | α (1) 30° | 54·300 | +0·905 | +10·431 | +0·516 | −0·092 | +11·760 | 66·060 | 67·663 |
| 8 | W | | 58·150 | +0·905 | +10·414 | −0·789 | −0·496 | +10·034 | 68·184 | |
| 9 | E | | 56·425 | +0·902 | +10·395 | +0·105 | −0·809 | +10·593 | 67·018 | |
| 10 | W | | 54·875 | +0·903 | +10·379 | −0·705 | −0·625 | + 9·952 | 64·827 | |
| 11 | E | α (1) 50° | 57·600 | +0·901 | +10·361 | +0·076 | +0·441 | +11·779 | 69·379 | 68·335 |
| 12 | W | | 58·525 | +0·898 | +10·344 | −0·404 | −0·037 | +10·801 | 69·326 | |
| 13 | E | | 60·525 | +0·901 | +10·325 | −0·033 | −1·911 | + 9·282 | 69·807 | |
| 14 | W | | 61·550 | +0·903 | +10·306 | −1·580 | −2·628 | + 7·001 | 68·551 | |
| 15 | E | α (1) 70° | 57·225 | +0·902 | +10·287 | +1·404 | −1·489 | +11·104 | 68·329 | 69·457 |
| 16 | W | | 64·000 | +0·902 | +10·267 | −1·536 | −0·110 | + 9·523 | 73·523 | |
| 17 | E | | 56·225 | +0·899 | +10·248 | +1·340 | −1·286 | +11·201 | 67·426 | |

Mean 0° 59′ 7″·2253

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 53″·350 | +0″·896 | +10″·228 | +0″·238 | +0″·882 | +12″·244 | 65″·594 | |
| 19 | E | α 20° | 53·225 | +0·902 | +10·207 | −1·953 | +0·202 | + 9·358 | 62·583 | 64″·427 |
| 20 | W | | 53·700 | +0·909 | +10·185 | −0·284 | −1·195 | + 9·615 | 63·315 | |
| 21 | E | | 55·225 | +0·905 | +10·167 | −0·008 | −0·074 | +10·990 | 66·215 | |
| 22 | W | | 56·125 | +0·904 | +10·147 | +0·461 | −0·478 | +11·034 | 67·159 | |
| 23 | E | α 40° | 54·175 | +0·898 | +10·125 | −1·405 | +0·368 | + 9·986 | 64·161 | 64·783 |
| 24 | W | | 53·750 | +0·894 | +10·103 | +0·306 | +0·276 | +11·579 | 65·329 | |
| 25 | E | | 52·575 | +0·892 | +10·082 | −0·956 | −0·110 | + 9·908 | 62·483 | |
| 26 | W | | 55·325 | +0·894 | +10·061 | +0·161 | −0·276 | +10·840 | 66·165 | |
| 27 | E | α 60° | 51·625 | +0·895 | +10·039 | −1·229 | +0·386 | +10·091 | 61·716 | 64·449 |
| 28 | W | | 55·350 | +0·892 | +10·018 | −0·038 | +0·312 | +11·184 | 66·534 | |
| 29 | E | | 51·150 | +0·889 | + 9·995 | −0·345 | +1·691 | +12·230 | 63·380 | |
| 30 | W | | 53·875 | +0·885 | + 9·972 | +0·459 | 0·000 | +11·316 | 65·191 | |
| 31 | E | α (1) 30° | 52·425 | +0·883 | + 9·949 | −1·173 | +0·129 | + 9·788 | 62·213 | 63·650 |
| Jan. 1 | W | | 56·475 | +0·886 | + 9·957 | −0·779 | −2·040 | + 8·024 | 64·499 | |
| 2 | E | | 53·400 | +0·882 | + 9·934 | −0·360 | −1·158 | + 9·298 | 62·698 | |
| 3 | W | | 50·650 | +0·886 | + 9·911 | +2·764 | +0·074 | +13·635 | 64·285 | |
| 4 | E | α (1) 50° | 59·750 | +0·891 | + 9·887 | −4·375 | +0·110 | + 6·513 | 66·263 | 64·780 |
| 5 | W | | 50·225 | +0·893 | + 9·864 | +3·705 | −0·423 | +14·039 | 64·264 | |
| 6 | E | | 57·750 | +0·895 | + 9·840 | −3·903 | −0·276 | + 6·556 | 64·306 | |
| 7 | W | | 51·175 | +0·896 | + 9·816 | +3·180 | −0·772 | +13·120 | 64·295 | |
| 8 | E | α (1) 70° | 57·775 | +0·894 | + 9·792 | −2·519 | −0·294 | + 7·873 | 65·648 | |
| 9 | W | | 54·925 | +0·893 | + 9·767 | −0·705 | −0·404 | + 9·551 | 64·476 | 64·825 |
| 10 | E | | 54·875 | +0·895 | + 9·743 | +0·486 | −0·368 | +10·756 | 65·631 | |
| 11 | W | | 55·425 | +0·895 | + 9·718 | −0·976 | −1·801 | + 7·836 | 63·261 | |

Mean 0° 59′ 4″·4857

Mean Result of both Faces..... 0° 59′ 5″·8555



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## G. T. STATION DAMARGIDA.

No. 20 (510) 77 Tauri $\theta^1$. South 2° 26′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 48″·275 | +2″·252 | +10″·551 | +0″·314 | +0″·625 | +13″·742 | 62″·017 | |
| 25 | W | α | 52·275 | +2·251 | +10·529 | +0·263 | +0·404 | +13·447 | 65·722 | 63″·820 |
| 26 | E | 20° | 48·525 | +2·253 | +10·508 | +0·385 | +0·276 | +13·422 | 61·947 | |
| 27 | W | | 51·325 | +2·244 | +10·484 | +1·154 | +0·386 | +14·268 | 65·593 | |
| 28 | E | | 46·800 | +2·246 | +10·461 | +2·200 | +0·496 | +15·403 | 62·203 | |
| 29 | W | α | 56·975 | +2·235 | +10·439 | −1·431 | −0·331 | +10·912 | 67·887 | 66·279 |
| 30 | E | 40° | 49·800 | +2·235 | +10·415 | +1·670 | −0·018 | +14·302 | 64·102 | |
| Dec. 1 | W | | 60·100 | +2·238 | +10·390 | −1·786 | −0·018 | +10·824 | 70·924 | |
| 2 | E | | 52·400 | +2·234 | +10·366 | −3·333 | +0·037 | + 9·304 | 61·704 | |
| 3 | W | α | 46·475 | +2·225 | +10·341 | +4·239 | −0·221 | +16·584 | 63·059 | 63·433 |
| 4 | E | 60° | 52·375 | +2·222 | +10·315 | −3·721 | −0·478 | + 8·338 | 60·713 | |
| 5 | W | | 52·175 | +2·232 | +10·289 | +3·671 | −0·110 | +16·082 | 68·257 | |
| 6 | E | | 50·300 | +2·245 | +10·263 | +0·096 | 0·000 | +12·604 | 62·904 | |
| 7 | W | α (1) | 54·100 | +2·257 | +10·237 | −0·516 | −0·037 | +11·941 | 66·041 | 65·296 |
| 8 | E | 30° | 51·050 | +2·257 | +10·210 | +0·789 | +0·055 | +13·311 | 64·361 | |
| 9 | W | | 55·550 | +2·250 | +10·181 | −0·105 | 0·000 | +12·326 | 67·876 | |
| 10 | E | | 54·375 | +2·252 | +10·154 | +0·705 | −0·496 | +12·615 | 66·990 | |
| 11 | W | α (1) | 57·400 | +2·247 | +10·126 | −0·076 | −0·790 | +11·507 | 68·907 | 68·452 |
| 12 | E | 50° | 55·175 | +2·241 | +10·099 | +0·404 | +1·525 | +14·269 | 69·444 | |
| 13 | W | | 56·850 | +2·248 | +10·071 | +0·033 | −0·735 | +11·617 | 68·467 | |
| 14 | E | | 47·850 | +2·253 | +10·043 | +1·580 | −2·573 | +11·303 | 59·153 | |
| 15 | W | α (1) | 58·250 | +2·248 | +10·014 | −1·404 | −1·728 | + 9·130 | 67·380 | 63·775 |
| 16 | E | 70° | 47·625 | +2·249 | + 9·984 | +1·536 | −0·018 | +13·751 | 61·376 | |
| 17 | W | | 57·600 | +2·242 | + 9·956 | −1·340 | −1·268 | + 9·590 | 67·190 | |

Mean 2° 27′ 5″·1758

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 55″·075 | +2″·236 | + 9″·927 | −0″·238 | −0″·018 | +11″·907 | 66″·982 | |
| 19 | W | α | 48·325 | +2·249 | + 9·896 | +1·953 | −0·037 | +14·061 | 62·386 | 63″·176 |
| 20 | E | 20° | 50·350 | +2·269 | + 9·865 | +0·284 | −1·654 | +10·764 | 61·114 | |
| 21 | W | | 50·175 | +2·257 | + 9·838 | +0·008 | −0·055 | +12·048 | 62·223 | |
| 22 | E | | 51·250 | +2·255 | + 9·809 | −0·461 | −2·334 | + 9·269 | 60·519 | |
| 23 | W | α | 50·275 | +2·239 | + 9·778 | +1·405 | 0·000 | +13·422 | 63·697 | 62·342 |
| 24 | E | 40° | 50·050 | +2·230 | + 9·748 | −0·306 | +0·643 | +12·315 | 62·365 | |
| 25 | W | | 49·925 | +2·224 | + 9·718 | +0·956 | −0·037 | +12·861 | 62·786 | |
| 26 | E | | 48·475 | +2·230 | + 9·688 | −0·161 | −0·386 | +11·371 | 59·846 | |
| 27 | W | α | 52·700 | +2·233 | + 9·658 | +1·229 | +0·294 | +13·414 | 66·114 | 62·949 |
| 28 | E | 60° | 48·250 | +2·224 | + 9·629 | +0·038 | +0·331 | +12·222 | 60·472 | |
| 29 | W | | 52·025 | +2·218 | + 9·598 | +0·345 | +1·176 | +13·337 | 65·362 | |
| 30 | E | | 49·550 | +2·208 | + 9·567 | −0·459 | −0·423 | +10·893 | 60·443 | |
| 31 | W | α (1) | 52·100 | +2·204 | + 9·536 | +1·173 | −0·423 | +12·490 | 64·590 | 62·254 |
| Jan. 1 | E | 30° | 49·800 | +2·211 | + 9·536 | +0·779 | −2·830 | + 9·696 | 59·496 | |
| 2 | W | | 53·650 | +2·201 | + 9·506 | +0·360 | −1·231 | +10·836 | 64·486 | |
| 3 | E | | 53·600 | +2·209 | + 9·475 | −2·764 | +0·055 | + 8·975 | 62·575 | |
| 4 | W | α (1) | 47·100 | +2·224 | + 9·444 | +4·375 | +0·074 | +16·117 | 63·217 | 63·035 |
| 5 | E | 50° | 55·275 | +2·229 | + 9·413 | −3·705 | −0·643 | + 7·294 | 62·569 | |
| 6 | W | | 48·500 | +2·233 | + 9·383 | +3·903 | −0·239 | +15·280 | 63·780 | |
| 7 | E | | 55·400 | +2·236 | + 9·352 | −3·180 | −0·864 | + 7·544 | 62·944 | |
| 8 | W | α (1) | 48·600 | +2·229 | + 9·321 | +2·519 | −0·533 | +13·536 | 62·136 | |
| 9 | E | 70° | 50·875 | +2·227 | + 9·290 | +0·705 | −0·441 | +11·781 | 62·656 | 62·719 |
| 10 | W | | 52·350 | +2·233 | + 9·259 | −0·486 | −0·368 | +10·638 | 62·988 | |
| 11 | E | | 52·225 | +2·232 | + 9·228 | +0·976 | −1·636 | +10·800 | 63·025 | |

Mean 2° 27′ 2″·7458

Mean Result of both Faces ..... 2° 27′ 3″·9608

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No. 21 (523) 86 TAURI ρ. South 3° 32′ +

## Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 47″·775 | +3″·264 | +10″·484 | −0″·314 | +0″·165 | +13″·599 | 61″·374 | |
| 25 | E | α 20° | 44·225 | +3·263 | +10·453 | −0·263 | −0·129 | +13·324 | 57·549 | 59″·687 |
| 26 | W | | 49·100 | +3·267 | +10·423 | −0·385 | +0·147 | +13·452 | 62·552 | |
| 27 | E | | 44·800 | +3·254 | +10·391 | −1·154 | −0·018 | +12·473 | 57·273 | |
| 28 | W | | 50·625 | +3·256 | +10·359 | −2·200 | −0·827 | +10·588 | 61·213 | |
| 29 | E | α 40° | 44·750 | +3·240 | +10·328 | +1·431 | +0·772 | +15·771 | 60·521 | 62·390 |
| 30 | W | | 54·225 | +3·241 | +10·296 | −1·670 | −0·496 | +11·371 | 65·596 | |
| Dec. 1 | E | | 47·375 | +3·246 | +10·263 | +1·786 | −0·441 | +14·854 | 62·229 | |
| 2 | W | | 43·450 | +3·239 | +10·230 | +3·333 | −0·754 | +16·048 | 59·498 | |
| 3 | E | α 60° | 49·750 | +3·228 | +10·196 | −4·239 | −0·129 | + 9·056 | 58·806 | 60·966 |
| 4 | W | | 48·450 | +3·212 | +10·162 | +3·721 | −0·459 | +16·636 | 65·086 | |
| 5 | E | | 51·000 | +3·236 | +10·128 | −3·671 | −0·221 | + 9·472 | 60·472 | |
| 6 | W | | 53·525 | +3·255 | +10·093 | −0·096 | +1·176 | +14·428 | 67·953 | |
| 7 | E | α (1) 30° | 49·225 | +3·274 | +10·059 | +0·516 | −0·055 | +13·794 | 63·019 | 62·758 |
| 8 | W | | 49·575 | +3·273 | +10·024 | −0·789 | −0·459 | +12·049 | 61·624 | |
| 9 | E | | 45·100 | +3·262 | + 9·987 | +0·105 | −0·018 | +13·336 | 58·436 | |
| 10 | W | | 49·675 | +3·266 | + 9·953 | −0·705 | −0·772 | +11·742 | 61·417 | |
| 11 | E | α (1) 50° | 50·450 | +3·259 | + 9·916 | +0·076 | −1·654 | +11·597 | 62·047 | 64·406 |
| 12 | W | | 54·475 | +3·250 | + 9·882 | −0·404 | +1·176 | +13·904 | 68·379 | |
| 13 | E | | 53·075 | +3·260 | + 9·845 | −0·033 | −0·368 | +12·704 | 65·779 | |
| 14 | W | | 56·350 | +3·268 | + 9·809 | −1·580 | −1·930 | + 9·567 | 65·917 | |
| 15 | E | α (1) 70° | 45·225 | +3·260 | + 9·772 | +1·404 | −1·268 | +13·168 | 58·393 | 64·321 |
| 16 | W | | 57·600 | +3·261 | + 9·735 | −1·536 | −0·717 | +10·743 | 68·343 | |
| 17 | E | | 52·125 | +3·250 | + 9·699 | +1·340 | −1·783 | +12·506 | 64·631 | |

Mean 3° 33′ 2″·4213

## Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 47″·750 | +3″·242 | + 9″·663 | +0″·238 | −0″·018 | +13″·125 | 60″·875 | |
| 19 | E | α 20° | 47·850 | +3·262 | + 9·625 | −1·953 | +0·349 | +11·283 | 59·133 | 59″·326 |
| 20 | W | | 46·550 | +3·290 | + 9·587 | −0·284 | −0·570 | +12·023 | 58·573 | |
| 21 | E | | 47·100 | +3·272 | + 9·552 | −0·008 | −1·195 | +11·621 | 58·721 | |
| 22 | W | | 49·250 | +3·271 | + 9·516 | +0·461 | −1·838 | +11·410 | 60·660 | |
| 23 | E | α 40° | 48·875 | +3·247 | + 9·478 | −1·405 | 0·000 | +11·320 | 60·195 | 59·869 |
| 24 | W | | 46·950 | +3·233 | + 9·441 | +0·306 | +0·680 | +13·660 | 60·610 | |
| 25 | E | | 46·375 | +3·225 | + 9·404 | −0·956 | −0·037 | +11·636 | 58·011 | |
| 26 | W | | 49·775 | +3·235 | + 9·368 | +0·161 | −0·276 | +12·488 | 62·263 | |
| 27 | E | α 60° | 45·650 | +3·239 | + 9·331 | −1·229 | +0·221 | +11·562 | 57·212 | 60·153 |
| 28 | W | | 50·200 | +3·224 | + 9·295 | −0·038 | −0·074 | +12·407 | 62·607 | |
| 29 | E | | 45·425 | +3·217 | + 9·258 | −0·345 | +0·974 | +13·104 | 58·529 | |
| 30 | W | | 48·125 | +3·201 | + 9·220 | +0·459 | −0·110 | +12·770 | 60·895 | |
| 31 | E | α (1) 30° | 46·450 | +3·198 | + 9·183 | −1·173 | −0·092 | +11·116 | 57·566 | 58·793 |
| Jan. 1 | W | | 50·675 | +3·209 | + 9·181 | −0·779 | −3·106 | + 8·505 | 59·180 | |
| 2 | E | | 47·100 | +3·191 | + 9·144 | −0·360 | −1·544 | +10·431 | 57·531 | |
| 3 | W | | 46·000 | +3·204 | + 9·107 | +2·764 | +0·110 | +15·185 | 61·185 | |
| 4 | E | α (1) 50° | 53·500 | +3·225 | + 9·071 | −4·375 | −0·055 | + 7·866 | 61·366 | 60·668 |
| 5 | W | | 45·225 | +3·232 | + 9·034 | +3·705 | −0·643 | +15·328 | 60·553 | |
| 6 | E | | 51·325 | +3·239 | + 8·998 | −3·903 | −0·092 | + 8·242 | 59·567 | |
| 7 | W | | 44·450 | +3·242 | + 8·962 | +3·180 | −0·882 | +14·502 | 58·952 | |
| 8 | E | α (1) 70° | 51·900 | +3·231 | + 8·925 | −2·519 | −0·754 | + 8·883 | 60·783 | 59·961 |
| 9 | W | | 48·800 | +3·231 | + 8·889 | −0·705 | −0·515 | +10·900 | 59·700 | |
| 10 | E | | 48·950 | +3·239 | + 8·854 | +0·486 | −1·378 | +11·201 | 60·151 | |
| 11 | W | | 50·175 | +3·237 | + 8·818 | −0·976 | −1·544 | + 9·535 | 59·710 | |

Mean 3° 32′ 59″·7950

Mean Result of both Faces..... 3° 33′ 1″·1082





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## G. T. STATION DAMARGIDA.

### No. 22 (541) Tauri. North 10° 14′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 46″·950 | +9″·518 | — 9″·790 | —0″·314 | —0″·037 | — 0″·623 | 46″·327 | |
| 25 | W | α | 44·575 | +9·515 | — 9·842 | —0·263 | +1·305 | + 0·715 | 45·290 | 45·336 |
| 26 | E | 20° | 47·500 | +9·529 | — 9·896 | —0·385 | —0·055 | — 0·807 | 46·693 | |
| 27 | W | | 44·625 | +9·491 | — 9·947 | —1·154 | +0·018 | — 1·592 | 43·033 | |
| 28 | E | | 48·975 | +9·499 | — 9·999 | —2·200 | +0·919 | — 1·781 | 47·194 | |
| 29 | W | α | 44·325 | +9·453 | —10·052 | +1·431 | +0·202 | + 1·034 | 45·359 | 48·661 |
| 30 | E | 40° | 54·225 | +9·455 | —10·104 | —1·670 | +0·827 | — 1·492 | 52·733 | |
| Dec. 1 | W | | 46·625 | +9·467 | —10·156 | +1·786 | +1·636 | + 2·733 | 49·358 | |
| 2 | E | | 42·700 | +9·447 | —10·207 | +3·333 | +0·974 | + 3·547 | 46·247 | |
| 3 | W | α | 49·675 | +9·420 | —10·257 | —4·239 | +1·838 | — 3·238 | 46·437 | 47·317 |
| 4 | E | 60° | 44·900 | +9·367 | —10·308 | +3·721 | +0·515 | + 3·295 | 48·195 | |
| 5 | W | | 51·250 | +9·439 | —10·358 | —3·671 | +1·728 | — 2·862 | 48·388 | |
| 6 | E | | 51·400 | +9·496 | —10·408 | —0·096 | +0·092 | — 0·916 | 50·484 | |
| 7 | W | α (1) | 48·650 | +9·553 | —10·458 | +0·516 | +0·625 | + 0·236 | 48·886 | 48·472 |
| 8 | E | 30° | 48·250 | +9·550 | —10·507 | —0·789 | +1·103 | — 0·643 | 47·607 | |
| 9 | W | | 46·375 | +9·513 | —10·554 | +0·105 | +1·470 | + 0·534 | 46·909 | |
| 10 | E | | 50·750 | +9·528 | —10·603 | —0·705 | +1·011 | — 0·769 | 49·981 | |
| 11 | W | α (1) | 49·850 | +9·506 | —10·650 | +0·076 | +1·195 | + 0·127 | 49·977 | 50·598 |
| 12 | E | 50° | 52·775 | +9·479 | —10·699 | —0·404 | +0·515 | — 1·109 | 51·666 | |
| 13 | W | | 50·400 | +9·512 | —10·746 | —0·033 | +1·636 | + 0·369 | 50·769 | |
| 14 | E | | 53·750 | +9·534 | —10·792 | —1·580 | +2·040 | — 0·798 | 52·952 | |
| 15 | W | α (1) | 45·550 | +9·507 | —10·838 | +1·404 | +2·095 | + 2·168 | 47·718 | 52·088 |
| 16 | E | 70° | 58·125 | +9·512 | —10·883 | —1·536 | +2·242 | — 0·665 | 57·460 | |
| 17 | W | | 48·750 | +9·481 | —10·929 | +1·340 | +1·581 | + 1·473 | 50·223 | |

Mean 10° 14′ 48″·7453

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 46″·525 | +9″·455 | —10″·974 | +0″·238 | +0″·055 | — 1″·226 | 45″·299 | |
| 19 | W | α | 44·825 | +9·515 | —11·018 | —1·953 | +0·754 | — 2·702 | 42·123 | 42″·673 |
| 20 | E | 20° | 43·175 | +9·602 | —11·061 | —0·284 | +0·607 | — 1·136 | 42·039 | |
| 21 | W | | 41·550 | +9·545 | —11·106 | —0·008 | +1·250 | — 0·319 | 41·231 | |
| 22 | E | | 48·250 | +9·542 | —11·150 | +0·461 | +1·470 | + 0·323 | 48·573 | |
| 23 | W | α | 47·425 | +9·470 | —11·191 | —1·405 | —0·790 | — 3·916 | 43·509 | 45·843 |
| 24 | E | 40° | 48·875 | +9·432 | —11·233 | +0·306 | —0·221 | — 1·716 | 47·159 | |
| 25 | W | | 47·650 | +9·408 | —11·274 | —0·956 | —0·698 | — 3·520 | 44·130 | |
| 26 | E | | 51·075 | +9·438 | —11·316 | +0·161 | +0·423 | — 1·294 | 49·781 | |
| 27 | W | α | 45·875 | +9·448 | —11·356 | —1·229 | —0·257 | — 3·394 | 42·481 | 46·228 |
| 28 | E | 60° | 51·050 | +9·404 | —11·396 | —0·038 | +0·074 | — 1·956 | 49·094 | |
| 29 | W | | 46·925 | +9·383 | —11·434 | —0·345 | —0·974 | — 3·370 | 43·555 | |
| 30 | E | | 49·400 | +9·335 | —11·472 | +0·459 | +0·809 | — 0·869 | 48·531 | |
| 31 | W | α (1) | 47·350 | +9·332 | —11·509 | —1·173 | +0·735 | — 2·615 | 44·735 | 46·585 |
| Jan. 1 | E | 30° | 48·450 | +9·367 | —11·587 | —0·779 | +3·032 | + 0·033 | 48·483 | |
| 2 | W | | 45·850 | +9·308 | —11·623 | —0·860 | +1·415 | — 1·260 | 44·590 | |
| 3 | E | | 44·075 | +9·345 | —11·658 | +2·764 | +0·496 | + 0·947 | 45·022 | |
| 4 | W | α (1) | 52·425 | +9·411 | —11·693 | —4·375 | +1·434 | — 5·223 | 47·202 | 45·577 |
| 5 | E | 50° | 43·600 | +9·430 | —11·727 | +3·705 | +0·643 | + 2·051 | 45·651 | |
| 6 | W | | 50·575 | +9·447 | —11·760 | —3·903 | +0·074 | — 6·142 | 44·433 | |
| 7 | E | | 42·825 | +9·458 | —11·792 | +3·180 | +0·974 | + 1·820 | 44·645 | |
| 8 | W | α (1) | 50·050 | +9·424 | —11·824 | —2·519 | +0·809 | — 4·110 | 45·940 | |
| 9 | E | 70° | 47·725 | +9·428 | —11·854 | —0·705 | +0·110 | — 3·021 | 44·704 | 45·472 |
| 10 | W | | 46·175 | +9·451 | —11·884 | +0·486 | +1·231 | — 0·716 | 45·459 | |
| 11 | E | | 47·275 | +9·446 | —11·914 | —0·976 | +2·555 | — 0·889 | 46·386 | |

Mean 10° 14′ 45″·3963

Mean Result of both Faces ..... 10° 14′ 47″·0708

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## G. T. STATION DAMARGIDA.

No. 23 (555) 96 TAURI *K*. South 2° 25′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | α 20° | 50″·075 | +2″·234 | +10″·153 | −0″·314 | +0″·257 | +12″·330 | 62″·405 | 60″·330 |
| 25 | E | | 46·725 | +2·233 | +10·123 | −0·263 | −1·213 | +10·880 | 57·605 | |
| 26 | W | | 51·150 | +2·237 | +10·094 | −0·385 | −0·533 | +11·413 | 62·563 | |
| 27 | E | | 47·700 | +2·229 | +10·063 | −1·154 | −0·092 | +11·046 | 58·746 | |
| 28 | W | α 40° | 52·200 | +2·231 | +10·033 | −2·200 | −0·662 | + 9·402 | 61·602 | 61·405 |
| 29 | E | | 45·550 | +2·220 | +10·003 | +1·431 | −0·239 | +13·415 | 58·965 | |
| 30 | W | | 56·375 | +2·220 | + 9·973 | −1·670 | −1·525 | + 8·998 | 65·373 | |
| Dec. 1 | E | | 47·550 | +2·223 | + 9·941 | +1·786 | −1·819 | +12·131 | 59·681 | |
| 2 | W | α 60° | 46·975 | +2·218 | + 9·911 | +3·333 | −1·654 | +13·808 | 60·783 | 60·603 |
| 3 | E | | 51·925 | +2·213 | + 9·879 | −4·239 | −2·316 | + 5·537 | 57·462 | |
| 4 | W | | 47·325 | +2·199 | + 9·847 | +3·721 | −0·110 | +15·657 | 62·982 | |
| 5 | E | | 54·700 | +2·216 | + 9·815 | −3·671 | −1·875 | + 6·485 | 61·185 | |
| 6 | W | α (1) 30° | 53·650 | +2·230 | + 9·782 | −0·096 | −1·268 | +10·648 | 64·298 | 61·962 |
| 7 | E | | 50·525 | +2·244 | + 9·751 | +0·516 | −0·037 | +12·474 | 62·999 | |
| 8 | W | | 51·575 | +2·243 | + 9·717 | −0·789 | −1·195 | + 9·976 | 61·551 | |
| 9 | E | | 48·925 | +2·233 | + 9·683 | +0·105 | −1·948 | +10·073 | 58·998 | |
| 10 | W | α (1) 50° | 55·600 | +2·238 | + 9·651 | −0·705 | −1·672 | + 9·512 | 65·112 | 63·947 |
| 11 | E | | 51·100 | +2·232 | + 9·618 | +0·076 | −1·342 | +10·584 | 61·684 | |
| 12 | W | | 53·775 | +2·226 | + 9·586 | −0·404 | −1·672 | + 9·736 | 63·511 | |
| 13 | E | | 52·550 | +2·235 | + 9·552 | −0·033 | +1·176 | +12·930 | 65·480 | |
| 14 | W | α (1) 70° | 60·000 | +2·239 | + 9·519 | −1·580 | −2·261 | + 7·917 | 67·917 | 64·046 |
| 15 | E | | 47·000 | +2·232 | + 9·486 | +1·404 | −2·518 | +10·604 | 57·604 | |
| 16 | W | | 59·975 | +2·234 | + 9·452 | −1·536 | −2·536 | + 7·614 | 67·589 | |
| 17 | E | | 51·375 | +2·227 | + 9·419 | +1·340 | −1·286 | +11·700 | 63·075 | |

Mean 2° 26′ 2″·0488

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | α 20° | 47″·875 | +2″·220 | + 9″·386 | +0″·238 | −0″·055 | +11″·789 | 59″·664 | 60″·632 |
| 19 | E | | 49·675 | +2·234 | + 9·351 | −1·953 | −0·827 | + 8·805 | 58·480 | |
| 20 | W | | 48·075 | +2·256 | + 9·317 | −0·284 | −0·368 | +10·921 | 58·996 | |
| 21 | E | | 53·950 | +2·241 | + 9·286 | −0·008 | −0·082 | +11·437 | 65·387 | |
| 22 | W | α 40° | 50·600 | +2·241 | + 9·253 | +0·461 | −1·470 | +10·485 | 61·085 | 60·232 |
| 23 | E | | 48·950 | +2·224 | + 9·219 | −1·405 | +0·790 | +10·828 | 59·778 | |
| 24 | W | | 49·075 | +2·215 | + 9·186 | +0·306 | −0·478 | +11·229 | 60·304 | |
| 25 | E | | 48·400 | +2·209 | + 9·153 | −0·956 | +0·956 | +11·362 | 59·762 | |
| 26 | W | α 60° | 51·325 | +2·217 | + 9·120 | +0·161 | −0·515 | +10·983 | 62·308 | 59·994 |
| 27 | E | | 47·325 | +2·219 | + 9·088 | −1·229 | +0·165 | +10·243 | 57·568 | |
| 28 | W | | 50·425 | +2·208 | + 9·056 | −0·038 | +0·662 | +11·888 | 62·313 | |
| 29 | E | | 46·225 | +2·203 | + 9·023 | −0·345 | +0·680 | +11·561 | 57·786 | |
| 30 | W | α (1) 30° | 49·650 | +2·191 | + 8·990 | +0·459 | −1·103 | +10·537 | 60·187 | 58·740 |
| 31 | E | | 48·225 | +2·193 | + 8·957 | −1·173 | −0·901 | + 9·076 | 57·301 | |
| Jan. 1 | W | | 52·000 | +2·202 | + 8·961 | −0·779 | −2·205 | + 8·179 | 60·179 | |
| 2 | E | | 47·475 | +2·186 | + 8·929 | −0·360 | −0·937 | + 9·818 | 57·293 | |
| 3 | W | α (1) 50° | 46·625 | +2·194 | + 8·897 | +2·764 | −1·066 | +12·789 | 59·414 | 59·827 |
| 4 | E | | 55·025 | +2·211 | + 8·865 | −4·375 | −2·040 | + 4·661 | 59·686 | |
| 5 | W | | 46·725 | +2·215 | + 8·833 | +3·705 | −0·662 | +14·091 | 60·816 | |
| 6 | E | | 52·550 | +2·219 | + 8·802 | −3·903 | −0·276 | + 6·842 | 59·392 | |
| 7 | W | α (1) 70° | 47·100 | +2·222 | + 8·770 | +3·180 | −1·084 | +13·088 | 60·188 | 60·233 |
| 8 | E | | 52·325 | +2·212 | + 8·739 | −2·519 | −0·423 | + 8·009 | 60·334 | |
| 9 | W | | 50·500 | +2·215 | + 8·707 | −0·705 | −0·110 | +10·107 | 60·607 | |
| 10 | E | | 49·675 | +2·221 | + 8·677 | +0·486 | −0·772 | +10·612 | 60·287 | |
| 11 | W | | 51·900 | +2·219 | + 8·645 | −0·976 | −2·775 | + 7·113 | 59·013 | |

Mean 2° 25′ 59″·9430

Mean Result of both Faces..... 2° 26′ 0″·9959

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## G. T. STATION DAMARGIDA.

### No. 24 (575) 98 Tauri *k*. North 6° 44′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | α 20° | 42″·500 | +6″·227 | — 9″·391 | —0″·314 | +0″·533 | — 2″·945 | 39″·555 | 39″·130 |
| 25 | W | | 40·675 | +6·225 | — 9·415 | —0·263 | +0·919 | — 2·534 | 38·141 | |
| 26 | E | | 44·275 | +6·235 | — 9·440 | —0·385 | +1·617 | — 1·973 | 42·302 | |
| 27 | W | | 39·750 | +6·212 | — 9·463 | —1·154 | +1·176 | — 3·229 | 36·521 | |
| 28 | E | α 40° | 44·025 | +6·217 | — 9·486 | —2·200 | +1·617 | — 3·852 | 40·173 | 41·158 |
| 29 | W | | 39·550 | +6·189 | — 9·511 | +1·431 | —0·827 | — 2·718 | 36·832 | |
| 30 | E | | 50·300 | +6·190 | — 9·535 | —1·670 | +0·551 | — 4·464 | 45·836 | |
| Dec. 1 | W | | 42·025 | +6·195 | — 9·559 | +1·786 | +1·342 | — 0·236 | 41·789 | |
| 2 | E | α 60° | 39·600 | +6·185 | — 9·583 | +3·333 | +1·893 | + 1·828 | 41·428 | 40·105 |
| 3 | W | | 44·475 | +6·170 | — 9·605 | —4·239 | +1·728 | — 5·946 | 38·529 | |
| 4 | E | | 41·550 | +6·135 | — 9·628 | +3·721 | +0·735 | + 0·963 | 42·513 | |
| 5 | W | | 43·200 | +6·180 | — 9·652 | —3·671 | +1·893 | — 5·250 | 37·950 | |
| 6 | E | α (1) 30° | 46·675 | +6·217 | — 9·674 | —0·096 | —0·129 | — 3·682 | 42·993 | 40·932 |
| 7 | W | | 42·800 | +6·254 | — 9·697 | +0·516 | —0·202 | — 3·129 | 39·671 | |
| 8 | E | | 44·950 | +6·254 | — 9·719 | —0·789 | +0·919 | — 3·335 | 41·615 | |
| 9 | W | | 41·275 | +6·227 | — 9·741 | +0·105 | +1·581 | — 1·828 | 39·447 | |
| 10 | E | α (1) 50° | 49·600 | +6·238 | — 9·764 | —0·705 | +1·838 | — 2·393 | 47·207 | 43·989 |
| 11 | W | | 44·350 | +6·220 | — 9·785 | +0·076 | +1·544 | — 1·945 | 42·405 | |
| 12 | E | | 49·975 | +6·203 | — 9·808 | —0·404 | +1·709 | — 2·300 | 47·675 | |
| 13 | W | | 41·900 | +6·229 | — 9·830 | —0·033 | +0·404 | — 3·230 | 38·670 | |
| 14 | E | α (1) 70° | 53·350 | +6·241 | — 9·851 | —1·580 | +2·040 | — 3·150 | 50·200 | 45·163 |
| 15 | W | | 39·575 | +6·225 | — 9·873 | +1·404 | +2·499 | + 0·255 | 39·830 | |
| 16 | E | | 51·600 | +6·229 | — 9·893 | —1·536 | +2·665 | — 2·535 | 49·065 | |
| 17 | W | | 43·500 | +6·208 | — 9·915 | +1·340 | +0·423 | — 1·944 | 41·556 | |

Mean 6° 44′ 41″·7462

#### Face B to the fixed Microscopes. A.D. 1840-1.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | α 20° | 42″·850 | +6″·190 | — 9″·936 | +0″·238 | 0″·000 | — 3″·508 | 39″·342 | 36″·497 |
| 19 | W | | 39·325 | +6·229 | — 9·956 | —1·953 | +0·221 | — 5·459 | 33·866 | |
| 20 | E | | 40·700 | +6·286 | — 9·976 | —0·284 | —1·029 | — 5·003 | 35·697 | |
| 21 | W | | 39·225 | +6·247 | — 9·998 | —0·008 | +1·617 | — 2·142 | 37·083 | |
| 22 | E | α 40° | 43·800 | +6·244 | —10·019 | +0·461 | +1·930 | — 1·384 | 42·416 | 38·933 |
| 23 | W | | 42·700 | +6·197 | —10·039 | —1·405 | —0·478 | — 5·725 | 36·975 | |
| 24 | E | | 44·400 | +6·176 | —10·059 | +0·306 | —0·092 | — 3·669 | 40·731 | |
| 25 | W | | 42·100 | +6·160 | —10·078 | —0·956 | —1·617 | — 6·491 | 35·609 | |
| 26 | E | α 60° | 46·525 | +6·184 | —10·099 | +0·161 | +0·368 | — 3·386 | 43·139 | 39·434 |
| 27 | W | | 40·875 | +6·183 | —10·118 | —1·229 | —0·037 | — 5·201 | 35·674 | |
| 28 | E | | 46·675 | +6·158 | —10·138 | —0·038 | —0·018 | — 4·036 | 42·639 | |
| 29 | W | | 40·550 | +6·141 | —10·156 | —0·345 | +0·092 | — 4·268 | 36·282 | |
| 30 | E | α (1) 30° | 43·600 | +6·112 | —10·175 | +0·459 | +0·018 | — 3·586 | 40·014 | 38·611 |
| 31 | W | | 40·825 | +6·113 | —10·192 | —1·173 | +0·662 | — 4·590 | 36·235 | |
| Jan. 1 | E | | 44·175 | +6·136 | —10·254 | —0·779 | +1·636 | — 3·261 | 40·914 | |
| 2 | W | | 40·475 | +6·096 | —10·272 | —0·360 | +1·342 | — 3·194 | 37·281 | |
| 3 | E | α (1) 50° | 40·325 | +6·118 | —10·289 | +2·764 | +1·121 | — 0·286 | 40·039 | 38·426 |
| 4 | W | | 45·325 | +6·163 | —10·306 | —4·375 | +2·132 | — 6·386 | 38·939 | |
| 5 | E | | 38·475 | +6·177 | —10·323 | +3·705 | +0·607 | + 0·166 | 38·641 | |
| 6 | W | | 43·425 | +6·185 | —10·340 | —3·903 | +0·717 | — 7·341 | 36·084 | |
| 7 | E | α (1) 70° | 38·825 | +6·192 | —10·356 | +3·180 | +1·048 | + 0·064 | 38·889 | 39·255 |
| 8 | W | | 44·750 | +6·166 | —10·371 | —2·519 | +0·496 | — 6·228 | 38·522 | |
| 9 | E | | 43·350 | +6·175 | —10·386 | —0·705 | +0·827 | — 4·089 | 39·261 | |
| 10 | W | | 41·150 | +6·190 | —10·402 | +0·486 | +2·114 | — 1·612 | 39·538 | |
| 11 | E | | 43·200 | +6·186 | —10·416 | —0·976 | +2·297 | — 2·909 | 40·291 | |

Mean 6° 44′ 38″·5260

Mean Result of both Faces..... 6° 44′ 40″·1361

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No. 25 (589) 11 ORIONIS $y'$. South 2° 52′+

Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | | 28″·975 | +2″·644 | + 9″·871 | —0″·314 | —1″·195 | +11″·006 | 39″·981 | |
| 25 | E | a | 24·900 | +2·643 | + 9·833 | —0·263 | —0·772 | +11·441 | 36·341 | 38″·752 |
| 26 | W | 20° | 30·075 | +2·647 | + 9·796 | —0·385 | —0·735 | +11·323 | 41·398 | |
| 27 | E | | 27·500 | +2·638 | + 9·756 | —1·154 | —1·452 | + 9·788 | 37·288 | |
| 28 | W | | 30·150 | +2·640 | + 9·718 | —2·200 | —0·441 | + 9·717 | 39·867 | |
| 29 | E | a | 24·475 | +2·629 | + 9·680 | +1·431 | +0·882 | +14·622 | 39·097 | |
| 30 | W | 40° | 35·000 | +2·628 | + 9·641 | —1·670 | —0·202 | +10·397 | 45·397 | 41·502 |
| Dec. 1 | E | | 29·100 | +2·630 | + 9·602 | +1·786 | —1·470 | +12·548 | 41·648 | |
| 2 | W | | 27·575 | +2·627 | + 9·563 | +3·333 | —1·948 | +13·575 | 41·150 | |
| 3 | E | a | 30·750 | +2·620 | + 9·523 | —4·239 | —1·709 | + 6·195 | 36·945 | |
| 4 | W | 60° | 26·525 | +2·607 | + 9·483 | +3·721 | —1·011 | +14·800 | 41·325 | 39·460 |
| 5 | E | | 31·950 | +2·626 | + 9·444 | —3·671 | —1·930 | + 6·469 | 38·419 | |
| 6 | W | | 32·625 | +2·640 | + 9·404 | —0·096 | +0·018 | +11·966 | 44·591 | |
| 7 | E | a (1) | 31·100 | +2·655 | + 9·365 | +0·516 | +0·312 | +12·848 | 43·948 | |
| 8 | W | 30° | 33·350 | +2·656 | + 9·324 | —0·789 | —0·937 | +10·254 | 43·604 | 43·014 |
| 9 | E | | 29·275 | +2·645 | + 9·283 | +0·105 | —1·397 | +10·636 | 39·911 | |
| 10 | W | | 37·325 | +2·649 | + 9·244 | —0·705 | —1·617 | + 9·571 | 46·896 | |
| 11 | E | a (1) | 33·000 | +2·640 | + 9·203 | +0·076 | —1·599 | +10·320 | 43·320 | |
| 12 | W | 50° | 33·375 | +2·633 | + 9·164 | —0·404 | —1·066 | +10·327 | 43·702 | 43·244 |
| 13 | E | | 28·075 | +2·645 | + 9·124 | —0·033 | —0·754 | +10·982 | 39·057 | |
| 14 | W | | 37·775 | +2·650 | + 9·084 | —1·580 | —1·617 | + 8·537 | 46·312 | |
| 15 | E | a (1) | 24·675 | +2·645 | + 9·044 | +1·404 | —2·536 | +10·557 | 35·232 | |
| 16 | W | 70° | 39·050 | +2·646 | + 9·003 | —1·536 | —2·261 | + 7·852 | 46·902 | 42·801 |
| 17 | E | | 30·350 | +2·636 | + 8·964 | +1·340 | —0·533 | +12·407 | 42·757 | |

Mean 2° 52′ 41″·4622

Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | | 28″·400 | +2″·629 | + 8″·925 | +0″·238 | —0″·423 | +11″·369 | 39″·769 | |
| 19 | E | a | 27·150 | +2·646 | + 8·884 | —1·953 | —0·074 | + 9·503 | 36·653 | 39″·477 |
| 20 | W | 20° | 26·975 | +2·668 | + 8·844 | —0·284 | +0·974 | +12·202 | 39·177 | |
| 21 | E | | 32·675 | +2·653 | + 8·807 | —0·008 | —1·819 | + 9·633 | 42·308 | |
| 22 | W | | 31·600 | +2·650 | + 8·769 | +0·461 | —2·702 | + 9·178 | 40·778 | |
| 23 | E | a | 29·250 | +2·631 | + 8·729 | —1·405 | +0·570 | +10·525 | 39·775 | |
| 24 | W | 40° | 28·475 | +2·623 | + 8·691 | +0·306 | +0·423 | +12·043 | 40·518 | 40·310 |
| 25 | E | | 28·550 | +2·616 | + 8·652 | —0·956 | +1·305 | +11·617 | 40·167 | |
| 26 | W | | 31·550 | +2·627 | + 8·615 | +0·161 | —0·184 | +11·219 | 42·769 | |
| 27 | E | a | 27·300 | +2·625 | + 8·577 | —1·229 | +0·018 | + 9·991 | 37·291 | |
| 28 | W | 60° | 30·150 | +2·616 | + 8·540 | —0·038 | —0·037 | +11·081 | 41·231 | 39·294 |
| 29 | E | | 25·525 | +2·607 | + 8·502 | —0·345 | —0·404 | +10·360 | 35·885 | |
| 30 | W | | 29·825 | +2·597 | + 8·465 | +0·459 | —0·680 | +10·841 | 40·666 | |
| 31 | E | a (1) | 26·025 | +2·596 | + 8·427 | —1·173 | —1·011 | + 8·839 | 34·864 | |
| Jan. 1 | W | 30° | 31·825 | +2·605 | + 8·432 | —0·779 | —1·617 | + 8·641 | 40·466 | 37·994 |
| 2 | E | | 26·750 | +2·590 | + 8·396 | —0·360 | —1·397 | + 9·229 | 35·979 | |
| 3 | W | | 24·475 | +2·598 | + 8·360 | +2·764 | +0·607 | +14·329 | 38·804 | |
| 4 | E | a (1) | 33·725 | +2·617 | + 8·324 | —4·375 | —1·378 | + 5·188 | 38·913 | |
| 5 | W | 50° | 26·825 | +2·624 | + 8·288 | +3·705 | —0·496 | +14·121 | 40·946 | 39·412 |
| 6 | E | | 32·375 | +2·626 | + 8·254 | —3·903 | —0·368 | + 6·609 | 38·984 | |
| 7 | W | | 28·300 | +2·630 | + 8·219 | +3·180 | —1·066 | +12·963 | 41·263 | |
| 8 | E | a (1) | 31·050 | +2·618 | + 8·184 | —2·519 | —0·478 | + 7·805 | 38·855 | |
| 9 | W | 70° | 30·725 | +2·622 | + 8·149 | —0·705 | —0·735 | + 9·331 | 40·056 | 39·135 |
| 10 | E | | 28·225 | +2·629 | + 8·116 | +0·486 | —2·132 | + 9·099 | 37·324 | |
| 11 | W | | 31·200 | +2·627 | + 8·082 | —0·976 | —1·709 | + 8·024 | 39·224 | |

Mean 2° 52′ 39″·2703

Mean Result of both Faces ..... 2° 52′ 40″·3663

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## G. T. STATION DAMARGIDA.

No. 26 (604) 15 Orionis $y^2$. South 2° 39′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 43″·675 | +2″·449 | + 9″·743 | +0″·314 | −0″·055 | +12″·451 | 56″·126 | |
| 25 | W | α | 48·000 | +2·449 | + 9·704 | +0·263 | −0·441 | +11·975 | 59·975 | 58″·160 |
| 26 | E | 20° | 44·575 | +2·452 | + 9·666 | +0·385 | −0·386 | +12·117 | 56·692 | |
| 27 | W | | 46·750 | +2·444 | + 9·626 | +1·154 | −0·129 | +13·095 | 59·845 | |
| 28 | E | | 42·050 | +2·446 | + 9·586 | +2·200 | −0·423 | +13·809 | 55·859 | |
| 29 | W | α | 50·500 | +2·436 | + 9·548 | −1·431 | −0·037 | +10·516 | 61·016 | |
| 30 | E | 40° | 43·775 | +2·435 | + 9·508 | +1·670 | +0·018 | +13·631 | 57·406 | 59·279 |
| Dec. 1 | W | | 54·500 | +2·436 | + 9·469 | −1·786 | −1·783 | + 8·336 | 62·836 | |
| 2 | E | | 49·850 | +2·435 | + 9·429 | −3·333 | −1·709 | + 6·822 | 56·672 | |
| 3 | W | α | 46·025 | +2·427 | + 9·389 | +4·239 | −1·011 | +15·044 | 61·069 | |
| 4 | E | 60° | 50·425 | +2·417 | + 9·349 | −3·721 | −0·129 | + 7·916 | 58·341 | 60·073 |
| 5 | W | | 50·100 | +2·433 | + 9·309 | +3·671 | −1·305 | +14·108 | 64·208 | |
| 6 | E | | 46·575 | +2·446 | + 9·268 | +0·096 | 0·000 | +11·810 | 58·385 | |
| 7 | W | α (1) | 51·575 | +2·460 | + 9·228 | −0·516 | +0·386 | +11·558 | 63·133 | |
| 8 | E | 30° | 47·650 | +2·461 | + 9·188 | +0·789 | −0·956 | +11·482 | 59·132 | 60·564 |
| 9 | W | | 52·650 | +2·451 | + 9·146 | −0·105 | −2·536 | + 8·956 | 61·606 | |
| 10 | E | | 50·025 | +2·455 | + 9·106 | +0·705 | −1·378 | +10·888 | 60·913 | |
| 11 | W | α (1) | 53·400 | +2·445 | + 9·066 | −0·076 | −1·286 | +10·149 | 63·549 | |
| 12 | E | 50° | 48·825 | +2·439 | + 9·026 | +0·404 | −0·588 | +11·281 | 60·106 | 62·057 |
| 13 | W | | 52·925 | +2·450 | + 8·986 | +0·033 | −0·735 | +10·734 | 63·659 | |
| 14 | E | | 44·750 | +2·455 | + 8·945 | +1·580 | −1·158 | +11·822 | 56·572 | |
| 15 | W | α (1) | 57·225 | +2·451 | + 8·905 | −1·404 | −2·665 | + 7·287 | 64·512 | |
| 16 | E | 70° | 44·725 | +2·452 | + 8·865 | +1·536 | −2·297 | +10·556 | 55·281 | 60·078 |
| 17 | W | | 56·500 | +2·443 | + 8·826 | −1·340 | −2·481 | + 7·448 | 63·948 | |

Mean 2° 39′ 60″·0352

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 52″·325 | +2″·437 | + 8″·786 | −0″·238 | −0″·331 | +10″·654 | 62″·979 | |
| 19 | W | α | 43·075 | +2·451 | + 8·746 | +1·953 | +0·459 | +13·609 | 56·684 | 58″·371 |
| 20 | E | 20° | 45·450 | +2·471 | + 8·706 | +0·284 | −0·276 | +11·185 | 56·635 | |
| 21 | W | | 47·225 | +2·458 | + 8·669 | +0·008 | −1·176 | + 9·959 | 57·184 | |
| 22 | E | | 47·800 | +2·455 | + 8·630 | −0·461 | −2·720 | + 7·904 | 55·704 | |
| 23 | W | α | 45·400 | +2·437 | + 8·591 | +1·405 | +0·772 | +13·205 | 58·605 | |
| 24 | E | 40° | 46·825 | +2·431 | + 8·553 | −0·306 | −0·055 | +10·623 | 57·448 | 57·553 |
| 25 | W | | 46·725 | +2·424 | + 8·515 | +0·956 | −0·165 | +11·730 | 58·455 | |
| 26 | E | | 45·425 | +2·435 | + 8·477 | −0·161 | −0·551 | +10·200 | 55·625 | |
| 27 | W | α | 49·525 | +2·432 | + 8·440 | +1·229 | 0·000 | +12·101 | 61·626 | |
| 28 | E | 60° | 46·050 | +2·425 | + 8·403 | +0·038 | +0·074 | +10·940 | 56·990 | 58·406 |
| 29 | W | | 48·550 | +2·415 | + 8·366 | +0·345 | −0·294 | +10·832 | 59·382 | |
| 30 | E | | 47·175 | +2·407 | + 8·328 | −0·459 | −1·342 | + 8·934 | 56·109 | |
| 31 | W | α (1) | 48·800 | +2·406 | + 8·292 | +1·173 | −0·239 | +11·632 | 60·432 | |
| Jan. 1 | E | 30° | 46·375 | +2·413 | + 8·298 | +0·779 | −1·470 | +10·020 | 56·395 | 58·287 |
| 2 | W | | 49·850 | +2·401 | + 8·263 | +0·360 | −0·662 | +10·362 | 60·212 | |
| 3 | E | | 50·850 | +2·408 | + 8·227 | −2·764 | +1·378 | + 9·249 | 60·099 | |
| 4 | W | α (1) | 43·700 | +2·424 | + 8·192 | +4·375 | −0·735 | +14·256 | 57·956 | |
| 5 | E | 50° | 52·025 | +2·431 | + 8·157 | −3·705 | −0·404 | + 6·479 | 58·504 | 59·013 |
| 6 | W | | 44·850 | +2·434 | + 8·123 | +3·903 | +0·184 | +14·644 | 59·494 | |
| 7 | E | | 52·600 | +2·436 | + 8·088 | −3·180 | −1·048 | + 6·296 | 58·896 | |
| 8 | W | α (1) | 46·325 | +2·425 | + 8·054 | +2·519 | −0·037 | +12·961 | 59·286 | |
| 9 | E | 70° | 48·225 | +2·429 | + 8·020 | +0·705 | −0·717 | +10·437 | 58·662 | 58·546 |
| 10 | W | | 49·625 | +2·436 | + 7·987 | −0·486 | −1·801 | + 8·136 | 57·761 | |
| 11 | E | | 48·200 | +2·434 | + 7·954 | +0·976 | −1·415 | + 9·949 | 58·149 | |

Mean 2° 39′ 58″·3627

Mean Result of both Faces ..... 2° 39′ 59″·1990

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## No. 27 (642) 112 TAURI $\beta$. North 10° 24′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | W | a 20° | 38″·500 | +9″·677 | — 8″·005 | +0″·314 | +0″·551 | + 2″·537 | 41″·037 | 42″·725 |
| 25 | E | | 42·400 | +9·675 | — 8·038 | +0·263 | +0·570 | + 2·470 | 44·870 | |
| 26 | W | | 38·300 | +9·685 | — 8·072 | +0·385 | +1·103 | + 3·101 | 41·401 | |
| 27 | E | | 40·625 | +9·660 | — 8·105 | +1·154 | +0·257 | + 2·966 | 43·591 | |
| 28 | W | a 40° | 39·475 | +9·663 | — 8·138 | +2·200 | +1·011 | + 4·736 | 44·211 | 46·275 |
| 29 | E | | 45·250 | +9·630 | — 8·173 | —1·431 | +1·176 | + 1·202 | 46·452 | |
| 30 | W | | 40·350 | +9·623 | — 8·208 | +1·670 | +0·386 | + 3·471 | 43·821 | |
| Dec. 1 | E | | 49·475 | +9·623 | — 8·242 | —1·786 | +1·544 | + 1·139 | 50·614 | |
| 2 | W | a 60° | 45·450 | +9·630 | — 8·278 | —3·333 | +1·672 | — 0·309 | 45·141 | 45·118 |
| 3 | E | | 39·325 | +9·592 | — 8·312 | +4·239 | +1·434 | + 6·953 | 46·278 | |
| 4 | W | | 44·725 | +9·568 | — 8·347 | —3·721 | 0·000 | — 2·500 | 42·225 | |
| 5 | E | | 40·150 | +9·626 | — 8·383 | +3·671 | +1·764 | + 6·678 | 46·828 | |
| 6 | W | a (1) 30° | 39·900 | +9·671 | — 8·418 | +0·096 | +0·901 | + 2·250 | 42·150 | 44·642 |
| 7 | E | | 43·800 | +9·716 | — 8·455 | —0·516 | +0·037 | + 0·782 | 44·582 | |
| 8 | W | | 40·675 | +9·728 | — 8·491 | +0·789 | +1·048 | + 3·074 | 43·749 | |
| 9 | E | | 45·575 | +9·692 | — 8·526 | —0·105 | +1·452 | + 2·513 | 48·088 | |
| 10 | W | a (1) 50° | 41·325 | +9·704 | — 8·563 | +0·705 | +1·617 | + 3·463 | 44·788 | 46·569 |
| 11 | E | | 45·425 | +9·656 | — 8·599 | —0·076 | +1·672 | + 2·653 | 48·078 | |
| 12 | W | | 43·925 | +9·634 | — 8·637 | +0·404 | —0·276 | + 1·125 | 45·050 | |
| 13 | E | | 47·375 | +9·682 | — 8·674 | +0·033 | —0·055 | + 0·986 | 48·361 | |
| 14 | W | a (1) 70° | 38·025 | +9·698 | — 8·711 | +1·580 | +1·360 | + 3·927 | 41·952 | 46·855 |
| 15 | E | | 48·950 | +9·696 | — 8·748 | —1·404 | +3·694 | + 3·238 | 52·188 | |
| 16 | W | | 39·750 | +9·699 | — 8·785 | +1·536 | +2·297 | + 4·747 | 44·497 | |
| 17 | E | | 46·625 | +9·657 | — 8·823 | —1·340 | +2·665 | + 2·159 | 48·784 | |

Mean 10° 24′ 45″·3640

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | W | b 20° | 39″·075 | +9″·636 | — 8″·861 | —0″·238 | +1″·728 | + 2″·265 | 41″·340 | 42″·094 |
| 19 | E | | 40·325 | +9·690 | — 8·898 | +1·953 | +1·250 | + 3·995 | 44·320 | |
| 20 | W | | 40·050 | +9·758 | — 8·935 | +0·284 | +1·121 | + 2·228 | 42·278 | |
| 21 | E | | 38·825 | +9·714 | — 8·975 | +0·008 | +0·864 | + 1·611 | 40·436 | |
| 22 | W | b 40° | 39·500 | +9·694 | — 9·013 | —0·461 | +2·499 | + 2·719 | 42·219 | 42·192 |
| 23 | E | | 40·725 | +9·629 | — 9·051 | +1·405 | —0·882 | + 1·101 | 41·826 | |
| 24 | W | | 41·050 | +9·611 | — 9·089 | —0·306 | +0·037 | + 0·253 | 41·303 | |
| 25 | E | | 42·375 | +9·586 | — 9·128 | +0·956 | —0·368 | + 1·046 | 43·421 | |
| 26 | W | b 60° | 38·025 | +9·635 | — 9·167 | —0·161 | +1·397 | + 1·704 | 39·729 | 43·650 |
| 27 | E | | 46·025 | +9·605 | — 9·205 | +1·229 | +0·202 | + 1·831 | 47·856 | |
| 28 | W | | 39·700 | +9·592 | — 9·244 | +0·038 | +0·717 | + 1·103 | 40·803 | |
| 29 | E | | 45·475 | +9·543 | — 9·282 | +0·345 | +0·129 | + 0·735 | 46·210 | |
| 30 | W | b (1) 30° | 43·950 | +9·523 | — 9·320 | —0·459 | +0·680 | + 0·424 | 44·374 | 43·946 |
| 31 | E | | 43·225 | +9·508 | — 9·358 | +1·173 | +0·533 | + 1·856 | 45·081 | |
| Jan. 1 | W | | 38·925 | +9·533 | — 9·448 | +0·779 | +1·599 | + 2·463 | 41·388 | |
| 2 | E | | 43·375 | +9·498 | — 9·486 | +0·360 | +1·195 | + 1·567 | 44·942 | |
| 3 | W | b (1) 50° | 44·675 | +9·519 | — 9·524 | —2·764 | +0·202 | — 2·567 | 42·108 | 42·777 |
| 4 | E | | 37·100 | +9·579 | — 9·562 | +4·375 | +1·342 | + 5·734 | 42·834 | |
| 5 | W | | 44·425 | +9·615 | — 9·599 | —3·705 | +0·221 | — 3·468 | 40·957 | |
| 6 | E | | 41·325 | +9·619 | — 9·638 | +3·903 | 0·000 | + 3·884 | 45·209 | |
| 7 | W | b (1) 70° | 44·250 | +9·628 | — 9·675 | —3·180 | +1·066 | — 2·161 | 42·089 | 43·297 |
| 8 | E | | 40·225 | +9·580 | — 9·711 | +2·519 | +0·588 | + 2·976 | 43·201 | |
| 9 | W | | 41·300 | +9·598 | — 9·748 | +0·705 | +1·360 | + 1·915 | 43·215 | |
| 10 | E | | 42·375 | +9·628 | — 9·785 | —0·486 | +2·518 | + 1·875 | 44·250 | |
| 11 | W | | 39·675 | +9·620 | — 9·821 | +0·976 | +2·849 | + 3·624 | 43·299 | |

Mean 10° 24′ 42″·9927

Mean Result of both Faces ..... 10° 24′ 44″·1784

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## G. T. STATION DAMARGIDA.

No. 28 (670) 35 Orionis *u*. South 3° 51′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 42″·950 | +3″·557 | + 9″·306 | +0″·314 | −0″·717 | +12″·460 | 55″·410 | |
| 25 | W | *a* | 49·800 | +3·556 | + 9·250 | +0·263 | −0·680 | +12·389 | 62·189 | 58″·621 |
| 26 | E | 20° | 44·550 | +3·559 | + 9·194 | +0·385 | −0·698 | +12·440 | 56·990 | |
| 27 | W | | 47·375 | +3·551 | + 9·137 | +1·154 | −1·323 | +12·519 | 59·894 | |
| 28 | E | | 41·600 | +3·552 | + 9·080 | +2·200 | −0·625 | +14·207 | 55·807 | |
| 29 | W | *a* | 50·500 | +3·541 | + 9·024 | −1·431 | −0·055 | +11·079 | 61·579 | 60·117 |
| 30 | E | 40° | 45·200 | +3·538 | + 8·968 | +1·670 | −0·074 | +14·102 | 59·302 | |
| Dec. 1 | W | | 54·425 | +3·536 | + 8·911 | −1·786 | −1·305 | + 9·356 | 63·781 | |
| 2 | E | | 47·900 | +3·542 | + 8·855 | −3·333 | −1·764 | + 7·300 | 55·200 | |
| 3 | W | *a* | 43·350 | +3·526 | + 8·798 | +4·239 | −1·470 | +15·093 | 68·443 | 61·245 |
| 4 | E | 60° | 48·200 | +3·521 | + 8·741 | −3·721 | −0·496 | + 8·045 | 56·245 | |
| 5 | W | | 50·700 | +3·541 | + 8·685 | +3·671 | −1·507 | +14·390 | 65·090 | |
| 6 | E | | 48·200 | +3·555 | + 8·627 | +0·096 | −0·827 | +11·451 | 59·651 | |
| 7 | W | *a* (1) | 51·575 | +3·571 | + 8·572 | −0·516 | +0·165 | +11·792 | 63·367 | 62·460 |
| 8 | E | 30° | 48·775 | +3·577 | + 8·515 | +0·789 | −0·717 | +12·164 | 60·939 | |
| 9 | W | | 53·525 | +3·564 | + 8·458 | −0·105 | +0·441 | +12·358 | 65·883 | |
| 10 | E | | 50·150 | +3·568 | + 8·402 | +0·705 | −2·536 | +10·139 | 60·289 | |
| 11 | W | *a* (1) | 53·425 | +3·548 | + 8·346 | −0·076 | −0·404 | +11·414 | 64·839 | 62·014 |
| 12 | E | 50° | 46·250 | +3·540 | + 8·291 | +0·404 | +0·772 | +13·007 | 59·257 | |
| 13 | W | | 52·375 | +3·559 | + 8·235 | +0·033 | −0·533 | +11·294 | 63·669 | |
| 14 | E | | 44·700 | +3·564 | + 8·180 | +1·580 | −0·496 | +12·828 | 57·528 | |
| 15 | W | *a* (1) | 58·975 | +3·567 | + 8·125 | −1·404 | −3·473 | + 6·815 | 65·790 | 63·443 |
| 16 | E | 70° | 51·225 | +3·567 | + 8·070 | +1·536 | −0·441 | +12·732 | 63·957 | |
| 17 | W | | 57·925 | +3·551 | + 8·016 | −1·340 | −1·654 | + 8·573 | 66·498 | |

Mean 3° 51′ 61″·3167

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 52″·525 | +3″·544 | + 7″·963 | −0″·238 | −1″·581 | + 9″·688 | 62″·213 | |
| 19 | W | *a* | 41·900 | +3·563 | + 7·908 | +1·953 | −1·893 | +11·531 | 53·431 | 57″·824 |
| 20 | E | 20° | 46·025 | +3·585 | + 7·855 | +0·284 | −1·342 | +10·382 | 56·407 | |
| 21 | W | | 47·000 | +3·571 | + 7·803 | +0·008 | +0·864 | +12·246 | 59·246 | |
| 22 | E | | 47·500 | +3·562 | + 7·751 | −0·461 | −1·636 | + 9·216 | 56·716 | |
| 23 | W | *a* | 46·150 | +3·539 | + 7·699 | +1·405 | +0·570 | +13·213 | 59·363 | 57·727 |
| 24 | E | 40° | 44·850 | +3·534 | + 7·647 | −0·306 | +0·018 | +10·893 | 55·743 | |
| 25 | W | | 47·175 | +3·525 | + 7·596 | +0·956 | −0·165 | +11·912 | 59·087 | |
| 26 | E | | 44·775 | +3·545 | + 7·546 | −0·161 | −1·911 | + 9·019 | 53·794 | |
| 27 | W | *a* | 50·175 | +3·530 | + 7·496 | +1·229 | −0·459 | +11·796 | 61·971 | 57·726 |
| 28 | E | 60° | 44·100 | +3·528 | + 7·448 | +0·038 | −0·496 | +10·518 | 54·618 | |
| 29 | W | | 48·775 | +3·508 | + 7·398 | +0·345 | +0·496 | +11·747 | 60·522 | |
| 30 | E | | 46·250 | +3·503 | + 7·350 | −0·459 | −0·625 | + 9·769 | 56·019 | |
| 31 | W | *a* (1) | 47·300 | +3·496 | + 7·302 | +1·173 | −1·323 | +10·648 | 57·948 | 57·100 |
| Jan. 1 | E | 30° | 45·775 | +3·503 | + 7·302 | +0·779 | −2·040 | + 9·544 | 55·319 | |
| 2 | W | | 49·750 | +3·494 | + 7·255 | +0·360 | −1·746 | + 9·363 | 59·113 | |
| 3 | E | | 50·750 | +3·500 | + 7·209 | −2·764 | −0·386 | + 7·559 | 58·309 | |
| 4 | W | *a* (1) | 42·275 | +3·521 | + 7·163 | +4·375 | −1·286 | +13·773 | 56·048 | 58·256 |
| 5 | E | 50° | 52·875 | +3·536 | + 7·118 | −3·705 | −1·084 | + 5·865 | 58·740 | |
| 6 | W | | 45·450 | +3·536 | + 7·074 | +3·903 | −0·037 | +14·476 | 59·926 | |
| 7 | E | | 52·575 | +3·539 | + 7·030 | −3·180 | −0·937 | + 6·452 | 59·027 | |
| 8 | W | *a* (1) | 46·825 | +3·521 | + 6·986 | +2·519 | −0·845 | +12·181 | 59·006 | |
| 9 | E | 70° | 48·075 | +3·528 | + 6·943 | +0·705 | −0·864 | +10·312 | 58·387 | 58·550 |
| 10 | W | | 51·000 | +3·540 | + 6·901 | −0·486 | −2·279 | + 7·676 | 58·676 | |
| 11 | E | | 48·725 | +3·537 | + 6·860 | +0·976 | −2·738 | + 8·635 | 57·360 | |

Mean 3° 51′ 57″·8638

Mean Result of both Faces ..... 3° 51′ 59″·5903

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No. 29 (688) 125 TAURI. North 7° 44′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 45″·325 | +7″·166 | — 7″·760 | +0″·314 | —0″·459 | — 0″·739 | 44″·586 | |
| 25 | E | a | 50·825 | +7·165 | — 7·769 | +0·263 | +0·459 | + 0·118 | 50·943 | 48″·202 |
| 26 | W | 20° | 44·250 | +7·171 | — 7·781 | +0·385 | +0·919 | + 0·694 | 44·944 | |
| 27 | E | | 50·400 | +7·155 | — 7·790 | +1·154 | +1·415 | + 1·934 | 52·334 | |
| 28 | W | | 45·175 | +7·156 | — 7·801 | +2·200 | +0·037 | + 1·592 | 46·767 | |
| 29 | E | a | 51·500 | +7·136 | — 7·812 | —1·431 | +0·459 | — 1·648 | 49·852 | 49·926 |
| 30 | W | 40° | 46·200 | +7·128 | — 7·824 | +1·670 | —0·735 | + 0·239 | 46·439 | |
| Dec. 1 | E | | 57·400 | +7·124 | — 7·837 | —1·786 | +1·746 | — 0·753 | 56·647 | |
| 2 | W | | 50·450 | +7·138 | — 7·849 | —3·333 | +1·452 | — 2·592 | 47·858 | |
| 3 | E | a | 47·100 | +7·104 | — 7·861 | +4·239 | +0·680 | + 4·162 | 51·262 | 50·567 |
| 4 | W | 60° | 51·175 | +7·098 | — 7·874 | —3·721 | +0·165 | — 4·332 | 46·843 | |
| 5 | E | | 51·475 | +7·136 | — 7·887 | +3·671 | +1·911 | + 4·831 | 56·306 | |
| 6 | W | | 48·275 | +7·165 | — 7·900 | +0·096 | +0·147 | — 0·492 | 47·783 | |
| 7 | E | a (1) | 49·575 | +7·194 | — 7·914 | —0·516 | +0·018 | — 1·218 | 48·357 | 48·421 |
| 8 | W | 30° | 46·375 | +7·207 | — 7·928 | +0·789 | +0·441 | + 0·509 | 46·884 | |
| 9 | E | | 51·925 | +7·184 | — 7·941 | —0·105 | —0·404 | — 1·266 | 50·659 | |
| 10 | W | | 49·775 | +7·189 | — 7·956 | +0·705 | +1·378 | + 1·316 | 51·091 | |
| 11 | E | a (1) | 55·750 | +7·146 | — 7·971 | —0·076 | —0·643 | — 1·544 | 54·206 | 53·037 |
| 12 | W | 50° | 52·300 | +7·132 | — 7·987 | +0·404 | —0·772 | — 1·223 | 51·077 | |
| 13 | E | | 55·175 | +7·170 | — 8·003 | +0·033 | +1·397 | + 0·597 | 55·772 | |
| 14 | W | | 44·525 | +7·181 | — 8·018 | +1·580 | +0·662 | + 1·405 | 45·930 | |
| 15 | E | a (1) | 54·450 | +7·189 | — 8·034 | —1·404 | +1·636 | — 0·613 | 53·837 | 50·268 |
| 16 | W | 70° | 44·800 | +7·189 | — 8·051 | +1·536 | +1·011 | + 1·685 | 46·485 | |
| 17 | E | | 55·325 | +7·155 | — 8·068 | —1·340 | +1·746 | — 0·507 | 54·818 | |

Mean 7° 44′ 50″·0702

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 53″·025 | +7″·142 | — 8″·086 | —0″·238 | +1″·654 | + 0″·472 | 53″·497 | |
| 19 | E | a | 45·050 | +7·180 | — 8·102 | +1·953 | +1·158 | + 2·189 | 47·239 | 47″·376 |
| 20 | W | 20° | 43·450 | +7·222 | — 8·120 | +0·284 | +2·224 | + 1·610 | 45·060 | |
| 21 | E | | 45·950 | +7·195 | — 8·139 | +0·008 | —1·305 | — 2·241 | 43·709 | |
| 22 | W | | 44·575 | +7·174 | — 8·158 | —0·461 | +1·268 | — 0·177 | 44·398 | |
| 23 | E | a | 48·925 | +7·130 | — 8·177 | +1·405 | +0·276 | + 0·634 | 49·559 | 47·652 |
| 24 | W | 40° | 47·975 | +7·123 | — 8·196 | —0·306 | 0·000 | — 1·379 | 46·596 | |
| 25 | E | | 50·375 | +7·104 | — 8·215 | +0·956 | —0·165 | — 0·320 | 50·055 | |
| 26 | W | | 48·975 | +7·145 | — 8·235 | —0·161 | +1·434 | + 0·183 | 49·158 | |
| 27 | E | a | 51·500 | +7·111 | — 8·256 | +1·229 | +0·717 | + 0·801 | 52·301 | 49·309 |
| 28 | W | 60° | 46·150 | +7·111 | — 8·277 | +0·038 | +0·184 | — 0·944 | 45·206 | |
| 29 | E | | 52·300 | +7·067 | — 8·297 | +0·345 | —0·845 | — 1·730 | 50·570 | |
| 30 | W | | 48·250 | +7·062 | — 8·317 | —0·459 | +0·845 | — 0·869 | 47·381 | |
| 31 | E | a (1) | 50·475 | +7·044 | — 8·338 | +1·173 | +0·992 | + 0·871 | 51·346 | 49·217 |
| Jan. 1 | W | 30° | 46·425 | +7·058 | — 8·412 | +0·779 | +1·048 | + 0·473 | 46·898 | |
| 2 | E | | 51·225 | +7·043 | — 8·434 | +0·360 | +1·048 | + 0·017 | 51·242 | |
| 3 | W | | 50·025 | +7·053 | — 8·455 | —2·764 | —0·294 | — 4·460 | 45·565 | |
| 4 | E | a (1) | 43·325 | +7·094 | — 8·476 | +4·375 | +1·268 | + 4·261 | 47·586 | 47·062 |
| 5 | W | 50° | 50·000 | +7·127 | — 8·498 | —3·705 | +1·066 | — 4·010 | 45·990 | |
| 6 | E | | 46·600 | +7·125 | — 8·521 | +3·903 | 0·000 | + 2·507 | 49·107 | |
| 7 | W | | 51·275 | +7·131 | — 8·543 | —3·180 | +0·754 | — 3·838 | 47·437 | |
| 8 | E | a (1) | 46·750 | +7·093 | — 8·564 | +2·519 | +0·680 | + 1·728 | 48·478 | |
| 9 | W | 70° | 46·975 | +7·108 | — 8·586 | +0·705 | +0·257 | — 0·516 | 46·459 | 48·534 |
| 10 | E | | 51·100 | +7·132 | — 8·609 | —0·486 | +1·728 | — 0·235 | 50·865 | |
| 11 | W | | 46·250 | +7·127 | — 8·631 | +0·976 | +2·573 | + 2·045 | 48·295 | |

Mean 7° 44′ 48″·1917

Mean Result of both Faces..... 7° 44′ 49″·1310

3 A

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## G. T. STATION DAMARGIDA.

No. 30 (704) 129 Tauri. South 2° 17′+

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 24 | E | | 46″·650 | +2″·114 | + 8″·801 | +0″·314 | +0″·386 | +11″·615 | 58″·265 | |
| 25 | W | 20° α | 52·025 | +2·113 | + 8·748 | +0·263 | −0·717 | +10·407 | 62·432 | 59″·888 |
| 26 | E | | 46·650 | +2·115 | + 8·696 | +0·385 | −1·121 | +10·075 | 56·725 | |
| 27 | W | | 50·350 | +2·111 | + 8·642 | +1·154 | −0·129 | +11·778 | 62·128 | |
| 28 | E | | 46·450 | +2·111 | + 8·589 | +2·200 | +1·084 | +13·984 | 60·434 | |
| 29 | W | 40° α | 55·050 | +2·106 | + 8·537 | −1·431 | −1·286 | + 7·926 | 62·976 | 63·273 |
| 30 | E | | 50·700 | +2·103 | + 8·484 | +1·670 | +0·018 | +12·275 | 62·975 | |
| Dec. 1 | W | | 59·725 | +2·101 | + 8·432 | −1·786 | −1·764 | + 6·983 | 66·708 | |
| 2 | E | | 55·050 | +2·106 | + 8·380 | −3·333 | −2·022 | + 5·131 | 60·181 | |
| 3 | W | 60° α | 50·600 | +2·096 | + 8·327 | +4·239 | −0·790 | +13·872 | 64·472 | 62·635 |
| 4 | E | | 53·275 | +2·096 | + 8·275 | −3·721 | −0·294 | + 6·356 | 59·631 | |
| 5 | W | | 54·150 | +2·106 | + 8·223 | +3·671 | −1·893 | +12·107 | 66·257 | |
| 6 | E | | 51·075 | +2·114 | + 8·170 | +0·096 | +0·018 | +10·398 | 61·473 | |
| 7 | W | 30° α (1) | 55·150 | +2·122 | + 8·119 | −0·516 | −0·349 | + 9·376 | 64·526 | 63·128 |
| 8 | E | | 50·675 | +2·126 | + 8·067 | +0·789 | −0·588 | +10·394 | 61·069 | |
| 9 | W | | 55·725 | +2·120 | + 8·015 | −0·105 | −0·312 | + 9·718 | 65·443 | |
| 10 | E | | 54·525 | +2·121 | + 7·964 | +0·705 | −0·625 | +10·165 | 64·690 | |
| 11 | W | 50° α (1) | 60·600 | +2·107 | + 7·913 | −0·076 | −0·643 | + 9·301 | 69·901 | 67·182 |
| 12 | E | | 55·300 | +2·103 | + 7·863 | +0·404 | +0·404 | +10·774 | 66·074 | |
| 13 | W | | 59·150 | +2·115 | + 7·813 | +0·033 | −1·048 | + 8·913 | 68·063 | |
| 14 | E | | 49·275 | +2·118 | + 7·763 | +1·580 | +1·581 | +13·042 | 62·317 | |
| 15 | W | 70° α (1) | 61·025 | +2·122 | + 7·714 | −1·404 | −1·195 | + 7·237 | 68·262 | 64·704 |
| 16 | E | | 52·675 | +2·122 | + 7·664 | +1·536 | −2·022 | + 9·300 | 61·975 | |
| 17 | W | | 59·325 | +2·111 | + 7·616 | −1·340 | −1·452 | + 6·935 | 66·260 | |

Mean 2° 18′ 3″·4683

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 18 | E | | 53″·525 | +2″·108 | + 7″·568 | −0″·238 | −0″·845 | + 8″·593 | 62″·118 | |
| 19 | W | 20° α | 49·650 | +2·118 | + 7·519 | +1·953 | −0·294 | +11·296 | 60·946 | 60″·977 |
| 20 | E | | 50·600 | +2·130 | + 7·472 | +0·284 | −0·754 | + 9·132 | 59·732 | |
| 21 | W | | 51·500 | +2·123 | + 7·426 | +0·008 | +0·055 | + 9·612 | 61·112 | |
| 22 | E | | 51·575 | +2·116 | + 7·380 | −0·461 | −2·187 | + 6·848 | 58·423 | |
| 23 | W | 40° α | 50·400 | +2·103 | + 7·334 | +1·405 | +0·147 | +10·989 | 61·389 | 60·577 |
| 24 | E | | 50·550 | +2·102 | + 7·289 | −0·306 | +0·018 | + 9·103 | 59·653 | |
| 25 | W | | 52·050 | +2·096 | + 7·244 | +0·956 | +0·496 | +10·792 | 62·842 | |
| 26 | E | | 48·675 | +2·109 | + 7·200 | −0·161 | −1·691 | + 7·457 | 56·132 | |
| 27 | W | 60° α | 52·500 | +2·097 | + 7·157 | +1·229 | −0·680 | + 9·803 | 62·303 | 60·165 |
| 28 | E | | 50·325 | +2·099 | + 7·114 | +0·038 | −0·570 | + 8·681 | 59·006 | |
| 29 | W | | 53·625 | +2·085 | + 7·072 | +0·345 | +0·092 | + 9·594 | 63·219 | |
| 30 | E | | 50·850 | +2·084 | + 7·029 | −0·459 | −1·121 | + 7·533 | 58·383 | |
| 31 | W | 30° α (1) | 51·875 | +2·078 | + 6·988 | +1·173 | +0·018 | +10·257 | 62·132 | 60·686 |
| Jan. 1 | E | | 51·175 | +2·082 | + 6·991 | +0·779 | −1·323 | + 8·529 | 59·704 | |
| 2 | W | | 53·925 | +2·079 | + 6·951 | +0·360 | −0·790 | + 8·600 | 62·525 | |
| 3 | E | | 56·000 | +2·081 | + 6·912 | −2·764 | +0·441 | + 6·670 | 62·670 | |
| 4 | W | 50° α (1) | 48·425 | +2·093 | + 6·872 | +4·375 | −1·636 | +11·704 | 60·129 | 61·783 |
| 5 | E | | 57·325 | +2·103 | + 6·834 | −3·705 | −0·754 | + 4·478 | 61·803 | |
| 6 | W | | 49·875 | +2·102 | + 6·797 | +3·903 | −0·147 | +12·655 | 62·530 | |
| 7 | E | | 56·925 | +2·104 | + 6·760 | −3·180 | −0·764 | + 4·930 | 61·855 | |
| 8 | W | 70° α (1) | 49·125 | +2·092 | + 6·723 | +2·519 | −0·551 | +10·783 | 59·908 | |
| 9 | E | | 52·325 | +2·097 | + 6·687 | +0·705 | −0·864 | + 8·625 | 60·950 | 60·714 |
| 10 | W | | 54·350 | +2·104 | + 6·652 | −0·486 | −1·801 | + 6·469 | 60·819 | |
| 11 | E | | 53·100 | +2·103 | + 6·618 | +0·976 | −2·408 | + 7·289 | 60·389 | |

Mean 2° 18′ 0″·8170

Mean Result of both Faces..... 2° 18′ 2″·1427

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No. 31 (722) 136 Tauri *C*. North 9° 30′ +

### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | W | | 43″·700 | +8″·829 | — 6″·969 | +0″·314 | +0″·974 | + 3″·148 | 46″·848 | |
| 25 | E | *a* | 47·350 | +8·827 | — 6·981 | +0·263 | +0·807 | + 2·916 | 50·266 | 48″·206 |
| 26 | W | 20° | 43·775 | +8·832 | — 6·995 | +0·385 | +0·331 | + 2·553 | 46·328 | |
| 27 | E | | 46·750 | +8·817 | — 7·008 | +1·154 | —0·331 | + 2·632 | 49·382 | |
| 28 | W | | 43·225 | +8·817 | — 7·022 | +2·200 | +0·643 | + 4·638 | 47·863 | |
| 29 | E | *a* | 52·425 | +8·797 | — 7·036 | —1·431 | +1·268 | + 1·598 | 54·023 | 51·781 |
| 30 | W | 40° | 46·050 | +8·784 | — 7·052 | +1·670 | +0·441 | + 3·843 | 49·893 | |
| Dec. 1 | E | | 54·650 | +8·775 | — 7·068 | —1·786 | +0·772 | + 0·693 | 55·343 | |
| 2 | W | | 47·650 | +8·802 | — 7·084 | —3·333 | +2·463 | + 0·848 | 48·498 | |
| 3 | E | *a* | 43·725 | +8·754 | — 7·100 | +4·239 | +1·728 | + 7·621 | 51·346 | 50·030 |
| 4 | W | 60° | 47·650 | +8·759 | — 7·117 | —3·721 | —0·349 | — 2·428 | 45·222 | |
| 5 | E | | 47·600 | +8·802 | — 7·135 | +3·671 | +2·114 | + 7·452 | 55·052 | |
| 6 | W | | 45·000 | +8·831 | — 7·153 | +0·096 | +0·147 | + 1·921 | 46·921 | |
| 7 | E | *a* (1) | 48·025 | +8·862 | — 7·172 | —0·516 | +0·221 | + 1·395 | 49·420 | 48·992 |
| 8 | W | 30° | 44·925 | +8·883 | — 7·191 | +0·789 | +0·423 | + 2·904 | 47·829 | |
| 9 | E | | 49·575 | +8·857 | — 7·210 | —0·105 | +0·680 | + 2·222 | 51·797 | |
| 10 | W | | 47·250 | +8·861 | — 7·230 | +0·705 | +1·011 | + 3·347 | 50·597 | |
| 11 | E | *a* (1) | 51·250 | +8·799 | — 7·250 | —0·076 | +0·680 | + 2·153 | 53·403 | 52·215 |
| 12 | W | 50° | 47·975 | +8·783 | — 7·272 | +0·404 | +0·478 | + 2·393 | 50·368 | |
| 13 | E | | 52·200 | +8·834 | — 7·294 | +0·033 | +0·717 | + 2·290 | 54·490 | |
| 14 | W | | 45·750 | +8·846 | — 7·316 | +1·580 | +1·599 | + 4·709 | 50·459 | |
| 15 | E | *a* (1) | 54·300 | +8·867 | — 7·338 | —1·404 | +1·378 | + 1·503 | 55·803 | 53·130 |
| 16 | W | 70° | 44·875 | +8·866 | — 7·361 | +1·536 | +3·290 | + 6·331 | 51·206 | |
| 17 | E | | 53·650 | +8·820 | — 7·385 | —1·340 | +1·305 | + 1·400 | 55·050 | |

Mean 9° 30′ 50″·7257

### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | W | | 49″·550 | +8″·806 | — 7″·409 | —0″·238 | +0″·662 | + 1″·821 | 51″·371 | |
| 19 | E | *a* | 43·350 | +8·850 | — 7·433 | +1·953 | +1·286 | + 4·656 | 48·006 | 47″·097 |
| 20 | W | 20° | 43·350 | +8·893 | — 7·458 | +0·284 | —0·717 | + 1·002 | 44·352 | |
| 21 | E | | 41·925 | +8·867 | — 7·485 | +0·008 | +1·342 | + 2·732 | 44·657 | |
| 22 | W | | 42·600 | +8·835 | — 7·511 | —0·461 | +2·334 | + 3·197 | 45·797 | |
| 23 | E | *a* | 46·825 | +8·784 | — 7·537 | +1·405 | —0·018 | + 2·634 | 49·459 | 47·974 |
| 24 | W | 40° | 45·450 | +8·782 | — 7·564 | —0·306 | +0·698 | + 1·610 | 47·060 | |
| 25 | E | | 48·100 | +8·758 | — 7·592 | +0·956 | —0·643 | + 1·479 | 49·579 | |
| 26 | W | | 43·725 | +8·815 | — 7·620 | —0·161 | +2·077 | + 3·111 | 46·836 | |
| 27 | E | *a* | 48·450 | +8·759 | — 7·648 | +1·229 | +0·827 | + 3·167 | 51·617 | 49·021 |
| 28 | W | 60° | 43·975 | +8·771 | — 7·677 | +0·038 | +0·551 | + 1·683 | 45·658 | |
| 29 | E | | 50·625 | +8·707 | — 7·706 | +0·345 | 0·000 | + 1·346 | 51·971 | |
| 30 | W | | 45·775 | +8·711 | — 7·735 | —0·459 | +1·250 | + 1·767 | 47·542 | |
| 31 | E | *a* (1) | 48·000 | +8·681 | — 7·765 | +1·173 | +0·239 | + 2·328 | 50·328 | 48·854 |
| Jan. 1 | W | 30° | 43·825 | +8·694 | — 7·852 | +0·779 | +1·470 | + 3·091 | 46·916 | |
| 2 | E | | 48·050 | +8·688 | — 7·883 | +0·360 | +1·415 | + 2·580 | 50·630 | |
| 3 | W | | 49·550 | +8·695 | — 7·913 | —2·764 | +0·074 | — 1·908 | 47·642 | |
| 4 | E | *a* (1) | 41·775 | +8·741 | — 7·944 | +4·375 | +1·470 | + 6·642 | 48·417 | 48·129 |
| 5 | W | 50° | 48·650 | +8·788 | — 7·975 | —3·705 | +1·048 | — 1·844 | 46·806 | |
| 6 | E | | 44·900 | +8·782 | — 8·007 | +3·903 | +0·074 | + 4·752 | 49·652 | |
| 7 | W | | 49·025 | +8·788 | — 8·038 | —3·180 | +1·103 | — 1·327 | 47·698 | |
| 8 | E | *a* (1) | 45·350 | +8·738 | — 8·070 | +2·519 | +0·662 | + 3·849 | 49·199 | |
| 9 | W | 70° | 44·525 | +8·758 | — 8·101 | +0·705 | +0·790 | + 2·152 | 46·677 | 48·974 |
| 10 | E | | 49·225 | +8·791 | — 8·134 | —0·486 | +1·856 | + 2·027 | 51·252 | |
| 11 | W | | 44·500 | +8·783 | — 8·166 | +0·976 | +2·702 | + 4·295 | 48·795 | |

Mean 9° 30′ 48″·3415

Mean Result of both Faces..... 9° 30′ 49″·5336





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## G. T. STATION DAMARGIDA.

### No. 32 (737) 139 Tauri. North 7° 52′+

#### Face A to the fixed Microscopes. A.D. 1840.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 24 | E | | 24″·850 | +7″·286 | — 7″·005 | —0″·314 | +1″·856 | + 1″·823 | 26″·673 | |
| 25 | W | α 20° | 20·575 | +7·285 | — 7·005 | —0·263 | +0·478 | + 0·495 | 21·070 | 23·503 |
| 26 | E | | 26·150 | +7·288 | — 7·007 | —0·385 | —0·037 | — 0·141 | 26·009 | |
| 27 | W | | 19·950 | +7·277 | — 7·007 | —1·154 | +1·195 | + 0·311 | 20·261 | |
| 28 | E | | 26·350 | +7·277 | — 7·009 | —2·200 | +1·305 | — 0·627 | 25·723 | |
| 29 | W | α 40° | 19·450 | +7·261 | — 7·011 | +1·431 | +1·342 | + 3·023 | 22·473 | 26·913 |
| 30 | E | | 33·000 | +7·250 | — 7·015 | —1·670 | +1·195 | — 0·240 | 32·760 | |
| Dec. 1 | W | | 23·750 | +7·241 | — 7·018 | +1·786 | +0·937 | + 2·946 | 26·696 | |
| 2 | E | | 21·325 | +7·266 | — 7·022 | +3·333 | +2·114 | + 5·691 | 27·016 | |
| 3 | W | α 60° | 25·775 | +7·225 | — 7·026 | —4·239 | +1·875 | — 2·165 | 23·610 | 25·614 |
| 4 | E | | 22·700 | +7·233 | — 7·031 | +3·721 | +0·588 | + 4·511 | 27·211 | |
| 5 | W | | 25·175 | +7·266 | — 7·036 | —3·671 | +2·885 | — 0·556 | 24·619 | |
| 6 | E | | 29·900 | +7·289 | — 7·041 | —0·096 | +1·544 | + 1·696 | 31·596 | |
| 7 | W | α (1) 30° | 21·875 | +7·313 | — 7·048 | +0·516 | +0·588 | + 1·369 | 23·244 | 25·690 |
| 8 | E | | 25·600 | +7·332 | — 7·055 | —0·789 | +0·312 | — 0·200 | 25·400 | |
| 9 | W | | 21·375 | +7·312 | — 7·061 | +0·105 | +0·790 | + 1·146 | 22·521 | |
| 10 | E | | 26·500 | +7·314 | — 7·069 | —0·705 | +1·029 | + 0·569 | 27·069 | |
| 11 | W | α (1) 50° | 24·075 | +7·260 | — 7·078 | +0·076 | +0·919 | + 1·177 | 25·252 | 26·375 |
| 12 | E | | 29·550 | +7·248 | — 7·087 | —0·404 | +0·937 | + 0·694 | 30·244 | |
| 13 | W | | 22·075 | +7·290 | — 7·097 | —0·033 | +0·698 | + 0·858 | 22·933 | |
| 14 | E | | 31·225 | +7·300 | — 7·106 | —1·580 | +2·941 | + 1·555 | 32·780 | |
| 15 | W | α (1) 70° | 17·925 | +7·321 | — 7·117 | +1·404 | +2·187 | + 3·795 | 21·720 | 27·509 |
| 16 | E | | 28·675 | +7·319 | — 7·128 | —1·536 | +3·198 | + 1·853 | 30·528 | |
| 17 | W | | 21·800 | +7·280 | — 7·140 | +1·340 | +1·728 | + 3·208 | 25·008 | |

Mean 7° 52′ 25″·9340

#### Face B to the fixed Microscopes. A.D. 1840-41.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 18 | E | | 21″·775 | +7″·270 | — 7″·152 | +0″·238 | +1″·029 | + 1″·385 | 23″·160 | |
| 19 | W | α 20° | 18·000 | +7·305 | — 7·164 | —1·953 | +1·728 | — 0·084 | 17·916 | 21″·000 |
| 20 | E | | 21·975 | +7·337 | — 7·177 | —0·284 | +1·121 | + 0·997 | 22·972 | |
| 21 | W | | 18·050 | +7·318 | — 7·192 | —0·008 | +1·783 | + 1·901 | 19·951 | |
| 22 | E | | 21·875 | +7·290 | — 7·206 | +0·461 | +2·279 | + 2·824 | 24·699 | |
| 23 | W | α 40° | 22·550 | +7·248 | — 7·221 | —1·405 | +0·404 | — 0·974 | 21·576 | 22·669 |
| 24 | E | | 23·400 | +7·249 | — 7·237 | +0·306 | +0·570 | + 0·888 | 24·288 | |
| 25 | W | | 21·075 | +7·229 | — 7·252 | —0·956 | +0·018 | — 0·961 | 20·114 | |
| 26 | E | | 25·300 | +7·278 | — 7·269 | +0·161 | +1·489 | + 1·659 | 26·959 | |
| 27 | W | α 60° | 21·075 | +7·228 | — 7·286 | —1·229 | +0·827 | — 0·460 | 20·615 | 23·494 |
| 28 | E | | 26·475 | +7·241 | — 7·304 | —0·038 | +0·625 | + 0·524 | 26·999 | |
| 29 | W | | 20·525 | +7·186 | — 7·322 | —0·345 | —0·643 | — 1·124 | 19·401 | |
| 30 | E | | 24·575 | +7·192 | — 7·340 | +0·459 | +1·268 | + 1·579 | 26·154 | |
| 31 | W | α (1) 30° | 22·350 | +7·165 | — 7·359 | —1·173 | +0·901 | — 0·466 | 21·884 | 23·677 |
| Jan. 1 | E | | 24·125 | +7·174 | — 7·435 | —0·779 | +1·360 | + 0·320 | 24·445 | |
| 2 | W | | 21·525 | +7·173 | — 7·455 | —0·360 | +1·342 | + 0·700 | 22·225 | |
| 3 | E | | 20·950 | +7·177 | — 7·475 | +2·764 | +0·827 | + 3·293 | 24·243 | |
| 4 | W | α (1) 50° | 25·275 | +7·213 | — 7·495 | —4·375 | +1·415 | — 3·242 | 22·033 | 22·561 |
| 5 | E | | 18·650 | +7·254 | — 7·515 | +3·705 | +0·992 | + 4·436 | 23·086 | |
| 6 | W | | 25·000 | +7·248 | — 7·537 | —3·903 | +0·074 | — 4·118 | 20·882 | |
| 7 | E | | 19·175 | +7·253 | — 7·558 | +3·180 | +1·360 | + 4·235 | 23·410 | |
| 8 | W | α (1) 70° | 24·125 | +7·211 | — 7·580 | —2·519 | +0·404 | — 2·484 | 21·641 | |
| 9 | E | | 23·800 | +7·228 | — 7·602 | —0·705 | +0·717 | — 0·362 | 23·438 | 22·864 |
| 10 | W | | 19·425 | +7·255 | — 7·625 | +0·486 | +1·489 | + 1·605 | 21·030 | |
| 11 | E | | 24·600 | +7·249 | — 7·647 | —0·976 | +3·106 | + 1·732 | 26·332 | |

Mean 7° 52′ 22″·7108

Mean Result of both Faces ..... 7° 52′ 24″·3224

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SYNOPSIS of the results of the above Observations.

| No. | Position. | Mean Zenith dist. 1st January, 1841. Kalianpur. | Mean Zenith dist. 1st January, 1841. Damargida. | Amplitude. | Mean Declination January 1st 1841. | LATITUDES. Kalianpur. | LATITUDES. Damargida. |
|---|---|---|---|---|---|---|---|
| 1 | N | 4° 50′ 8″·420 | 10° 54′ 6″·003 | 6° 3′ 57″·583 | 28° 57′ 20″·825 | 24° 7′ 12″·405 | 18° 3′ 14″·822 |
| 2 | S | 9 47 33·289 | 3 43 37·562 | .. 55·727 | 14 19 36·774 | .. 10·063 | .. 14·336 |
| 3 | N | 2 15 14·907 | 8 19 12·721 | .. 57·814 | 26 22 28·044 | .. 13·137 | .. 15·323 |
| 4 | N | 4 27 45·134 | 10 31 42·213 | .. 57·079 | 28 34 57·709 | .. 12·575 | .. 15·496 |
| 5 | S | 9 41 48·178 | 3 37 53·539 | .. 54·639 | 14 25 21·618 | .. 9·796 | .. 15·157 |
| 6 | S | 6 44 6·492 | 0 40 11·530 | .. 54·962 | 17 23 4·846 | .. 11·338 | .. 16·376 |
| 7 | N | 1 42 31·638 | 7 46 28·129 | .. 56·491 | 25 49 40·015 | .. 12·377 | .. 15·886 |
| 8 | S | 6 51 29·107 | 0 47 33·561 | .. 55·546 | 17 15 42·196 | .. 11·302 | .. 15·756 |
| 9 | N | 2 31 57·513 | 8 35 54·729 | .. 57·216 | 26 39 8·978 | .. 11·465 | .. 14·249 |
| 10 | N | 4 20 49·425 | 10 24 46·770 | .. 57·345 | 28 28 1·483 | .. 12·058 | .. 14·713 |
| 11 | N | 0 2 10·802 | 6 6 7·436 | .. 56·634 | 24 9 20·412 | .. 9·610 | .. 12·976 |
| 12 | N | 0 41 23·738 | 6 45 21·478 | .. 57·740 | 24 48 35·691 | .. 11·953 | .. 14·213 |
| 13 | N | 0 12 55·429 | 6 16 52·323 | .. 56·894 | 24 20 5·691 | .. 10·262 | .. 13·368 |
| 14 | N | 0 58 26·644 | 7 2 24·250 | .. 57·606 | 25 5 39·059 | .. 12·415 | .. 14·809 |
| 15 | S | 6 22 46·576 | 0 18 52·151 | .. 54·425 | 17 44 23·772 | .. 10·348 | .. 15·923 |
| 16 | S | 7 12 38·024 | 1 8 42·998 | .. 55·026 | 16 54 34·258 | .. 12·276 | .. 17·250 |
| 17 | S | 9 7 21·122 | 3 3 27·121 | .. 54·001 | 14 59 49·982 | .. 11·104 | .. 17·103 |
| 18 | S | 8 52 54·184 | 2 48 58·861 | .. 55·323 | 15 14 16·441 | .. 10·625 | .. 15·302 |
| 19 | S | 7 2 59·343 | 0 59 5·856 | .. 53·487 | 17 4 11·175 | .. 10·518 | .. 17·031 |
| 20 | S | 8 30 58·630 | 2 27 3·961 | .. 54·669 | 15 36 12·075 | .. 10·705 | .. 16·036 |
| 21 | S | 9 36 54·775 | 3 33 1·108 | .. 53·667 | 14 30 14·920 | .. 9·695 | .. 16·028 |
| 22 | N | 4 10 49·881 | 10 14 47·071 | .. 57·190 | 28 18 2·143 | .. 12·262 | .. 15·072 |
| 23 | S | 8 29 55·853 | 2 26 0·996 | .. 54·857 | 15 37 15·685 | .. 11·538 | .. 16·681 |
| 24 | N | 0 40 42·687 | 6 44 40·136 | .. 57·449 | 24 47 55·122 | .. 12·435 | .. 14·986 |
| 25 | S | 8 56 34·951 | 2 52 40·366 | .. 54·585 | 15 10 35·301 | .. 10·252 | .. 15·667 |
| 26 | S | 8 43 54·773 | 2 39 59·199 | .. 55·574 | 15 23 18·520 | .. 13·293 | .. 17·719 |
| 27 | N | 4 40 46·813 | 10 24 44·178 | .. 57·365 | 28 27 58·508 | .. 11·695 | .. 14·330 |
| 28 | S | 9 55 53·638 | 3 51 59·590 | .. 54·048 | 14 11 15·942 | .. 9·580 | .. 15·532 |
| 29 | N | 1 40 51·762 | 7 44 49·131 | .. 57·369 | 25 48 3·504 | .. 11·742 | .. 14·373 |
| 30 | S | 8 21 56·411 | 2 18 2·143 | .. 54·268 | 15 45 14·765 | .. 11·176 | .. 16·908 |
| 31 | N | 3 26 52·280 | 9 30 49·534 | .. 57·254 | 27 34 2·993 | .. 10·713 | .. 13·459 |
| 32 | N | 1 48 27·011 | 7 52 24·322 | .. 57·311 | 25 55 38·458 | .. 11·447 | .. 14·136 |
| Mean Zen. Dist. by North Stars ..... | | | | 6 3 57·2713 | Mean | 24 7 11·3175 | 18 3 15·3442 |
| Do. do. do. by South Stars ..... | | | | 6 3 54·6753 | | | |
| General Mean ..... | | | | 6 3 55·9733 | | | |



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SYNOPSIS shewing the Amplitude of the Celestial Arc as derived from Stars North and South of the Zenith.

6° 3′+

| North Stars. | | South Stars. | |
|---|---|---|---|
| 57″·583 | | 55″·727 | |
| 57 ·814 | | 54 ·639 | |
| 57 ·079 | | 54 ·962 | |
| 56 ·491 | | 55 ·546 | |
| 57 ·216 | | 54 ·425 | |
| 57 ·345 | | 55 ·026 | |
| 56 ·634 | Maximum Diff. = 1″·323 | 54 ·001 | Maximum Diff. = 2″·240 |
| 57 ·740 | | 55 ·323 | |
| 56 ·894 | | 53 ·487 | |
| 57 ·606 | | 54 ·669 | |
| 57 ·190 | | 53 ·667 | |
| 57 ·449 | | 54 ·857 | |
| 57 ·365 | | 54 ·585 | |
| 57 ·369 | | 55 ·574 | |
| 57 ·254 | | 54 ·048 | |
| 57 ·311 | | 54 ·268 | |

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# OBSERVED ANGLES

OF THE

# SECTION KALIANPUR—KALIANA.

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## SERIES A.

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No. 1.—At the STATION of KALIANPUR.—December 1836 and January 1837.

| Zero. | Bhaorasa and Surantal. | Bhaorasa and Pardho. | Kamkhera and Bhaorasa. |
|---|---|---|---|
| | (87° 22′) − (10° 27′) = (76° 55′) | (87° 21′) − (34° 52′) = (52° 29′) | (154° 43′) − (87° 22′) = (67° 21′) |
| 0 | 40″·413 (3) − 12″·833 (3) = 27″·580 | 100″·413 (3) − 60″·507 (3) = 39″·907 | 69″·053 (3) − 40″·413 (3) = 28″·640 |
| 180 | 38″·900 (5) − 11″·913 (3) = 26″·987 | 98″·900 (5) − 59″·580 (3) = 39″·320 | 70″·400 (3) − 38″·900 (5) = 31″·500 |
| 9 | 42″·533 (3) − 12″·973 (3) = 29″·560 | 102″·533 (3) − 62″·053 (3) = 40″·480 | 71″·200 (3) − 42″·533 (3) = 28″·667 |
| 189 | 43″·507 (3) − 13″·133 (3) = 30″·373 | 103″·507 (3) − 61″·320 (3) = 42″·187 | 71″·480 (3) − 43″·507 (3) = 27″·973 |
| 18 | 43″·580 (3) − 14″·053 (3) = 29″·527 | 103″·580 (3) − 62″·467 (3) = 41″·113 | 70″·393 (3) − 43″·580 (3) = 26″·813 |
| 198 | 43″·740 (3) − 12″·873 (3) = 30″·867 | 103″·740 (3) − 60″·160 (3) = 43″·580 | 70″·680 (3) − 43″·740 (3) = 26″·940 |
| 27 | 41″·640 (3) − 13″·073 (3) = 28″·567 | 101″·640 (3) − 61″·693 (3) = 39″·947 | 71″·153 (3) − 41″·640 (3) = 29″·513 |
| 207 | 41″·407 (3) − 11″·847 (3) = 29″·560 | 101″·407 (3) − 59″·693 (3) = 41″·713 | 69″·447 (3) − 41″·407 (3) = 28″·040 |
| Means | 76° 55′ 29″·128 | 52° 29′ 41″·031 | 67° 21′ 28″·511 |
| Prob. | = 0·440 | = 0·467 | = 0·498 |

| Zero. | Kamkhera and Surantal. | Kamkhera and Pardho. | N. End Base and Surantal. |
|---|---|---|---|
| | (154° 43′) − (10° 27′) = (144° 16′) | (154° 43′) − (34° 52′) = (119° 51′) | (80° 41′) − (10° 27′) = (70° 14′) |
| 0 | 69″·053 (3) − 12″·833 (3) = 56″·220 | 69″·053 (3) − 60″·507 (3) = 8″·547 | 58″·473 (3) − 12″·833 (3) = 45″·640 |
| 180 | 70″·400 (3) − 11″·913 (3) = 58″·487 | 70″·400 (3) − 59″·580 (3) = 10″·820 | 59″·393 (3) − 11″·913 (3) = 47″·480 |
| 9 | 71″·200 (3) − 12″·973 (3) = 58″·227 | 71″·200 (3) − 62″·053 (3) = 9″·147 | 59″·893 (3) − 12″·973 (3) = 46″·920 |
| 189 | 71″·480 (3) − 13″·133 (3) = 58″·347 | 71″·480 (3) − 61″·320 (3) = 10″·160 | 59″·820 (3) − 13″·133 (3) = 46″·687 |
| 18 | 70″·393 (3) − 14″·053 (3) = 56″·340 | 70″·393 (3) − 62″·467 (3) = 7″·927 | 61″·040 (3) − 14″·053 (3) = 46″·987 |
| 198 | 70″·680 (3) − 12″·873 (3) = 57″·807 | 70″·680 (3) − 60″·160 (3) = 10″·520 | 61″·160 (3) − 12″·873 (3) = 48″·287 |
| 27 | 71″·153 (3) − 13″·073 (3) = 58″·080 | 71″·153 (3) − 61″·693 (3) = 9″·460 | 61″·313 (3) − 13″·073 (3) = 48″·240 |
| 207 | 69″·447 (3) − 11″·847 (3) = 57″·600 | 69″·447 (3) − 59″·693 (3) = 9″·753 | 60″·293 (3) − 11″·847 (3) = 48″·447 |
| Means | 144° 16′ 57″·639 | 119° 51′ 9″·542 | 70° 14′ 47″·336 |
| Prob. | = 0·293 | = 0·325 | = 0·320 |

| Zero. | Kamkhera and N. End Base. | N. End Base and Bhaorasa. | North Referring Lamp and Surantal. |
|---|---|---|---|
| | (154° 43′) − (80° 41′) = (74° 2′) | (87° 21′) − (80° 41′) = (6° 40′) | |
| 0 | 69″·053 (3) − 58″·473 (3) = 10″·580 | 100″·413 (3) − 58″·473 (3) = 41″·940 | 10° 27′ 12″·833 (3) |
| 180 | 70″·400 (3) − 59″·393 (3) = 11″·007 | 98″·900 (5) − 59″·393 (3) = 39″·507 | 11″·913 (3) |
| 9 | 71″·200 (3) − 59″·893 (3) = 11″·307 | 102″·533 (3) − 59″·893 (3) = 42″·640 | 12″·973 (3) |
| 189 | 71″·480 (3) − 59″·820 (3) = 11″·660 | 103″·507 (3) − 59″·820 (3) = 43″·687 | 13″·133 (3) |
| 18 | 70″·393 (3) − 61″·040 (3) = 9″·353 | 103″·580 (3) − 61″·040 (3) = 42″·540 | 14″·053 (3) |
| 198 | 70″·680 (3) − 61″·160 (3) = 9″·520 | 103″·740 (3) − 61″·160 (3) = 42″·580 | 12″·873 (3) |
| 27 | 71″·153 (3) − 61″·313 (3) = 9″·840 | 101″·640 (3) − 61″·313 (3) = 40″·327 | 13″·073 (3) |
| 207 | 69″·447 (3) − 60″·293 (3) = 9″·153 | 101″·407 (3) − 60″·293 (3) = 41″·113 | 11″·847 (3) |
| Means | 74° 2′ 10″·303 | 6° 40′ 41″·792 | 10° 27′ 12″·837 |
| Prob. | = 0·318 | = 0·457 | |

Azimuth of Lamp ..... = 179° 59′ 53″·368

Lamp and Surantal ..... = + 10° 27′ 12″·837

Azimuth of Surantal ..... = 190° 27′ 6″·205

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No. 2.—At the NORTH END of SERONJ BASE.—January 1837.

| Zero. | Kamkhera and S. End Base. | | Kamkhera and Kalianpur. | | Bhaorasa and Kalianpur. | |
|---|---|---|---|---|---|---|
| | (83° 34′) — (71° 25′) = (12° 9′) | | (83° 34′) — (40° 4′) = (43° 30′) | | (205° 41′) — (40° 4′) = (165° 37′) | |
| 0 | 75″·893 (3) — 14″·993 (3) = 60″·900 | | 75″·893 (3) — 52″·213 (3) = 23″·680 | | 110″·540 (3) — 52″·213 (3) = 58″·327 | |
| 180 | 76″·833 (3) — 14″·127 (3) = 62″·707 | | 76″·833 (3) — 51″·747 (3) = 25″·087 | | 111″·333 (3) — 51″·747 (3) = 59″·587 | |
| 9 | 74″·020 (3) — 14″·640 (3) = 59″·380 | | 74″·020 (3) — 52″·167 (3) = 21″·853 | | 109″·587 (3) — 52″·167 (3) = 57″·420 | |
| 189 | 74″·513 (3) — 13″·253 (3) = 61″·260 | | 74″·513 (3) — 51″·893 (3) = 22″·620 | | 109″·687 (3) — 51″·893 (3) = 57″·793 | |
| 18 | 77″·253 (3) — 13″·593 (3) = 63″·660 | | 77″·253 (3) — 54″·287 (3) = 22″·967 | | 109″·620 (3) — 54″·287 (3) = 55″·333 | |
| 198 | 76″·333 (3) — 12″·880 (3) = 63″·453 | | 76″·333 (3) — 53″·420 (3) = 22″·913 | | 109″·087 (3) — 53″·420 (3) = 55″·667 | |
| 27 | 77″·013 (3) — 14″·053 (3) = 62″·960 | | 77″·013 (3) — 52″·367 (3) = 24″·647 | | 109″·227 (3) — 52″·367 (3) = 56″·860 | |
| 207 | 77″·147 (3) — 13″·113 (3) = 64″·033 | | 77″·147 (3) — 54″·153 (3) = 22″·993 | | 110″·487 (3) — 54″·153 (3) = 56″·333 | |
| Means | 12° 10′ 2″·294 | Prob. = 0·535 | 43° 30′ 23″·345 | Prob. = 0·355 | 165° 37′ 57″·165 | Prob. = 0·469 |

| Zero. | Bhaorasa and Kamkhera. | | S. End Base and Surantal. | | Kamkhera and Surantal. | |
|---|---|---|---|---|---|---|
| | (205° 42′) — (83° 35′) = (122° 7′) | | | | | |
| 0 | 50″·540 (3) — 15″·893 (3) = 34″·647 | | 71° 25′ 14″·993 (3) | | 83° 35′ 15″·893 (3) | |
| 180 | 51″·333 (3) — 16″·833 (3) = 34″·500 | | 14″·127 (3) | | 16″·833 (3) | |
| 9 | 49″·587 (3) — 14″·020 (3) = 35″·567 | | 14″·640 (3) | | 14″·020 (3) | |
| 189 | 49″·687 (3) — 14″·513 (3) = 35″·173 | | 13″·253 (3) | | 14″·513 (3) | |
| 18 | 49″·620 (3) — 17″·253 (3) = 32″·367 | | 13″·593 (3) | | 17″·253 (3) | |
| 198 | 49″·087 (3) — 16″·333 (3) = 32″·753 | | 12″·880 (3) | | 16″·333 (3) | |
| 27 | 49″·227 (3) — 17″·013 (3) = 32″·213 | | 14″·053 (3) | | 17″·013 (3) | |
| 207 | 50″·487 (3) — 17″·147 (3) = 33″·340 | | 13″·113 (3) | | 17″·147 (3) | |
| Means | 122° 7′ 33″·820 | Prob. = 0·435 | 71° 25′ 13″·832 | Prob. = 0·249 | 83° 35′ 16″·126 | Prob. = 0·410 |

| Zero. | Kalianpur and Surantal. | | Surantal and Bhaorasa. | | | |
|---|---|---|---|---|---|---|
| 0 | 40° 4′ 52″·213 (3) | | 154° 17′ 9″·460 (3) | | | |
| 180 | 51″·747 (3) | | 8″·667 (3) | | | |
| 9 | 52″·167 (3) | | 10″·413 (3) | | | |
| 189 | 51″·893 (3) | | 10″·315 (3) | | | |
| 18 | 54″·287 (3) | | 10″·380 (3) | | | |
| 198 | 53″·420 (3) | | 10″·913 (3) | | | |
| 27 | 52″·367 (3) | | 10″·773 (3) | | | |
| 207 | 54″·153 (3) | | 9″·513 (3) | | | |
| Means | 40° 4′ 52″·781 | Prob. = 0·337 | 154° 17′ 10″·054 | Prob. = 0·254 | | |

No. 3.—At the SOUTH END of SERONJ BASE.—January 1837.

| Zero. | N. End Base and Surantal. | | Surantal and Kamkhera. | | Kamkhera and N. End Base. | |
|---|---|---|---|---|---|---|
| 0 | 73° 39′ 13″·773 (3) | | 132° 42′ 28″·780 (3) | | 153° 38′ 17″·447 (3) | |
| 180 | 15″·380 (3) | | 28″·767 (3) | | 15″·853 (3) | |
| 9 | 14″·420 (3) | | 26″·980 (3) | | 18″·600 (3) | |
| 189 | 15″·320 (3) | | 26″·607 (3) | | 18″·073 (3) | |
| 18 | 14″·827 (3) | | 26″·167 (3) | | 19″·007 (3) | |
| 198 | 16″·520 (3) | | 29″·320 (3) | | 14″·160 (3) | |
| 27 | 14″·960 (3) | | 27″·533 (3) | | 17″·507 (3) | |
| 207 | 15″·173 (3) | | 30″·087 (3) | | 14″·740 (3) | |
| Means | 73° 39′ 15″·047 | Prob. = 0·264 | 132° 42′ 28″·030 | Prob. = 0·465 | 153° 38′ 16″·923 | Prob. = 0·595 |



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No. 4.—At the STATION of SURANTAL.—December 1836.

| Zero. | Bhaorasa and Kamkhera. | | Bhaorasa and Kalianpur. | | Bhaorasa and N. End Base. | |
|---|---|---|---|---|---|---|
| | (35° 23′) + (27° 12′) = (62° 35′) | | (54° 22′) + (27° 12′) = (81° 34′) | | (27° 12′) − (15° 17′) = (11° 55′) | |
| 0 | 27·913″(3) + 30·920″(3) = 58″·833 | | 56·740″(3) + 30·920″(3) = 87″·660 | | 30·920″(3) − 23·947″(3) = 6″·973 | |
| 180 | 26·573″(3) + 32·053″(3) = 58·627 | | 55·607″(3) + 32·053″(3) = 87·660 | | 32·053″(3) − 25·640″(3) = 6·413 | |
| 9 | 27·733″(3) + 30·613″(3) = 58·347 | | 58·420″(3) + 30·613″(3) = 89·033 | | 30·613″(3) − 23·547″(3) = 7·067 | |
| 189 | 25·467″(3) + 32·080″(3) = 57·547 | | 56·907″(3) + 32·080″(3) = 88·987 | | 32·080″(3) − 25·040″(3) = 7·040 | |
| 18 | 25·940″(4) + 29·660″(3) = 55·600 | | 56·313″(3) + 29·660″(3) = 85·973 | | 29·660″(3) − 23·833″(3) = 5·827 | |
| 198 | 24·440″(3) + 31·673″(3) = 56·113 | | 57·080″(3) + 31·673″(3) = 88·753 | | 31·673″(3) − 24·533″(3) = 7·140 | |
| 27 | 24·567″(3) + 32·000″(3) = 56·567 | | 55·840″(3) + 32·000″(3) = 87·840 | | 32·000″(3) − 26·530″(4) = 5·470 | |
| 207 | 24·753″(3) + 30·613″(3) = 55·367 | | 56·153″(3) + 30·613″(3) = 86·767 | | 30·613″(3) − 25·373″(3) = 5·240 | |
| Means | 62° 35′ 57·125 | Prob. = 0·461 | 81° 35′ 27·834 | Prob. = 0·360 | 11° 55′ 6·396 | Prob. = 0·258 |

| Zero. | N. End Base and Kalianpur. | | N. End Base and S. End Base. | | N. End Base and Kamkhera. | |
|---|---|---|---|---|---|---|
| | (54° 22′) + (15° 17′) = (69° 39′) | | (15° 17′) + (19° 38′) = (34° 55′) | | (15° 17′) + (35° 23′) = (50° 40′) | |
| 0 | 56·740″(3) + 23·947″(3) = 80″·687 | | 23·947″(3) + 6·653″(3) = 30″·600 | | 23·947″(3) + 27·913″(3) = 51″·860 | |
| 180 | 55·607″(3) + 25·640″(3) = 81·247 | | 25·640″(3) + 6·747″(3) = 32·387 | | 25·640″(3) + 26·573″(3) = 52·213 | |
| 9 | 58·420″(3) + 23·547″(3) = 81·967 | | 23·547″(3) + 6·233″(3) = 29·780 | | 23·547″(3) + 27·733″(3) = 51·280 | |
| 189 | 56·907″(3) + 25·040″(3) = 81·947 | | 25·040″(3) + 5·393″(2) = 30·433 | | 25·040″(3) + 25·467″(3) = 50·507 | |
| 18 | 56·313″(3) + 23·833″(3) = 80·147 | | 23·833″(3) + 7·133″(3) = 30·967 | | 23·833″(3) + 25·940″(4) = 49·773 | |
| 198 | 57·080″(3) + 24·533″(3) = 81·613 | | 24·533″(3) + 4·653″(3) = 29·187 | | 24·533″(3) + 24·440″(3) = 48·973 | |
| 27 | 55·840″(3) + 26·530″(4) = 82·370 | | 26·530″(4) + 5·727″(3) = 32·257 | | 26·530″(4) + 24·567″(3) = 51·097 | |
| 207 | 56·153″(3) + 25·373″(3) = 81·527 | | 25·373″(3) + 4·390″(4) = 29·763 | | 25·373″(3) + 24·753″(3) = 50·127 | |
| Means | 69° 40′ 21·438 | Prob. = 0·341 | 34° 55′ 30·672 | Prob. = 0·384 | 50° 40′ 50·729 | Prob. = 0·361 |

| Zero. | Kamkhera and S. End Base. | | Kalianpur and Kamkhera. | | | |
|---|---|---|---|---|---|---|
| | (35° 23′) − (19° 38′) = (15° 45′) | | (54° 22′) − (35° 23′) = (18° 59′) | | | |
| 0 | 27·913″(3) − 6·653″(3) = 21″·260 | | 56·740″(3) − 27·913″(3) = 28″·827 | | | |
| 180 | 26·573″(3) − 6·747″(3) = 19·827 | | 55·607″(3) − 26·573″(3) = 29·033 | | | |
| 9 | 27·733″(3) − 6·233″(3) = 21·500 | | 58·420″(3) − 27·733″(3) = 30·687 | | | |
| 189 | 25·467″(3) − 5·393″(3) = 20·073 | | 56·907″(3) − 25·467″(3) = 31·440 | | | |
| 18 | 25·940″(4) − 7·133″(3) = 18·807 | | 56·313″(3) − 25·940″(4) = 30·373 | | | |
| 198 | 24·440″(3) − 4·653″(3) = 19·787 | | 57·080″(3) − 24·440″(3) = 32·640 | | | |
| 27 | 24·567″(3) − 5·727″(3) = 18·840 | | 55·840″(3) − 24·567″(3) = 31·273 | | | |
| 207 | 24·753″(3) − 4·390″(4) = 20·363 | | 56·153″(3) − 24·753″(3) = 31·400 | | | |
| Means | 15° 45′ 20·057 | Prob. = 0·326 | 18° 59′ 30·709 | Prob. = 0·424 | | |

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No. 5.—At the STATION of PARDHO.—December 1836.

| Zero. | Deadheri and Handiaparo. | | Handiaparo and Bhaorasa. | | Bhaorasa and Kamkhera. | |
|---|---|---|---|---|---|---|
| | (11° 13′) + (56° 19′) = (67° 32′) | | (125° 27′) − (56° 19′) = (69° 8′) | | (193° 26′) − (125° 27′) = (57° 59′) | |
| 0 | 37″·535(4) + 49″·133(3) = 86″·668 | | 51″·773(3) − 49″·133(3) = 2″·640 | | 90″·400(3) − 51″·773(3) = 38″·627 | |
| 180 | 38″·880(3) + 47″·347(3) = 86″·227 | | 52″·093(3) − 47″·347(3) = 4″·747 | | 91″·065(4) − 52″·093(3) = 38″·972 | |
| 9 | 38″·233(3) + 49″·100(3) = 87″·333 | | 51″·760(3) − 49″·100(3) = 2″·660 | | 91″·713(3) − 51″·760(3) = 39″·953 | |
| 189 | 38″·653(3) + 48″·887(3) = 87″·540 | | 52″·447(3) − 48″·887(3) = 3″·560 | | 90″·153(3) − 52″·447(3) = 37″·706 | |
| 18 | 38″·947(3) + 47″·653(3) = 86″·600 | | 52″·780(3) − 47″·653(3) = 5″·127 | | 90″·793(3) − 52″·780(3) = 38″·013 | |
| 198 | 39″·020(3) + 50″·200(3) = 89″·220 | Prob. = 0″·319 | 53″·620(3) − 50″·200(3) = 3″·420 | Prob. = 0″·303 | 90″·580(3) − 53″·620(3) = 36″·960 | Prob. = 0″·314 |
| 27 | 39″·547(3) + 47″·053(3) = 86″·600 | | 50″·800(3) − 47″·053(3) = 3″·747 | | 89″·293(3) − 50″·800(3) = 38″·493 | |
| 207 | 38″·940(3) + 48″·873(3) = 87″·813 | | 51″·873(3) − 48″·873(3) = 3″·000 | | 91″·233(3) − 51″·873(3) = 39″·360 | |
| Means | 67° 33′ 27″·250 | | 69° 8′ 3″·613 | | 67° 59′ 38″·511 | |

| Zero. | Kamkhera and Kalianpur. | | Kalianpur and Bhaorasa. | | |
|---|---|---|---|---|---|
| | (166° 32′) − (141° 24′) = (25° 8′) | | (218° 34′) − (125° 27′) = (93° 7′) | | |
| 0 | 29″·600(3) − 15″·320(4) = 14″·280 | | 104″·680(4) − 51″·773(3) = 52″·907 | | |
| 180 | 28″·935(4) − 14″·915(4) = 14″·020 | | 105″·085(4) − 52″·093(3) = 52″·992 | | |
| 9 | 28″·287(3) − 15″·873(3) = 12″·413 | | 104″·127(3) − 51″·760(3) = 52″·367 | | |
| 189 | 29″·847(3) − 16″·393(3) = 13″·453 | | 103″·607(3) − 52″·447(3) = 51″·160 | | |
| 18 | 29″·207(3) − 16″·473(3) = 12″·733 | | 103″·527(3) − 52″·780(3) = 50″·747 | | |
| 198 | 29″·420(3) − 15″·280(3) = 14″·140 | Prob. = 0″·364 | 104″·720(3) − 53″·620(3) = 51″·100 | Prob. = 0″·432 | |
| 27 | 30″·707(3) − 14″·687(3) = 16″·020 | | 105″·313(3) − 50″·800(3) = 54″·513 | | |
| 207 | 28″·767(3) − 14″·787(3) = 13″·980 | | 105″·213(3) − 51″·873(3) = 53″·340 | | |
| Means | 25° 8′ 13″·880 | | 93° 7′ 52″·391 | | |

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No. 6.—At the STATION of BHAORASA.—January 1837.

| Zero. | Handiaparo and Pardho. | | Pardho and Kalianpur. | | Kalianpur and Surantal. | |
|---|---|---|---|---|---|---|
| | (72° 49′) − (16° 27′) = (56° 22′) | | (17° 55′) + (16° 27′) = (34° 22′) | | (17° 55′) + (3° 33′) = (21° 28′) | |
| 0 | 20·075(4) − 13·733(3) = 6″·342 | | 14·565(4) + 13·733(3) = 28″·298 | | 14·565(4) + 50·287(3) = 64″·852 | |
| 180 | 21·733(3) − 13·140(4) = 8·593 | | 14·835(4) + 13·140(4) = 27·975 | | 14·835(4) + 51·380(3) = 66·215 | |
| 9 | 20·820(3) − 15·553(3) = 5·267 | | 12·410(4) + 15·553(3) = 27·963 | | 12·410(4) + 52.673(3) = 65·083 | |
| 189 | 23·007(3) − 13·593(3) = 9·413 | | 15·153(3) + 13·593(3) = 28·747 | | 15·153(3) + 50·280(3) = 65·433 | |
| 18 | 22·693(3) − 14·793(3) = 7·900 | | 13·665(4) + 14·793(3) = 28·458 | | 13·665(4) + 50·947(3) = 64·612 | |
| 198 | 22·887(3) − 13·453(3) = 9·433 | | 13·920(3) + 13·453(3) = 27·273 | | 13·920(3) + 51·813(3) = 65·733 | |
| 27 | 20·947(3) − 12·060(3) = 8·887 | | 15·250(4) + 12·060(3) = 27·310 | | 15·250(4) + 50·255(4) = 65·505 | |
| 207 | 23·647(3) − 13·833(3) = 9·813 | | 15·850(4) + 13·833(3) = 29·683 | | 15·850(4) + 50·480(3) = 66·330 | |
| Means | 56 22 8·206 | Prob. = 0·536 | 34 22 28·226 | Prob. = 0·255 | 21 29 5·470 | Prob. = 0·203 |

| Zero. | Kamkhera and Surantal. | | Kamkhera and Kalianpur. | | N. End Base and Kalianpur. | |
|---|---|---|---|---|---|---|
| | (42° 39′) + (3° 33′) = (46° 12′) | | (42° 38′) − (17° 55′) = (24° 43′) | | (17° 54′) − (10° 13′) = (7° 41′) | |
| 0 | 9″·140(3) + 50·287(3) = 59″·427 | | 69″·140(3) − 14″·565(4) = 54″·575 | | 74″·565(4) − 54″·513(3) = 20″·052 | |
| 180 | 8·873(3) + 51·380(3) = 60·253 | | 68·873(3) − 14·835(4) = 54·038 | | 74·835(4) − 55·027(3) = 19·808 | |
| 9 | 8.073(3) + 52·673(3) = 60·747 | | 68·073(3) − 12·410(4) = 55·663 | | 72·410(4) − 53·513(3) = 18·897 | |
| 189 | 9·813(3) + 50·280(3) = 60·093 | | 69·813(3) − 15·153(3) = 54·660 | | 75·153(3) − 55·027(3) = 20·127 | |
| 18 | 8·953(3) + 50·947(3) = 59·900 | | 68·953(3) − 13·665(4) = 55·288 | | 73·665(4) − 54·133(3) = 19·532 | |
| 198 | 9.820(3) + 51·813(3) = 61·633 | | 69·820(3) − 13·920(3) = 55·900 | | 73·920(3) − 54·820(3) = 19·100 | |
| 27 | 9·340(3) + 50·255(4) = 59·595 | | 69·340(3) − 15·250(4) = 54·090 | | 75·250(4) − 56·413(3) = 18·837 | |
| 207 | 11·127(3) + 50·480(3) = 61·607 | | 71·127(3) − 15·850(4) = 55·277 | | 75·850(4) − 56·313(3) = 19·537 | |
| Means | 46 13 0·407 | Prob. = 0·281 | 24 43 54·936 | Prob. = 0·231 | 7 41 19·486 | Prob. = 0·166 |

| Zero. | N. End Base and Surantal. | | N. End Base and Kamkhera. | | Kamkhera and Pardho. | |
|---|---|---|---|---|---|---|
| | (10° 13′) + (3° 33′) = (13° 46′) | | (42° 38′) − (10° 13′) = (32° 25′) | | (42° 39′) + (16° 27′) = (59° 6′) | |
| 0 | 54″·513(3) + 50″·287(3) = 104″·800 | | 69″·140(3) − 54″·513(3) = 14″·627 | | 9″·140(3) + 13″·733(3) = 22″·873 | |
| 180 | 55·027(3) + 51·380(3) = 106·407 | | 68·873(3) − 55·027(3) = 13·847 | | 8·873(3) + 13·140(4) = 22·013 | |
| 9 | 53·513(3) + 52·673(3) = 106·187 | | 68·073(3) − 53·513(3) = 14·560 | | 8·073(3) + 15·553(3) = 23·627 | |
| 189 | 55·027(3) + 50·280(3) = 105·307 | | 69·813(3) − 55·027(3) = 14·787 | | 9·813(3) + 13·593(3) = 23·407 | |
| 18 | 54·133(3) + 50·947(3) = 105·080 | | 68·953(3) − 54·133(3) = 14·820 | | 8·953(3) + 14·793(3) = 23·747 | |
| 198 | 54·820(3) + 51·813(3) = 106·633 | | 69·820(3) − 54·820(3) = 15·000 | | 9·820(3) + 13·453(3) = 23·273 | |
| 27 | 56·413(3) + 50·255(4) = 106·668 | | 69·340(3) − 56·413(3) = 12·927 | | 9·340(3) + 12·060(3) = 21·400 | |
| 207 | 56·313(3) + 50·480(3) = 106·793 | | 71·127(3) − 56·313(3) = 14·813 | | 11·127(3) + 13·833(3) = 24·960 | |
| Means | 13 47 45·984 | Prob. = 0·263 | 32 25 14·423 | Prob. = 0·231 | 59 6 23·163 | Prob. = 0·362 |

| Zero. | Kamkhera and Gargaja. | |
|---|---|---|
| | (110° 24′) − (42° 39′) = (67° 45′) | |
| 0 | 12″·033(3) − 9″·140(3) = 2″·893 | |
| 180 | 10·427(3) − 8·873(3) = 1·554 | |
| 9 | 10·580(3) − 8·073(3) = 2·507 | |
| 189 | 13·173(3) − 9·813(3) = 3·360 | |
| 18 | 10·927(3) − 8·953(3) = 1·974 | |
| 198 | 11·300(3) − 9·820(3) = 1·480 | |
| 27 | 10·653(3) − 9·340(3) = 1·313 | |
| 207 | 11·980(3) − 11·127(3) = 0·853 | |
| Mean | 67 45 1·992 | Prob. = 0·284 |

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No. 7.—At the STATION of KAMKHERA.—January 1837.

| Zero. | Bhaorasa and Pardho. | | Bhaorasa and N. End Base. | | N. End Base and Surantal. | |
|---|---|---|---|---|---|---|
| | (228° 35′) − (175° 42′) = (52° 53′) | | (228° 35′) − (203° 8′) = (25° 27′) | | (203° 8′) − (157° 25′) = (45° 43′) | |
| 0 | 72·513″(3) − 12·687″(3) = 59″·827 | | 72·513″(3) − 61·827″(3) = 10″·687 | | 61·827″(3) − 7·560″(3) = 54″·267 | |
| 180 | 70·873(3) − 12·960(3) = 57·913 | | 70·873(3) − 60·400(3) = 10·473 | | 60·400(3) − 8·047(3) = 52·353 | |
| 9 | 73·207(3) − 13·707(3) = 59·500 | | 73·207(3) − 63·427(3) = 9·780 | | 63·427(3) − 8·280(3) = 55·147 | |
| 189 | 72·693(3) − 12·500(3) = 60·193 | | 72·693(3) − 61·980(3) = 10·713 | | 61·980(3) − 9·900(3) = 52·080 | |
| 18 | 72·640(3) − 12·300(3) = 60·340 | | 72·640(3) − 60·287(3) = 12·353 | | 60·287(3) − 8·173(3) = 52·113 | |
| 198 | 73·460(3) − 12·480(3) = 60·980 | | 73·460(3) − 60·687(3) = 12·773 | | 60·687(3) − 9·293(3) = 51·393 | |
| 27 | 72·680(3) − 13·860(3) = 58·820 | | 72·680(3) − 60·827(3) = 11·853 | | 60·827(3) − 7·840(3) = 52·987 | |
| 207 | 70·627(3) − 13·340(3) = 57·287 | | 70·627(3) − 59·667(3) = 10·960 | | 59·667(3) − 7·560(3) = 52·107 | |
| Means | 52 53 59·358 | Prob. = 0·418 | 25 27 11·99 | Prob. = 0·338 | 45 43 52·806 | Prob. = 0·421 |

| Zero. | N. End Base and Kalianpur. | | N. End Base and S. End Base. | | S. End Base and Surantal. | |
|---|---|---|---|---|---|---|
| | (203° 8′) − (140° 41′) = (62° 27′) | | (203° 8′) − (188° 57′) = (14° 11′) | | (188° 57′) − (157° 25′) = (31° 32′) | |
| 0 | 61·827″(3) − 35·007″(3) = 26″·820 | | 61·827″(3) − 21·460″(3) = 40″·367 | | 21·460″(3) − 7·560″(3) = 13″·900 | |
| 180 | 60·400(3) − 36·027(3) = 24·373 | | 60·400(3) − 20·160(3) = 40·240 | | 20·160(3) − 8·047(3) = 12·113 | |
| 9 | 63·427(3) − 36·387(3) = 27·040 | | 63·427(3) − 22·327(3) = 41·100 | | 22·327(3) − 8·280(3) = 14·047 | |
| 189 | 61·980(3) − 35·800(3) = 26·180 | | 61·980(3) − 21·527(3) = 40·453 | | 21·527(3) − 9·900(3) = 11·627 | |
| 18 | 60·287(3) − 34·080(3) = 26·207 | | 60·287(3) − 20·593(3) = 39·693 | | 20·593(3) − 8·173(3) = 12·420 | |
| 198 | 60·687(3) − 35·440(3) = 25·247 | | 60·687(3) − 21·360(3) = 39·327 | | 21·360(3) − 9·293(3) = 12·067 | |
| 27 | 60·827(3) − 34·427(3) = 26·400 | | 60·827(3) − 20·333(3) = 40·493 | | 20·333(3) − 7·840(3) = 12·493 | |
| 207 | 59·667(3) − 37·140(3) = 22·527 | | 59·667(3) − 21·733(3) = 37·933 | | 21·733(3) − 7·560(3) = 14·173 | |
| Means | 62 27 25·599 | Prob. = 0·500 | 14 11 39·951 | Prob. = 0·322 | 31 32 12·855 | Prob. = 0·337 |

| Zero. | Surantal and Kalianpur. | | Bhaorasa and Surantal. | | Pardho and Kalianpur. | |
|---|---|---|---|---|---|---|
| | (157° 24′) − (140° 41′) = (16° 43′) | | (228° 36′) − (157° 25′) = (71° 11′) | | (175° 41′) − (140° 41′) = (35° 0′) | |
| 0 | 67·560″(3) − 35·007″(3) = 32″·553 | | 12·513″(3) − 7·560″(3) = 4″·953 | | 72·687″(3) − 35·007″(3) = 37″·680 | |
| 180 | 68·047(3) − 36·027(3) = 32·020 | | 10·873(3) − 8·047(3) = 2·827 | | 72·960(3) − 36·027(3) = 36·933 | |
| 9 | 68·280(3) − 36·387(3) = 31·893 | | 13·207(3) − 8·280(3) = 4·927 | | 73·707(3) − 36·387(3) = 37·320 | |
| 189 | 69·900(3) − 35·800(3) = 34·100 | | 12·693(3) − 9·900(3) = 2·793 | | 72·500(3) − 35·800(3) = 36·700 | |
| 18 | 68·173(3) − 34·080(3) = 34·093 | | 12·640(3) − 8·173(3) = 4·467 | | 72·300(3) − 34·080(3) = 38·220 | |
| 198 | 69·293(3) − 35·440(3) = 33·853 | | 13·460(3) − 9·293(3) = 4·167 | | 72·480(3) − 35·440(3) = 37·040 | |
| 27 | 67·840(3) − 34·427(3) = 33·413 | | 12·680(3) − 7·840(3) = 4·840 | | 73·860(3) − 34·427(3) = 39·433 | |
| 207 | 67·560(3) − 37·140(3) = 30·420 | | 10·627(3) − 7·560(3) = 3·067 | | 73·340(3) − 37·140(3) = 36·200 | |
| Means | 16 43 32·793 | Prob. = 0·433 | 71 11 4·005 | Prob. = 0·317 | 35 0 37·441 | Prob. = 0·334 |

| Zero. | Bhaorasa and Kalianpur. | | Bhaorasa and Gargaja. | | Gargaja and Ehmadpur. | |
|---|---|---|---|---|---|---|
| | (228° 35′) − (140° 41′) = (87° 54′) | | (296° 59′) − (228° 36′) = (68° 23′) | | (351° 7′) − (297° 0′) = (54° 7′) | |
| 0 | 72·513″(3) − 35·007″(3) = 37″·507 | | 62·260″(3) − 12·513″(3) = 49″·747 | | 47·813″(3) − 2·260″(3) = 45″·553 | |
| 180 | 70·873(3) − 36·027(3) = 34·847 | | 64·580(3) − 10·873(3) = 53·707 | | 47·667(3) − 4·580(3) = 43·087 | |
| 9 | 73·207(3) − 36·387(3) = 36·820 | | 65·307(3) − 13·207(3) = 52·100 | | 50·493(3) − 5·307(3) = 45·187 | |
| 189 | 72·693(3) − 35·800(3) = 36·893 | | 64·393(3) − 12·693(3) = 51·700 | | 48·740(3) − 4·393(3) = 44·347 | |
| 18 | 72·640(3) − 34·080(3) = 38·560 | | 64·687(3) − 12·640(3) = 52·047 | | 46·787(3) − 4·687(3) = 42·100 | |
| 198 | 73·460(3) − 35·440(3) = 38·020 | | 65·693(3) − 13·460(3) = 52·233 | | 48·787(3) − 5·693(3) = 43·093 | |
| 27 | 72·680(3) − 34·427(3) = 38·253 | | 65·613(3) − 12·680(3) = 52·933 | | 47·807(3) − 5·613(3) = 42·193 | |
| 207 | 70·627(3) − 37·140(3) = 33·487 | | 62·613(3) − 10·627(3) = 51·987 | | 47·427(3) − 2·613(3) = 44·813 | |
| Means | 87 54 36·798 | Prob. = 0·586 | 68 23 52·057 | Prob = 0·375 | 54 7 43·797 | Prob. = 0·447 |



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No. 8.—At the STATION of HANDIAPARO.—January and February 1837.

| Zero. | Hatiapahar and Deadheri. | Prob. = 0·312 | Deadheri and Pardho. | Prob. = 0·230 | Pardho and Bhaorasa. | Prob. = 0·367 |
|---|---|---|---|---|---|---|
| | (135° 10′) − (91° 30′) = (43° 40′) | | (91° 30′) − (20° 35′) = (70° 55′) | | (33° 54′) + (20° 35′) = (54° 29′) | |
| 0 | 69·000″(3) − 51·787″(3) = 17″·213 | | 51·787″(3) − 6·227″(3) = 45″·560 | | 43·833″(3) + 6·227″(3) = 50″·060 | |
| 180 | 68·740(3) − 50·873(3) = 17·867 | | 50·873(3) − 6·613(3) = 44·260 | | 45·927(3) + 6·613(3) = 52·540 | |
| 9 | 70·913(3) − 52·893(3) = 18·020 | | 52·893(3) − 7·320(3) = 45·573 | | 43·300(3) + 7·320(3) = 50·620 | |
| 189 | 70·333(3) − 51·600(3) = 18·733 | | 51·600(3) − 6·700(3) = 44·900 | | 46·067(3) + 6·700(3) = 52·767 | |
| 18 | 68·393(3) − 52·167(3) = 16·227 | | 52·167(3) − 7·947(3) = 44·220 | | 43·467(3) + 7·947(3) = 51·414 | |
| 198 | 68·627(3) − 51·240(3) = 17·387 | | 51·240(3) − 6·647(3) = 44·593 | | 45·560(3) + 6·647(3) = 52·207 | |
| 27 | 69·860(3) − 52·040(3) = 17·820 | | 52·040(3) − 5·893(3) = 46·147 | | 44·293(3) + 5·893(3) = 50·187 | |
| 207 | 70·347(3) − 51·013(3) = 19·330 | | 51·013(3) − 5·633(3) = 45·380 | | 44·733(3) + 5·633(3) = 50·367 | |
| Means | 43 40 17·825 | | 70 55 45·079 | | 54 29 51·270 | |

No. 9.—At the STATION of DEADHERI.—December 1836.

| Zero. | Bherkheri and Pahargarh. | Prob. = 0·219 | Pahargarh and Hatiapahar. | Prob. = 0·348 | Hatiapahar and Handiaparo. | Prob. = 0·207 |
|---|---|---|---|---|---|---|
| | (38° 23′) − (0° 31′) = (37° 52′) | | (0° 31′) + (45° 41′) = (46° 12′) | | (117° 19′) − (45° 41′) = (71° 38′) | |
| 0 | 31·107″(3) − 28·380″(3) = 2″·727 | | 28·380″(3) + 9·547″(3) = 37″·927 | | 32·013″(3) − 9·547″(3) = 22″·467 | |
| 180 | 32·947(3) − 29·113(3) = 3·833 | | 29·113(3) + 7·427(3) = 36·540 | | 29·860(3) − 7·427(3) = 22·433 | |
| 9 | 31·053(3) − 28·513(3) = 2·540 | | 28·513(3) + 9·793(3) = 38·307 | | 32·927(3) − 9·793(3) = 23·133 | |
| 189 | 32·007(3) − 27·993(3) = 4·013 | | 27·993(3) + 9·353(3) = 37·347 | | 31·940(3) − 9·353(3) = 22·587 | |
| 18 | 32·860(3) − 29·093(3) = 3·767 | | 29·093(3) + 10·753(3) = 39·847 | | 32·100(3) − 10·753(3) = 21·347 | |
| 198 | 33·007(3) − 28·873(3) = 4·133 | | 28·873(3) + 9·173(3) = 38·047 | | 31·367(3) − 9·173(3) = 22·193 | |
| 27 | 32·253(3) − 29·407(3) = 2·847 | | 29·407(3) + 8·933(3) = 38·340 | | 30·307(3) − 8·933(3) = 21·373 | |
| 207 | 33·327(3) − 30·527(3) = 2·800 | | 30·527(3) + 8·860(3) = 39·387 | | 30·613(2) − 8·860(3) = 21·753 | |
| Means | 37 52 3·333 | | 46 12 38·218 | | 71 38 22·161 | |

| Zero. | Handiaparo and Pardho. | Prob. = 0·441 |
|---|---|---|
| 0 | 41° 30′ 48·327″(3) | |
| 180 | 52·753(3) | |
| 9 | 50·793(3) | |
| 189 | 52·333(3) | |
| 18 | 51·593(3) | |
| 198 | 51·280(3) | |
| 27 | 51·033(3) | |
| 207 | 51·560(3) | |
| Means | 41 30 51·209 | |

No. 10.—At the STATION of HATIAPAHAR.—February 1837.

| Zero. | Nimdant and Pahargarh. | Prob. = 0·399 | Pahargarh and Deadheri. | Prob. = 0·193 | Deadheri and Handiaparo. | Prob. = 0·267 |
|---|---|---|---|---|---|---|
| | (63° 21′) − (13° 36′) = (49° 45′) | | (56° 46′) + (13° 36′) = (70° 22′) | | (121° 27′) − (56° 46′) = (64° 41′) | |
| 0 | 30·293″(3) − 12·153″(3) = 18″·140 | | 59·847″(3) + 12·153″(3) = 72″·000 | | 84·393″(3) − 59·847″(3) = 24″·547 | |
| 180 | 29·073(3) − 11·787(3) = 17·287 | | 59·947(3) + 11·787(3) = 71·733 | | 83·107(3) − 59·947(3) = 23·160 | |
| 9 | 30·173(3) − 14·000(3) = 16·173 | | 58·213(3) + 14·000(3) = 72·213 | | 82·313(3) − 58·213(3) = 24·100 | |
| 189 | 28·227(3) − 12·827(3) = 15·400 | | 59·747(3) + 12·827(3) = 72·573 | | 85·153(3) − 59·747(3) = 25·407 | |
| 18 | 28·160(3) − 13·200(3) = 14·960 | | 58·273(3) + 13·200(3) = 71·473 | | 83·773(3) − 58·273(3) = 25·500 | |
| 198 | 28·973(3) − 11·867(3) = 17·107 | | 60·653(3) + 11·867(3) = 72·520 | | 84·607(3) − 60·653(3) = 23·953 | |
| 27 | 28·667(3) − 12·693(3) = 15·973 | | 60·160(3) + 12·693(3) = 72·853 | | 83·853(3) − 60·160(3) = 23·693 | |
| 207 | 27·567(3) − 9·413(3) = 18·153 | | 61·753(3) + 9·413(3) = 71·167 | | 86·160(3) − 61·753(3) = 24·407 | |
| Means | 49 45 16·649 | | 70 23 12·067 | | 64 41 24·346 | |

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No. 11.—At the STATION of BHERKHERI.—December 1836.

| Zero. | Gugubara and Pahargarh. | Pahargarh and Deadheri. | |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | |
| 0 | 68 53 58·487 | 51 41 16·580 | |
| 180 | 59·807 | 16·573 | |
| 9 | 59·220 | 14·780 | |
| 189 | 59·313 | 17·793 | |
| 18 | 59·040 | 17·013 | |
| 198 | 58·440 | 17·867 | |
| 27 | 59·347 | 14·980 | |
| 207 | 59·140 | 15·940 | |
| Means | 68 53 59·099 | 51 41 16·441 | |
| | Prob. = 0·150 | Prob. = 0·383 | |

No. 12.—At the STATION of PAHARGARH.—December 1836 and January 1837.

| Zero. | Gugubara and Nimdant. | Nimdant and Hatiapahar. | Hatiapahar and Deadheri. |
|---|---|---|---|
| | ° ′ ″ (3) | ° ′ ″ (3) | ° ′ ° ′ ° ′ |
| | | | (129 23) — (65 59) = (63 24) |
| 0 | 78 37 38·840 | 65 59 9·667 | ″ (3) ″ (3) ″ |
| | | | 24·040 — 9·667 = 14·373 |
| 180 | 39·760 | 10·200 | 21·760 — 10·200 = 11·560 |
| 9 | 39·673 | 8·727 | 24·013 — 8·727 = 15·287 |
| 189 | 38·113 | 9·393 | 24·360 — 9·393 = 14·967 |
| 18 | 39·393 | 9·227 | 21·847 — 9·227 = 12·620 |
| 198 | 39·167 | 10·000 | 23·213 — 10·000 = 13·213 |
| 27 | 40·605 | 9·255 | 22·145 — 9·255 = 12·890 |
| 207 | 39·547 | 11·807 | 23·353 — 11·807 = 11·547 |
| Means | 78 37 39·387 | 65 59 9·785 | 63 24 13·307 |
| | Prob. = 0·240 | Prob. = 0·311 | Prob. = 0·478 |

| Zero. | Deadheri and Bherkheri. | Bherkheri and Gugubara. | Refers Lamp and Nimdant.—Dec. 1836. |
|---|---|---|---|
| | ° ′ ° ′ ° ′ | ° ′ ° ′ ° ′ | |
| | (219 49) — (129 23) = (90 26) | (281 22) — (219 50) = (61 32) | |
| 0 | ″ (3) ″ (3) ″ | ″ (3) ″ (3) ″ | ° ′ ″ (3) |
| | 61·887 — 24·040 = 37·847 | 21·160 — 1·887 = 19·273 | 56 53 31·847 |
| 180 | 62·587 — 21·760 = 40·827 | 20·240 — 2·587 = 17·653 | 31·540 |
| 9 | 63·200 — 24·013 = 39·187 | 20·327 — 3·200 = 17·127 | 30·407 |
| 189 | 63·073 — 24·360 = 38·713 | 21·887 — 3·073 = 18·813 | 29·473 |
| 18 | 62·707 — 21·847 = 40·860 | 20·607 — 2·707 = 17·900 | 31·060 |
| 198 | 63·340 — 23·213 = 40·127 | 20·833 — 3·340 = 17·493 | 30·910 |
| 27 | 63·860 — 22·145 = 41·715 | 19·395 — 3·860 = 15·535 | 31·680 |
| 207 | 64·213 — 23·353 = 40·860 | 20·453 — 4·213 = 16·240 | 31·940 |
| Means | 90 26 40·017 | 61 32 17·504 | 56 53 31·107 |
| | Prob. = 0·434 | Prob. = 0·408 | |

| Zero. | Refers Lamp and Nimdant.—Jan. 1837. | Azimuth of Nimdant determined. | |
|---|---|---|---|
| | | By ε Ursæ Minoris December 1836. | By λ Ursæ Minoris January 1837. |
| | ° ′ ″ (3) | | |
| 0 | 56 53 31·967 | | |
| 180 | 31·913 | | |
| 9 | 32·933 | | |
| 189 | 32·633 | | |
| 18 | 32·433 | | |
| 198 | 31·353 | | |
| 27 | 32·180 | | |
| 207 | 31·200 | | |
| | | Azimuth of Lamp = 179° 25′ 47″·727 | Azimuth of Lamp .. = 179° 25′ 47″·678 |
| | | Lamp and Nimdant = +56 53 31·107 | Lamp and Nimdant = +56 53 32·077 |
| | | Azimuth of Nimdant = 236 19 18·834 | Azimuth of Nimdant = 236 19 19·755 |
| Mean | 56 53 32·077 | Mean Azimuth = 236 19 19·295 | |

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No. 13.—At the STATION of NIMDANT.—February 1837.

| Zero. | Mao and Gugubara. | Gugubara and Pahargarh. | Pahargarh and Hatiapahar. |
|---|---|---|---|
| | | $(191^\circ\ 11') - (127^\circ\ 17') = (63^\circ\ 54')$ | $(127^\circ\ 16') - (63^\circ\ 1') = (64^\circ\ 15')$ |
| 0 | $62^\circ\ 45'\ 58''\cdot400^{(3)}$ | $61''\cdot680^{(3)} - 18''\cdot153^{(3)} = 43''\cdot527$ | $78''\cdot153^{(3)} - 42''\cdot833^{(3)} = 35''\cdot320$ |
| 180 | $57''\cdot427^{(3)}$ | $61''\cdot507^{(3)} - 17''\cdot393^{(3)} = 44''\cdot113$ | $77''\cdot393^{(3)} - 40''\cdot920^{(3)} = 36''\cdot473$ |
| 9 | $58''\cdot287^{(3)}$ | $64''\cdot293^{(3)} - 18''\cdot220^{(3)} = 46''\cdot073$ | $78''\cdot220^{(3)} - 43''\cdot853^{(3)} = 34''\cdot367$ |
| 189 | $59''\cdot407^{(3)}$ | $60''\cdot253^{(3)} - 16''\cdot387^{(3)} = 43''\cdot867$ | $76''\cdot387^{(3)} - 39''\cdot913^{(3)} = 36''\cdot473$ |
| 18 | $58''\cdot753^{(3)}$ | $62''\cdot380^{(3)} - 14''\cdot467^{(3)} = 47''\cdot913$ | $74''\cdot467^{(3)} - 40''\cdot433^{(3)} = 34''\cdot033$ |
| 198 | $59''\cdot713^{(3)}$ | $63''\cdot473^{(3)} - 17''\cdot407^{(3)} = 46''\cdot067$ | $77''\cdot407^{(3)} - 40''\cdot913^{(3)} = 36''\cdot493$ |
| 27 | $58''\cdot673^{(3)}$ | $61''\cdot993^{(3)} - 15''\cdot747^{(3)} = 46''\cdot247$ | $75''\cdot747^{(3)} - 41''\cdot033^{(3)} = 34''\cdot713$ |
| 207 | $60''\cdot515^{(4)}$ | $61''\cdot213^{(3)} - 15''\cdot640^{(3)} = 45''\cdot573$ | $75''\cdot640^{(3)} - 40''\cdot020^{(3)} = 35''\cdot620$ |
| Means | $62^\circ\ 45'\ 58''\cdot897$ | $63^\circ\ 54'\ 45''\cdot423$ | $64^\circ\ 15'\ 35''\cdot487$ |
| | Prob. = 0·316 | Prob. = 0·492 | Prob. = 0·330 |

No. 14.—At the STATION of GUGUBARA.—February 1837.

| Zero. | Memoni and Mao. | Mao and Nimdant. | Nimdant and Pahargarh. |
|---|---|---|---|
| 0 | $55^\circ\ 42'\ 52''\cdot227^{(3)}$ | $46^\circ\ 19'\ 48''\cdot380^{(3)}$ | $37^\circ\ 27'\ 35''\cdot947^{(3)}$ |
| 180 | $51''\cdot173^{(3)}$ | $49''\cdot693^{(3)}$ | $34''\cdot713^{(3)}$ |
| 9 | $53''\cdot373^{(3)}$ | $49''\cdot047^{(3)}$ | $36''\cdot680^{(3)}$ |
| 189 | $54''\cdot793^{(3)}$ | $48''\cdot870^{(4)}$ | $34''\cdot340^{(3)}$ |
| 18 | $52''\cdot775^{(4)}$ | $47''\cdot784^{(5)}$ | $35''\cdot833^{(2)}$ |
| 198 | $50''\cdot135^{(4)}$ | $48''\cdot453^{(3)}$ | $35''\cdot180^{(3)}$ |
| 27 | $53''\cdot940^{(3)}$ | $49''\cdot400^{(3)}$ | $33''\cdot967^{(3)}$ |
| 207 | $53''\cdot187^{(3)}$ | $50''\cdot875^{(4)}$ | $35''\cdot167^{(3)}$ |
| Means | $55^\circ\ 42'\ 52''\cdot700$ | $46^\circ\ 19'\ 49''\cdot063$ | $37^\circ\ 27'\ 35''\cdot228$ |
| | Prob. = 0·496 | Prob. = 0·314 | Prob. = 0·297 |

| Zero. | Pahargarh and Bherkheri. |
|---|---|
| 0 | $49^\circ\ 33'\ 48''\cdot407^{(3)}$ |
| 180 | $48''\cdot160^{(3)}$ |
| 9 | $46''\cdot333^{(2)}$ |
| 189 | $45''\cdot660^{(3)}$ |
| 18 | $45''\cdot340^{(3)}$ |
| 198 | $44''\cdot180^{(3)}$ |
| 27 | $47''\cdot113^{(2)}$ |
| 207 | $44''\cdot313^{(3)}$ |
| Mean | $49^\circ\ 33'\ 46''\cdot188$ |
| | Prob. = 0·534 |

No. 15.—At the STATION of MAO.—January 1837.

| Zero. | Shergarh and Memoni. | Memoni and Gugubara. | Gugubara and Nimdant. |
|---|---|---|---|
| | | | $(141^\circ\ 5') - (70^\circ\ 11') = (70^\circ\ 54')$ |
| 0 | $41^\circ\ 28'\ 35''\cdot115^{(4)}$ | $70^\circ\ 11'\ 48''\cdot610^{(4)}$ | $63''\cdot015^{(4)} - 48''\cdot610^{(4)} = 14''\cdot405$ |
| 180 | $35''\cdot840^{(4)}$ | $49''\cdot335^{(4)}$ | $64''\cdot360^{(4)} - 49''\cdot335^{(4)} = 15''\cdot025$ |
| 9 | $37''\cdot027^{(2)}$ | $48''\cdot760^{(3)}$ | $62''\cdot627^{(3)} - 48''\cdot760^{(3)} = 13''\cdot867$ |
| 189 | $35''\cdot027^{(3)}$ | $50''\cdot580^{(3)}$ | $64''\cdot307^{(3)} - 50''\cdot580^{(3)} = 13''\cdot727$ |
| 18 | $35''\cdot607^{(3)}$ | $51''\cdot413^{(3)}$ | $65''\cdot067^{(3)} - 51''\cdot413^{(3)} = 13''\cdot654$ |
| 198 | $36''\cdot267^{(3)}$ | $49''\cdot387^{(3)}$ | $64''\cdot040^{(3)} - 49''\cdot387^{(3)} = 14''\cdot653$ |
| 27 | $35''\cdot793^{(3)}$ | $48''\cdot787^{(3)}$ | $63''\cdot867^{(3)} - 48''\cdot787^{(3)} = 15''\cdot080$ |
| 207 | $36''\cdot287^{(3)}$ | $51''\cdot007^{(3)}$ | $65''\cdot113^{(3)} - 51''\cdot007^{(3)} = 14''\cdot106$ |
| Means | $41^\circ\ 28'\ 35''\cdot870$ | $70^\circ\ 11'\ 49''\cdot735$ | $70^\circ\ 54'\ 14''\cdot315$ |
| | Prob. = 0·218 | Prob. = 0·365 | Prob. = 0·187 |

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No. 16.—At the STATION of MEMONI.—December 1836 and January 1837.

| Zero. | Kasri and Shergarh. | Shergarh and Mao. | Mao and Gugubara. |
|---|---|---|---|
| | | (146° 54′) − (75° 7′) = (71° 47′) | |
| 0 | 75° 7′ 39″·953 (3) | 41″·887 (3) − 39″·953 (3) = 1″·934 | 54° 5′ 21″·440 (3) |
| 180 | 39″·267 (3) | 41″·927 (3) − 39″·267 (3) = 2″·660 | 18″·805 (4) |
| 9 | 40″·153 (3) | 41″·100 (3) − 40″·153 (3) = 0″·947 | 17″·200 (3) |
| 189 | 39″·000 (4) | 40″·405 (4) − 39″·000 (4) = 1″·405 | 18″·980 (3) |
| 18 | 39″·087 (3) | 41″·173 (3) − 39″·087 (3) = 2″·086 | 18″·367 (3) |
| 198 | 39″·200 (3) | 42″·027 (3) − 39″·200 (3) = 2″·827 | 17″·193 (3) |
| 27 | 40″·440 (3) | 42″·060 (3) − 40″·440 (3) = 1″·620 | 18″·940 (3) |
| 207 | 39″·073 (3) | 41″·327 (3) − 39″·073 (3) = 2″·254 | 18″·927 (3) |
| Prob. | = 0″·188 | = 0″·209 | = 0″·439 |
| Means | 75° 7′ 39″·522 | 71° 47′ 1″·967 | 54° 5′ 18″·732 |

No. 17.—At the STATION of SHERGARH.—January 1837.

| Zero. | Dhobai and Kasri. | Kasri and Memoni. | Memoni and Mao. |
|---|---|---|---|
| | | | (124° 54′) − (58° 10′) = (66° 44′) |
| 0 | 60° 52′ 57″·653 (3) | 58° 10′ 9″·680 (3) | 34″·247 (3) − 9″·680 (3) = 24″·567 |
| 180 | 59″·280 (3) | 9″·047 (3) | 32″·913 (3) − 9″·047 (3) = 23″·866 |
| 9 | 59″·027 (3) | 10″·980 (3) | 32″·967 (3) − 10″·980 (3) = 21″·987 |
| 189 | 61″·347 (3) | 9″·247 (3) | 34″·747 (3) − 9″·247 (3) = 25″·500 |
| 18 | 60″·100 (3) | 9″·227 (3) | 33″·267 (3) − 9″·227 (3) = 24″·040 |
| 198 | 58″·793 (3) | 11″·733 (3) | 36″·080 (3) − 11″·733 (3) = 24″·347 |
| 27 | 60″·067 (3) | 8″·880 (3) | 33″·827 (3) − 8″·880 (3) = 24″·947 |
| 207 | 58″·540 (3) | 10″·747 (3) | 35″·413 (3) − 10″·747 (3) = 24″·666 |
| Prob. | = 0″·375 | = 0″·352 | = 0″·346 |
| Means | 60° 52′ 59″·351 | 58° 10′ 9″·943 | 66° 44′ 24″·240 |

No. 18.—At the STATION of KASRI.—December 1836.

| Zero. | Chilwani and Den. | Den and Dhobai. | Dhobai and Shergarh. |
|---|---|---|---|
| | (36° 20′) + (26° 42′) = (63° 2′) | (61° 49′) − (26° 42′) = (35° 7′) | (130° 29′) − (61° 49′) = (68° 39′) |
| 0 | 37″·933 (3) + 2″·720 (3) = 40″·653 | 36″·580 (3) − 2″·720 (3) = 33″·860 | 6″·953 (3) − 36″·580 (3) = 30″·373 |
| 180 | 37″·080 (3) + 3″·913 (3) = 40″·993 | 36″·407 (3) − 3″·913 (3) = 32″·494 | 8″·480 (3) − 36″·407 (3) = 32″·073 |
| 9 | 35″·200 (3) + 4″·493 (3) = 39″·693 | 38″·440 (3) − 4″·493 (3) = 33″·947 | 9″·087 (3) − 38″·440 (3) = 30″·647 |
| 189 | 36″·540 (3) + 4″·427 (3) = 40″·967 | 37″·427 (3) − 4″·427 (3) = 33″·000 | 8″·507 (3) − 37″·427 (3) = 31″·080 |
| 18 | 37″·160 (3) + 3″·700 (3) = 40″·860 | 36″·687 (3) − 3″·700 (3) = 32″·987 | 7″·487 (3) − 36″·687 (3) = 30″·800 |
| 198 | 35″·820 (3) + 4″·893 (3) = 40″·713 | 37″·275 (4) − 4″·893 (3) = 32″·382 | 7″·693 (3) − 37″·275 (4) = 30″·418 |
| 27 | 37″·107 (3) + 4″·427 (3) = 41″·534 | 36″·627 (3) − 4″·427 (3) = 32″·200 | 6″·447 (3) − 36″·627 (3) = 29″·820 |
| 207 | 38″·200 (3) + 3″·767 (3) = 41″·967 | 37″·660 (3) − 3″·767 (3) = 33″·893 | 7″·253 (3) − 37″·660 (3) = 29″·593 |
| Prob. | = 0″·220 | = 0″·238 | = 0″·255 |
| Means | 63° 2′ 40″·923 | 35° 7′ 33″·095 | 68° 39′ 30″·601 |

| Zero. | Shergarh and Memoni. | Referring Lamp and Den. |
|---|---|---|
| | (177° 11′) − (130° 29′) = (46° 42′) | |
| 0 | 20″·687 (3) − 6″·953 (3) = 13″·734 | 26° 42′ 2″·720 (3) |
| 180 | 21″·713 (3) − 8″·480 (3) = 13″·233 | 3″·913 (3) |
| 9 | 23″·387 (3) − 9″·087 (3) = 14″·300 | 4″·493 (3) |
| 189 | 22″·553 (3) − 8″·507 (3) = 14″·046 | 4″·427 (3) |
| 18 | 21″·140 (3) − 7″·487 (3) = 13″·653 | 3″·700 (3) |
| 198 | 22″·060 (3) − 7″·693 (3) = 14″·367 | 4″·893 (3) |
| 27 | 20″·493 (3) − 6″·447 (3) = 14″·046 | 4″·427 (3) |
| 207 | 22″·033 (3) − 7″·253 (3) = 14″·780 | 3″·767 (3) |
| Prob. | = 0″·159 | |
| Means | 46° 42′ 14″·020 | 26° 42′ 4″·043 |

Azimuth of Lamp = 179° 59′ 34″·462

Lamp and Den .. = +26° 42′ 4″·043

Azimuth of Den.. = 206° 41′ 38″·505



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No. 19.—At the STATION of DHOBAI.—December 1836.

| Zero. | Raipur and Den. | | Den and Kasri. | | Kasri and Shergarh. | |
|---|---|---|---|---|---|---|
| | ° ′ | | ° ′ ° ′ ° ′ | | ° ′ ° ′ ° ′ | |
| | 81 18 | | (137 50) − (81 18) = (56 32) | | (188 17) − (137 50) = (50 27) | |
| 0 | ″ (3) | | ″ ″ (3) ″ | | ″ ″ (3) ″ | |
| | 2·227 | | 59·447 − 2·227 = 57·220 | | 92·093 − 59·447 = 32·646 | |
| 180 | (3) | | (3) (3) | | (3) (3) | |
| | 1·787 | | 59·953 − 1·787 = 58·166 | | 93·073 − 59·953 = 33·120 | |
| 9 | (3) | | (3) (3) | | (3) (3) | |
| | 2·693 | | 59·040 − 2·693 = 56·347 | | 90·007 − 59·040 = 30·967 | |
| 189 | (3) | | (3) (3) | | (3) (3) | |
| | 1·513 | | 60·160 − 1·513 = 58·647 | | 92·160 − 60·160 = 32·000 | |
| 18 | (3) | | (3) (3) | | (4) (3) | |
| | 1·300 | | 58·753 − 1·300 = 57·453 | | 90·720 − 58·753 = 31·967 | |
| 198 | (3) | | (3) (3) | | (3) (3) | |
| | 1·613 | | 58·247 − 1·613 = 56·634 | | 92·413 − 58·247 = 34·166 | |
| 27 | (3) | | (3) (3) | | (3) (3) | |
| | 2·187 | | 59·167 − 2·187 = 56·980 | | 92·253 − 59·167 = 33·086 | |
| 207 | (3) | | (4) (3) | | (3) (4) | |
| | 1·693 | | 60·045 − 1·693 = 58·352 | | 92·073 − 60·045 = 32·028 | |
| Means | 81 18 | 1·877 | 56 32 | 57·475 | 50 27 | 32·498 |
| | | Prob. = 0·151 | | Prob. = 0·277 | | Prob. = 0·322 |

No. 20.—At the STATION of RAIPUR.—December 1836.

| Zero. | Dhobai and Den. | | Den and Pagaro. | | | |
|---|---|---|---|---|---|---|
| | ° ′ | | ° ′ ° ′ ° ′ | | | |
| | 43 54 | | (103 13) − (43 54) = (59 19) | | | |
| 0 | ″ (3) | | ″ ″ (3) ″ | | | |
| | 37·507 | | 92·107 − 37·507 = 54·600 | | | |
| 180 | (3) | | (3) (3) | | | |
| | 35·073 | | 90·580 − 35·073 = 55·507 | | | |
| 9 | (3) | | (3) (3) | | | |
| | 38·000 | | 91·273 − 38·000 = 53·273 | | | |
| 189 | (4) | | (4) (4) | | | |
| | 38·905 | | 92·415 − 38·905 = 53·510 | | | |
| 18 | (3) | | (3) (3) | | | |
| | 39·073 | | 91·780 − 39·073 = 52·707 | | | |
| 198 | (3) | | (3) (3) | | | |
| | 36·547 | | 90·313 − 36·547 = 53·766 | | | |
| 27 | (3) | | (3) (3) | | | |
| | 36·340 | | 92·213 − 36·340 = 55·873 | | | |
| 207 | (3) | | (3) (3) | | | |
| | 37·520 | | 91·880 − 37·520 = 54·360 | | | |
| Means | 43 54 | 37·371 | 59 19 | 54·200 | | |
| | | Prob. = 0·446 | | Prob. = 0·363 | | |

No. 21.—At the STATION of DEN.—December 1836.

| Zero. | Pagaro and Raipur. | | Raipur and Dhobai. | | Dhobai and Kasri. | |
|---|---|---|---|---|---|---|
| | ° ′ | | ° ′ ° ′ ° ′ | | ° ′ ° ′ ° ′ | |
| | (394 53) − (339 1) = (55 52) | | (89 40) − (34 53) = (54 47) | | (177 59) − (89 40) = (88 19) | |
| 0 | ″ ″ (4) ″ | | ″ ″ (4) ″ | | ″ ″ (4) ″ | |
| | 34·435 − 25·265 = 9·170 | | 55·410 − 34·435 = 20·975 | | 85·505 − 55·410 = 30·095 | |
| 180 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 32·193 − 24·680 = 7·513 | | 53·347 − 32·193 = 21·154 | | 83·947 − 53·347 = 30·600 | |
| 9 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 34·173 − 26·200 = 7·973 | | 53·487 − 34·173 = 19·314 | | 84·513 − 53·487 = 31·026 | |
| 189 | (4) (3) | | (4) (4) | | (4) (4) | |
| | 32·705 − 25·073 = 7·632 | | 54·675 − 32·705 = 21·970 | | 84·695 − 54·675 = 30·020 | |
| 18 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 32·787 − 24·420 = 8·367 | | 54·153 − 32·787 = 21·366 | | 84·727 − 54·153 = 30·574 | |
| 198 | (3) (4) | | (4) (3) | | (4) (4) | |
| | 32·207 − 25·075 = 7·132 | | 55·080 − 32·207 = 22·873 | | 83·545 − 55·080 = 28·465 | |
| 27 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 32·960 − 25·647 = 7·313 | | 54·387 − 32·960 = 21·427 | | 85·607 − 54·387 = 31·220 | |
| 207 | (3) (4) | | (3) (3) | | (3) (3) | |
| | 32·867 − 25·770 = 7·097 | | 54·160 − 32·867 = 21·293 | | 84·500 − 54·160 = 30·340 | |
| Means | 55 52 | 7·775 | 54 47 | 21·296 | 88 19 | 30·293 |
| | | Prob. = 0·234 | | Prob. = 0·331 | | Prob. = 0·280 |

| Zero. | Kasri and Chilwani. | | Chilwani and Juktipura. | | Juktipura and Pagaro. | |
|---|---|---|---|---|---|---|
| | ° ′ | | ° ′ ° ′ ° ′ | | ° ′ ° ′ ° ′ | |
| | (229 46) − (178 0) = (51 46) | | (271 40) − (229 46) = (41 54) | | (339 1) − (271 41) = (67 20) | |
| 0 | ″ ″ (4) ″ | | ″ ″ (4) ″ | | ″ ″ (4) ″ | |
| | 49·980 − 25·505 = 24·475 | | 72·525 − 49·980 = 22·545 | | 25·265 − 12·525 = 12·740 | |
| 180 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 47·240 − 23·947 = 23·293 | | 71·780 − 47·240 = 24·540 | | 24·680 − 11·780 = 12·900 | |
| 9 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 49·733 − 24·513 = 25·220 | | 73·500 − 49·733 = 23·767 | | 26·200 − 13·500 = 12·700 | |
| 189 | (4) (4) | | (4) (4) | | (3) (4) | |
| | 50·165 − 24·695 = 25·470 | | 72·130 − 50·165 = 21·965 | | 25·073 − 12·130 = 12·943 | |
| 18 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 48·907 − 24·727 = 24·180 | | 72·813 − 48·907 = 23·906 | | 24·420 − 12·813 = 11·607 | |
| 198 | (3) (4) | | (3) (3) | | (4) (3) | |
| | 48·147 − 23·545 = 24·602 | | 71·553 − 48·147 = 23·406 | | 25·075 − 11·553 = 13·522 | |
| 27 | (3) (3) | | (3) (3) | | (3) (3) | |
| | 50·600 − 25·607 = 24·993 | | 72·560 − 50·600 = 21·960 | | 25·647 − 12·560 = 13·087 | |
| 207 | (3) (3) | | (3) (3) | | (4) (3) | |
| | 48·947 − 24·500 = 24·447 | | 73·227 − 48·947 = 24·280 | | 25·770 − 13·227 = 12·543 | |
| Means | 51 46 | 24·585 | 41 54 | 23·296 | 67 20 | 12·755 |
| | | Prob. = 0·224 | | Prob. = 0·336 | | Prob. = 0·182 |

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No. 22.—At the STATION of CHILWANI.—November and December 1836.

| Zero. | Juktipura and Den. | | Den and Kasri. | |
|---|---|---|---|---|
| | ° ′ ″ | | (155 22) − (90 12) = (65 10) | |
| 0 | 90 12 39·930 (4) | | 97·765 (4) − 39·930 (4) = 57″·835 | |
| 180 | 39·900 (4) | | 94·285 (4) − 39·900 (4) = 54·385 | |
| 9 | 40·687 (3) | Prob. = 0·284 | 97·407 (3) − 40·687 (3) = 56·720 | Prob. = 0·584 |
| 189 | 40·347 (3) | | 97·893 (3) − 40·347 (3) = 57·546 | |
| 18 | 42·493 (3) | | 99·993 (3) − 42·493 (3) = 57·500 | |
| 198 | 40·803 (6) | | 94·277 (6) − 40·803 (6) = 53·474 | |
| 27 | 41·347 (3) | | 99·213 (3) − 41·347 (3) = 57·866 | |
| 207 | 41·267 (3) | | 96·080 (3) − 41·267 (3) = 54·813 | |
| Means | 90 12 40·847 | | 65 10 56·267 | |

No. 23.—At the STATION of JUKTIPURA.—November 1836.

| Zero. | Nindhar and Gurjapahar. | | Gurjapahar and Pagaro. | | Pagaro and Den. | |
|---|---|---|---|---|---|---|
| | (131 53) − (47 42) = (84 11) | | (47 42) + (15 54) = (63 36) | | (57 42) − (15 54) = (41 48) | |
| 0 | 64·973 (3) − 59·627 (3) = 5″·346 | | 59·627 (3) + 26·300 (3) = 85″·927 | | 68·247 (3) − 26·300 (3) = 41″·947 | |
| 180 | 62·867 (3) − 59·700 (3) = 3·167 | | 59·700 (3) + 26·053 (3) = 85·753 | | 68·333 (3) − 26·053 (3) = 42·280 | |
| 9 | 63·853 (3) − 60·333 (3) = 3·520 | Prob. = 0·281 | 60·333 (3) + 26·673 (3) = 87·006 | Prob. = 0·162 | 69·560 (3) − 26·673 (3) = 42·887 | Prob. = 0·209 |
| 189 | 65·313 (3) − 60·053 (3) = 5·260 | | 60·053 (3) + 26·147 (3) = 86·200 | | 67·267 (3) − 26·147 (3) = 41·120 | |
| 18 | 63·460 (4) − 59·055 (4) = 4·405 | | 59·055 (4) + 27·590 (4) = 86·645 | | 69·640 (4) − 27·590 (4) = 42·050 | |
| 198 | 65·527 (3) − 60·233 (3) = 5·294 | | 60·233 (3) + 26·140 (3) = 86·373 | | 68·033 (3) − 26·140 (3) = 41·893 | |
| 27 | 65·353 (3) − 60·287 (3) = 5·066 | | 60·287 (3) + 26·660 (3) = 86·947 | | 67·580 (3) − 26·660 (3) = 40·920 | |
| 207 | 63·540 (3) − 58·613 (3) = 4·927 | | 58·613 (3) + 27·247 (3) = 85·860 | | 69·447 (3) − 27·247 (3) = 42·200 | |
| Means | 84 11 4·623 | | 63 37 26·339 | | 41 48 41·912 | |

| Zero. | Den and Chilwani. | |
|---|---|---|
| | (105 35) − (57 43) = (47 52) | |
| 0 | 69·400 (3) − 8·247 (3) = 61″·153 | |
| 180 | 68·233 (3) − 8·333 (3) = 59·900 | |
| 9 | 69·787 (3) − 9·560 (3) = 60·227 | Prob. = 0·186 |
| 189 | 67·073 (3) − 7·267 (3) = 59·806 | |
| 18 | 69·220 (4) − 9·640 (4) = 59·580 | |
| 198 | 67·847 (3) − 8·033 (3) = 59·814 | |
| 27 | 67·880 (3) − 7·580 (3) = 60·300 | |
| 207 | 68·753 (3) − 9·447 (3) = 59·306 | |
| Mean | 47 53 0·011 | |

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No. 24.—At the STATION of PAGARO.—November 1836.

| Zero. | Dholpur and Gurjapahar. | | Gurjapahar and Juktipura. | | Juktipura and Den. | |
|---|---|---|---|---|---|---|
| | (174° 39′) − (125° 38′) = (49° 1′) | | (125° 38′) − (77° 0′) = (48° 38′) | | (77° 0′) − (6° 9′) = (70° 51′) | |
| 0 | 45″·355 (4) − 33″·465 (4) = 11″·890 | Prob. = 0·263 | 33″·465 (4) − 28″·313 (3) = 5″·152 | Prob. = 0·283 | 28″·313 (3) − 21″·830 (4) = 6″·483 | Prob. = 0·271 |
| 180 | 44·347 (3) − 31·533 (3) = 12·814 | | 31·533 (3) − 28·447 (3) = 3·086 | | 28·447 (3) − 21·073 (3) = 7·374 | |
| 9 | 45·633 (3) − 34·173 (3) = 11·460 | | 34·173 (3) − 28·953 (3) = 5·220 | | 28·953 (3) − 21·033 (3) = 7·920 | |
| 189 | 44·167 (3) − 33·207 (3) = 10·960 | | 33·207 (3) − 28·960 (3) = 4·247 | | 28·960 (3) − 20·593 (3) = 8·367 | |
| 18 | 45·833 (3) − 33·660 (3) = 12·173 | | 33·660 (3) − 28·480 (3) = 5·180 | | 28·480 (3) − 21·553 (3) = 6·927 | |
| 198 | 43·533 (3) − 31·680 (3) = 11·853 | | 31·680 (3) − 28·513 (3) = 3·167 | | 28·513 (3) − 20·873 (3) = 7·640 | |
| 27 | 43·720 (3) − 33·480 (3) = 10·240 | | 33·480 (3) − 28·960 (3) = 4·520 | | 28·960 (3) − 20·645 (3) = 8·315 | |
| 207 | 44·233 (3) − 32·140 (3) = 12·093 | | 32·140 (3) − 27·653 (3) = 4·487 | | 27·653 (3) − 21·493 (3) = 6·160 | |
| Means | 49° 1′ 11″·685 | | 48° 38′ 4″·382 | | 70° 51′ 7″·398 | |

| Zero. | Den and Raipur. | |
|---|---|---|
| | (58° 38′) + (6° 9′) = (64° 47′) | |
| 0 | 36″·970 (4) + 21″·830 (4) = 58″·800 | Prob. = 0·148 |
| 180 | 37·760 (3) + 21·073 (3) = 58·833 | |
| 9 | 37·260 (3) + 21·033 (3) = 58·293 | |
| 189 | 38·347 (3) + 20·593 (3) = 58·940 | |
| 18 | 37·953 (3) + 21·553 (3) = 59·506 | |
| 198 | 38·540 (3) + 20·873 (3) = 59·413 | |
| 27 | 38·373 (3) + 20·645 (4) = 59·018 | |
| 207 | 38·167 (3) + 21·493 (3) = 59·660 | |
| Mean | 64° 47′ 59″·058 | |

No. 25.—At the STATION of DHOLPUR.—April and May 1836.

| Zero. | Usira and Gurjapahar. | | Gurjapahar and Pagaro. | |
|---|---|---|---|---|
| 0 | 95° 31′ 59″·425 (4) | Prob. = 0·142 | 57° 55′ 20″·255 (4) | Prob. = 0·256 |
| 180 | 59·353 (3) | | 19·347 (3) | |
| 9 | 60·487 (3) | | 18·487 (3) | |
| 189 | 59·347 (3) | | 19·640 (3) | |
| 18 | 59·760 (3) | | 19·660 (3) | |
| 198 | 59·247 (3) | | 21·153 (3) | |
| 27 | 60·073 (3) | | 19·287 (3) | |
| 207 | 59·600 (3) | | 19·787 (3) | |
| Means | 95° 31′ 59″·662 | | 57° 55′ 19″·702 | |

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No. 26.—At the STATION of GURJAPAHAR.—April 1836.

| Zero. | Usira and Dimdima. | Dimdima and Machi. | Machi and Nindhar. |
|---|---|---|---|
| | (173 31) − (133 8) = (40 23) | (133 7) − (85 27) = (47 40) | (85 27) − (47 18) = (38 9) |
| 0 | 29·647 (3) − 16·613 (3) = 13·034 | 76·613 (3) − 35·413 (3) = 41·200 | 35·413 (3) − 11·260 (3) = 24·153 |
| 180 | 28·240 (3) − 14·533 (3) = 13·707 | 74·533 (3) − 33·773 (3) = 40·760 | 33·773 (3) − 9·910 (4) = 23·863 |
| 9 | 27·880 (4) − 14·367 (3) = 13·513 | 74·367 (3) − 34·487 (3) = 39·880 | 34·487 (3) − 11·867 (3) = 22·620 |
| 189 | 28·915 (4) − 14·765 (4) = 14·150 | 74·765 (4) − 34·125 (4) = 40·640 | 34·125 (4) − 9·800 (3) = 24·325 |
| 18 | 28·133 (3) − 14·300 (3) = 13·833 | 74·300 (3) − 33·100 (3) = 41·200 | 33·100 (3) − 10·895 (4) = 22·205 |
| 198 | 28·240 (3) − 17·224 (5) = 11·016 | 77·224 (5) − 33·720 (3) = 43·504 | 33·720 (3) − 12·093 (3) = 21·627 |
| 27 | 26·827 (3) − 17·133 (3) = 9·694 | 77·133 (3) − 34·573 (3) = 42·560 | 34·573 (3) − 11·073 (3) = 23·500 |
| 207 | 27·807 (3) − 14·893 (3) = 12·914 | 74·893 (3) − 34·973 (3) = 39·920 | 34·973 (3) − 11·807 (3) = 23·166 |
| Means | 40 23 12·733 | 47 40 41·208 | 38 9 23·182 |
| Prob. | = 0·517 | = 0·415 | = 0·319 |

| Zero. | Nindhar and Juktipura. | Juktipura and Pagaro. | Pagaro and Dholpur. |
|---|---|---|---|
| 0 | 47 18 11·260 (3) | 67 44 34·465 (4) | (292 14) − (219 11) = (73 3) |
| 180 | 9·910 (4) | 33·333 (3) | 85·535 (4) − 55·755 (4) = 29·780 |
| 9 | 11·867 (3) | 33·673 (3) | 86·667 (3) − 55·793 (3) = 30·874 |
| 189 | 9·800 (3) | 33·313 (3) | 86·327 (3) − 54·553 (3) = 31·774 |
| 18 | 10·895 (4) | 35·367 (3) | 86·687 (3) − 53·720 (4) = 32·967 |
| 198 | 12·093 (3) | 34·000 (3) | 84·633 (3) − 54·100 (3) = 30·533 |
| 27 | 11·073 (3) | 33·927 (3) | 86·000 (3) − 54·173 (3) = 31·827 |
| 207 | 11·807 (3) | 34·907 (3) | 86·073 (3) − 54·840 (3) = 31·233 |
| | | | 85·093 (3) − 55·007 (3) = 30·086 |
| Means | 47 18 11·088 | 67 44 34·123 | 73 3 31·134 |
| Prob. | = 0·286 | = 0·244 | = 0·345 |

| Zero. | Dholpur and Usira. |
|---|---|
| | (219 11) − (173 31) = (45 40) |
| 0 | 55·755 (4) − 29·647 (3) = 26·108 |
| 180 | 55·793 (3) − 28·240 (3) = 27·553 |
| 9 | 54·553 (3) − 27·880 (4) = 26·673 |
| 189 | 53·720 (4) − 28·915 (4) = 24·805 |
| 18 | 54·100 (3) − 28·133 (3) = 25·967 |
| 198 | 54·173 (3) − 28·240 (3) = 25·933 |
| 27 | 54·840 (3) − 26·827 (3) = 28·013 |
| 207 | 55·007 (3) − 27·807 (3) = 27·200 |
| Mean | 45 40 26·532 |
| Prob. | = 0·343 |

No. 27.—At the STATION of NINDHAR.—April 1836.

| Zero. | Machi and Gurjapahar. | Gurjapahar and Juktipura. |
|---|---|---|
| | | (134 45) − (86 15) = (48 30) |
| 0 | 86 15 31·960 (4) | 77·640 (4) − 31·960 (4) = 45·680 |
| 180 | 30·320 (5) | 74·508 (5) − 30·320 (5) = 44·188 |
| 9 | 30·487 (3) | 76·500 (3) − 30·487 (3) = 46·013 |
| 189 | 31·527 (3) | 77·380 (3) − 31·527 (3) = 45·853 |
| 18 | 31·713 (3) | 78·487 (3) − 31·713 (3) = 46·774 |
| 198 | 31·793 (3) | 76·793 (3) − 31·793 (3) = 45·000 |
| 27 | 31·533 (3) | 78·453 (3) − 31·533 (3) = 46·920 |
| 207 | 30·590 (4) | 77·445 (4) − 30·590 (4) = 46·855 |
| Means | 86 15 31·240 | 48 30 45·910 |
| Prob. | = 0·218 | = 0·319 |



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No. 28.—At the STATION of MACHI.—April 1836.

| Zero. | Dimdima and Gurjapahar. | | Gurjapahar and Nindhar. | |
|---|---|---|---|---|
| | (128° 37′) — (55° 35′) = (73° 2′) | | | |
| 0 | 17″·367 (3) — 9″·780 (3) = 7″·587 | | 55° 35′ 9″·780 (3) | |
| 180 | 17·067 (3) — 9·107 (3) = 7·960 | | 9·107 (3) | |
| 9 | 17·727 (3) — 8·387 (3) = 9·340 | | 8·387 (3) | |
| 189 | 18·020 (3) — 9·320 (3) = 8·700 | | 9·320 (3) | |
| 18 | 17·273 (3) — 7·407 (3) = 9·866 | | 7·407 (3) | |
| 198 | 17·840 (3) — 8·013 (3) = 9·827 | | 8·013 (3) | |
| 27 | 17·847 (3) — 8·820 (3) = 9·027 | | 8·820 (3) | |
| 207 | 18·573 (3) — 7·747 (3) = 10·826 | | 7·747 (3) | |
| Means | 73 2 9·142 | Prob. = 0·351 | 55 35 8·573 | Prob. = 0·272 |

No. 29.—At the STATION of USIRA.—April 1836.

| Zero. | Madhoni and Dimdima. | | Dimdima and Gurjapahar. | | Gurjapahar and Dholpur. | |
|---|---|---|---|---|---|---|
| | (105° 43′) — (41° 25′) = (64° 18′) | | (179° 53′) — (105° 44′) = (74° 9′) | | (218° 41′) — (179° 54′) = (38° 47′) | |
| 0 | 62″·910 (4) — 9″·175 (4) = 53″·735 | | 65″·667 (3) — 2″·910 (4) = 62″·757 | | 40″·755 (4) — 5″·667 (3) = 35″·088 | |
| 180 | 63·840 (3) — 10·140 (3) = 53·700 | | 66·160 (3) — 3·840 (3) = 62·320 | | 42·400 (3) — 6·160 (3) = 36·240 | |
| 9 | 62·773 (3) — 8·347 (3) = 54·426 | | 65·680 (3) — 2·773 (3) = 62·907 | | 40·793 (3) — 5·680 (3) = 35·113 | |
| 189 | 64·887 (3) — 10·160 (3) = 54·727 | | 68·613 (3) — 4·887 (3) = 63·726 | | 42·640 (3) — 8·613 (3) = 34·027 | |
| 18 | 66·480 (3) — 8·600 (3) = 57·880 | | 66·280 (3) — 6·480 (3) = 59·800 | | 42·267 (3) — 6·280 (3) = 35·987 | |
| 198 | 65·720 (3) — 11·007 (3) = 54·713 | | 65·987 (3) — 5·720 (3) = 60·267 | | 43·520 (3) — 5·987 (3) = 37·533 | |
| 27 | 64·100 (3) — 10·340 (3) = 53·760 | | 67·287 (3) — 4·100 (3) = 63·187 | | 42·853 (3) — 7·287 (3) = 35·566 | |
| 207 | 64·727 (3) — 10·213 (3) = 54·514 | | 68·147 (3) — 4·727 (3) = 63·420 | | 43·633 (3) — 8·147 (3) = 35·486 | |
| Means | 64 18 54·682 | Prob. = 0·451 | 74 10 2·298 | Prob. = 0·485 | 38 47 35·630 | Prob. = 0·337 |

| Zero. | Refer$^{e}$ Lamp and Madhoni. 1838. |
|---|---|
| | 22° 0′ 35″·883 (6) |
| 0 | 35·626 (6) |
| 180 | 32·650 (6) |
| 9 | 35·543 (6) |
| 189 | 34·170 (6) |
| 18 | 34·533 (6) |
| 198 | 35·877 (6) |
| 27 | 35·233 (6) |
| 207 | |
| Mean | 22 0 34·939 |

Azimuth of Lamp ..... = 168° 56′ 1″·850

Lamp and Madhoni..... = — 22 0 34·939

Azimuth of Madhoni ..... = 146 55 26·911

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No. 30.—At the STATION of DIMDIMA.—April 1836.

| Zero. | Alipur and Madhoni. | | Madhoni and Usira. | | Usira and Gurjapahar. | |
|---|---|---|---|---|---|---|
| | (64° 15′) + (6° 52′) = (71° 7′) | | (63° 23′) − (6° 52′) = (56° 31′) | | (128° 49′) − (63° 23′) = (65° 26′) | |
| 0 | 31″·007 (3) + 38″·220 (3) = 69″·227 | | 45″·013 (3) − 38″·220 (3) = 6″·793 | | 95″·195 (4) − 45″·013 (3) = 50″·182 | |
| 180 | 30″·907 (3) + 39″·633 (3) = 70″·540 | | 44″·233 (3) − 39″·633 (3) = 4″·600 | | 95″·713 (3) − 44″·233 (3) = 51″·480 | |
| 9 | 30″·393 (3) + 38″·773 (3) = 69″·166 | | 45″·080 (3) − 38″·773 (3) = 6″·307 | | 96″·520 (3) − 45″·080 (3) = 51″·440 | |
| 189 | 30″·953 (3) + 37″·987 (3) = 68″·940 | | 44″·213 (3) − 37″·987 (3) = 6″·226 | | 94″·320 (3) − 44″·213 (3) = 50″·107 | |
| 18 | 31″·193 (3) + 37″·880 (3) = 69″·073 | | 44″·880 (3) − 37″·880 (3) = 7″·000 | | 96″·627 (3) − 44″·880 (3) = 51″·747 | |
| 198 | 30″·313 (3) + 38″·913 (3) = 69″·226 | | 45″·767 (3) − 38″·913 (3) = 6″·854 | | 94″·227 (3) − 45″·767 (3) = 48″·460 | |
| 27 | 31″·287 (3) + 38″·447 (3) = 69″·734 | | 45″·340 (3) − 38″·447 (3) = 6″·893 | | 95″·880 (3) − 45″·340 (3) = 50″·540 | |
| 207 | 32″·033 (3) + 38″·200 (3) = 70″·233 | | 45″·067 (3) − 38″·200 (3) = 6″·867 | | 94″·600 (3) − 45″·067 (3) = 49″·533 | |
| Means | 71° 8′ 9″·517 | Prob. = 0·195 | 56° 31′ 6″·443 | Prob = 0·264 | 65° 26′ 50″·436 | Prob. = 0·369 |

| Zero. | Gurjapahar and Machi. | |
|---|---|---|
| | (188° 7′) − (128° 50′) = (59° 17′) | |
| 0 | 51″·827 (3) − 35″·195 (4) = 16″·632 | |
| 180 | 52″·853 (3) − 35″·713 (3) = 17″·140 | |
| 9 | 51″·887 (3) − 36″·520 (3) = 15″·367 | |
| 189 | 50″·927 (3) − 34″·320 (3) = 16″·607 | |
| 18 | 52″·447 (3) − 36″·627 (3) = 15″·820 | |
| 198 | 52″·773 (3) − 34″·227 (3) = 18″·546 | |
| 27 | 52″·920 (3) − 35″·880 (3) = 17″·040 | |
| 207 | 52″·020 (3) − 34″·600 (3) = 17″·420 | |
| Mean | 59° 17′ 16″·822 | Prob. = 0·323 |

No. 31.—At the STATION of MADHONI.—March 1837.

| Zero. | Aring and Rasia. | | Rasia and Alipur. | | Alipur and Dimdima. | |
|---|---|---|---|---|---|---|
| | | | | | | |
| 0 | 66° 58′ 33″·047 (3) | | 54° 43′ 57″·367 (3) | | 51° 43′ 44″·200 (3) | |
| 180 | 33″·027 (3) | | 61″·587 (3) | | 41″·267 (3) | |
| 9 | 33″·700 (3) | | 59″·680 (3) | | 41″·953 (3) | |
| 189 | 33″·867 (3) | | 60″·673 (3) | | 41″·007 (3) | |
| 18 | 34″·620 (3) | | 58″·167 (3) | | 44″·293 (3) | |
| 198 | 35″·453 (3) | | 59″·080 (3) | | 41″·787 (3) | |
| 27 | 33″·553 (3) | | 57″·893 (3) | | 45″·247 (3) | |
| 207 | 34″·287 (3) | | 58″·400 (3) | | 42″·720 (3) | |
| Means | 66° 58′ 33″·944 | Prob. = 0·271 | 54° 43′ 59″·106 | Prob. = 0·481 | 51° 43′ 42″·809 | Prob. = 0·523 |

| Zero. | Dimdima and Usira. | |
|---|---|---|
| | | |
| 0 | 59° 10′ 3″·793 (3) | |
| 180 | 4″·540 (3) | |
| 9 | 5″·847 (3) | |
| 189 | 4″·920 (3) | |
| 18 | 4″·640 (3) | |
| 198 | 5″·393 (3) | |
| 27 | 3″·820 (3) | |
| 207 | 3″·327 (3) | |
| Mean | 59° 10′ 4″·535 | Prob. = 0·283 |

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No. 32.—At the STATION of ALIPUR.—March 1836.

| Zero. | Ladpur and Rasia. | | Rasia and Madhoni. | | Madhoni and Dimdima. | |
|---|---|---|---|---|---|---|
| | (54° 18′) − (2° 2′) = (52° 16′) | | (102° 9′) − (54° 18′) = (47° 51′) | | (159° 18′) − (102° 10′) = (57° 8′) | |
| 0 | 52″·730 (4) − 19″·075 (4) = 33″·655 | Prob. = 0·197 | 106″·627 (3) − 52″·730 (4) = 53″·897 | Prob. = 0·337 | 58″·925 (4) − 46″·627 (3) = 12″·298 | Prob. = 0·357 |
| 180 | 50·987 (3) − 18·313 (3) = 32·674 | | 106·473 (3) − 50·987 (3) = 55·486 | | 57·880 (3) − 46·473 (3) = 11·407 | |
| 9 | 51·800 (4) − 18·825 (4) = 32·975 | | 107·465 (4) − 51·800 (4) = 55·665 | | 59·090 (4) − 47·465 (4) = 11·625 | |
| 189 | 52·313 (3) − 18·407 (3) = 33·906 | | 105·560 (3) − 52·313 (3) = 53·247 | | 58·973 (3) − 45·560 (3) = 13·413 | |
| 18 | 52·767 (3) − 20·253 (3) = 32·514 | | 107·060 (3) − 52·767 (3) = 54·293 | | 59·713 (2) − 47·060 (3) = 12·653 | |
| 198 | 53·225 (4) − 19·625 (4) = 33·600 | | 107·427 (3) − 53·225 (4) = 54·202 | | 58·880 (3) − 47·427 (3) = 11·453 | |
| 27 | 51·220 (3) − 18·967 (3) = 32·253 | | 106·967 (3) − 51·220 (3) = 55·747 | | 58·060 (3) − 46·967 (3) = 11·093 | |
| 207 | 51·327 (3) − 18·373 (3) = 32·954 | | 107·267 (3) − 51·327 (3) = 55·940 | | 57·107 (3) − 47·267 (3) = 9·840 | |
| Means | 52 16 33·065 | | 47 51 54·810 | | 57 8 11·723 | |

No. 33.—At the STATION of LADPUR.—March 1836.

| Zero. | Chapra and Rasia. | | Rasia and Alipur. | | |
|---|---|---|---|---|---|
| | (123° 13′) − (58° 26′) = (64° 47′) | | (178° 25′) − (123° 14′) = (55° 11′) | | |
| 0 | 97″·647 (3) − 60″·333 (3) = 37″·314 | Prob. = 0·319 | 94″·840 (3) − 37″·647 (3) = 57″·193 | Prob. = 0·345 | |
| 180 | 96·380 (3) − 57·847 (3) = 38·533 | | 92·293 (3) − 36·380 (3) = 55·913 | | |
| 9 | 97·440 (3) − 59·493 (3) = 37·947 | | 94·867 (3) − 37·440 (3) = 57·427 | | |
| 189 | 96·947 (3) − 57·807 (3) = 39·140 | | 92·720 (3) − 36·947 (3) = 55·773 | | |
| 18 | 96·853 (3) − 57·653 (3) = 39·200 | | 93·660 (3) − 36·853 (3) = 56·807 | | |
| 198 | 96·940 (4) − 58·645 (4) = 38·295 | | 93·365 (4) − 36·940 (4) = 56·425 | | |
| 27 | 96·707 (3) − 58·700 (3) = 38·007 | | 93·480 (3) − 36·707 (3) = 56·773 | | |
| 207 | 97·513 (3) − 57·087 (3) = 40·426 | | 91·660 (3) − 37·513 (3) = 54·147 | | |
| Means | 64 47 38·608 | | 55 11 56·307 | | |

No. 34.—At the STATION of RASIA.—March 1837.

| Zero. | Chapra and Manpur. | | Manpur and Aring. | | Aring and Madhoni. | |
|---|---|---|---|---|---|---|
| | | | | | | |
| 0 | 66° 12′ 41″·827 (3) | Prob. = 0·281 | 41° 39′ 26″·247 (3) | Prob. = 0·229 | 50° 51′ 28″·807 (3) | Prob. = 0·555 |
| 180 | 40·887 (3) | | 27·033 (3) | | 26·333 (3) | |
| 9 | 41·467 (3) | | 25·373 (3) | | 25·813 (3) | |
| 189 | 43·707 (3) | | 25·907 (3) | | 24·213 (3) | |
| 18 | 42·087 (3) | | 26·527 (3) | | 24·753 (3) | |
| 198 | 41·940 (3) | | 25·333 (3) | | 26·580 (3) | |
| 27 | 41·640 (3) | | 27·187 (3) | | 23·667 (3) | |
| 207 | 42·673 (3) | | 25·973 (3) | | 27·107 (3) | |
| Means | 66 12 42·029 | | 41 39 26·198 | | 50 51 25·909 | |
| Zero. | Madhoni and Alipur. | | Alipur and Ladpur. | | Ladpur and Chapra. | |
| | | | | | | |
| 0 | 77° 24′ 6″·033 (3) | Prob. = 0·505 | 72° 31′ 33″·093 (3) | Prob. = 0·172 | 51° 20′ 42″·353 (3) | Prob. = 0·518 |
| 180 | 9·020 (3) | | 33·413 (3) | | 41·907 (3) | |
| 9 | 8·467 (3) | | 33·087 (3) | | 46·133 (3) | |
| 189 | 11·293 (3) | | 33·100 (3) | | 41·780 (3) | |
| 18 | 8·660 (3) | | 33·793 (3) | | 44·180 (3) | |
| 198 | 8·827 (3) | | 33·693 (3) | | 43·627 (3) | |
| 27 | 10·273 (3) | | 34·233 (3) | | 43·000 (3) | |
| 207 | 8·420 (3) | | 34·407 (3) | | 41·420 (3) | |
| Means | 77 24 8·874 | | 72 31 33·602 | | 51 20 43·050 | |

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No. 35.—At the STATION of CHAPRA.—March 1838.

| Zero. | Meoli and Pahera. | | Pahera and Manpur. | | Manpur and Rasia. | |
|---|---|---|---|---|---|---|
| | (18° 21′) + (29° 14′) = (47° 35′) | | (97° 54′) − (29° 14′) = (68° 40′) | | (144° 25′) − (97° 54′) = (46° 31′) | |
| 0 | 16″·053 (3) + 30″·847 (3) = 46″·900 | | 34″·693 (3) − 30″·847 (3) = 3″·847 | | 58″·747 (3) − 34″·693 (3) = 24″·053 | |
| 180 | 16″·640 (3) + 30″·813 (3) = 47″·453 | | 35″·993 (3) − 30″·813 (3) = 5″·180 | | 57″·787 (3) − 35″·993 (3) = 21″·793 | |
| 9 | 14″·673 (3) + 32″·473 (3) = 47″·147 | | 35″·153 (3) − 32″·473 (3) = 2″·680 | | 56″·787 (3) − 35″·153 (3) = 21″·633 | |
| 189 | 14″·553 (3) + 31″·793 (3) = 46″·347 | | 35″·693 (3) − 31″·793 (3) = 3″·900 | | 59″·720 (3) − 35″·693 (3) = 24″·027 | |
| 18 | 15″·773 (3) + 29″·800 (3) = 45″·573 | | 33″·967 (3) − 29″·800 (3) = 4″·167 | | 57″·807 (3) − 33″·967 (3) = 23″·840 | |
| 198 | 16″·327 (3) + 30″·147 (3) = 46″·473 | | 34″·620 (3) − 30″·147 (3) = 4″·473 | | 56″·920 (3) − 34″·620 (3) = 22″·300 | |
| 27 | 16″·840 (3) + 32″·627 (3) = 49″·467 | | 34″·453 (3) − 32″·627 (3) = 1″·827 | | 58″·413 (3) − 34″·453 (3) = 23″·960 | |
| 207 | 16″·333 (3) + 29″·940 (3) = 46″·273 | | 34″·080 (3) − 29″·940 (3) = 4″·140 | | 57″·873 (3) − 34″·080 (3) = 23″·793 | |
| Means | 47° 35′ 46″·954 | Prob. = 0·387 | 68° 40′ 3″·777 | Prob. = 0·348 | 46° 31′ 23″·175 | Prob. = 0·353 |

| Zero. | Rasia and Ladpur. | |
|---|---|---|
| | (208° 16′) − (144° 25′) = (63° 51′) | |
| 0 | 98″·413 (3) − 58″·747 (3) = 39″·667 | |
| 180 | 97″·913 (3) − 57″·787 (3) = 40″·127 | |
| 9 | 98″·967 (3) − 56″·787 (3) = 42″·180 | |
| 189 | 98″·967 (3) − 59″·720 (3) = 39″·247 | |
| 18 | 98″·100 (3) − 57″·807 (3) = 40″·293 | |
| 198 | 98″·347 (3) − 56″·920 (3) = 41″·427 | |
| 27 | 98″·207 (3) − 58″·413 (3) = 39″·793 | |
| 207 | 99″·120 (3) − 57″·873 (3) = 41″·247 | |
| Mean | 63° 51′ 40″·498 | Prob. = 0·335 |

No. 36.—At the STATION of MEOLI.—February 1836.

| Zero. | Deri and Pahera. | | Pahera and Chapra. | |
|---|---|---|---|---|
| | (114° 26′) − (55° 3′) = (59° 23′) | | (193° 5′) − (114° 26′) = (78° 39′) | |
| 0 | 52″·585 (4) − 18″·880 (4) = 33″·705 | | 84″·885 (4) − 52″·585 (4) = 32″·300 | |
| 180 | 49″·927 (3) − 18″·360 (5) = 31″·567 | | 84″·728 (5) − 49″·927 (3) = 34″·801 | |
| 9 | 49″·920 (3) − 18″·880 (3) = 31″·040 | | 83″·787 (3) − 49″·920 (3) = 33″·867 | |
| 189 | 51″·835 (4) − 19″·605 (4) = 32″·230 | | 84″·370 (4) − 51″·835 (4) = 32″·535 | |
| 18 | 51″·340 (3) − 15″·750 (6) = 35″·590 | | 84″·160 (3) − 51″·340 (3) = 32″·820 | |
| 198 | 51″·020 (3) − 17″·668 (5) = 33″·352 | | 84″·965 (4) − 51″·020 (3) = 33″·945 | |
| 27 | 50″·025 (4) − 19″·470 (4) = 30″·555 | | 85″·410 (4) − 50″·025 (4) = 35″·385 | |
| 207 | 52″·347 (3) − 17″·970 (4) = 34″·377 | | 83″·775 (4) − 52″·347 (3) = 31″·428 | |
| Means | 59° 23′ 32″·802 | Prob. = 0·578 | 78° 39′ 33″·385 | Prob. = 0·444 |



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**No. 37.—At the STATION of DERI.—February 1836.**

| Zero. | Pir Ghyb and Bostan. | | Bostan and Karol. | | Karol and Pahera. | |
|---|---|---|---|---|---|---|
| | (48 58) + (22 55) = (66 53) | | (82 19) − (22 55) = (59 24) | | (122 85) − (82 20) = (40 15) | |
| 0 | 40·393 (3) + 52·880 (3) = 93″·273 | Prob. = 0·523 | 101·240 (5) − 52·880 (3) = 48″·360 | Prob. = 0·737 | 65·813 (3) − 41·240 (5) = 24″·573 | Prob. = 0·664 |
| 180 | 41·793 (3) + 53·715 (4) = 95·508 | | 100·545 (4) − 53·715 (4) = 46·830 | | 64·327 (3) − 40·545 (4) = 23·782 | |
| 9 | 40·213 (3) + 53·420 (3) = 93·633 | | 99·353 (3) − 53·420 (3) = 45·933 | | 64·073 (3) − 39·353 (3) = 24·720 | |
| 189 | 44·867 (3) + 51·774 (7) = 96·641 | | 102·527 (3) − 51·774 (7) = 50·753 | | 64·640 (4) − 42·527 (3) = 22·113 | |
| 18 | 42·406 (4) + 53·680 (5) = 96·085 | | 100·627 (3) − 53·680 (5) = 46·947 | | 63·060 (3) − 40·627 (3) = 22·433 | |
| 198 | 43·867 (3) + 49·040 (4) = 92·907 | | 100·600 (7) − 49·040 (4) = 51·560 | | 59·790 (4) − 40·600 (7) = 19·190 | |
| 27 | 40·470 (4) + 52·035 (4) = 92·505 | | 101·590 (4) − 52·035 (4) = 49·555 | | 66·005 (4) − 41·590 (4) = 24·415 | |
| 207 | 43·535 (4) + 51·744 (5) = 95·279 | | 97·393 (3) − 51·744 (5) = 45·649 | | 62·705 (4) − 37·393 (3) = 25·312 | |
| Means | 66 54 34·479 | | 59 24 48·198 | | 40 15 23·317 | |

| Zero. | Pahera and Meoli. | |
|---|---|---|
| | (167 2) − (122 35) = (44 27) | |
| 0 | 85·793 (3) − 65·813 (3) = 19″·980 | Prob. = 0·628 |
| 180 | 84·793 (3) − 64·327 (3) = 20·466 | |
| 9 | 84·300 (3) − 64·073 (3) = 20·227 | |
| 189 | 83·970 (4) − 64·640 (4) = 19·330 | |
| 18 | 83·933 (6) − 63·060 (3) = 20·873 | |
| 198 | 84·227 (3) − 59·790 (4) = 24·437 | |
| 27 | 84·093 (6) − 66·005 (4) = 18·088 | |
| 207 | 81·640 (4) − 62·705 (4) = 18·935 | |
| Mean | 44 27 20·292 | |

**No. 38.—At the STATION of PIR GHYB.—January and February 1836.**

| Zero. | Dholri and Dateri. | | Dateri and Bostan. | | Bostan and Deri. | |
|---|---|---|---|---|---|---|
| | (165 59) − (128 26) = (37 33) | | (128 26) − (88 35) = (39 51) | | (88 34) − (27 56) = (60 38) | |
| 0 | 88·273 (3) − 47·007 (3) = 41″·266 | Prob. = 0·466 | 47·007 (3) − 18·160 (6) = 28″·847 | Prob. = 0·720 | 78·160 (6) − 35·780 (7) = 42″·380 | Prob. = 0·487 |
| 180 | 88·347 (3) − 43·547 (3) = 44·800 | | 43·547 (3) − 21·290 (4) = 22·257 | | 81·290 (4) − 35·805 (4) = 45·485 | |
| 9 | 89·453 (3) − 47·080 (3) = 42·373 | | 47·080 (3) − 19·506 (7) = 27·574 | | 79·506 (7) − 34·240 (4) = 45·266 | |
| 189 | 89·805 (4) − 45·110 (4) = 44·695 | | 45·110 (4) − 20·545 (4) = 24·565 | | 80·545 (4) − 34·485 (4) = 46·060 | |
| 18 | 88·860 (3) − 45·026 (7) = 43·834 | | 45·026 (7) − 19·227 (3) = 25·799 | | 79·227 (3) − 36·150 (4) = 43·077 | |
| 198 | 89·365 (4) − 43·671 (7) = 45·694 | | 43·671 (7) − 20·530 (4) = 23·141 | | 80·530 (4) − 33·800 (6) = 46·730 | |
| 27 | 88·775 (4) − 44·735 (4) = 44·040 | | 44·735 (4) − 19·260 (4) = 25·475 | | 79·260 (4) − 33·790 (4) = 45·470 | |
| 207 | 87·876 (5) − 43·985 (4) = 43·891 | | 43·985 (4) − 19·524 (5) = 24·461 | | 79·524 (5) − 34·655 (4) = 44·869 | |
| Means | 37 33 43·824 | | 39 51 25·265 | | 60 38 44·917 | |

**No. 39.—At the STATION of BULANDSHEHER.—March 1836.**

| Zero. | Dateri and Bostan. | | Bostan and Karol. | | Karol and Chandaos. | |
|---|---|---|---|---|---|---|
| | (24 45) + (15 28) = (40 13) | | (85 10) − (24 45) = (60 25) | | (134 35) − (85 10) = (49 25) | |
| 0 | 38·273 (3) + 34·727 (3) = 73″·000 | Prob. = 0·883 | 48·235 (4) − 38·273 (3) = 9″·962 | Prob. = 0·510 | 107·040 (2) − 48·235 (4) = 58″·805 | Prob. = 0·445 |
| 180 | 40·165 (4) + 31·193 (3) = 71·358 | | 49·573 (3) − 40·165 (4) = 9·408 | | 106·920 (3) − 49·573 (3) = 57·347 | |
| 9 | 35·560 (3) + 30·735 (4) = 66·295 | | 47·200 (4) − 35·560 (3) = 11·640 | | 103·887 (3) − 47·200 (4) = 56·687 | |
| 189 | 39·845 (4) + 35·567 (3) = 75·412 | | 47·107 (3) − 39·845 (4) = 7·262 | | 103·913 (3) − 47·107 (3) = 56·807 | |
| 18 | 38·055 (4) + 31·587 (3) = 69·642 | | 48·185 (4) − 38·055 (4) = 10·130 | | 104·260 (3) − 48·185 (4) = 56·075 | |
| 198 | 40·613 (3) + 31·287 (3) = 71·900 | | 48·120 (3) − 40·613 (3) = 7·507 | | 103·667 (3) − 48·120 (3) = 55·547 | |
| 27 | 40·227 (3) + 31·667 (3) = 71·893 | | 49·200 (3) − 40·227 (3) = 8·973 | | 105·667 (3) − 49·200 (3) = 56·467 | |
| 207 | 38·547 (3) + 31·475 (4) = 70·022 | | 50·100 (3) − 38·547 (3) = 11·553 | | 104·267 (3) − 50·100 (3) = 54·167 | |
| Means | 40 14 11·190 | | 60 25 9·554 | | 49 25 56·488 | |

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No. 40.—At the STATION of CHANDAOS.—March 1836.

| Zero. | Bulandshehar and Karol. | | Karol and No. | | |
|---|---|---|---|---|---|
| | (65 3) + (7 43) = (72 46) | | (133 27) − (65 3) = (68 24) | | |
| 0 | 28·553 (3) + 15·427 (3) = 43·980 | | 73·007 (3) − 28·553 (3) = 44·453 | | |
| 180 | 27·320 (3) + 15·065 (4) = 42·385 | | 72·973 (3) − 27·320 (3) = 45·653 | | |
| 9 | 28·360 (3) + 16·805 (4) = 45·165 | | 71·535 (4) − 28·360 (3) = 43·175 | | |
| 189 | 28·480 (3) + 15·073 (3) = 43·553 | | 72·133 (3) − 28·480 (3) = 43·653 | | |
| 18 | 29·660 (3) + 15·853 (3) = 45·513 | | 72·067 (3) − 29·660 (3) = 42·407 | | |
| 198 | 27·490 (4) + 17·513 (3) = 45·003 | Prob. = 0·410 | 70·993 (3) − 27·490 (4) = 43·503 | Prob. = 0·438 | |
| 27 | 28·033 (3) + 17·327 (3) = 45·360 | | 70·387 (3) − 28·033 (3) = 42·353 | | |
| 207 | 29·300 (3) + 16·880 (3) = 46·180 | | 70·720 (3) − 29·300 (3) = 41·420 | | |
| Means | 72 46 44·642 | | 68 24 43·327 | | |

No. 41.—At the STATION of NO.—March 1836 and April 1837.

| Zero. | Chandaos and Karol. | | Karol and Pahera. | | Pahera and Manpur. | |
|---|---|---|---|---|---|---|
| | (37 8) + (16 25) = (53 33) | | (80 16) − (37 8) = (43 8) | | (152 7) − (80 16) = (71 51) | |
| 0 | 49·525 (4) + 44·267 (3) = 93·792 | | 58·015 (4) − 49·525 (4) = 8·490 | | 117·687 (3) − 58·015 (4) = 59·672 | |
| 180 | 48·547 (3) + 44·365 (4) = 92·912 | | 59·680 (4) − 48·547 (3) = 11·133 | | 114·073 (3) − 59·680 (4) = 54·393 | |
| 9 | 48·447 (3) + 44·080 (4) = 92·527 | | 59·560 (3) − 48·447 (3) = 11·113 | | 115·400 (3) − 59·560 (3) = 55·840 | |
| 189 | 49·267 (3) + 40·870 (4) = 90·137 | | 57·587 (3) − 49·267 (3) = 8·320 | | 114·107 (3) − 57·587 (3) = 56·520 | |
| 18 | 49·507 (3) + 45·247 (3) = 94·753 | | 58·967 (3) − 49·507 (3) = 9·460 | | 117·960 (3) − 58·967 (3) = 58·993 | |
| 198 | 50·185 (4) + 44·753 (3) = 94·938 | Prob. = 0·551 | 58·690 (4) − 50·185 (4) = 8·505 | Prob. = 0·492 | 115·380 (3) − 58·690 (4) = 56·690 | Prob. = 0·652 |
| 27 | 48·890 (4) + 46·360 (3) = 95·250 | | 60·073 (3) − 48·890 (4) = 11·183 | | 119·887 (3) − 60·073 (3) = 59·813 | |
| 207 | 47·320 (5) + 46·113 (3) = 93·433 | | 59·310 (4) − 47·320 (5) = 11·990 | | 117·740 (3) − 59·310 (4) = 58·430 | |
| Means | 53 34 33·468 | | 43 8 10·024 | | 71 51 57·544 | |

| Zero. | Referring Lamp and Manpur. | | Manpur and Aring. | |
|---|---|---|---|---|
| | | | (207 50) − (173 31) = (34 19) | |
| 0 | 207 51 2·707 (3) | | 62·707 (3) − 59·100 (3) = 3·607 | |
| 180 | 3·353 (3) | | 63·353 (3) − 60·805 (4) = 2·548 | |
| 9 | 4·413 (3) | | 64·413 (3) − 60·833 (3) = 3·580 | |
| 189 | 4·273 (3) | | 64·273 (3) − 57·590 (3) = 6·683 | |
| 18 | 2.267 (3) | | 62·267 (3) − 59·193 (3) = 3·074 | |
| 198 | 4·167 (3) | | 64·167 (3) − 57·453 (3) = 6·714 | Prob. = 0·609 |
| 27 | 3·020 (3) | | 63·020 (3) − 59·407 (3) = 3·613 | |
| 207 | 4·587 (3) | | 64·587 (3) − 57·673 (3) = 6·914 | |
| Means | 207 51 3·598 | | 34 19 4·592 | |

Azimuth of Lamp = 202° 31′ 32″·585
Lamp and Manpur = +207 51 3·598
Azimuth of Manpur = 50 22 36·183

No. 42.—At the STATION of ARING.—March 1837.

| Zero. | No and Manpur. | | Manpur and Rasia. | | Rasia and Madhoni. | |
|---|---|---|---|---|---|---|
| | | | | | (115 44) − (53 34) = (62 10) | |
| 0 | 60 46 29·727 (3) | | 53 34 43·335 (4) | | 44·553 (3) − 43·335 (4) = 1·218 | |
| 180 | 30·933 (3) | | 43·053 (3) | | 44·240 (3) − 43·053 (3) = 1·187 | |
| 9 | 30·280 (3) | | 41·753 (3) | | 43·167 (3) − 41·753 (3) = 1·413 | |
| 189 | 30·233 (3) | | 43·093 (3) | | 45·947 (3) − 43·093 (3) = 2·853 | |
| 18 | 28·547 (3) | | 42·913 (3) | | 44·313 (3) − 42·913 (3) = 1·400 | |
| 198 | 31·040 (3) | Prob. = 0·298 | 43·360 (3) | Prob. = 0·441 | 45·547 (3) − 43·360 (3) = 2·187 | Prob. = 0·251 |
| 27 | 28·953 (3) | | 43·127 (3) | | 47·793 (3) − 43·127 (3) = 1·667 | |
| 207 | 29·360 (3) | | 46·433 (3) | | 46·700 (3) − 46·433 (3) = 0·267 | |
| Means | 60 46 29·884 | | 53 34 43·383 | | 62 10 1·524 | |

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No. 43.—At the STATION of MANPUR.—March 1838.

| Zero. | Pahera and No. | | Prob. | No and Aring. | | Prob. | Aring and Rasia. | | Prob. |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ | | | ° ′ | | | ° ′ | | |
| | (177 29) | — (118 39) = | (58 50) | (182 29) | — (97 35) = | (84 54) | (97 34) | — (12 49) = | (84 45) |
| | ″ | ″ | | ″ | ″ | | ″ | ″ | |
| 0 | 47·353 (3) | — 2·607 (3) = | 44·747 | 72·647 (3) | — 43·007 (3) = | 29·640 | 103·007 (3) | — 50·240 (3) = | 52·767 |
| 180 | 48·467 (3) | — 3·707 (3) = | 44·760 | 71·533 (3) | — 42·993 (3) = | 28·540 | 102·993 (3) | — 50·226 (3) = | 52·767 |
| 9 | 47·853 (3) | — 5·313 (3) = | 42·540 | 72·147 (3) | — 41·640 (3) = | 30·507 | 101·640 (3) | — 48·653 (3) = | 52·987 |
| 189 | 48·480 (3) | — 4·800 (3) = | 43·680 | 71·520 (3) | — 43·187 (3) = | 28·333 | 103·186 (3) | — 51·073 (3) = | 52·113 |
| 18 | 47·127 (3) | — 4·487 (3) = | 42·640 | 72·873 (3) | — 41·693 (3) = | 31·180 | 101·693 (3) | — 52·040 (3) = | 49·653 |
| 198 | 48·127 (3) | — 3·913 (3) = | 44·213 | 71·873 (3) | — 42·953 (3) = | 28·920 | 102·953 (3) | — 51·246 (3) = | 51·707 |
| 27 | 49·393 (3) | — 3·947 (3) = | 45·447 | 70·606 (3) | — 43·373 (3) = | 27·233 | 103·373 (3) | — 51·500 (3) = | 51·873 |
| 207 | 47·420 (3) | — 4·873 (3) = | 42·547 | 72·580 (3) | — 42·553 (3) = | 30·027 | 102·553 (3) | — 51·013 (3) = | 51·540 |
| Means | 58 50 | 43·822 | | 84 54 | 29·298 | | 84 45 | 51·926 | |

| Zero. | Rasia and Chapra. | | Prob. | Chapra and Pahera. | | Prob. |
|---|---|---|---|---|---|---|
| | ° ′ | | | ° ′ | | |
| | (12 49) | + (54 26) = | (67 15) | (118 38) | — (54 26) = | (64 12) |
| | ″ | ″ | | ″ | ″ | |
| 0 | 50·240 (3) | + 4·680 (3) = | 54·920 | 62·607 (3) | — 4·680 (3) = | 57·927 |
| 180 | 50·227 (3) | + 5·733 (3) = | 55·960 | 63·707 (3) | — 5·733 (3) = | 57·973 |
| 9 | 48·653 (3) | + 7·227 (3) = | 55·880 | 65·313 (3) | — 7·227 (3) = | 58·087 |
| 189 | 51·073 (3) | + 6·807 (3) = | 57·880 | 64·800 (3) | — 6·807 (3) = | 57·993 |
| 18 | 52·040 (3) | + 6·273 (3) = | 58·313 | 64·487 (3) | — 6·273 (3) = | 58·213 |
| 198 | 51·247 (3) | + 6·813 (3) = | 58·060 | 63·913 (3) | — 6·813 (3) = | 57·100 |
| 27 | 51·500 (3) | + 5·400 (3) = | 56·900 | 63·947 (3) | — 5·400 (3) = | 58·547 |
| 207 | 51·013 (3) | + 6·347 (3) = | 57·360 | 64·873 (3) | — 6·347 (3) = | 58·527 |
| Means | 67 15 | 56·909 | | 64 12 | 58·046 | |

No. 44.—At the STATION of PAHERA.—February 1836.

| Zero. | Deri and Karol. | | Prob. | Karol and No. | | Prob. | No and Manpur. | | Prob. |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ | | | ° ′ | | | ° ′ | | |
| | (186 17) | — (112 39) = | (73 38) | (112 38) | — (52 36) = | (60 2) | (52 36) | — (3 19) = | (49 17) |
| | ″ | ″ | | ″ | ″ | | ″ | ″ | |
| 0 | 97·653 (3) | — 52·113 (3) = | 45·540 | 112·113 (3) | — 55·347 (3) = | 56·766 | 55·347 (3) | — 28·620 (3) = | 26·727 |
| 180 | 96·320 (3) | — 52·020 (3) = | 44·300 | 112·020 (3) | — 54·387 (3) = | 57·633 | 54·387 (3) | — 28·780 (3) = | 25·607 |
| 9 | 96·163 (7) | — 51·813 (3) = | 44·350 | 111·813 (3) | — 53·353 (3) = | 58·460 | 53·353 (3) | — 30·547 (3) = | 22·806 |
| 189 | 98·213 (3) | — 51·540 (3) = | 46·673 | 111·540 (3) | — 53·047 (3) = | 58·493 | 53·047 (3) | — 29·240 (3) = | 23·807 |
| 18 | 95·560 (3) | — 51·260 (3) = | 44·300 | 111·260 (3) | — 53·775 (4) = | 57·485 | 53·775 (4) | — 29·653 (3) = | 24·122 |
| 198 | 97·573 (3) | — 52·713 (3) = | 44·860 | 112·713 (3) | — 54·560 (3) = | 58·153 | 54·560 (3) | — 29·853 (3) = | 24·707 |
| 27 | 97·740 (3) | — 51·020 (3) = | 46·720 | 111·020 (3) | — 56·767 (6) = | 54·253 | 56·767 (6) | — 31·320 (3) = | 25·447 |
| 207 | 99·055 (4) | — 51·793 (3) = | 47·262 | 111·793 (3) | — 56·633 (3) = | 55·160 | 56·633 (3) | — 28·207 (3) = | 28·426 |
| Means | 73 38 | 45·501 | | 60 2 | 57·050 | | 49 17 | 25·206 | |

| Zero. | Manpur and Chapra. | | Prob. | Chapra and Meoli. | | Prob. | Meoli and Deri. | | Prob. |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ | | | ° ′ | | | ° ′ | | |
| | (3 19) | + (43 47) = | (47 6) | (97 31) | — (43 47) = | (53 44) | (173 41) | — (97 32) = | (76 9) |
| | ″ | ″ | | ″ | ″ | | ″ | ″ | |
| 0 | 28·620 (3) | + 30·660 (3) = | 59·280 | 71·805 (4) | — 30·660 (3) = | 41·145 | 22·347 (3) | — 11·805 (4) = | 10·542 |
| 180 | 28·780 (3) | + 28·675 (4) = | 57·455 | 73·645 (4) | — 28·675 (4) = | 44·970 | 23·680 (3) | — 13·645 (4) = | 10·035 |
| 9 | 30·547 (3) | + 31·080 (3) = | 61·627 | 72·407 (3) | — 31·080 (3) = | 41·327 | 23·837 (7) | — 12·407 (3) = | 11·430 |
| 189 | 29·240 (3) | + 29·240 (3) = | 58·480 | 71·960 (3) | — 29·240 (3) = | 42·720 | 21·787 (3) | — 11·960 (3) = | 9·827 |
| 18 | 29·653 (3) | + 30·627 (3) = | 60·280 | 72·887 (3) | — 30·627 (3) = | 42·260 | 24·440 (3) | — 12·887 (3) = | 11·553 |
| 198 | 29·853 (3) | + 30·300 (3) = | 60·153 | 74·913 (3) | — 30·300 (3) = | 44·613 | 22·427 (3) | — 14·913 (3) = | 7·513 |
| 27 | 31·320 (3) | + 27·600 (3) = | 58·920 | 71·307 (3) | — 27·600 (3) = | 43·707 | 22·260 (3) | — 11·307 (3) = | 10·953 |
| 207 | 28·207 (3) | + 29·373 (3) = | 57·580 | 70·987 (3) | — 29·373 (3) = | 41·613 | 20·945 (4) | — 10·987 (3) = | 9·958 |
| Means | 47 6 | 59·222 | | 53 44 | 42·795 | | 76 9 | 10·226 | |

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No. 45.—At the STATION of KAROL.—February 1836.

| Zero. | Bostan and Bulandsheher. | | Bulandsheher and Chandaos. | | Chandaos and No. | |
|---|---|---|---|---|---|---|
| | (81° 17′) — (26° 17′) = (55° 0′) | | (26° 17′) + (31° 30′) = (57° 47′) | | (89° 30′) — (31° 30′) = (58° 0′) | |
| 0 | 27″·273 (3) — 4″·233 (3) = 23″·040 | | 4″·233 (3) + 16″·960 (3) = 21″·193 | | 61″·947 (3) — 16″·960 (3) = 44″·987 | |
| 180 | 25″·300 (3) — 4″·793 (3) = 20″·507 | | 4″·793 (3) + 18″·193 (3) = 22″·986 | | 62″·187 (3) — 18″·193 (3) = 43″·993 | |
| 9 | 26″·593 (3) — 2″·140 (3) = 24″·453 | | 2″·140 (3) + 17″·967 (3) = 20″·107 | | 63″·420 (3) — 17″·967 (3) = 45″·453 | |
| 189 | 27″·440 (3) — 3″·027 (3) = 24″·413 | | 3″·027 (3) + 17″·780 (3) = 20″·807 | | 64″·600 (3) — 17″·780 (3) = 46″·820 | |
| 18 | 27″·047 (3) — 3″·133 (3) = 23″·914 | | 3″·133 (3) + 18″·073 (3) = 21″·206 | | 64″·047 (3) — 18″·073 (3) = 45″·973 | |
| 198 | 26″·807 (3) — 4″·285 (4) = 22″·522 | | 4″·285 (4) + 17″·040 (3) = 21″·325 | | 65″·033 (3) — 17″·040 (3) = 47″·993 | |
| 27 | 28″·493 (3) — 3″·880 (4) = 24″·613 | | 3″·880 (4) + 18″·560 (3) = 22″·440 | | 63″·935 (4) — 18″·560 (3) = 45″·375 | |
| 207 | 26″·133 (3) — 3″·720 (4) = 22″·413 | | 3″·720 (4) + 18″·660 (3) = 22″·380 | | 63″·990 (4) — 18″·660 (3) = 45″·330 | |
| Means | 55° 0′ 23″·234 | Prob. = 0·466 | 57° 47′ 21″·556 | Prob = 0·318 | 58° 0′ 45″·741 | Prob. = 0·401 |

| Zero. | No and Pahera. | | Pahera and Deri. | | Deri and Bostan. | |
|---|---|---|---|---|---|---|
| | (166° 19′) — (89° 31′) = (76° 48′) | | (193° 39′) — (127° 34′) = (66° 5′) | | (127° 33′) — (81° 17′) = (46° 16′) | |
| 0 | 57″·460 (3) — 1″·947 (3) = 55″·513 | | 62″·540 (3) — 10″·467 (3) = 52″·073 | | 70″·467 (3) — 27″·273 (3) = 43″·193 | |
| 180 | 57″·400 (3) — 2″·187 (3) = 55″·213 | | 62″·600 (3) — 11″·467 (3) = 51″·133 | | 71″·467 (3) — 25″·300 (3) = 46″·167 | |
| 9 | 57″·573 (3) — 3″·420 (3) = 54″·153 | | 62″·427 (3) — 9″·547 (3) = 52″·880 | | 69″·547 (3) — 26″·593 (3) = 42″·953 | |
| 189 | 58″·793 (3) — 4″·600 (3) = 54″·193 | | 61″·207 (3) — 9″·047 (3) = 52″·160 | | 69″·047 (3) — 27″·440 (3) = 41″·607 | |
| 18 | 56″·673 (3) — 4″·047 (3) = 52″·627 | | 63″·327 (3) — 8″·620 (3) = 54″·707 | | 68″·620 (3) — 27″·047 (3) = 41″·573 | |
| 198 | 56″·987 (3) — 5″·033 (3) = 51″·953 | | 63″·013 (3) — 9″·133 (3) = 53″·880 | | 69″·133 (3) — 26″·807 (3) = 42″·327 | |
| 27 | 56″·880 (3) — 3″·935 (4) = 52″·945 | | 63″·120 (3) — 10″·633 (3) = 52″·487 | | 70″·633 (3) — 28″·493 (3) = 42″·140 | |
| 207 | 56″·187 (3) — 3″·990 (4) = 52″·197 | | 63″·813 (3) — 9″·900 (3) = 53″·913 | | 69″·900 (3) — 26″·133 (3) = 43″·767 | |
| Means | 76° 48′ 53″·599 | Prob. = 0·450 | 66° 5′ 52″·904 | Prob. = 0·391 | 46° 16′ 42″·966 | Prob. = 0·497 |

No. 46.—At the STATION of BOSTAN.—February 1836.

| Zero. | Dateri and Bulandsheher. | | Bulandsheher and Karol. | | Karol and Deri. | |
|---|---|---|---|---|---|---|
| | (108° 19′) — (27° 4′) = (81° 15′) | | (172° 53′) — (108° 19′) = (64° 34′) | | (187° 5′) — (112° 47′) = (74° 18′) | |
| 0 | 46″·973 (3) — 34″·093 (3) = 12″·880 | | 74″·227 (3) — 46″·973 (3) = 27″·253 | | 45″·773 (3) — 8″·307 (3) = 37″·467 | |
| 180 | 47″·033 (3) — 30″·267 (3) = 16″·767 | | 75″·193 (3) — 47″·033 (3) = 28″·160 | | 44″·807 (3) — 11″·260 (3) = 33″·547 | |
| 9 | 47″·973 (3) — 34″·850 (4) = 13″·123 | | 76″·853 (3) — 47″·973 (3) = 28″·880 | | 43″·147 (3) — 8″·060 (3) = 35″·087 | |
| 189 | 46″·073 (3) — 30″·455 (4) = 15″·618 | | 74″·720 (3) — 46″·073 (3) = 28″·647 | | 45″·280 (3) — 9″·507 (3) = 35″·773 | |
| 18 | 49″·355 (4) — 32″·090 (4) = 17″·265 | | 74″·467 (3) — 49″·355 (4) = 25″·112 | | 45″·533 (3) — 9″·227 (3) = 36″·306 | |
| 198 | 47″·655 (4) — 31″·953 (3) = 15″·702 | | 76″·513 (3) — 47″·655 (4) = 28″·858 | | 43″·487 (3) — 11″·373 (3) = 32″·113 | |
| 27 | 47″·500 (3) — 29″·600 (4) = 17″·900 | | 76″·413 (3) — 47″·500 (3) = 28″·913 | | 43″·587 (3) — 10″·440 (4) = 33″·147 | |
| 207 | 47″·033 (3) — 30″·847 (3) = 16″·187 | | 76″·093 (3) — 47″·033 (3) = 29″·060 | | 43″·907 (3) — 10″·490 (4) = 33″·417 | |
| Means | 81° 15′ 15″·680 | Prob. = 0·603 | 64° 34′ 28″·110 | Prob. = 0·446 | 74° 18′ 34″·607 | Prob. = 0·607 |

| Zero. | Deri and Pir Ghyb. | | Pir Ghyb and Dateri. | | | |
|---|---|---|---|---|---|---|
| | (112° 46′) — (60° 20′) = (52° 26′) | | (60° 20′) + (27° 4′) = (87° 24′) | | | |
| 0 | 68″·307 (3) — 27″·227 (3) = 41″·080 | | 27″·227 (3) + 34″·093 (3) = 61″·320 | | | |
| 180 | 71″·260 (3) — 28″·480 (3) = 42″·780 | | 28″·480 (3) + 30″·267 (3) = 58″·747 | | | |
| 9 | 68″·060 (3) — 25″·067 (3) = 42″·993 | | 25″·067 (3) + 34″·850 (4) = 59″·917 | | | |
| 189 | 69″·507 (3) — 26″·693 (3) = 42″·814 | | 26″·693 (3) + 30″·455 (4) = 57″·148 | | | |
| 18 | 69″·227 (3) — 26″·576 (5) = 42″·651 | | 26″·576 (5) + 32″·090 (4) = 58″·666 | | | |
| 198 | 71″·373 (3) — 25″·773 (3) = 45″·600 | | 25″·773 (3) + 31″·953 (3) = 57″·726 | | | |
| 27 | 70″·440 (4) — 27″·830 (4) = 42″·610 | | 27″·830 (4) + 29″·600 (4) = 57″·430 | | | |
| 207 | 70″·490 (4) — 27″·447 (3) = 43″·043 | | 27″·447 (3) + 30″·847 (3) = 58″·294 | | | |
| Means | 52° 26′ 42″·946 | Prob. = 0·410 | 87° 24′ 58″·656 | Prob. = 0·459 | | |



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### No. 47.—At the STATION of DATERI.—January and March 1836.

| Zero. | Saini and Dholri. | | Dholri and Pir Ghyb. | | Pir Ghyb and Bostan. | |
|---|---|---|---|---|---|---|
| | (28 57) + (31 48) = (60 45) | | (88 48) − (28 57) = (59 51) | | (141 31) − (88 48) = (52 43) | |
| 0 | 18·367 (3) + 60·067 (3) = 78″·433 | | 45·180 (4) − 18·367 (3) = 26″·813 | | 86·400 (3) − 45·180 (4) = 41″·220 | |
| 180 | 18·080 (3) + 63·080 (3) = 81·160 | | 45·333 (3) − 18·080 (3) = 27·253 | | 84·767 (3) − 45·333 (3) = 39·433 | |
| 9 | 20·720 (4) + 59·955 (4) = 80·675 | | 43·370 (4) − 20·720 (4) = 22·650 | | 87·200 (3) − 43·370 (4) = 43·830 | |
| 189 | 19·120 (3) + 60·925 (4) = 80·045 | | 48·328 (5) − 19·120 (3) = 29·208 | | 86·987 (3) − 48·328 (5) = 38·659 | |
| 18 | 18·993 (3) + 60·153 (3) = 79·147 | | 46·453 (3) − 18·993 (3) = 27·460 | | 87·953 (3) − 46·453 (3) = 41·500 | |
| 198 | 19·480 (3) + 59·612 (5) = 79·092 | | 46·353 (3) − 19·480 (3) = 26·873 | | 84·613 (3) − 46·353 (3) = 38·260 | |
| 27 | 18·887 (3) + 60·600 (3) = 79·487 | | 47·587 (3) − 18·887 (3) = 28·700 | | 84·767 (3) − 47·587 (3) = 37·180 | |
| 207 | 17·873 (3) + 61·873 (3) = 79·747 | | 48·120 (3) − 17·873 (3) = 30·247 | | 84·453 (3) − 48·120 (3) = 36·333 | |
| Means | 60 46 19·723 | Prob. = 0·294 | 59 51 27·401 | Prob. = 0·753 | 52 43 39·552 | Prob. = 0·823 |

| Zero. | Referring Lamp and Bostan. | Bostan and Bulandsheher. | |
|---|---|---|---|
| | | (200 2) − *(141 32) = (58 30) | |
| 0 | 141 32 26″·400 (3) | 71″·873 (3) − 34″·367 (3) = 37″·507 | |
| 180 | 24·767 (3) | 70·207 (3) − 32·453 (3) = 37·753 | |
| 9 | 27·200 (3) | 69·320 (4) − 33·880 (3) = 35·440 | |
| 189 | 26·987 (3) | 70·193 (3) − 35·247 (3) = 34·947 | |
| 18 | 27·953 (3) | 70·927 (3) − 33·207 (3) = 37·720 | |
| 198 | 24·613 (3) | 69·693 (3) − 34·160 (3) = 35·533 | |
| 27 | 24·767 (3) | 71·547 (3) − 32·407 (3) = 39·140 | |
| 207 | 24·453 (3) | 71·215 (4) − 32·953 (3) = 38·262 | |
| Means | 141 32 25·893 | 58 30 37·038 | Prob. = 0·505 |

Azimuth of Lamp = 170° 16′ 59″·879
Lamp and Bostan = −141 32 25·893
Azimuth of Bostan = 28 44 33·986

### No. 48.—At the STATION of DHOLRI.—January 1836.

| Zero. | Saroli and Saini. | | Saini and Dateri. | | Dateri and Pir Ghyb. | |
|---|---|---|---|---|---|---|
| | (57 28) + (0 17) = (57 45) | | (75 6) − (0 17) = (74 49) | | (157 40) − (75 6) = (82 34) | |
| 0 | 12″·963 (6) + 32″·003 (6) = 44″·966 | | 59″·520 (5) − 32″·003 (6) = 27″·517 | | 108″·873 (3) − 59″·520 (5) = 49″·353 | |
| 180 | 11·093 (6) + 32·527 (3) = 43·620 | | 61·173 (3) − 32·527 (3) = 28·646 | | 111·230 (4) − 61·173 (3) = 50·057 | |
| 9 | 13·733 (3) + 32·360 (3) = 46·093 | | 62·735 (4) − 32·360 (3) = 30·375 | | 109·907 (3) − 62·735 (4) = 47·172 | |
| 189 | 9·313 (3) + 32·393 (3) = 41·706 | | 61·180 (3) − 32·393 (3) = 28·787 | | 112·505 (4) − 61·180 (3) = 51·325 | |
| 18 | 11·546 (7) + 31·825 (4) = 43·371 | | 61·340 (4) − 31·825 (4) = 29·515 | | 104·200 (3) − 61·340 (4) = 42·860 | |
| 198 | 10·590 (6) + 37·440 (6) = 48·030 | | 65·313 (3) − 37·440 (6) = 27·873 | | 112·007 (3) − 65·313 (3) = 46·694 | |
| 27 | 12·165 (4) + 33·150 (4) = 45·315 | | 58·927 (3) − 33·150 (4) = 25·777 | | 110·725 (4) − 58·927 (3) = 51·798 | |
| 207 | 8·187 (3) + 34·427 (3) = 42·614 | | 65·753 (3) − 34·427 (3) = 31·326 | | 110·024 (5) − 65·753 (3) = 44·271 | |
| Means | 57 45 44·464 | Prob. = 0·676 | 74 49 28·727 | Prob. = 0·573 | 82 34 47·941 | Prob. = 1·077 |

### No. 49.—At the STATION of SAROLI.—December 1835 and January 1836.

| Zero. | Begarazpur and Saini. | | Saini and Dholri. | | |
|---|---|---|---|---|---|
| | (97 54) − (16 8) = (81 46) | | (168 15) − (97 55) = (70 20) | | |
| 0 | 101″·733 (3) − 43″·100 (3) = 58″·633 | | 92″·633 (3) − 41″·733 (3) = 50″·900 | | |
| 180 | 102·707 (3) − 40·335 (4) = 62·372 | | 95·067 (3) − 42·707 (3) = 52·360 | | |
| 9 | 101·280 (3) − 41·913 (3) = 59·367 | | 93·987 (3) − 41·280 (3) = 52·707 | | |
| 189 | 99·467 (3) − 44·620 (3) = 54·847 | | 94·787 (3) − 39·467 (3) = 55·320 | | |
| 18 | 100·033 (3) − 42·367 (3) = 57·667 | | 92·120 (4) − 40·033 (3) = 52·087 | | |
| 198 | 101·527 (3) − 42·747 (3) = 58·780 | | 92·365 (4) − 41·527 (3) = 50·838 | | |
| 27 | 100·767 (3) − 43·320 (3) = 57·447 | | 91·967 (3) − 40·767 (3) = 51·200 | | |
| 207 | 100·413 (3) − 43·013 (3) = 57·400 | | 91·253 (3) − 40·413 (3) = 50·840 | | |
| Means | 81 46 58·314 | Prob. = 0·706 | 70 20 52·032 | Prob. = 0·503 | |

* Between January and March the position of the Referring Mark was altered.

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No. 50.—At the STATION of SAINI.—January 1836.

| Zero. | Saroli and Begarazpur. | | Begarazpur and Sheopuri. | | Dholri and Saroli. | |
|---|---|---|---|---|---|---|
| | $(13\ 7) + (35\ 23) = (48\ 30)$ | | $(80\ 58) - (35\ 23) = (45\ 35)$ | | $(65\ 0) - (13\ 7) = (51\ 53)$ | |
| 0 | $26''\cdot249^{(7)} + 27''\cdot480^{(4)} = 53''\cdot729$ | | $82''\cdot227^{(3)} - 27''\cdot480^{(4)} = 54''\cdot747$ | | $52''\cdot680^{(3)} - 26''\cdot249^{(7)} = 26''\cdot431$ | |
| 180 | $23''\cdot271^{(7)} + 27''\cdot813^{(3)} = 51''\cdot084$ | | $81''\cdot887^{(3)} - 27''\cdot813^{(3)} = 54''\cdot074$ | | $53''\cdot943^{(3)} - 23''\cdot271^{(7)} = 30''\cdot672$ | |
| 9 | $24''\cdot560^{(3)} + 25''\cdot693^{(3)} = 50''\cdot253$ | | $83''\cdot020^{(3)} - 25''\cdot693^{(3)} = 57''\cdot327$ | | $54''\cdot673^{(3)} - 24''\cdot560^{(3)} = 30''\cdot113$ | |
| 189 | $23''\cdot493^{(3)} + 28''\cdot907^{(3)} = 52''\cdot400$ | | $83''\cdot333^{(3)} - 28''\cdot907^{(3)} = 54''\cdot426$ | | $51''\cdot620^{(3)} - 23''\cdot493^{(3)} = 28''\cdot127$ | |
| 18 | $26''\cdot513^{(3)} + 26''\cdot665^{(4)} = 53''\cdot178$ | | $81''\cdot600^{(3)} - 26''\cdot665^{(4)} = 54''\cdot935$ | | $52''\cdot345^{(4)} - 26''\cdot513^{(3)} = 25''\cdot832$ | |
| 198 | $26''\cdot507^{(3)} + 26''\cdot820^{(4)} = 53''\cdot327$ | | $82''\cdot940^{(3)} - 26''\cdot820^{(4)} = 56''\cdot120$ | | $52''\cdot080^{(4)} - 26''\cdot507^{(3)} = 25''\cdot573$ | |
| 27 | $27''\cdot887^{(3)} + 29''\cdot013^{(3)} = 56''\cdot900$ | | $81''\cdot460^{(3)} - 29''\cdot013^{(3)} = 52''\cdot447$ | | $52''\cdot287^{(3)} - 27''\cdot887^{(3)} = 24''\cdot400$ | |
| 207 | $29''\cdot420^{(3)} + 29''\cdot447^{(3)} = 58''\cdot867$ | | $82''\cdot160^{(3)} - 29''\cdot447^{(3)} = 52''\cdot713$ | | $49''\cdot800^{(3)} - 29''\cdot420^{(3)} = 20''\cdot380$ | |
| Means | 48 30 53·717 | Prob. = 0·950 | 45 35 54·599 | Prob. = 0·536 | 51 53 26·441 | Prob. = 1·092 |

| Zero. | Dateri and Dholri. | |
|---|---|---|
| | $(109\ 24) - (65\ 0) = (44\ 24)$ | |
| 0 | $65''\cdot580^{(3)} - 52''\cdot680^{(3)} = 12''\cdot900$ | |
| 180 | $64''\cdot540^{(3)} - 53''\cdot943^{(3)} = 10''\cdot597$ | |
| 9 | $66''\cdot135^{(4)} - 54''\cdot673^{(3)} = 11''\cdot462$ | |
| 189 | $64''\cdot647^{(3)} - 51''\cdot620^{(3)} = 13''\cdot027$ | |
| 18 | $68''\cdot303^{(3)} - 52''\cdot345^{(4)} = 15''\cdot958$ | |
| 198 | $67''\cdot020^{(3)} - 52''\cdot080^{(4)} = 14''\cdot940$ | |
| 27 | $65''\cdot480^{(3)} - 52''\cdot287^{(3)} = 13''\cdot193$ | |
| 207 | $66''\cdot700^{(3)} - 49''\cdot800^{(3)} = 16''\cdot900$ | |
| Mean | 44 24 13·622 | Prob. = 0·716 |

No. 51.—At the STATION of SHEOPURI.—April 1836.

| Zero. | Godhna and Begarazpur. | | Saini and Begarazpur. | | |
|---|---|---|---|---|---|
| | $(120\ 9) - (58\ 2) = (62\ 7)$ | | $(12\ 32) + (58\ 2) = (70\ 34)$ | | |
| 0 | $28''\cdot167^{(3)} - 24''\cdot400^{(3)} = 3''\cdot767$ | | $18''\cdot500^{(4)} + 24''\cdot400^{(3)} = 42''\cdot900$ | | |
| 180 | $27''\cdot613^{(3)} - 24''\cdot073^{(3)} = 3''\cdot540$ | | $20''\cdot560^{(3)} + 24''\cdot073^{(3)} = 44''\cdot633$ | | |
| 9 | $32''\cdot787^{(3)} - 24''\cdot253^{(3)} = 8''\cdot533$ | | $20''\cdot000^{(3)} + 24''\cdot253^{(3)} = 44''\cdot253$ | | |
| 189 | $30''\cdot445^{(4)} - 24''\cdot253^{(3)} = 6''\cdot192$ | | $18''\cdot227^{(8)} + 24''\cdot253^{(3)} = 42''\cdot480$ | | |
| 18 | $30''\cdot757^{(6)} - 21''\cdot027^{(3)} = 9''\cdot730$ | | $20''\cdot700^{(3)} + 21''\cdot027^{(3)} = 41''\cdot727$ | | |
| 198 | $30''\cdot853^{(3)} - 23''\cdot280^{(3)} = 7''\cdot573$ | | $20''\cdot660^{(4)} + 23''\cdot280^{(3)} = 43''\cdot940$ | | |
| 27 | $27''\cdot320^{(3)} - 20''\cdot840^{(3)} = 6''\cdot480$ | | $21''\cdot420^{(3)} + 20''\cdot840^{(3)} = 42''\cdot260$ | | |
| 207 | $28''\cdot340^{(3)} - 20''\cdot020^{(3)} = 8''\cdot320$ | | $20''\cdot813^{(3)} + 20''\cdot020^{(3)} = 40''\cdot833$ | | |
| Means | 62 7 6·767 | Prob. = 0·737 | 70 34 42·878 | Prob. = 0·436 | |

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No. 52.—At the STATION of BEGARAZPUR.—December 1835.

| Zero. | Kaliana and Dahera. | | Kaliana and Godhna. | | Dahera and Godhna. | |
|---|---|---|---|---|---|---|
| | (52° 13′) − (51° 35′) = (0° 38′) | | (52° 13′) + (0° 19′) = (52° 32′) | | (51° 35′) + (0° 19′) = (51° 54′) | |
| 0 | 52″·220 (3) − 25″·300 (3) = 26″·920 | | 52″·220 (3) + 27″·220 (3) = 79″·440 | | 25″·300 (3) + 27″·220 (3) = 52″·520 | |
| 180 | 56″·013 (3) − 25″·547 (3) = 30″·466 | | 56″·013 (3) + 25″·485 (4) = 81″·498 | | 25″·547 (3) + 25″·485 (4) = 51″·032 | |
| 9 | 57″·287 (3) − 29″·267 (3) = 28″·020 | | 57″·287 (3) + 26″·535 (4) = 83″·822 | | 29″·267 (3) + 26″·535 (4) = 55″·802 | |
| 189 | 54″·840 (3) − 26″·067 (3) = 28″·773 | | 54″·840 (3) + 27″·545 (4) = 82″·385 | | 26″·067 (3) + 27″·545 (4) = 53″·612 | |
| 18 | 52″·713 (3) − 24″·647 (3) = 28″·067 | | 52″·713 (3) + 27″·585 (4) = 80″·298 | | 24″·647 (3) + 27″·585 (4) = 52″·232 | |
| 198 | 55″·133 (3) − 27″·067 (3) = 28″·066 | | 55″·133 (3) + 24″·820 (4) = 79″·953 | | 27″·067 (3) + 24″·820 (4) = 51″·887 | |
| 27 | 52″·753 (3) − 23″·987 (3) = 28″·767 | | 52″·753 (3) + 28″·533 (3) = 81″·286 | | 23″·987 (3) + 28″·533 (3) = 52″·520 | |
| 207 | 55″·480 (4) − 26″·070 (4) = 29″·410 | | 55″·480 (4) + 26″·040 (3) = 81″·520 | | 26″·070 (4) + 26″·040 (3) = 52″·110 | |
| Means | 0 38 28·561 | Prob. = 0·352 | 52 33 21·275 | Prob. = 0·466 | 51 54 52·714 | Prob. = 0·476 |
| Zero. | Godhna and Sheopuri. | | Sheopuri and Saini. | | Saini and Saroli. | |
| | (67° 58′) − (0° 19′) = (67° 39′) | | (131° 47′) − (67° 58′) = (63° 49′) | | (181° 30′) − (131° 48′) = (49° 42′) | |
| 0 | 51″·747 (3) − 27″·220 (3) = 24″·527 | | 74″·933 (3) − 51″·747 (3) = 23″·186 | | 27″·553 (3) − 14″·933 (3) = 12″·620 | |
| 180 | 52″·867 (3) − 25″·485 (4) = 27″·382 | | 75″·187 (3) − 52″·867 (3) = 22″·320 | | 29″·007 (3) − 15″·187 (3) = 13″·820 | |
| 9 | 52″·820 (3) − 26″·535 (4) = 26″·285 | | 74″·473 (3) − 52″·820 (3) = 21″·653 | | 25″·120 (3) − 14″·473 (3) = 10″·647 | |
| 189 | 51″·807 (4) − 27″·545 (4) = 24″·262 | | 75″·575 (4) − 51″·807 (4) = 23″·768 | | 26″·673 (3) − 15″·575 (4) = 11″·098 | |
| 18 | 52″·327 (3) − 27″·585 (4) = 24″·742 | | 74″·635 (4) − 52″·327 (3) = 22″·308 | | 28″·240 (3) − 14″·635 (4) = 13″·605 | |
| 198 | 52″·040 (4) − 24″·820 (4) = 27″·220 | | 76″·327 (3) − 52″·040 (4) = 24″·287 | | 26″·567 (3) − 16″·327 (3) = 10″·240 | |
| 27 | 51″·990 (4) − 28″·533 (3) = 23″·457 | | 74″·193 (3) − 51″·990 (4) = 22″·203 | | 26″·140 (3) − 14″·193 (3) = 11″·947 | |
| 207 | 53″·287 (3) − 26″·040 (3) = 27″·247 | | 76″·700 (4) − 53″·287 (3) = 23″·413 | | 25″·827 (3) − 16″·700 (4) = 9″·127 | |
| Means | 67 39 25·640 | Prob. = 0·519 | 63 49 22·892 | Prob. = 0·300 | 49 42 11·638 | Prob. = 0·548 |

No. 53.—At the STATION of GODHNA.—December 1835 and April 1836.

| Zero. | Dhoiwala and Nojhili. | | Nojhili and Dahera. | | Kaliana and Dahera. | |
|---|---|---|---|---|---|---|
| | (104° 59′) − (55° 35′) = (49° 24′) | | (55° 35′) − (3° 20′) = (52° 15′) | | (24° 6′) + (3° 20′) = (27° 26′) | |
| 0 | 28″·773 (3) − 19″·973 (3) = 8″·800 | | 19″·973 (3) − 11″·300 (3) = 8″·673 | | 24″·527 (3) + 13″·073 (3) = 37″·600 | |
| 180 | 31″·047 (3) − 18″·410 (4) = 12″·637 | | 18″·410 (4) − 12″·873 (3) = 5″·537 | | 25″·830 (4) + 12″·320 (3) = 38″·150 | |
| 9 | 28″·613 (3) − 20″·920 (2) = 7″·693 | | 20″·920 (2) − 13″·867 (3) = 7″·053 | | 22″·673 (3) + 13″·307 (3) = 35″·980 | |
| 189 | 30″·107 (3) − 21″·300 (3) = 8″·807 | | 21″·300 (3) − 12″·560 (3) = 8″·740 | | 20″·470 (4) + 11″·960 (3) = 32″·430 | |
| 18 | 25″·105 (4) − 20″·787 (3) = 4″·318 | | 20″·787 (3) − 12″·647 (3) = 8″·140 | | 23″·767 (3) + 12″·740 (3) = 36″·507 | |
| 198 | 26″·847 (3) − 20″·293 (3) = 6″·554 | | 20″·293 (3) − 15″·180 (3) = 5″·113 | | 23″·495 (4) + 15″·473 (3) = 38″·968 | |
| 27 | 27″·580 (3) − 19″·900 (3) = 7″·680 | | 19″·900 (3) − 11″·653 (3) = 8″·247 | | 24″·795 (4) + 13″·605 (4) = 38″·400 | |
| 207 | 27″·507 (3) − 20″·453 (3) = 7″·054 | | 20″·453 (3) − 13″·733 (3) = 6″·720 | | 25″·220 (3) + 14″·360 (4) = 39″·580 | |
| Means | 49 24 7·943 | Prob. = 0·786 | 52 15 7·278 | Prob. = 0·465 | 27 26 37·202 | Prob. = 0·750 |
| Zero. | Begarazpur and Kaliana. | | Begarazpur and Dahera. | | Sheopuri and Begarazpur. | |
| | (52° 31′) − (24° 6′) = (28° 25′) | | (52° 32′) + (3° 20′) = (55° 52′) | | (102° 45′) − (52° 32′) = (50° 13′) | |
| 0 | 72″·680 (3) − 24″·527 (3) = 48″·153 | | 12″·680 (3) + 13″·073 (3) = 25″·753 | | 44″·560 (3) − 12″·680 (3) = 31″·880 | |
| 180 | 72″·740 (3) − 25″·830 (4) = 46″·910 | | 12″·740 (3) + 12″·320 (3) = 25″·060 | | 44″·920 (3) − 12″·740 (3) = 32″·180 | |
| 9 | 74″·587 (3) − 22″·673 (3) = 51″·913 | | 14″·587 (3) + 13″·307 (3) = 27″·893 | | 46″·000 (3) − 14″·587 (3) = 31″·413 | |
| 189 | 71″·740 (3) − 20″·470 (4) = 51″·270 | | 11″·740 (3) + 11″·960 (3) = 23″·700 | | 45″·980 (3) − 11″·740 (3) = 34″·240 | |
| 18 | 72″·060 (4) − 23″·767 (3) = 48″·293 | | 12″·060 (4) + 12″·740 (3) = 24″·800 | | 44″·813 (3) − 12″·060 (4) = 32″·753 | |
| 198 | 73″·887 (3) − 23″·495 (4) = 50″·392 | | 13″·887 (3) + 15″·473 (3) = 29″·360 | | 43″·827 (3) − 13″·887 (3) = 29″·940 | |
| 27 | 71″·720 (4) − 24″·795 (4) = 46″·925 | | 11″·720 (4) + 13″·605 (4) = 25″·325 | | 43″·907 (3) − 11″·720 (4) = 32″·187 | |
| 207 | 72″·773 (3) − 25″·220 (3) = 47″·553 | | 12″·773 (3) + 14″·360 (4) = 27″·133 | | 45″·067 (3) − 12″·773 (3) = 32″·293 | |
| Means | 28 25 48·926 | Prob. = 0·656 | 55 52 26·128 | Prob. = 0·614 | 50 13 32·111 | Prob. = 0·400 |

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No. 54.—At the STATION of KALIANA.—December 1835—April and October 1836.

| Zero. | Dahera and Begarazpur. | Dahera and the North Mark. | Dahera and Godhna. |
|---|---|---|---|
| | $\overline{178\ 33\ 38\cdot447}^{(3)}$ | $\overline{15\ 41\ 13\cdot343}^{(6)}$ | $(\overline{15\ 42}) + (\overline{63\ 50}) = (\overline{79\ 32})$ |
| 0 | $\overline{40\cdot193}^{(3)}$ | $\overline{14\cdot850}^{(6)}$ | $\overline{6\cdot313}^{(3)} + \overline{41\cdot893}^{(3)} = 48''\cdot207$ |
| 180 | $\overline{37\cdot520}^{(3)}$ | $\overline{10\cdot770}^{(6)}$ | $\overline{8\cdot547}^{(3)} + \overline{42\cdot407}^{(3)} = 50\cdot953$ |
| 9 | $\overline{38\cdot820}^{(3)}$ | $\overline{12\cdot723}^{(6)}$ | $\overline{5\cdot693}^{(3)} + \overline{40\cdot293}^{(3)} = 45\cdot987$ |
| 189 | $\overline{38\cdot907}^{(3)}$ | $\overline{13\cdot153}^{(6)}$ | $\overline{8\cdot840}^{(3)} + \overline{42\cdot080}^{(3)} = 50\cdot920$ |
| 18 | $\overline{38\cdot827}^{(3)}$ | $\overline{13\cdot000}^{(6)}$ | $\overline{7\cdot907}^{(3)} + \overline{40\cdot613}^{(3)} = 48\cdot520$ |
| 198 | $\overline{40\cdot187}^{(3)}$ | $\overline{13\cdot953}^{(6)}$ | $\overline{8\cdot473}^{(3)} + \overline{39\cdot393}^{(3)} = 47\cdot867$ |
| 27 | $\overline{36\cdot813}^{(3)}$ | $\overline{14\cdot209}^{(7)}$ | $\overline{8\cdot220}^{(3)} + \overline{42\cdot093}^{(3)} = 50\cdot313$ |
| 207 | Prob. = 0·386 | | $\overline{6\cdot920}^{(3)} + \overline{39\cdot260}^{(3)} = 46\cdot180$ |
| Means | 178 33 38·714 | 15 41 13·250 | Prob. = 0·652 |
| | | | 79 32 48·618 |

| Zero. | Begarazpur and Godhna. | |
|---|---|---|
| | $(\overline{178\ 32}) - (\overline{79\ 32}) = (\overline{99\ 0})$ | |
| 0 | $\overline{98\cdot447}'' - \overline{48\cdot207}'' = 50''\cdot240$ | |
| 180 | $\overline{100\cdot193} - \overline{50\cdot953} = 49\cdot240$ | Azimuth of Lamp .. = 179 59 59·302 |
| 9 | $\overline{97\cdot520} - \overline{45\cdot987} = 51\cdot533$ | Lamp and Dahera .. = — 15 41 13·250 |
| 189 | $\overline{98\cdot820} - \overline{50\cdot920} = 47\cdot900$ | |
| 18 | $\overline{98\cdot907} - \overline{48\cdot520} = 50\cdot387$ | Azimuth of Dahera = 164 18 46·052 |
| 198 | $\overline{98\cdot827} - \overline{47\cdot867} = 50\cdot960$ | |
| 27 | $\overline{100\cdot187} - \overline{50\cdot313} = 49\cdot873$ | |
| 207 | $\overline{96\cdot813} - \overline{46\cdot180} = 50\cdot633$ | |
| | Prob. = 0·371 | |
| Mean | 99 0 50·096 | |

No. 55.—At the STATION of DAHERA.—December 1835.

| Zero. | Nojhili and Godhna. | Godhna and Kaliana. | Godhna and Begarazpur. |
|---|---|---|---|
| | $\overline{80\ 25\ 29\cdot400}^{(3)}$ | $\overline{73\ 0\ 35\cdot240}^{(3)}$ | $\overline{72\ 12\ 41\cdot593}^{(3)}$ |
| 0 | $\overline{30\cdot447}^{(3)}$ | $\overline{34\cdot404}^{(4)}$ | $\overline{42\cdot813}^{(3)}$ |
| 180 | $\overline{31\cdot993}^{(3)}$ | $\overline{34\cdot360}^{(3)}$ | $\overline{42\cdot833}^{(3)}$ |
| 9 | $\overline{30\cdot313}^{(3)}$ | $\overline{34\cdot007}^{(3)}$ | $\overline{43\cdot107}^{(3)}$ |
| 189 | $\overline{30\cdot327}^{(3)}$ | $\overline{36\cdot373}^{(3)}$ | $\overline{41\cdot360}^{(3)}$ |
| 18 | $\overline{31\cdot380}^{(3)}$ | $\overline{40\cdot080}^{(3)}$ | $\overline{46\cdot793}^{(3)}$ |
| 198 | $\overline{29\cdot955}^{(3)}$ | $\overline{34\cdot360}^{(3)}$ | $\overline{41\cdot680}^{(3)}$ |
| 27 | $\overline{31\cdot613}^{(3)}$ | $\overline{34\cdot233}^{(3)}$ | $\overline{42\cdot160}^{(3)}$ |
| 207 | Prob. = 0·295 | Prob. = 0·677 | Prob. = 0·576 |
| Means | 80 25 30·679 | 73 0 35·382 | 72 12 42·792 |

| Zero. | Begarazpur and Kaliana. |
|---|---|
| | $(\overline{72\ 59}) - (\overline{72\ 12}) = (\overline{0\ 47})$ |
| 0 | $\overline{95\cdot240}'' - \overline{41\cdot593}'' = 53''\cdot647$ |
| 180 | $\overline{94\cdot404} - \overline{42\cdot813} = 51\cdot591$ |
| 9 | $\overline{94\cdot360} - \overline{42\cdot833} = 51\cdot527$ |
| 189 | $\overline{94\cdot007} - \overline{43\cdot107} = 50\cdot900$ |
| 18 | $\overline{96\cdot373} - \overline{41\cdot360} = 55\cdot013$ |
| 198 | $\overline{100\cdot080} - \overline{46\cdot793} = 53\cdot287$ |
| 27 | $\overline{94\cdot360} - \overline{41\cdot680} = 52\cdot680$ |
| 207 | $\overline{94\cdot233} - \overline{42\cdot160} = 52\cdot073$ |
| | Prob. = 0·446 |
| Mean | 0 47 52·590 |



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No. 56.—At the STATION of NOJHILI.—November 1835.

| Zero. | Amsot and Dhoiwala. | Dahera and Godhna. | Dhoiwala and Godhna. |
|---|---|---|---|
| | | | $(137\ 5) - (47\ 19) = (89\ 46)$ |
| 0 | $52\ 22\ 4{\cdot}393^{(2)}$ | $47\ 19\ 21{\cdot}000^{(4)}$ | $67{\cdot}120^{(3)} - 21{\cdot}000^{(4)} = 46{\cdot}120$ |
| 180 | $3{\cdot}827^{(3)}$ | $23{\cdot}195^{(4)}$ | $66{\cdot}187^{(3)} - 23{\cdot}195^{(4)} = 42{\cdot}992$ |
| 9 | $5{\cdot}967^{(3)}$ | $26{\cdot}025^{(4)}$ | $67{\cdot}773^{(3)} - 26{\cdot}025^{(4)} = 41{\cdot}748$ |
| 189 | $3{\cdot}360^{(3)}$ | $25{\cdot}187^{(3)}$ | $64{\cdot}920^{(3)} - 25{\cdot}187^{(3)} = 39{\cdot}733$ |
| 18 | $7{\cdot}920^{(3)}$ | $18{\cdot}753^{(3)} + 11{\cdot}700^{(3)} = 30{\cdot}453$ | $66{\cdot}533^{(3)} - 30{\cdot}453^{(3)} = 36{\cdot}080$ |
| 198 | $5{\cdot}380^{(3)}$ | $14{\cdot}880^{(4)} + 9{\cdot}300^{(4)} = 24{\cdot}180$ | $62{\cdot}667^{(3)} - 24{\cdot}180^{(4)} = 38{\cdot}487$ |
| 27 | $7{\cdot}047^{(3)}$ | $27{\cdot}933^{(3)}$ | $67{\cdot}500^{(3)} - 27{\cdot}933^{(3)} = 39{\cdot}567$ |
| 207 | $4{\cdot}280^{(3)}$ | $25{\cdot}827^{(3)}$ | $65{\cdot}020^{(3)} - 25{\cdot}827^{(3)} = 39{\cdot}193$ |
| Means | $52\ 22\ 5{\cdot}272$ | $47\ 19\ 25{\cdot}475$ | $89\ 46\ 40{\cdot}490$ |
| | Prob. = 0·533 | Prob. = 0·954 | Prob. = 1·016 |

No. 57.—At the STATION of DHOIWALA.—October and November 1835.

| Zero. | Banog and Amsot. | Amsot and Nojhili. | Nojhili and Godhna. |
|---|---|---|---|
| 0 | $46\ 36\ 50{\cdot}093^{(3)}$ | $76\ 51\ 7{\cdot}273^{(3)}$ | $40\ 49\ 13{\cdot}567^{(3)}$ |
| 180 | $52{\cdot}520^{(3)}$ | $8{\cdot}987^{(3)}$ | $11{\cdot}893^{(3)}$ |
| 9 | $49{\cdot}447^{(3)}$ | $7{\cdot}865^{(4)}$ | $14{\cdot}040^{(3)}$ |
| 189 | $49{\cdot}220^{(3)}$ | $8{\cdot}280^{(5)}$ | $14{\cdot}460^{(3)}$ |
| 18 | $48{\cdot}580^{(3)}$ | $9{\cdot}740^{(3)}$ | $13{\cdot}655^{(4)}$ |
| 198 | $48{\cdot}187^{(3)}$ | $9{\cdot}273^{(3)}$ | $12{\cdot}300^{(4)}$ |
| 27 | $48{\cdot}720^{(3)}$ | $7{\cdot}500^{(3)}$ | $14{\cdot}600^{(3)}$ |
| 207 | $49{\cdot}713^{(3)}$ | $9{\cdot}133^{(3)}$ | $15{\cdot}000^{(3)}$ |
| Mean | $46\ 36\ 49{\cdot}560$ | $76\ 51\ 8{\cdot}506$ | $40\ 49\ 13{\cdot}689$ |
| | Prob. = 0·446 | Prob. = 0·999 | Prob. = 0·363 |

No. 58.—At the STATION of AMSOT.—April and November 1835.

| Zero. | Banog and W. End Base. | Banog and E. End Base. | W. End and E. End Base. |
|---|---|---|---|
| 0 | $37\ 29\ 59{\cdot}933^{(3)}$ | $39\ 34\ 34{\cdot}807^{(3)}$ | $2\ 4\ 34{\cdot}874^{(3)}$ |
| 180 | $59{\cdot}767^{(3)}$ | $35{\cdot}193^{(3)}$ | $35{\cdot}426^{(3)}$ |
| 9 | $62{\cdot}600^{(4)}$ | $35{\cdot}720^{(4)}$ | $33{\cdot}120^{(3)}$ |
| 189 | $61{\cdot}180^{(3)}$ | $35{\cdot}227^{(3)}$ | $34{\cdot}047^{(3)}$ |
| 18 | $60{\cdot}440^{(3)}$ | $34{\cdot}800^{(3)}$ | $34{\cdot}360^{(3)}$ |
| 198 | $60{\cdot}333^{(3)}$ | $36{\cdot}347^{(3)}$ | $36{\cdot}014^{(3)}$ |
| 27 | $59{\cdot}373^{(3)}$ | $34{\cdot}147^{(3)}$ | $34{\cdot}774^{(3)}$ |
| 207 | $58{\cdot}987^{(3)}$ | $34{\cdot}073^{(3)}$ | $35{\cdot}086^{(3)}$ |
| Means | $37\ 30\ 0{\cdot}327$ | $39\ 34\ 35{\cdot}039$ | $2\ 4\ 34{\cdot}713$ |
| | Prob. = 0·377 | Prob. = 0·252 | Prob. = 0·292 |

| Zero. | Banog and Dhoiwala. | Dhoiwala and Nojhili. |
|---|---|---|
| 0 | $59\ 42\ 30{\cdot}895^{(4)}$ | $50\ 46\ 51{\cdot}313^{(3)}$ |
| 180 | $31{\cdot}055^{(4)}$ | $50{\cdot}327^{(3)}$ |
| 9 | $29{\cdot}880^{(3)}$ | $48{\cdot}795^{(4)}$ |
| 189 | $31{\cdot}587^{(3)}$ | $50{\cdot}727^{(3)}$ |
| 18 | $30{\cdot}267^{(3)}$ | $52{\cdot}640^{(3)}$ |
| 198 | $30{\cdot}147^{(3)}$ | $52{\cdot}807^{(3)}$ |
| 27 | $29{\cdot}980^{(3)}$ | $47{\cdot}080^{(3)}$ |
| 207 | $30{\cdot}147^{(3)}$ | $49{\cdot}107^{(3)}$ |
| Means | $59\ 42\ 30{\cdot}495$ | $50\ 46\ 50{\cdot}350$ |
| | Prob. = 0·202 | Prob. = 0·650 |

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No. 59.—At the STATION of BANOG.—May and June 1835.

| Zero. | W. End Base and Amsot. | E. End and W. End Base. | E. End Base and Amsot. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 29 3 9·527 (3) | 31 41 34·127 (3) | 60 44 43·653 (3) |
| 180 | 10·600 (3) | 34·753 (3) | 45·353 (3) |
| 9 | 8·867 (3) | 34·427 (3) | 43·293 (3) |
| 189 | 10·840 (3) | 33·180 (3) | 44·020 (3) |
| 18 | 9·833 (3) | 33·373 (3) | 43·207 (4) |
| 198 | 10·453 (3) | 33·053 (3) | 43·507 (3) |
| 27 | 10·747 (3) | 32·280 (3) | 43·027 (3) |
| 207 | 10·053 (3) | 34·953 (3) | 45·007 (3) |
| Means | 29 3 10·115 | 31 41 33·768 | 60 44 43·883 |
| Prob. = | 0·226 | 0·310 | 0·284 |

| Zero. | Amsot and Ref$^{e}$ Lamp.—Sept. 1837. | Dhoiwala and Amsot. |
|---|---|---|
| | ° ′ ″ | ° ′ ″ |
| 0 | 21 43 31·953 (3) | 73 40 41·200 (4) |
| 180 | 30·127 (3) | 42·373 (3) |
| 9 | 31·613 (3) | 41·433 (3) |
| 189 | 32·827 (3) | 41·040 (3) |
| 18 | 31·900 (3) | 40·633 (3) |
| 198 | 30·893 (3) | 41·507 (3) |
| 27 | 31·227 (3) | 43·160 (3) |
| 207 | 31·467 (3) | 42·060 (3) |
| Means | 21 43 31·501 | 73 40 41·676 |
| Prob. = | | 0·269 |

Azimuth of Lamp .. = 92° 49′ 26″·191
Lamp and Amsot .. = −21 43 31·501
Azimuth of Amsot .. = 71 5 54·690

No. 60.—At the EAST END of the DEHRA DUN BASE.—March 1835.

| Zero. | W. End Base and Banog. | Banog and Amsot. | W. End Base and Amsot. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 76 36 36·800 (3) | 79 40 43·080 (3) | 3 4 6·280 (3) |
| 180 | 37·780 (3) | 40·253 (3) | 2·473 (3) |
| 9 | 40·240 (3) | 42·767 (3) | 2·527 (3) |
| 189 | 36·940 (3) | 39·540 (3) | 2·600 (3) |
| 18 | 38·000 (3) | 41·373 (3) | 3·373 (3) |
| 198 | 38·073 (3) | 42·507 (3) | 4·434 (3) |
| 27 | 38·400 (3) | 41·567 (3) | 3·167 (3) |
| 207 | 38·515 (4) | 41·573 (3) | 3·058 (3) |
| Means | 76 36 38·094 | 79 40 41·583 | 3 4 3·489 |
| Prob. = | 0·353 | 0·405 | 0·428 |

No. 61.—At the WEST END of the DEHRA DUN BASE.—March and April 1835.

| Zero. | E. End Base and Banog. | Banog and Amsot. | E. End Base and Amsot. |
|---|---|---|---|
| | ° ′ ″ | ′ ″ | ° ′ ″ |
| 0 | 71 41 51·873 (3) | 113 26 48·540 (3) | 174 51 19·587 (3) |
| 180 | 49·647 (3) | 48·293 (3) | 22·060 (3) |
| 9 | 49·320 (3) | 47·067 (3) | 23·613 (3) |
| 189 | 48·833 (3) | 49·213 (3) | 21·954 (3) |
| 18 | 50·580 (3) | 49·307 (3) | 20·113 (3) |
| 198 | 50·487 (3) | 49·293 (3) | 20·220 (3) |
| 27 | 49·573 (3) | 48·407 (3) | 22·020 (3) |
| 207 | 49·233 (3) | 48·407 (3) | 22·360 (3) |
| Means | 71 41 49·943 | 113 26 48·566 | 174 51 21·491 |
| Prob. = | 0·325 | 0·246 | 0·454 |

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# PRINCIPAL TRIANGLES

OF THE

# SECTION KALIANPUR—KALIANA.

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## SERIES A.



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# RECAPITULATION

## OF CERTAIN PARTICULARS NECESSARY TO BE ATTENDED TO.

THE correction for reducing the base line at Seronj to the sea-level was originally made on the assumed height of 1644·5 feet of the south end, but subsequent observations shew that the real height of the south end is 1620·0 feet, which will diminish that correction by 0·0449557 parts of a foot, and consequently increase the length of the base by the same quantity.

This will induce a constant correction of +0·0000006 to the logarithm of each side derived from the Seronj base as an origin, and the numerical value of each side will need to be increased by a term of the form $a \times 0{\cdot}0000011703$, wherein $a$ is the value originally brought out in feet.

For the same cause the whole length of the arc between Kalianpur and Kaliana will, as previously explained in the Introduction, be increased by the quantity 2·29512 feet which is deduced in the same way; but the latitudes and longitudes previously deduced will not be affected.

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 1.—S. End to N. End Seronj Base = 38413·3225703 Feet...Log. 4·5844818; Miles 7·2753.

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·264 | S. End Seronj Base | 73° 39′ 15″·047 | — 0·184 | + 0·207 | + 0·023 | 73° 39′ 15″·070 | 9·9820814 | 63599·700 | 12·0454 | 0·074 |
| 0·249 | N. End Seronj Base | 71 25 13·832 | — 0·184 | + 0·296 | + 0·112 | 71 25 13·944 | 9·9767546 | 64384·574 | 12·1941 | 0·075 |
| 0·384 | Surantal ..... | 34 55 30·672 | — 0·184 | + 0·498 | + 0·314 | 34 55 30·986 | 9·7577813 | Logs. | | |
| | | 179 59 59·551 | — 0·552 | + 1·001 | + 0·449 | 180 0 0·000 | | 4·8034551 | | |
| | | | | | | | | 4·8087819 | | |

No. 2.—N. End Seronj Base to Surantal = 64384·574 Feet...Log. 4·8087819; Miles 12·1941. (Δ 1)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·410 | N. End Seronj Base | 83 35 16·126 | — 0·349 | + 0·484 | + 0·135 | 83 35 16·261 | 9·9972747 | 69559·363 | 13·1741 | 0·081 |
| 0·361 | Surantal ..... | 50 40 50·729 | — 0·349 | + 0·495 | + 0·146 | 50 40 50·875 | 9·8885321 | 89350·742 | 16·9225 | 0·105 |
| 0·421 | Kamkhera ..... | 45 43 52·806 | — 0·349 | + 0·407 | + 0·058 | 45 43 52·864 | 9·8549584 | Logs. | | |
| | | 179 59 59·661 | — 1·047 | + 1·386 | + 0·339 | 180 0 0·000 | | 4·8423556 | | |
| | | | | | | | | 4·9510982 | | |

No. 3.—S. End Seronj Base to Surantal = 63599·700 Feet...Log. 4·803455 Miles 12·0454. (Δ 1)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·465 | S. End Seronj Base | 132 42 28·030 | — 0·121 | — 0·466 | — 0·587 | 132 42 27·443 | 9·8661836 | 33017·038 | 6·2532 | 0·039 |
| 0·326 | Surantal ..... | 15 45 20·057 | — 0·121 | — 0·003 | — 0·124 | 15 45 19·933 | 9·4338234 | 89350·762 | 16·9225 | 0·105 |
| 0·337 | Kamkhera ..... | 31 32 12·855 | — 0·121 | — 0·110 | — 0·231 | 31 32 12·624 | 9·7185404 | Logs. | | |
| | | 180 0 0·942 | — 0·363 | — 0·579 | — 0·942 | 180 0 0·000 | | 4·5187381 | | |
| | | | | | | | | 4·9510983 | | |

No. 4.—S. End to N. End Seronj Base = 38413·3225703 Feet...Log. 4·5844818; Miles 7·2753.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·595 | S. End Seronj Base | 153 38 16·923 | — 0·045 | + 0·259 | + 0·214 | 153 38 17·137 | 9·6474216 | 33017·038 | 6·2532 | 0·039 |
| 0·535 | N. End Seronj Base | 12 10 2·294 | — 0·044 | + 0·189 | + 0·145 | 12 10 2·439 | 9·3238040 | 69599·380 | 13·1741 | 0·081 |
| 0·322 | Kamkhera ..... | 14 11 39·951 | — 0·044 | + 0·517 | + 0·473 | 14 11 40·424 | 9·3895477 | Logs. | | |
| | | 179 59 59·168 | — 0·133 | + 0·965 | + 0·832 | 180 0 0·000 | | 4·5187381 | | |
| | | | | | | | | 4·8423557 | | |

No. 5.—Surantal to Kamkhera = 89350·752 Feet...Log. 4·9510982; Miles 16·9225. (Δs 2 & 3)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·461 | Surantal ..... | 62 35 57·125 | — 0·729 | + 0·312 | — 0·417 | 62 35 56·708 | 9·9483191 | 117147·646 | 22·1871 | 0·137 |
| 0·317 | Kamkhera ..... | 71 11 4·005 | — 0·729 | + 0·403 | — 0·326 | 71 11 3·679 | 9·9761487 | 109876·278 | 20·8099 | 0·129 |
| 0·281 | Bhaorasa..... | 46 13 0·407 | — 0·729 | — 0·065 | — 0·794 | 46 12 59·613 | 9·8585133 | Logs. | | |
| | | 180 0 1·537 | — 2·187 | + 0·650 | — 1·537 | 180 0 0·000 | | 5·0687336 | | |
| | | | | | | | | 5·0409040 | | |

No. 6.—N. End Seronj Base to Surantal = 64384·574 Feet...Log. 48087819; Miles 12·1941. (Δ 1)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·337 | N. End Seronj Base | 40 4 52·781 | — 0·208 | — 0·247 | — 0·455 | 40 4 52·326 | 9·8087999 | 64149·773 | 12·1496 | 0·075 |
| 0·241 | Surantal ..... | 69 40 21·438 | — 0·209 | — 0·334 | — 0·543 | 69 40 20·895 | 9·9720741 | 44047·471 | 8·3423 | 0·052 |
| 0·320 | Kalianpur ..... | 70 14 47·336 | — 0·209 | — 0·348 | — 0·557 | 70 14 46·779 | 9·9736608 | Logs. | | |
| | | 180 0 1·555 | — 0·626 | — 0·929 | — 1·555 | 180 0 0·000 | | 4·8071952 | | |
| | | | | | | | | 4·6439210 | | |

*Note.*—Correction ·0000006 to be added to all the logarithms throughout the Series.

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 7.—N. End Seronj Base to Kalianpur = 64149·773 Feet...Log. 4·8071952; Miles 12·1496. (Δ 6)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·355 | N. End Seronj Base | 43° 30′ 23″·345 | — 0·241 | + 0·731 | + 0·490 | 43° 30′ 23″·835 | 9·8378650 | 69559·363 | 13·1741 | + 0·081 |
| 0·318 | Kalianpur ..... | 74 2 10·303 | — 0·241 | + 0·256 | + 0·015 | 74 2 10·318 | 9·9829202 | 49808·146 | 9·4334 | 0·058 |
| 0·500 | Kamkhera ..... | 62 27 25·599 | — 0·241 | + 0·489 | + 0·248 | 62 27 25·847 | 9·9477598 | Logs. 4·8423556 | | |
| | | 179 59 59·247 | — 0·723 | + 1·476 | + 0·753 | 180 0 0·000 | | 4·6973004 | | |

No. 8.—N. End Seronj Base to Kamkhera = 69559·369 Feet...Log. 4·8423556; Miles 13·1741. (Δs 2, 4, & 7)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·435 | N. End Seronj Base | 122 7 33·820 | — 0·258 | + 0·438 | + 0·180 | 122 7 34·000 | 9·9278217 | 55759·564 | 10·5605 | 0·065 |
| 0·338 | Kamkhera ..... | 25 27 11·199 | — 0·257 | — 0·005 | — 0·262 | 25 27 10·937 | 9·6332372 | 109876·253 | 20·8099 | 0·129 |
| 0·231 | Bhaorasa..... | 32 25 14·423 | — 0·258 | + 0·898 | + 0·640 | 32 25 15·063 | 9·7292734 | Logs. 4·7463194 | | |
| | | 179 59 59·442 | — 0·773 | + 1·331 | + 0·558 | 180 0 0·000 | | 5·0409039 | | |

No. 9.—Surantal to Kamkhera = 89350·752 Feet...Log. 4·9510982; Miles 16·9225. (Δs 2 & 3)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·424 | Surantal ..... | 18 59 30·709 | — 0·101 | — 0·828 | — 0·929 | 18 59 29·780 | 9·5124571 | 44047·471 | 8·3423 | 0·052 |
| 0·433 | Kamkhera ..... | 16 43 32·793 | — 0·100 | + 0·080 | — 0·020 | 16 43 32·773 | 9·4590776 | 49808·157 | 9·4334 | 0·058 |
| 0·293 | Kalianpur ..... | 144 16 57·639 | — 0·100 | — 0·092 | — 0·192 | 144 16 57·447 | 9·7662548 | Logs. 4·6439210 | | |
| | | 180 0 1·141 | — 0·301 | — 0·840 | — 1·141 | 180 0 0·000 | | 4·6973005 | | |

No. 10.—N. End Seronj Base to Surantal = 64384·574 Feet...Log. 4·8087819; Miles 12·1941. (Δ 1)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·254 | N. End Seronj Base | 154 17 10·054 | — 0·123 | — 0·922 | — 1·045 | 154 17 9·009 | 9·6373715 | 55759·564 | 10·5605 | 0·065 |
| 0·258 | Surantal ..... | 11 55 6·396 | — 0·122 | — 0·182 | — 0·304 | 11 55 6·092 | 9·3149573 | 117147·646 | 22·1871 | 0·137 |
| 0·263 | Bhaorasa..... | 13 47 45·984 | — 0·122 | — 0·963 | — 1·085 | 13 47 44·899 | 9·3774198 | Logs. 4·7463194 | | |
| | | 180 0 2·434 | — 0·367 | — 2·067 | — 2·434 | 180 0 0·000 | | 5·0687336 | | |

No. 11.—N. End Seronj Base to Bhaorasa = 55759·564 Feet...Log. 4·7463194; Miles 10·5605. (Δs 8 & 10)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·469 | N. End Seronj Base | 165 37 57·165 | — 0·069 | + 1·170 | + 1·101 | 165 37 58·266 | 9·3946871 | 64149·773 | 12·1496 | 0·075 |
| 0·166 | Bhaorasa..... | 7 41 19·486 | — 0·070 | + 0·464 | + 0·394 | 7 41 19·880 | 9·1264348 | 118972·738 | 22·5327 | 0·139 |
| 0·457 | Kalianpur ..... | 6 40 41·792 | — 0·070 | + 0·132 | + 0·062 | 6 40 41·854 | 9·0655590 | Logs. 4·8071952 | | |
| | | 179 59 58·443 | — 0·209 | + 1·766 | + 1·557 | 180 0 0·000 | | 5·0754475 | | |

No. 12.—Surantal to Bhaorasa = 117147·646 Feet...Log. 5·0687336; Miles 22·1871. (Δ 5 & 10)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·360 | Surantal ..... | 81 35 27·834 | — 0·401 | — 0·516 | — 0·917 | 81 35 26·917 | 9·9953056 | 44047·471 | 8·3423 | 0·052 |
| 0·203 | Bhaorasa..... | 21 29 5·470 | — 0·400 | — 0·498 | — 0·898 | 21 29 4·572 | 9·5637790 | 118972·766 | 22·5327 | 0·139 |
| 0·440 | Kalianpur ..... | 76 55 29·128 | — 0·400 | — 0·217 | — 0·617 | 76 55 28·511 | 6·9885916 | Logs. 4·6439210 | | |
| | | 180 0 2·432 | — 1·201 | — 1·231 | — 2·432 | 180 0 0·000 | | 5·0754476 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 13.—Bhaorasa to Kalianpur=118972·752 Feet...Log. 5·0754476; Miles 22·5327. (Δs 11 & 12)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·231 | Bhaorasa..... | 24° 43′ 54″·936 | — 0·429 | + 0·434 | + 0·005 | 24° 43′ 54″·941 | 9·6215639 | 109876·253 | 20·8099 | 0·129 |
| 0·498 | Kalianpur ..... | 67 21 28·511 | — 0·429 | + 0·125 | — 0·304 | 67 21 28·207 | 9·9651674 | 49808·146 | 9·4334 | 0·058 |
| 0·586 | Kamkhera ..... | 87 54 36·798 | — 0·429 | + 0·483 | + 0·054 | 87 54 36·852 | 9·9997111 | Logs. 5·0409039 | | |
| | | 180 0 0·245 | — 1·287 | + 1·042 | — 0·245 | 180 0 0·000 | | 4·6973004 | | |

No. 14.—Kamkhera to Bhaorasa=109876·261 Feet...Log. 5·0409039; Miles 20·8099. (Δs 5, 8 & 13)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·418 | Kamkhera ..... | 52 53 59·358 | — 0·699 | + 0·360 | — 0·339 | 52 53 59·019 | 9·9017748 | 101696·351 | 19·2607 | 0·119 |
| 0·362 | Bhaorasa..... | 59 6 23·163 | — 0·699 | + 0·324 | — 0·375 | 59 6 22·788 | 9·9335488 | 94521·664 | 17·9018 | 0·111 |
| 0·314 | Pardho ..... | 67 59 38·511 | — 0·699 | + 0·381 | — 0·318 | 67 59 38·193 | 9·9671473 | Logs. 5·0073054 | | |
| | | 180 0 1·032 | — 2·097 | + 1·065 | — 1·032 | 180 0 0·000 | | 4·9755314 | | |

No. 15.—Bhaorasa to Kalianpur=118972·752 Feet...Log. 5·0754476; Miles 22·5327. (Δs 11 & 12)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·255 | Bhaorasa..... | 34 22 28·226 | — 0·498 | — 0·109 | — 0·607 | 34 22 27·619 | 9·7517389 | 94521·700 | 17·9018 | 0·111 |
| 0·467 | Kalianpur ..... | 52 29 41·031 | — 0·498 | — 0·082 | — 0·580 | 52 29 40·451 | 9·8994351 | 67272·146 | 12·7409 | 0·079 |
| 0·432 | Pardho ..... | 93 7 52·391 | — 0·498 | + 0·037 | — 0·461 | 93 7 51·930 | 9·9993512 | Logs. 4·9755315 | | |
| | | 180 0 1·648 | — 1·494 | — 0·154 | — 1·648 | 180 0 0·000 | | 4·8278353 | | |

No. 16.—Kamkhera to Kalianpur=49808·150 Feet...Log. 4·6973004; Miles 9·4334. (Δs 7, 9 & 13)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·334 | Kamkhera ..... | 35 0 37·441 | — 0·228 | + 0·122 | — 0·106 | 35 0 37·335 | 9·7587035 | 101696·351 | 19·2607 | 0·119 |
| 0·325 | Kalianpur ..... | 119 51 9·542 | — 0·228 | + 0·042 | — 0·186 | 119 51 9·356 | 9·9381738 | 67272·115 | 12·7409 | 0·079 |
| 0·364 | Pardho ..... | 25 8 13·880 | — 0·228 | — 0·343 | — 0·571 | 25 8 13·309 | 9·6281688 | Logs. 5·0073054 | | |
| | | 180 0 0·863 | — 0·684 | — 0·179 | — 0·863 | 180 0 0·000 | | 4·8278351 | | |

No. 17.—Bhaorasa to Pardho=94521·682 Feet...Log. 4·9755315; Miles 17·9018. (Δs 14 & 15)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·536 | Bhaorasa..... | 56 22 8·206 | — 0·670 | — 0·480 | — 1·150 | 56 22 7·056 | 9·9204459 | 108492·700 | 20·5479 | 0·127 |
| 0·303 | Pardho ..... | 69 8 3·613 | — 0·670 | — 0·271 | — 0·941 | 69 8 2·672 | 9·9705404 | 96673·167 | 18·3093 | 0·113 |
| 0·367 | Handiaparo..... | 54 29 51·270 | — 0·669 | — 0·329 | — 0·998 | 54 29 50·272 | 9·9106714 | Logs. 5·0354005 | | |
| | | 180 0 3·089 | — 2·009 | — 1·080 | — 3·089 | 180 0 0·000 | | 4·9853060 | | |

No. 18.—Pardho to Handiaparo=96673·167 Feet...Log. 4·9853060; Miles 18·3093. (Δ 17)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·319 | Pardho ..... | 67 33 27·250 | — 0·966 | — 0·206 | — 1·172 | 67 33 26·078 | 9·9657949 | 137849·951 | 26·1080 | 0·161 |
| 0·230 | Handiaparo..... | 70 55 45·079 | — 0·966 | — 0·149 | — 1·115 | 70 55 43·964 | 9·9754841 | 134808·559 | 25·5319 | 0·158 |
| 0·441 | Deadheri..... | 41 30 51·209 | — 0·966 | — 0·285 | — 1·251 | 41 30 49·958 | 9·8213834 | Logs. 5·1394067 | | |
| | | 180 0 3·538 | — 2·898 | — 0·640 | — 3·538 | 180 0 0·000 | | 5·1297175 | | |



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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 19.—Handiaparo to Deadheri = 134808·559 Feet...Log. 5·1297175; Miles 25·5319. (Δ 18)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·312 | Handiaparo..... | 43° 40′ 17″·825 | — 1·033 | — 0·489 | — 1·522 | 43° 40′ 16″·303 | 9·8391756 | 141531·878 | 26·8053 | 0·166 |
| 0·207 | Deadheri..... | 71 38 22·161 | — 1·033 | — 0·324 | — 1·357 | 71 38 20·804 | 9·9773080 | 102972·664 | 19·5024 | 0·121 |
| 0·267 | Hatiapahar..... | 64 41 24·346 | — 1·034 | — 0·419 | — 1·453 | 64 41 22·893 | 9·9561712 | Logs. | | |
| | | 180 0 4·332 | — 3·100 | — 1·232 | — 4·332 | 180 0 0·000 | | 5·1508543 | | |
| | | | | | | | | 5·0127219 | | |

No. 20.—Deadheri to Hatiapahar = 102972·664 Feet...Log. 5·0127219; Miles 19·5024. (Δ 19)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·348 | Deadheri..... | 46 12 38·218 | — 0·633 | — 0·386 | — 1·019 | 46 12 37·199 | 9·8584680 | 108476·922 | 20·5449 | 0·127 |
| 0·193 | Hatiapahar..... | 70 23 12·067 | — 0·632 | — 0·507 | — 1·139 | 70 23 10·928 | 9·9740405 | 83131·358 | 15·7446 | 0·097 |
| 0·478 | Pahargarh ..... | 63 24 13·307 | — 0·632 | — 0·802 | — 1·434 | 63 24 11·873 | 9·9514250 | Logs. | | |
| | | 180 0 3·592 | — 1·897 | — 1·695 | — 3·592 | 180 0 0·000 | | 5·0353374 | | |
| | | | | | | | | 4·9197649 | | |

No. 21.—Hatiapahar to Pahargarh = 83131·358 Feet...Log. 4·9197649; Miles 15·7446. (Δ 20)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·399 | Hatiapahar..... | 49 45 16·649 | — 0·420 | + 0·025 | — 0·395 | 49 45 16·254 | 9·8826858 | 84301·058 | 15·9661 | 0·099 |
| 0·311 | Pahargarh ..... | 65 59 9·785 | — 0·419 | — 0·158 | — 0·577 | 65 59 9·208 | 9·9606825 | 70442·750 | 13·3414 | 0·082 |
| 0·330 | Nimdant..... | 64 15 35·437 | — 0·420 | — 0·479 | — 0·899 | 64 15 34·538 | 9·9546144 | Logs. | | |
| | | 180 0 1·871 | — 1·259 | — 0·612 | — 1·871 | 180 0 0·000 | | 4·9258330 | | |
| | | | | | | | | 4·8478363 | | |

No. 22.—Pahargarh to Nimdant = 70442·750 Feet...Log. 4·8478363; Miles 13·3414. (Δ 21)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·240 | Pahargarh ..... | 78 37 39·387 | — 0.564 | + 0·387 | — 0·177 | 78 37 39·210 | 9·9913883 | 104021·886 | 19·7011 | 0·122 |
| 0·492 | Nimdant..... | 63 54 45·423 | — 0·563 | + 1·071 | + 0·508 | 63 54 45·931 | 9·9533370 | 113547·105 | 21·5051 | 0·133 |
| 0·297 | Gugubara ..... | 37 27 35·228 | — 0·563 | + 0·194 | — 0·369 | 37 27 34·859 | 9·7840486 | Logs. | | |
| | | 180 0 0·038 | — 1·690 | + 1·652 | — 0·038 | 180 0 0·000 | | 5·0171247 | | |
| | | | | | | | | 5·0551760 | | |

No. 23.—Deadheri to Pahargarh = 108476·922 Feet...Log. 5·0353374; Miles 20·5449. (Δ 20)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·219 | Deadheri..... | 37 52 3·333 | — 0·722 | + 0·290 | — 0·432 | 37 52 2·901 | 9·7880531 | 138245·254 | 26·1828 | 0·162 |
| 0·434 | Pahargarh ..... | 90 26 40·017 | — 0·722 | + 0·992 | + 0·270 | 90 26 40·287 | 9·9999869 | 84862·600 | 16·0725 | 0·099 |
| 0·383 | Bherkheri ..... | 51 41 16·441 | — 0·722 | + 1·093 | + 0·371 | 51 41 16·812 | 9·8946741 | Logs. | | |
| | | 179 59 59·791 | — 2·166 | + 2·375 | + 0·209 | 180 0 0·000 | | 5·1406502 | | |
| | | | | | | | | 4·9287164 | | |

No. 24.—Pahargarh to Bherkheri = 84862·600 Feet...Log. 4·9287164; Miles 16·0725. (Δ 23)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·408 | Pahargarh ..... | 61 32 17·504 | — 0·609 | — 0·419 | — 1·028 | 61 32 16·476 | 9·9440544 | 104021·886 | 19·7011 | 0·122 |
| 0·150 | Bherkheri ..... | 68 53 59·099 | — 0·609 | — 0·298 | — 0·907 | 68 53 58·192 | 9·9698586 | 98021·300 | 18·5646 | 0·115 |
| 0·534 | Gugubara ..... | 49 33 46·188 | — 0·608 | — 0·248 | — 0·856 | 49 33 45·332 | 9·8814503 | Logs. | | |
| | | 180 0 2·791 | — 1·826 | — 0·965 | — 2·791 | 180 0 0·000 | | 5·0171247 | | |
| | | | | | | | | 4·9913205 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 25.—Pahargarh to Gugubara = 104021·886 Feet...Log. 5·0171247; Miles 19·7011. (Δ 24)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·240 | Pahargarh ..... | 78° 37′ 39″·387 | — 0·564 | + 0·387 | — 0·177 | 78° 37′ 39″·210 | 9·9913883 | 70442·750 | 13·3414 | + 0·082 |
| 0·297 | Gugubara ..... | 37 27 35·228 | — 0·563 | + 0·194 | — 0·369 | 37 27 34·859 | 9·7840486 | 113547·105 | 21·5051 | 0·133 |
| 0·492 | Nimdant..... | 63 54 45·423 | — 0·563 | + 1·071 | + 0·508 | 63 54 45·931 | 9·9533370 | Logs. 4·8478363 | | |
| | | 180 0 0·038 | — 1·690 | + 1·652 | — 0·038 | 180 0 0·000 | | 5·0551760 | | |

No. 26.—Gugubara to Nimdant = 113547·105 Feet...Log. 5·0551760; Miles 21·5051. (Δs 22 & 25)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·314 | Gugubara ..... | 46 19 49·063 | — 0·688 | — 0·081 | — 0·769 | 46 19 48·294 | 9·8593364 | 106839·271 | 20·2347 | 0·125 |
| 0·316 | Nimdant..... | 62 45 58·897 | — 0·688 | — 0·081 | — 0·769 | 62 45 58·128 | 9·9489731 | 86914·900 | 16·4612 | 0·102 |
| 0·187 | Mao..... | 70 54 14·315 | — 0·689 | — 0·048 | — 0·737 | 70 54 13·578 | 9·9754182 | Logs. 5·0287309 | | |
| | | 180 0 2·275 | — 2·065 | — 0·210 | — 2·275 | 180 0 0·000 | | 4·9390942 | | |

No. 27.—Gugubara to Mao = 106839·271 Feet...Log. 5·0287309; Miles 20·2347. (Δ 26)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·496 | Gugubara ..... | 55 42 52·700 | — 0·859 | + 0·538 | — 0·321 | 55 42 52·379 | 9·9171069 | 124111·943 | 23·5061 | 0·145 |
| 0·365 | Mao..... | 70 11 49·735 | — 0·860 | + 0·396 | — 0·464 | 70 11 49·271 | 9·9735265 | 108991·830 | 20·6424 | 0·128 |
| 0·439 | Memoni ..... | 54 5 18·732 | — 0·859 | + 0·477 | — 0·382 | 54 5 18·350 | 9·9084438 | Logs. 5·0938136 | | |
| | | 180 0 1·167 | — 2·578 | + 1·411 | — 1·167 | 180 0 0·000 | | 5·0373940 | | |

No. 28.—Mao to Memoni = 108991·830 Feet...Log. 5·0373940; Miles 20·6424. (Δ 27)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·218 | Mao..... | 41 28 35·870 | — 0·638 | — 0·046 | — 0·684 | 41 28 35·186 | 9·8210626 | 112688·673 | 21·3426 | 0·132 |
| 0·209 | Memoni ..... | 71 47 1·967 | — 0·638 | — 0·044 | — 0·682 | 71 47 1·285 | 9·9776702 | 78572·890 | 14·8812 | 0·092 |
| 0·346 | Shergarh..... | 66 44 24·240 | — 0·638 | — 0·073 | — 0·711 | 66 44 23·529 | 9·9631839 | Logs. 5·0518803 | | |
| | | 180 0 2·077 | — 1·914 | — 0·163 | — 2·077 | 180 0 0·000 | | 4·8952727 | | |

No. 29.—Memoni to Shergarh = 78572·890 Feet...Log. 4·8952727; Miles 14·8812. (Δ 28)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·188 | Memoni ..... | 75 7 39·522 | — 0·547 | — 0·496 | — 1·043 | 75 7 38·479 | 9·9852013 | 91721·122 | 17·3714 | 0·107 |
| 0·352 | Shergarh..... | 58 10 9·943 | — 0·546 | — 0·930 | — 1·476 | 58 10 8·467 | 9·9292184 | 104340·360 | 19·7614 | 0·122 |
| 0·159 | Kasri ..... | 46 42 14·020 | — 0·546 | — 0·420 | — 0·966 | 46 42 13·054 | 9·8620217 | Logs. 4·9624694 | | |
| | | 180 0 3·485 | — 1·639 | — 1·846 | — 3·485 | 180 0 0·000 | | 5·0184523 | | |

No. 30.—Shergarh to Kasri = 104340·360 Feet...Log. 5·0184523; Miles 19·7614. (Δ 29)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·375 | Shergarh..... | 60 52 59·351 | — 0·901 | + 0·100 | — 0·801 | 60 52 58·550 | 9·9413262 | 126023·726 | 23·8681 | 0·147 |
| 0·255 | Kasri ..... | 68 39 30·601 | — 0·901 | + 0·068 | — 0·833 | 68 39 29·768 | 9·9691485 | 118203·408 | 22·3870 | 0·138 |
| 0·322 | Dhobai ..... | 50 27 32·498 | — 0·901 | + 0·085 | — 0·816 | 50 27 31·682 | 9·8871485 | Logs. 5·1004523 | | |
| | | 180 0 2·450 | — 2·703 | + 0·253 | — 2·450 | 180 0 0·000 | | 5·0726300 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 31.—Kasri to Dhobai = 118203·408 Feet...Log. 5·0726300; Miles 22·3870. (Δ 30)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·238 | Kasri ..... | 35° 7′ 33″·095 | — 0·526 | — 0·384 | — 0·910 | 35° 7′ 32″·185 | 9·7599479 | 98666·544 | 18·6868 | + 0·115 |
| 0·277 | Dhobai ..... | 56 32 57·475 | — 0·526 | + 0·986 | + 0·460 | 56 32 57·935 | 9·9213543 | 68039·878 | 12·8863 | 0·080 |
| 0·280 | Den..... | 88 19 30·293 | — 0·527 | + 0·114 | — 0·413 | 88 19 29·880 | 9·9998144 | Logs. 4·9941699 | | |
| | | 180 0 0·863 | — 1·579 | + 0·716 | — 0·863 | 180 0 0·000 | | 4·8327635 | | |

No. 32.—Dhobai to Den = 68039·878 Feet...Log. 4·8327635; Miles 12·8863. (Δ 31)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·151 | Dhobai ..... | 81 18 1·877 | — 0·423 | — 0·366 | — 0·789 | 81 18 1·088 | 9·9949743 | 80155·937 | 15·1810 | 0·094 |
| 0·331 | Den..... | 54 47 21·296 | — 0·423 | — 0·135 | — 0·558 | 54 47 20·738 | 9·9122407 | 96977·122 | 18·3669 | 0·113 |
| 0·446 | Raipur..... | 43 54 37·371 | — 0·422 | + 1·225 | + 0·803 | 43 54 38·174 | 9·8410685 | Logs. 4·9039357 | | |
| | | 180 0 0·544 | — 1·268 | + 0·724 | — 0·544 | 180 0 0·000 | | 4·9866693 | | |

No. 33.—Den to Raipur = 96977·122 Feet...Log. 4·9866693; Miles 18·3669. (Δ 32)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·234 | Den..... | 55 52 7·775 | — 0·580 | + 0·303 | — 0·277 | 55 52 7·498 | 9·9179015 | 92187·084 | 17·4597 | 0·108 |
| 0·363 | Raipur..... | 59 19 54·200 | — 0·580 | — 0·257 | — 0·837 | 59 19 53·363 | 9·9345655 | 88716·862 | 16·8024 | 0·104 |
| 0·148 | Pagaro..... | 64 47 59·058 | — 0·581 | + 0·662 | + 0·081 | 64 47 59·139 | 9·9565647 | Logs. 4·9646701 | | |
| | | 180 0 1·033 | — 1·741 | + 0·708 | — 1·033 | 180 0 0·000 | | 4·9480061 | | |

No. 34.—Den to Pagaro = 92187·084 Feet...Log. 4·9646701; Miles 17·4597. (Δ 33)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·182 | Den..... | 67 20 12·755 | — 0·872 | + 0·120 | — 0·752 | 67 20 12·003 | 9·9651005 | 130626·633 | 24·7399 | 0·153 |
| 0·271 | Pagaro..... | 70 51 7·398 | — 0·872 | — 0·367 | — 1·239 | 70 51 6·159 | 9·9752814 | 127600·029 | 24·1667 | 0·149 |
| 0·209 | Juktipura ..... | 41 48 41·912 | — 0·871 | + 0·797 | — 0·074 | 41 48 41·838 | 9·8239198 | Logs. 5·1160317 | | |
| | | 180 0 2·065 | — 2·615 | + 0·550 | — 2·065 | 180 0 0·000 | | 5·1058508 | | |

No. 35.—Kasri to Den = 98666·544 Feet...Log. 4·9941699; Miles 18·6868. (Δ 31)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·220 | Kasri ..... | 63 2 40·923 | — 0·589 | + 0·794 | + 0·205 | 63 2 41·128 | 9·9500535 | 85396·200 | 16·1735 | 0·100 |
| 0·224 | Den..... | 51 46 24·585 | — 0·589 | + 0·104 | — 0·485 | 51 46 24·100 | 9·8951845 | 96896·367 | 18·3516 | 0·113 |
| 0·584 | Chilwani..... | 65 10 56·267 | — 0·589 | — 0·906 | — 1·495 | 65 10 54·772 | 9·9579159 | Logs. 4·9314385 | | |
| | | 180 0 1·775 | — 1·767 | — 0·008 | — 1·775 | 180 0 0·000 | | 4·9863075 | | |

No. 36.—Den to Chilwani = 96896·367 Feet...Log. 4·9863075; Miles 18·3516. (Δ 35)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·336 | Den..... | 41 54 23·296 | — 0·663 | — 0·506 | — 1·169 | 41 54 22·127 | 9·8247195 | 130626·572 | 24·7399 | 0·153 |
| 0·284 | Chilwani..... | 90 12 40·847 | — 0·663 | — 1·001 | — 1·664 | 90 12 39·183 | 9·9999971 | 87247·680 | 16·5242 | 0·102 |
| 0·186 | Juktipura ..... | 47 53 0·011 | — 0·663 | — 0·658 | — 1·321 | 47 52 58·690 | 9·8702731 | Logs. 5·1160315 | | |
| | | 180 0 4·154 | — 1·989 | — 2·165 | — 4·154 | 180 0 0·000 | | 4·9407539 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 37.—Den to Juktipura = 130626·572 Feet...Log. 5·1160315; Miles 24·7399. (Δ 36)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·182 | Den..... | 67° 20′ 12″755 | — 0·872 | + 0·120 | — 0·752 | 67° 20′ 12″003 | 9·9651005 | 92187·042 | 17·4597 | 0·108 |
| 0·209 | Juktipura ..... | 41 48 41·912 | — 0·871 | + 0·797 | — 0·074 | 41 48 41·838 | 9·8239198 | 127599·967 | 24·1667 | 0·149 |
| 0·271 | Pagaro..... | 70 51 7·398 | — 0·872 | — 0·367 | — 1·239 | 70 51 6·159 | 9·9752814 | Logs. 4·9646699 | | |
| | | 180 0 2·065 | — 2·615 | + 0·550 | — 2·065 | 180 0 0·000 | | 5·1058506 | | |

No. 38.—Pagaro to Juktipura = 127599·998 Feet...Log. 5·1058507; Miles 24·1667. (Δs 34 & 37)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·283 | Pagaro..... | 48 38 4·382 | — 0·927 | — 0·551 | — 1·478 | 48 38 2·904 | 9·8753536 | 123519·540 | 23·3939 | 0·145 |
| 0·162 | Juktipura ..... | 63 37 26·339 | — 0·928 | — 0·787 | — 1·715 | 63 37 24·624 | 9·9522567 | 103474·333 | 19·5974 | 0·121 |
| 0·244 | Gurjapahar..... | 67 44 34·123 | — 0·928 | — 0·723 | — 1·651 | 67 44 32·472 | 9·9663717 | Logs. 5·0917357 | | |
| | | 180 0 4·844 | — 2·783 | — 2·061 | — 4·844 | 180 0 0·000 | | 5·0148326 | | |

No. 39.—Pagaro to Gurjapahar = 123519·540 Feet...Log. 5·0917357; Miles 23·3939. (Δ 38)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·263 | Pagaro..... | 49 1 11·685 | — 1·019 | — 0·265 | — 1·284 | 49 1 10·401 | 9·8779087 | 139449·484 | 26·4109 | 0·163 |
| 0·345 | Gurjapahar..... | 73 3 31·134 | — 1·020 | + 0·312 | — 0·708 | 73 3 30·426 | 9·9807316 | 110051·000 | 20·8430 | 0·129 |
| 0·256 | Dholpur ..... | 57 55 19·702 | — 1·020 | + 0·491 | — 0·529 | 57 55 19·173 | 9·9280504 | Logs. 5·1444169 | | |
| | | 180 0 2·521 | — 3·059 | + 0·538 | — 2·521 | 180 0 0·000 | | 5·0415940 | | |

No. 40.—Dholpur to Gurjapahar = 110051·000 Feet...Log. 5·0415940; Miles 20·8430. (Δ 39)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·142 | Dholpur ..... | 95 31 59·662 | — 1·080 | + 0·304 | — 0·776 | 95 31 58·886 | 9·9979718 | 125660·493 | 23·7993 | 0·147 |
| 0·343 | Gurjapahar..... | 45 40 26·532 | — 1·079 | + 0·387 | — 0·692 | 45 40 25·840 | 9·8545331 | 174838·685 | 33·1134 | 0·205 |
| 0·337 | Usira ..... | 38 47 35·630 | — 1·079 | + 0·723 | — 0·356 | 38 47 35·274 | 9·7969283 | Logs. 5·0991988 | | |
| | | 180 0 1·824 | — 3·238 | + 1·414 | — 1·824 | 180 0 0·000 | | 5·2426375 | | |

No. 41.—Gurjapahar to Usira = 174838·685 Feet...Log. 5·2426375; Miles 33·1134. (Δ 40)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·517 | Gurjapahar..... | 40 23 12·733 | — 1·643 | + 0·003 | — 1·640 | 40 23 11·093 | 9·8115343 | 184926·681 | 35·0240 | 0·216 |
| 0·485 | Usira ..... | 74 10 2·298 | — 1·643 | — 0·919 | — 2·562 | 74 9 59·736 | 9·9832017 | 124546·689 | 23·5884 | 0·146 |
| 0·369 | Dimdima..... | 65 26 50·436 | — 1·643 | + 0·378 | — 1·265 | 65 26 49·171 | 9·9588396 | Logs. 5·2669996 | | |
| | | 180 0 5·467 | — 4·929 | — 0·538 | — 5·467 | 180 0 0·000 | | 5·0953322 | | |

No. 42.—Juktipura to Gurjapahar = 103474·333 Feet...Log. 5·0148326; Miles 19·5974. (Δ 38)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·281 | Juktipura ..... | 84 11 4·623 | — 0·820 | + 0·655 | — 0·165 | 84 11 4·458 | 9·9977591 | 101519·700 | 19·2272 | 0·119 |
| 0·286 | Gurjapahar..... | 47 18 11·088 | — 0·819 | + 0·373 | — 0·446 | 47 18 10·642 | 9·8662575 | 137420·632 | 26·0266 | 0·161 |
| 0·319 | Nindhar ..... | 48 30 45·910 | — 0·820 | — 0·190 | — 1·010 | 48 30 44·900 | 9·8745398 | Logs. 5·0065503 | | |
| | | 180 0 1·621 | — 2·459 | + 0·838 | — 1·621 | 180 0 0·000 | | 5·1380519 | | |



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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 43.—Gurjapahar to Nindhar = 137420·632 Feet...Log. 5·1380519; Miles 26·0266. (Δ 42)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·319 | Gurjapahar..... | 38° 9′ 23″·182 | — 1·106 | + 0·245 | — 0·861 | 38° 9′ 22″·321 | 9·7908532 | 166221·727 | 31·4814 | 0·195 |
| 0·218 | Nindhar ..... | 86 15 31·240 | — 1·107 | + 0·388 | — 0·719 | 86 15 30·521 | 9·9990734 | 102912·378 | 19·4910 | 0·120 |
| 0·272 | Machi ..... | 55 35 8·573 | — 1·107 | — 0·308 | — 1·415 | 55 35 7·158 | 9·9164375 | Logs. 5·2206878 | | |
| | | 180 0 2·995 | — 3·320 | + 0·325 | — 2·995 | 180 0 0·000 | | 5·0124676 | | |

No. 44.—Gurjapahar to Machi = 166221·727 Feet...Log. 5·2206878; Miles 31·4814. (Δ 43)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·415 | Gurjapahar..... | 47 40 41·208 | — 1·782 | — 0·597 | — 2·379 | 47 40 38·829 | 9·8688596 | 184926·681 | 35·0240 | 0·216 |
| 0·351 | Machi ..... | 73 2 9·142 | — 1·783 | — 0·149 | — 1·932 | 73 2 7·210 | 9·9806781 | 142948·986 | 27·0737 | 0·167 |
| 0·323 | Dimdima..... | 59 17 16·822 | — 1·782 | — 1·079 | — 2·861 | 59 17 13·961 | 9·9343663 | Logs. 5·2669996 | | |
| | | 180 0 7·172 | — 5·347 | — 1·825 | — 7·172 | 180 0 0·000 | | 5·1551811 | | |

No. 45.—Gurjapahar to Dimdima = 184926·681 Feet...Log 5·2669996; Miles 35·0240. (Δ 44)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·517 | Gurjapahar..... | 40 23 12·733 | — 1·643 | + 0·003 | — 1·640 | 40 23 11·093 | 9·8115343 | 174838·685 | 33·1134 | 0·205 |
| 0·369 | Dimdima..... | 65 26 50·436 | — 1·643 | + 0·378 | — 1·265 | 65 26 49·171 | 9·9588396 | 124546·689 | 23·5884 | 0·146 |
| 0·485 | Usira ..... | 74 10 2·298 | — 1·643 | — 0·919 | — 2·562 | 74 9 59·736 | 9·9832017 | Logs. 5·2426375 | | |
| | | 180 0 5·467 | — 4·929 | — 0·538 | — 5·467 | 180 0 0·000 | | 5·0953322 | | |

No. 46.—Dimdima to Usira = 124546·689 Feet...Log. 5·0953322; Miles 23·5884. (Δ 41 & 45)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·264 | Dimdima..... | 56 31 6·443 | — 1·065 | — 0·652 | — 1·717 | 56 31 4·726 | 9·9211967 | 130713·872 | 24·7564 | 0·153 |
| 0·451 | Usira ..... | 64 18 54·682 | — 1·065 | — 1·114 | — 2·179 | 64 18 52·503 | 9·9548151 | 120977·139 | 22·9123 | 0·142 |
| 0·283 | Madhoni..... | 59 10 4·535 | — 1·065 | — 0·699 | — 1·764 | 59 10 2·771 | 9·9338256 | Logs. 5·1163217 | | |
| | | 180 0 5·660 | — 3·195 | — 2·465 | — 5·660 | 180 0 0·000 | | 5·0827033 | | |

No. 47.—Dimdima to Madhoni = 130713·872 Feet...Log. 5·1163217; Miles 24·7564. (Δ 46)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·195 | Dimdima..... | 71 8 9·517 | — 1·185 | — 0·090 | — 1·275 | 71 8 8·242 | 9·9760227 | 122173·168 | 23·1389 | 0·143 |
| 0·523 | Madhoni..... | 51 43 42·809 | — 1·185 | — 0·240 | — 1·425 | 51 43 41·384 | 9·8949144 | 147259·778 | 27·8901 | 0·172 |
| 0·357 | Alipur..... | 57 8 11·723 | — 1·185 | — 0·164 | — 1·349 | 57 8 10·374 | 9·9242602 | Logs. 5·0869759 | | |
| | | 180 0 4·049 | — 3·555 | — 0·494 | — 4·049 | 180 0 0·000 | | 5·1680842 | | |

No. 48.—Madhoni to Alipur = 147259·778 Feet...Log. 5·1680842; Miles 27·8901. (Δ 47)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·481 | Madhoni..... | 54 43 59·106 | — 1·055 | — 0·023 | — 1·078 | 54 43 58·028 | 9·9119392 | 111896·852 | 21·1926 | 0·131 |
| 0·337 | Alipur..... | 47 51 54·810 | — 1·055 | + 0·370 | — 0·685 | 47 51 54·125 | 9·8701501 | 123198·937 | 23·3331 | 0·144 |
| 0·505 | Rasia ..... | 77 24 8·874 | — 1·055 | + 0·028 | — 1·027 | 77 24 7·847 | 9·9894164 | Logs. 5·0488179 | | |
| | | 180 0 2·790 | — 3·165 | + 0·375 | — 2·790 | 180 0 0·000 | | 5·0906070 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 49.—Madhoni to Rasia = 111896·852 Feet...Log. 5·0488179; Miles 21·1926. (Δ 48)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·271 | Madhoni..... | 66° 58′ 33″·944 | — 0·793 | + 0·471 | — 0·322 | 66° 58′ 33″·622 | 9·9639489 | 98137·669 | 18·5867 | + 0·115 |
| 0·555 | Rasia ..... | 50 51 25·909 | — 0·792 | + 0·382 | — 0·410 | 50 51 25·499 | 9·8896231 | 116455·886 | 22·0560 | 0·136 |
| 0·251 | Aring ..... | 62 10 1·524 | — 0·793 | + 0·148 | — 0·645 | 62 10 0·879 | 9·9466053 | Logs. 4·9918357 | | |
| | | 180 0 1·377 | — 2·378 | + 1·001 | — 1·377 | 180 0 0·000 | | 5·0661615 | | |

No. 50.—Rasia to Aring = 116455·886 Feet...Log. 5·0661615; Miles 22·0560. (Δ 49)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·229 | Rasia ..... | 41 39 26·198 | — 0·571 | — 0·101 | — 0·672 | 41 39 25·526 | 9·8226068 | 94101·500 | 17·8223 | 0·110 |
| 0·441 | Aring ..... | 53 34 43·383 | — 0·571 | + 0·357 | — 0·214 | 53 34 43·169 | 9·9056193 | 77729·172 | 14·7214 | 0·091 |
| 0·352 | Manpur ..... | 84 45 51·926 | — 0·572 | — 0·049 | — 0·621 | 84 45 51·305 | 9·9981842 | Logs. 4·9735966 | | |
| | | 180 0 1·507 | — 1·714 | + 0·207 | — 1·507 | 180 0 0·000 | | 4·8905841 | | |

No. 51.—Aring to Manpur = 77729·172 Feet...Log. 4·8905841; Miles 14·7214. (Δ 50)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·298 | Aring ..... | 60 46 29·834 | — 0·731 | — 0·422 | — 1·153 | 60 46 28·731 | 9·9408680 | 137327·600 | 26·0090 | 0·161 |
| 0·425 | Manpur ..... | 84 54 29·298 | — 0·731 | — 0·426 | — 1·157 | 84 54 28·141 | 9·9982825 | 120321·525 | 22·7882 | 0·141 |
| 0·609 | No ..... | 34 19 4·592 | — 0·730 | — 0·734 | — 1·464 | 34 19 3·128 | 9·7511088 | Logs. 5·1377578 | | |
| | | 180 0 3·774 | — 2·192 | — 1·582 | — 3·774 | 180 0 0·000 | | 5·0803433 | | |

No. 52.—Manpur to No = 120321·525 Feet...Log. 5·0803433; Miles 22·7882. (Δ 51)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·379 | Manpur ..... | 58 50 43·822 | — 1·218 | — 0·528 | — 1·746 | 58 50 42·076 | 9·9323576 | 150847·521 | 28·5696 | 0·177 |
| 0·652 | No ..... | 71 51 57·544 | — 1·218 | — 1·062 | — 2·280 | 71 51 55·264 | 9·9778734 | 135838·344 | 25·7270 | 0·159 |
| 0·587 | Pahera ..... | 49 17 25·206 | — 1·218 | — 1·328 | — 2·546 | 49 17 22·660 | 9·8796785 | Logs. 5·1785382 | | |
| | | 180 0 6·572 | — 3·654 | — 2·918 | — 6·572 | 180 0 0·000 | | 5·1330224 | | |

No. 53.—No to Pahera = 135838·344 Feet...Log. 5·1330224; Miles 25·7270. (Δ 52)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·492 | No ..... | 43 8 10·024 | — 0·880 | + 0·941 | + 0·061 | 43 8 10·085 | 9·8248873 | 120884·306 | 22·8948 | 0·141 |
| 0·520 | Pahera..... | 60 2 57·050 | — 0·880 | + 0·437 | — 0·443 | 60 2 56·607 | 9·9377451 | 95392·044 | 18·0667 | 0·112 |
| 0·450 | Karol ..... | 76 48 53·599 | — 0·881 | + 0·590 | — 0·291 | 76 48 53·308 | 9·9883975 | Logs. 5·0823700 | | |
| | | 180 0 0·673 | — 2·641 | + 1·968 | — 0·673 | 180 0 0·000 | | 4·9795122 | | |

No. 54.—No to Karol = 120884·306 Feet...Log. 5·0823700; Miles 22·8948. (Δ 53)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·551 | No ..... | 53 34 33·468 | — 0·841 | — 0·022 | — 0·863 | 53 34 32·605 | 9·9056029 | 110264·381 | 20·8834 | 0·129 |
| 0·401 | Karol ..... | 58 0 45·741 | — 0·841 | — 0·156 | — 0·997 | 58 0 44·744 | 9·9284794 | 104606·529 | 19·8118 | 0·122 |
| 0·438 | Chandaos ..... | 68 24 43·327 | — 0·841 | + 0·165 | — 0·676 | 68 24 42·651 | 9·9684141 | Logs. 5·0424353 | | |
| | | 180 0 2·536 | — 2·523 | — 0·013 | — 2·536 | 180 0 0·000 | | 5·0195588 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 55.—Chandaos to Karol = 104606·529 Feet...Log. 5·0195588; Miles 19·8118. (Δ 54)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·410 | Chandaos ..... | 72° 46′ 44″·642 | — 0·913 | — 0·009 | — 0·922 | 72° 46′ 43″·720 | 9·9800802 | 116511·886 | 22·0666 | 0·136 |
| 0·318 | Karol ..... | 57 47 21·556 | — 0·913 | — 0·117 | — 1·030 | 57 47 20·526 | 9·9274172 | 131532·545 | 24·9115 | 0·154 |
| 0·445 | Bulandsheher.... | 49 25 56·488 | — 0·913 | + 0·179 | — 0·734 | 49 25 55·754 | 9·8806058 | Logs. | | |
| | | 180 0 2·686 | — 2·739 | + 0·053 | — 2·686 | 180 0 0·000 | | 5·0663702 | | |
| | | | | | | | | 5·1190332 | | |

No. 56.—Karol to Bulandsheher = 131532·545 Feet...Log. 5·1190332; Miles 24·9115. (Δ 55)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·466 | Karol ..... | 55 0 23·234 | — 1·070 | + 0·656 | — 0·414 | 55 0 22·820 | 9·9133981 | 126656·029 | 23·9879 | 0·148 |
| 0·510 | Bulandsheher.... | 60 25 9·554 | — 1·070 | + 0·611 | — 0·459 | 60 25 9·095 | 9·9393497 | 119309·303 | 22·5965 | 0·140 |
| 0·446 | Bostan..... | 64 34 28·110 | — 1·071 | + 1·046 | — 0·025 | 64 34 28·085 | 9·9557570 | Logs. | | |
| | | 180 0 0·898 | — 3·211 | + 2·313 | — 0·898 | 180 0 0·000 | | 5·1026259 | | |
| | | | | | | | | 5·0766743 | | |

No. 57.—Bulandsheher to Bostan = 119309·303 Feet...Log. 5·0766743; Miles 22·5965. (Δ 56)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·883 | Bulandsheher.... | 40 14 11·190 | — 0·835 | — 0·536 | — 1·371 | 40 14 9·819 | 9·8101910 | 138287·573 | 26·1908 | 0·162 |
| 0·603 | Bostan..... | 81 15 15·680 | — 0·836 | — 0·268 | — 1·104 | 81 15 14·576 | 9·9949206 | 90376·100 | 17·1167 | 0·106 |
| 0·505 | Dateri ..... | 58 30 37·038 | — 0·836 | — 0·597 | — 1·433 | 58 30 35·605 | 9·9308117 | Logs. | | |
| | | 180 0 3·908 | — 2·507 | — 1·401 | — 3·908 | 180 0 0·000 | | 5·1407832 | | |
| | | | | | | | | 4·9560536 | | |

No. 58.—Bostan to Dateri = 90376·100 Feet...Log. 4·9560536; Miles 17·1167. (Δ 57)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·459 | Bostan..... | 87 24 58·656 | — 0·795 | — 0·097 | — 0·892 | 87 24 57·764 | 9·9995582 | 112219·465 | 21·2537 | 0·131 |
| 0·823 | Dateri ..... | 52 43 39·552 | — 0·794 | — 0·308 | — 1·102 | 52 43 38·450 | 9·9007835 | 140877·910 | 26·6814 | 0·165 |
| 0·720 | Pir Ghyb ..... | 39 51 25·265 | — 0·794 | — 0·685 | — 1·479 | 39 51 23·786 | 9·8067689 | Logs. | | |
| | | 180 0 3·473 | — 2·383 | — 1·090 | — 3·473 | 180 0 0·000 | | 5·0500682 | | |
| | | | | | | | | 5·1488429 | | |

No. 59.—Alipur to Rasia = 123198·937 Feet...Log. 5·0906070; Miles 23·3331. (Δ 48)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·197 | Alipur..... | 52 16 33·065 | — 1·093 | — 0·029 | — 1·122 | 52 16 31·943 | 9·8981558 | 143110·759 | 27·1043 | 0·167 |
| 0·172 | Rasia ..... | 72 31 33·602 | — 1·094 | — 0·007 | — 1·101 | 72 31 32·501 | 9·9794809 | 118671·711 | 22·4757 | 0·139 |
| 0·345 | Ladpur ..... | 55 11 56·307 | — 1·094 | + 0·343 | — 0·751 | 55 11 55·556 | 9·9144156 | Logs. | | |
| | | 180 0 2·974 | — 3·281 | + 0·307 | — 2·974 | 180 0 0·000 | | 5·1556723 | | |
| | | | | | | | | 5·0743472 | | |

No. 60.—Rasia to Ladpur = 118671·711 Feet...Log. 5·0743472; Miles 22·4757. (Δ 59)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·518 | Rasia ..... | 51 20 43·050 | — 0·869 | + 0·059 | — 0·810 | 51 20 42·240 | 9·8926076 | 119603·963 | 22·6523 | 0·140 |
| 0·319 | Ladpur ..... | 64 47 38·608 | — 0·870 | + 0·004 | — 0·866 | 64 47 37·742 | 9·9565435 | 103230·902 | 19·5513 | 0·121 |
| 0·335 | Chapra ..... | 63 51 40·498 | — 0·869 | + 0·389 | — 0·480 | 63 51 40·018 | 9·9531451 | Logs. | | |
| | | 180 0 2·156 | — 2·608 | + 0·452 | — 2·156 | 180 0 0·000 | | 5·0777456 | | |
| | | | | | | | | 5·0138097 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 61.—Rasia to Chapra = 119603·963 Feet...Log. 5·0777456; Miles 22·6523. (Δ 60)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·281 | Rasia ..... | 66° 12′ 42″·029 | — 0·808 | — 0·023 | — 0·831 | 66° 12′ 41″·198 | 9·9614402 | 94101·500 | 17·8223 | 0·110 |
| 0·353 | Chapra ..... | 46 31 23·175 | — 0·807 | — 0·136 | — 0·943 | 46 31 22·232 | 9·8607265 | 118661·627 | 22·4738 | 0·139 |
| 0·402 | Manpur ..... | 67 15 56·909 | — 0·808 | + 0·469 | — 0·339 | 67 15 56·570 | 9·9648755 | Logs. 4·9735966 | | |
| | | 180 0 2·113 | — 2·423 | + 0·310 | — 2·113 | 180 0 0·000 | | 5·0743103 | | |

No. 62.—Chapra to Manpur = 118661·627 Feet...Log. 5·0743103; Miles 22·4738. (Δ 61)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·348 | Chapra ..... | 68 40 3·777 | — 1·264 | + 1·112 | — 0·152 | 68 40 3·625 | 9·9691764 | 145819·737 | 27·6174 | 0·171 |
| 0·149 | Manpur ..... | 64 12 58·046 | — 1·264 | + 0·533 | — 0·731 | 64 12 57·315 | 9·9544546 | 150847·487 | 28·5696 | 0·177 |
| 0·472 | Pahera..... | 47 6 59·222 | — 1·264 | + 1·102 | — 0·162 | 47 6 59·060 | 9·8649486 | Logs. 5·1638163 | | |
| | | 180 0 1·045 | — 3·792 | + 2·747 | — 1·045 | 180 0 0·000 | | 5·1785381 | | |

No. 63.—Chapra to Pahera = 145819·737 Feet...Log. 5·1638163; Miles 27·6174. (Δ 62)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·387 | Chapra ..... | 47 35 46·954 | — 1·012 | + 0·114 | — 0·898 | 47 35 46·056 | 9·8682974 | 119929·525 | 22·7139 | 0·140 |
| 0·491 | Pahera..... | 53 44 42·795 | — 1·013 | — 0·263 | — 1·276 | 53 44 41·519 | 9·9065460 | 109819·000 | 20·7991 | 0·129 |
| 0·444 | Meoli ..... | 78 39 33·385 | — 1·013 | + 0·053 | — 0·960 | 78 39 32·425 | 9·9914362 | Logs. 5·0789261 | | |
| | | 180 0 3·134 | — 3·038 | — 0·096 | — 3·134 | 180 0 0·000 | | 5·0406775 | | |

No. 64.—Pahera to Meoli = 109819·000 Feet...Log. 5·0406775; Miles 20·7991. (Δ 63)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·423 | Pahera..... | 76 9 10·226 | — 1·129 | — 0·214 | — 1·343 | 76 9 8·883 | 9·9871906 | 134957·900 | 25·5602 | 0·158 |
| 0·578 | Meoli ..... | 59 23 32·802 | — 1·128 | + 0·188 | — 0·940 | 59 23 31·862 | 9·9348379 | 152247·770 | 28·8348 | 0·178 |
| 0·628 | Deri..... | 44 27 20·292 | — 1·128 | + 0·091 | — 1·037 | 44 27 19·255 | 9·8453171 | Logs. 5·1301983 | | |
| | | 180 0 3·320 | — 3·385 | + 0·065 | — 3·320 | 180 0 0·000 | | 5·1825510 | | |

No. 65.—Pahera to Deri = 134957·900 Feet...Log. 5·1301983; Miles 25·5602. (Δ 64)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·407 | Pahera..... | 73 38 45·501 | — 0·969 | + 0·266 | — 0·703 | 73 38 44·798 | 9·9820628 | 95392·000 | 18·0667 | 0·112 |
| 0·664 | Deri..... | 40 15 23·317 | — 0·968 | + 0·708 | — 0·260 | 40 15 23·057 | 9·8103732 | 141645·098 | 26·8267 | 0·166 |
| 0·391 | Karol ..... | 66 5 52·904 | — 0·969 | + 0·210 | — 0·759 | 66 5 52·145 | 9·9610595 | Logs. 4·9795120 | | |
| | | 180 0 1·722 | — 2·906 | + 1·184 | — 1·722 | 180 0 0·000 | | 5·1512016 | | |

No. 66.—Deri to Karol = 141645·098 Feet...Log. 5·1512016; Miles 26·8267. (Δ 65)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·737 | Deri..... | 59 24 48·198 | — 1·017 | — 0·756 | — 1·773 | 59 24 46·425 | 9·9349308 | 106329·539 | 20·1382 | 0·124 |
| 0·497 | Karol ..... | 46 16 42·966 | — 1·016 | — 1·183 | — 2·199 | 46 16 40·767 | 9·8589590 | 126655·961 | 23·9879 | 0·148 |
| 0·607 | Bostan..... | 74 18 34·607 | — 1·017 | — 0·782 | — 1·799 | 74 18 32·808 | 9·9835067 | Logs. 5·0266539 | | |
| | | 180 0 5·771 | — 3·050 | — 2·721 | — 5·771 | 180 0 0·000 | | 5·1026257 | | |



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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 67.—Deri to Bostan = 106329·539 Feet...Log. 5·0266539; Miles 20·1382. (Δ 66)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·523 | Deri..... | 66° 54′ 34″·479 | — 0·742 | — 0·257 | — 0·999 | 66° 54′ 33″·480 | 9·9637336 | 96712·222 | 18·3167 | + 0·113 |
| 0·410 | Bostan..... | 52 26 42·946 | — 0·741 | + 0·102 | — 0·639 | 52 26 42·307 | 9·8991469 | 112219·439 | 21·2537 | 0·131 |
| 0·487 | Pir Ghyb ..... | 60 38 44·917 | — 0·742 | + 0·038 | — 0·704 | 60 38 44·213 | 9·9403194 | Logs. 4·9854814 | | |
| | | 180 0 2·342 | — 2·225 | — 0·117 | — 2·342 | 180 0 0·000 | | 5·0500681 | | |

No. 68.—Bostan to Pir Ghyb = 112219·439 Feet...Log. 5·0500681; Miles 21·2537. (Δ 67)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·459 | Bostan..... | 87 24 58·656 | — 0·795 | — 0·097 | — 0·892 | 87 24 57·764 | 9·9995582 | 90376·084 | 17·1167 | 0·106 |
| 0·720 | Pir Ghyb ..... | 39 51 25·265 | — 0·794 | — 0·685 | — 1·479 | 39 51 23·786 | 9·8067689 | 140877·878 | 26·6814 | 0·165 |
| 0·823 | Dateri..... | 52 43 39·552 | — 0·794 | — 0·308 | — 1·102 | 52 43 38·450 | 9·9007835 | Logs. 4·9560535 | | |
| | | 180 0 3·473 | — 2·383 | — 1·090 | — 3·473 | 180 0 0·000 | | 5·1488428 | | |

No. 69.—Pir Ghyb to Dateri = 140877·894 Feet...Log. 5·1488428; Miles 26·6814. (Δs 58 & 68)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·466 | Pir Ghyb ..... | 37 33 43·824 | — 0·827 | + 0·673 | — 0·154 | 37 33 43·670 | 9·7850602 | 122857·225 | 23·2684 | 0·144 |
| 0·753 | Dateri..... | 59 51 27·401 | — 0·827 | + 1·088 | + 0·261 | 59 51 27·662 | 9·9369060 | 86607·380 | 16·4029 | 0·101 |
| 1·077 | Dholri..... | 82 34 47·941 | — 0·828 | + 1·555 | + 0·727 | 82 34 48·668 | 9·9963481 | Logs. 5·0894007 | | |
| | | 179 59 59·166 | — 2·482 | + 3·316 | + 0·834 | 180 0 0·000 | | 4·9375549 | | |

No. 70.—Dateri to Dholri = 86607·380 Feet...Log. 4·9375549; Miles 16·4029. (Δ 69)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·294 | Dateri..... | 60 46 19·723 | — 0·708 | + 0·010 | — 0·698 | 60 46 19·025 | 9·9408566 | 119460·111 | 22·6250 | 0·140 |
| 0·573 | Dholri..... | 74 49 28·727 | — 0·708 | + 0·019 | — 0·689 | 74 49 28·038 | 9·9845850 | 108017·597 | 20·4579 | 0·126 |
| 0·716 | Saini ..... | 44 24 13·622 | — 0·708 | + 0·023 | — 0·685 | 44 24 12·937 | 9·8449170 | Logs. 5·0772229 | | |
| | | 180 0 2·072 | — 2·124 | + 0·052 | — 2·072 | 180 0 0·000 | | 5·0334945 | | |

No. 71.—Dholri to Saini = 108017·597 Feet...Log. 5·0334945; Miles 20·4579. (Δ 70)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·676 | Dholri..... | 57 45 44·464 | — 0·647 | — 0·297 | — 0·944 | 57 45 43·520 | 9·9272884 | 90248·600 | 17·0925 | 0·106 |
| 1·092 | Saini ..... | 51 53 26·441 | — 0·646 | — 0·479 | — 1·125 | 51 53 25·316 | 9·8958816 | 97016·890 | 18·3744 | 0·114 |
| 0·503 | Saroli ..... | 70 20 52·032 | — 0·647 | — 0·221 | — 0·868 | 70 20 51·164 | 9·9739356 | Logs. 4·9554405 | | |
| | | 180 0 2·937 | — 1·940 | — 0·997 | — 2·937 | 180 0 0·000 | | 4·9868473 | | |

No. 72.—Saini to Saroli = 97016·890 Feet...Log. 4·9868473; Miles 18·3744. (Δ 71)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·950 | Saini ..... | 48 30 53·717 | — 0·717 | — 0·654 | — 1·371 | 48 30 52·346 | 9·8745536 | 125895·609 | 23·8439 | 0·147 |
| 0·706 | Saroli ..... | 81 46 58·314 | — 0·718 | — 0·486 | — 1·204 | 81 46 57·110 | 9·9955179 | 95289·767 | 18·0473 | 0·112 |
| 0·548 | Begarazpur..... | 49 42 11·638 | — 0·717 | — 0·377 | — 1·094 | 49 42 10·544 | 9·8823546 | Logs. 5·1000106 | | |
| | | 180 0 3·669 | — 2·152 | — 1·517 | — 3·669 | 180 0 0·000 | | 4·9790463 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 73.—Saini to Begarazpur = 125895·609 Feet...Log. 5·1000106; Miles 23·8439. (Δ 72)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | | | | ° ′ ″ | | | | + |
| 0·536 | Saini ..... | 45 35 54·599 | — 0·845 | + 0·913 | + 0·068 | 45 35 54·667 | 9·8539746 | 119799·966 | 22·6894 | 0·140 |
| 0·300 | Begarazpur..... | 63 49 22·892 | — 0·845 | + 0·511 | — 0·334 | 63 49 22·558 | 9·9530030 | 95373·622 | 18·0632 | 0·112 |
| 0·436 | Sheopuri..... | 70 34 42·878 | — 0·845 | + 0·742 | — 0·103 | 70 34 42·775 | 9·9745569 | Logs. 5·0784567 | | |
| | | 180 0 0·369 | — 2·535 | + 2·166 | — 0·369 | 180 0 0·000 | | 4·9794283 | | |

**No. 74.—Begarazpur to Sheopuri = 95373·622 Feet...Log. 4·9794283; Miles 18·0632. (Δ 73)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·519 | Begarazpur..... | 67 39 25·640 | — 0·759 | — 0·703 | — 1·462 | 67 39 24·178 | 9·9661055 | 109687·481 | 20·7741 | 0·128 |
| 0·737 | Sheopuri..... | 62 7 6·767 | — 0·759 | — 0·998 | — 1·757 | 62 7 5·010 | 9·9464095 | 114776·503 | 21·7380 | 0·134 |
| 0·400 | Godhna ..... | 50 13 32·111 | — 0·758 | — 0·541 | — 1·299 | 50 13 30·812 | 9·8856808 | Logs. 5·0401570 | | |
| | | 180 0 4·518 | — 2·276 | — 2·242 | — 4·518 | 180 0 0·000 | | 5·0598530 | | |

**No. 75.—Begarazpur to Godhna = 109687·481 Feet...Log. 5·0401570; Miles 20·7741. (Δ 74)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·476 | Begarazpur..... | 51 54 52·714 | — 0·645 | + 0·236 | — 0·409 | 51 54 52·305 | 9·8960252 | 95358·622 | 18·0603 | 0·112 |
| 0·614 | Godhna ..... | 55 52 26·128 | — 0·646 | + 0·173 | — 0·473 | 55 52 25·655 | 9·9179274 | 90668·800 | 17·1721 | 0·106 |
| 0·576 | Dahera ..... | 72 12 42·792 | — 0·646 | — 0·106 | — 0·752 | 72 12 42·040 | 9·9787244 | Logs. 4·9793600 | | |
| | | 180 0 1·634 | — 1·937 | + 0·303 | — 1·634 | 180 0 0·000 | | 4·9574578 | | |

**No. 76.—Begarazpur to Godhna = 109687·481 Feet...Log. 5·0401570; Miles 20·7741. (Δ 74)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·466 | Begarazpur..... | 52 33 21·275 | — 0·361 | + 0·275 | — 0·086 | 52 33 21·189 | 9·8997914 | 52873·885 | 10·0140 | 0·062 |
| 0·656 | Godhna ..... | 28 25 48·926 | — 0·361 | + 0·279 | — 0·082 | 28 25 48·844 | 9·6776875 | 88174·940 | 16·6998 | 0·103 |
| 0·371 | Kaliana ..... | 99 0 50·096 | — 0·361 | + 0·232 | — 0·129 | 99 0 49·967 | 9·9946032 | Logs. 4·7232413 | | |
| | | 180 0 0·297 | — 1·083 | + 0·786 | — 0·297 | 180 0 0·000 | | 4·9453452 | | |

**No. 77.—Godhna to Kaliana = 88174·940 Feet...Log. 4·9453452; Miles 16·6998. (Δ 76)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·750 | Godhna ..... | 27 26 37·202 | — 0·289 | — 0·106 | — 0·395 | 27 26 36·807 | 9·6625827 | 90668·842 | 17·1721 | 0·106 |
| 0·652 | Kaliana ..... | 79 32 48·618 | — 0·289 | — 0·203 | — 0·492 | 79 32 48·126 | 9·9927316 | 42492·188 | 8·0478 | 0·050 |
| 0·677 | Dahera ..... | 73 0 35·382 | — 0·289 | — 0·026 | — 0·315 | 73 0 35·067 | 9·9806188 | Logs. 4·9574580 | | |
| | | 180 0 1·202 | — 0·867 | — 0·335 | — 1·202 | 180 0 0·000 | | 4·6283091 | | |

**No. 78.—Begarazpur to Dahera = 95358·622 Feet...Log. 4·9793600; Miles 18·0603. (Δ 75)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·352 | Begarazpur..... | 0 38 28·561 | — 0·004 | + 0·039 | + 0·035 | 0 38 28·596 | 8·0489137 | 52873·861 | 10·0140 | 0·062 |
| 0·446 | Dahera ..... | 0 47 52·590 | — 0·004 | + 0·080 | + 0·076 | 0 47 52·666 | 8·1438459 | 42492·169 | 8·0478 | 0·050 |
| 0·386 | Kaliana ..... | 178 33 38·714 | — 0·005 | + 0·029 | + 0·024 | 178 33 38·738 | 8·3999648 | Logs. 4·7232411 | | |
| | | 179 59 59·865 | — 0·013 | + 0·148 | + 0·135 | 180 0 0·000 | | 4·6283089 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

**No. 79.—Godhna to Dahera = 90668·821 Feet...Log. 4·9574579; Miles 17·1721. (As 75 & 77)**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·465 | Godhna ..... | 52° 15′ 7″·278 | — 0·684 | — 0·374 | — 1·058 | 52° 15′ 6″·220 | 9·8980162 | 121608·784 | 23·0320 | 0·142 |
| 0·295 | Dahera ..... | 80 25 30·679 | — 0·684 | — 0·238 | — 0·922 | 80 25 29·757 | 9·9939071 | 97515·600 | 18·4689 | 0·114 |
| 0·954 | Nojhili ..... | 47 19 25·475 | — 0·683 | — 0·769 | — 1·452 | 47 19 24·023 | 9·8664000 | Logs. 5·0849650 | | |
| | | 180 0 3·432 | — 2·051 | — 1·381 | — 3·432 | 180 0 0·000 | | 4·9890741 | | |

**No. 80.—Godhna to Nojhili = 121608·784 Feet...Log. 5·0849650; Miles 23·0320. (Δ 79)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·786 | Godhna ..... | 49 24 7·943 | — 1·347 | + 0·696 | — 0·651 | 49 24 7·292 | 9·8804101 | 186033·730 | 35·2337 | 0·218 |
| 1·016 | Nojhili ..... | 89 46 40·490 | — 1·347 | + 0·900 | — 0·447 | 89 46 40·043 | 9·9999967 | 141255·391 | 26·7529 | 0·165 |
| 0·363 | Dhoiwala ..... | 40 49 13·689 | — 1·346 | + 0·322 | — 1·024 | 40 49 12·665 | 9·8153700 | Logs. 5·2695917 | | |
| | | 180 0 2·122 | — 4·040 | + 1·918 | — 2·122 | 180 0 0·000 | | 5·1500051 | | |

**No. 81.—Nojhili to Dhoiwala = 141255·391 Feet...Log. 5·1500051; Miles 26·7529. (Δ 80)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·533 | Nojhili ..... | 52 22 5·272 | — 1·557 | + 0·196 | — 1·361 | 52 22 3·911 | 9·8986957 | 177549·569 | 33·6268 | 0·208 |
| 0·299 | Dhoiwala ..... | 76 51 8·506 | — 1·558 | + 0·110 | — 1·448 | 76 51 7·058 | 9·9884633 | 144394·996 | 27·3475 | 0·169 |
| 0·650 | Amsot..... | 50 46 50·350 | — 1·557 | + 0·238 | — 1·319 | 50 46 49·031 | 9·8891487 | Logs. 5·2493197 | | |
| | | 180 0 4·128 | — 4·672 | + 0·544 | — 4·128 | 180 0 0·000 | | 5·1595521 | | |

**No. 82.—Dhoiwala to Amsot = 144394·996 Feet...Log. 5·1595521; Miles 27·3475. (Δ 81)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·446 | Dhoiwala ..... | 46 36 49·560 | — 1·069 | + 0·717 | — 0·352 | 46 36 49·208 | 9·8613782 | 129916·418 | 24·6054 | 0·152 |
| 0·202 | Amsot..... | 59 42 30·495 | — 1·068 | + 0·325 | — 0·743 | 59 42 29·752 | 9·9362464 | 109344·203 | 20·7091 | 0·128 |
| 0·269 | Banog ..... | 73 40 41·676 | — 1·069 | + 0·433 | — 0·636 | 73 40 41·040 | 9·9821345 | Logs. 5·1136640 | | |
| | | 180 0 1·731 | — 3·206 | + 1·475 | — 1·731 | 180 0 0·000 | | 5·0387958 | | |

**No. 83.—Amsot to Banog = 109344·203 Feet...Log. 5·0387958; Miles 20·7091. (Δ 82)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·252 | Amsot..... | 39 34 35·039 | — 0·530 | + 1·012 | + 0·482 | 39 34 35·521 | 9·8042133 | 96967·400 | 18·3650 | 0·113 |
| 0·284 | Banog ..... | 60 44 43·883 | — 0·530 | + 0·229 | — 0·301 | 60 44 43·582 | 9·9407441 | 70810·065 | 13·4110 | 0·083 |
| 0·405 | E. End Base.... | 79 40 41·583 | — 0·529 | — 0·157 | — 0·686 | 79 40 40·897 | 9·9929141 | Logs. 4·9866258 | | |
| | | 180 0 0·505 | — 1·589 | + 1·084 | — 0·505 | 180 0 0·000 | | 4·8500950 | | |

**No. 84.—Banog to E. End Dehra Dun Base = 70810·065 Feet...Log. 4·8500950; Miles 13·4110. (Δ 83)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·310 | Banog ..... | 31 41 33·768 | — 0·212 | — 0·173 | — 0·385 | 31 41 33·383 | 9·7204585 | 72555·967 | 13·7417 | 0·085 |
| 0·353 | E. End Base.... | 76 36 38·094 | — 0·211 | — 0·534 | — 0·745 | 76 36 37·349 | 9·9880315 | 39183·218 | 7·4211 | 0·046 |
| 0·325 | W. End Base.... | 71 41 49·943 | — 0·212 | — 0·463 | — 0·675 | 71 41 49·268 | 9·9774534 | Logs. 4·8606731 | | |
| | | 180 0 1·805 | — 0·635 | — 1·170 | — 1·805 | 180 0 0·000 | | 4·5931001 | | |

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## COMPUTATION OF PRINCIPAL TRIANGLES.

No. 85.—Amsot to Banog = 109344·203 Feet...Log. 5·0387958; Miles 20·7091. (Δ 82)

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. | Corr. for Feet. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | + |
| 0·377 | Amsot..... | 37° 30′ 0″·327 | — 0·302 | + 1·035 | + 0·733 | 37° 30′ 1″·060 | 9·7844501 | 57878·353 | 10·9618 | 0·068 |
| 0·226 | Banog..... | 29 3 10·115 | — 0·302 | + 0·402 | + 0·100 | 29 3 10·215 | 9·6862930 | 72556·000 | 13·7417 | 0·085 |
| 0·246 | W. End Base.... | 113 26 48·566 | — 0·302 | + 0·461 | + 0·159 | 113 26 48·725 | 9·9625726 | Logs. 4·7625162 | | |
| | | 179 59 59·008 | — 0·906 | + 1·898 | + 0·992 | 180 0 0·000 | | 4·8606733 | | |

No. 86.—Amsot to W. End Dehra Dun Base = 57878·353 Feet...Log. 4·7625162; Miles 10·9618. (Δ 85)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·292 | Amsot..... | 2 4 34·713 | — 0·016 | — 0·025 | — 0·041 | 2 4 34·672 | 8·5590719 | 96967·444 | 18·3651 | 0·113 |
| 0·454 | W. End Base.... | 174 51 21·491 | — 0·016 | + 0·002 | — 0·014 | 174 51 21·477 | 8·9525976 | 39183·236 | 7·4211 | 0·046 |
| 0·428 | E. End Base .... | 3 4 3·489 | — 0·016 | + 0·378 | + 0·362 | 3 4 3·851 | 8·7284878 | Logs. 4·9866260 | | |
| | | 179 59 59·693 | — 0·048 | + 0·355 | + 0·307 | 180 0 0·000 | | 4·5931003 | | |
| | | | | | | | | | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | | | |
| | | | | | | | | Logs. | | |
| | | | | | | | | | | |
| | | | | | | | | Logs. | | |

| | Feet | Log |
|---|---|---|
| Dehra Dun Base by Measurement = | 39183·873 | Log 4·5931074 |
| .. .. .. .. Δ's 84 and 86 = | 39183·273 | Log 4·5931008 |
| Diff. in parts of a foot = | 0·600 | 0·0000066 |



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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 1.—Kalianpur to Bhaorasa = 118972·752 Feet...Log. 5·0754476; Miles 22·5327.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | + | |
| Kalianpur..... | 87° 22′ 35″·116 | — 0·736 | .... | — 0·736 | 87° 22′ 34″·380 | 9·9995444 | 78993·100 | 14·9608 |
| Bhaorasa ..... | 34 22 28·117 | — 0·736 | .... | — 0·736 | 34 22 27·381 | 9·7517381 | 139764·064 | 26·4705 |
| $\mu^{I}$ ..... | 58 14 58·976 | — 0·737 | .... | — 0·736 | 58 14 58·239 | 9·9295965 | Logs. | |
| | 180 0 2·209 | — 2·209 | .... | — 2·209 | 180 0 0·000 | | 4·8975892 | |
| | | | | | | | 5·1453955 | |

No. 2.—Pardho to $\mu^{I}$ (139764·064 — 94521·682) = 45242·382 Feet...Log. 4·6555455; Miles 8·5686.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | — | |
| $\mu^{I}$ ..... | 58 14 58·976 | — 0·161 | .... | — 0·161 | 58 14 58·815 | 9·9295973 | 53204·174 | 10·0765 |
| Pardho ..... | 69 8 3·342 | — 0·161 | .... | — 0·161 | 69 8 3·181 | 9·9705408 | 48417·479 | 9·1700 |
| $\mu^{II}$ ..... | 52 36 58·164 | — 0·160 | .... | — 0·160 | 52 36 58·004 | 9·9001406 | Logs. | |
| | 180 0 0·482 | — 0·482 | .... | — 0·482 | 180 0 0·000 | | 4·7259457 | |
| | | | | | | | 4·6850022 | |

No. 3.—Handiaparo to $\mu^{II}$ (48417·479 + 96673·167) = 145090·646 Feet...Log. 5·1616394; Miles 27·4793.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | + | |
| $\mu^{II}$ ..... | 52 36 58·164 | — 1·487 | .... | — 1·487 | 52 36 56·677 | 9·9001385 | 164528·038 | 31·1606 |
| Handiaparo ..... | 70 55 44·930 | — 1·488 | .... | — 1·488 | 70 55 43·442 | 9·9754837 | 138323·095 | 26·1976 |
| $\mu^{III}$..... | 56 27 21·369 | — 1·488 | .... | — 1·488 | 56 27 19·881 | 9·9208832 | Logs. | |
| | 180 0 4·463 | — 4·463 | .... | — 4·463 | 180 0 0·000 | | 5·2162399 | |
| | | | | | | | 5·1408947 | |

No. 4.—Deadheri to $\mu^{III}$ (138323·095 — 134808·559) = 3514·536 Feet...Log. 3·5458679; Miles 0·6656.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | — | |
| $\mu^{III}$..... | 56 27 21·369 | — 0·001 | .... | — 0·001 | 56 27 21·368 | 9·9208853 | 4238·479 | 0·8027 |
| Deadheri ..... | 71 38 21·837 | — 0·001 | .... | — 0·001 | 71 38 21.836 | 9·9773087 | 3722·088 | 0·7049 |
| $\mu^{IV}$..... | 51 54 16·797 | — 0·001 | .... | — 0·001 | 51 54 16·796 | 9·8959666 | Logs. | |
| | 180 0 0·003 | — 0·003 | .... | — 0·003 | 180 0 0·000 | | 3·6272100 | |
| | | | | | | | 3·5707866 | |

No. 5.—Hatiapahar to $\mu^{IV}$ (3722·088 + 102972·664) = 106694·752 Feet...Log. 5·0281431; Miles 20·2073.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | + | |
| $\mu^{IV}$..... | 51 54 16·797 | — 0·783 | .... | — 0·783 | 51 54 16·014 | 9·8959653 | 118890·738 | 22·5172 |
| Hatiapahar ..... | 70 23 11·560 | — 0·783 | .... | — 0·783 | 70 23 10·777 | 9·9740404 | 99328·269 | 18·8122 |
| $\mu^{V}$ ..... | 57 42 33·992 | — 0·783 | .... | — 0·783 | 57 42 33·209 | 9·9270355 | Logs. | |
| | 180 0 2·349 | — 2·349 | .... | — 2·349 | 180 0 0·000 | | 5·0751480 | |
| | | | | | | | 4·9970729 | |

No. 6.—Pahargarh to $\mu^{V}$ (99328·269 — 83131·358) = 16196·911 Feet...Log. 4·2094322; Miles 3·0676.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | — | |
| $\mu^{V}$ ..... | 57 42 33·992 | — 0·019 | .... | — 0·019 | 57 42 33·973 | 9·9270365 | 17782·494 | 3·3679 |
| Pahargarh..... | 65 59 9·627 | — 0·019 | .... | — 0·019 | 65 59 9·608 | 9·9606829 | 16456·834 | 3·1168 |
| $\mu^{VI}$..... | 56 18 16·438 | — 0·019 | .... | — 0·019 | 56 18 16·419 | 9·9201224 | Logs. | |
| | 180 0 0·057 | — 0·057 | .... | — 0·057 | 180 0 0·000 | | 4·2499927 | |
| | | | | | | | 4·2163463 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 7.—Nimdant to $\mu^{VI} = (16456 \cdot 834 + 70442 \cdot 750) = 86899 \cdot 584$ Feet...Log. 4·9390177; Miles 16·4583.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $\mu^{VI}$ | 56° 18′ 16″·438 | — 0·512 | .... | — 0·512 | 56° 18′ 15″·926 | 9·9201217 | + 90318·962 | 17·1059 |
| Nimdant | 63 54 46·494 | — 0·513 | .... | — 0·513 | 63 54 45·981 | 9·9533371 | 83668·796 | 15·8464 |
| $\mu^{VII}$ | 59 46 58·605 | — 0·512 | .... | — 0·512 | 59 46 58·093 | 9·9365759 | Logs. 4·9557789 | |
| | 180 0 1·537 | — 1·537 | .... | — 1·537 | 180 0 0·000 | | 4·9225635 | |

No. 8.—Gugubara to $\mu^{VII} = (113547 \cdot 105 - 83668 \cdot 796) = 29878 \cdot 309$ Feet...Log. 4·4753560; Miles 5·6588.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\mu^{VII}$ | 59 46 58·605 | — 0·045 | .... | — 0·045 | 59 46 58·560 | 9·9365765 | + 22495·673 | 4·2605 |
| Gugubara | 46 19 48·982 | — 0·046 | .... | — 0·046 | 46 19 48·936 | 9·8593377 | 26874·337 | 5·0898 |
| $\mu^{VIII}$ | 73 53 12·550 | — 0·046 | .... | — 0·046 | 73 53 12·504 | 9·9825947 | Logs. 4·3520990 | |
| | 180 0 0·137 | — 0·137 | .... | — 0·137 | 180 0 0·000 | | 4·4293378 | |

No. 9.—Mao to $\mu^{VIII} = (106839 \cdot 271 - 26874 \cdot 337) = 79964 \cdot 934$ Feet...Log. 4·9028996; Miles 15·1449.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\mu^{VIII}$ | 73 53 12·550 | — 0·773 | .... | — 0·773 | 73 53 11·777 | 9·9825943 | + 128257·147 | 24·2911 |
| Mao | 70 11 50·131 | — 0·773 | .... | — 0·773 | 70 11 49·358 | 9·9735266 | 130963·212 | 24·8036 |
| $\mu^{IX}$ | 35 54 59·637 | — 0·772 | .... | — 0·772 | 35 54 58·865 | 9·7683446 | Logs. 5·1080816 | |
| | 180 0 2·318 | — 2·318 | .... | — 2·318 | 180 0 0·000 | | 5·1171493 | |

No. 10.—Memoni to $\mu^{IX} = (130963 \cdot 212 - 108991 \cdot 830) = 21971 \cdot 382$ Feet...Log. 4·3418573; Miles 4·1612.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\mu^{IX}$ | 35 54 59·637 | — 0·022 | .... | — 0·022 | 35 54 59·615 | 9·7683468 | — 21907·376 | 4·1491 |
| Memoni | 71 47 1·923 | — 0·022 | .... | — 0·022 | 71 47 1·901 | 9·9776706 | 13529·025 | 2·5623 |
| $\mu^{X}$ | 72 17 58·506 | — 0·022 | .... | — 0·022 | 72 17 58·484 | 9·9789376 | Logs. 4·3405903 | |
| | 180 0 0·066 | — 0·066 | .... | — 0·066 | 180 0 0·000 | | 4·1312665 | |

No. 11.—Shergarh to $\mu^{X} = (13529 \cdot 025 + 78572 \cdot 890) = 92101 \cdot 915$ Feet...Log. 4·9642687; Miles 17·4435.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\mu^{X}$ | 72 17 58·506 | — 0·708 | .... | — 0·708 | 72 17 57·798 | 9·9789372 | + 102857·688 | 19·4806 |
| Shergarh | 58 10 9·013 | — 0·708 | .... | — 0·708 | 58 10 8·305 | 9·9292182 | 115333·559 | 21·8435 |
| $\mu^{XI}$ | 49 31 54·604 | — 0·707 | .... | — 0·707 | 49 31 53·897 | 9·8812502 | Logs. 5·0122367 | |
| | 180 0 2·123 | — 2·123 | .... | — 2·123 | 180 0 0·000 | | 5·0619557 | |

No. 12.—Kasri to $\mu^{XI} = (115333 \cdot 559 - 104340 \cdot 360) = 10993 \cdot 199$ Feet...Log. 4·0401241; Miles 2·0773.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\mu^{XI}$ | 49 31 54·604 | — 0·005 | .... | — 0·005 | 49 31 54·599 | 9·8812515 | — 7118·456 | 1·3482 |
| Kasri | 40 28 5·410 | — 0·004 | .... | — 0·004 | 40 28 5·406 | 9·8122618 | 8344·026 | 1·5803 |
| $p^{I}$ | 90 0 0·000 | — 0·005 | .... | — 0·005 | 89 59 59·995 | 10·0000000 | Logs. 3·8523859 | |
| | 180 0 0·014 | — 0·014 | .... | — 0·014 | 180 0 0·000 | | 3·9213756 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

**No. 13.—Kasri to $p^{\cdot}$ = 8344·026 Feet...Log. 3·9213756; Miles 1·5803.**

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $p^{I}$ ..... | 90° 0′ 0″·000 | — 0·007 | .... | — 0·007 | 89° 59′ 59″·993 | 10·0000000 | + 11333·694 | 2·1465 |
| Kasri..... | 53 38 20·313 | — 0·008 | .... | — 0·008 | 53 38 20·305 | 9·9059563 | 14073·926 | 2·6655 |
| $\mu^{XII}$ ..... | 36 21 39·709 | — 0·007 | .... | — 0·007 | 36 21 39·702 | 9·7729604 | Logs. | |
| | 180 0 0·022 | — 0·022 | .... | — 0·022 | 180 0 0·000 | | 4·0543715 | |
| | | | | | | | 4·1484152 | |

**No. 14.—Chilwani to $\mu^{XII}$ = (85396·200 — 14073·926) = 71322·274 Feet...Log. 4·8532252; Miles 13·5080.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XII}$ ..... | 36 21 39·709 | — 0·219 | .... | — 0·219 | 36 21 39·490 | 9·7729598 | + 66071·630 | 12·5136 |
| Chilwani ..... | 65 10 55·361 | — 0·219 | .... | — 0·219 | 65 10 55·142 | 9·9579162 | 43157·740 | 8·1738 |
| $\mu^{XIII}$ ..... | 78 27 25·587 | — 0·219 | .... | — 0·219 | 78 27 25·368 | 9·9911263 | Logs. | |
| | 180 0 0·657 | — 0·657 | .... | — 0·657 | 180 0 0·000 | | 4·8200151 | |
| | | | | | | | 4·6350587 | |

**No. 15.—Den to $\mu^{XIII}$ = (96896·367 — 43157·740) = 53738·627 Feet...Log. 4·7302866; Miles 10·1778.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XIII}$ ..... | 78 27 25·587 | — 0·172 | .... | — 0·172 | 78 27 25·415 | 9·9911264 | + 41598·568 | 7·8785 |
| Den ..... | 41 54 22·790 | — 0·171 | .... | — 0·171 | 41 54 22·619 | 9·8247207 | 61021·670 | 11·5571 |
| $\mu^{XIV}$ ..... | 59 38 12·138 | — 0·172 | .... | — 0·172 | 59 38 11·966 | 9·9359289 | Logs. | |
| | 180 0 0·515 | — 0·515 | .... | — 0·515 | 180 0 0·000 | | 4·6190784 | |
| | | | | | | | 4·7854841 | |

**No. 16.—Juktipura to $\mu^{XIV}$ = (130626·572 — 61021·670) = 69604·902 Feet...Log. 4·8426398; Miles 13·1827.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XIV}$ ..... | 59 38 12·138 | — 0·223 | .... | — 0·223 | 59 38 11·915 | 9·9359288 | + 47346·643 | 8·9672 |
| Juktipura ..... | 41 48 42·709 | — 0·223 | .... | — 0·223 | 41 48 42·486 | 9·8239214 | 61276·870 | 11·6055 |
| $\mu^{XV}$..... | 78 33 5·822 | — 0·223 | .... | — 0·223 | 78 33 5·599 | 9·9912720 | Logs. | |
| | 180 0 0·669 | — 0·669 | .... | — 0·669 | 180 0 0·000 | | 4·6752892 | |
| | | | | | | | 4·7872966 | |

**No. 17.—Pagaro to $\mu^{XV}$ = (127599·998 — 61276·870) = 66323·128 Feet...Log. 4·8216651; Miles 12·5612.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XV}$..... | 78 33 5·822 | — 0·319 | .... | — 0·319 | 78 33 5·503 | 9·9912720 | + 62479·300 | 11·8332 |
| Pagaro ..... | 48 38 3·831 | — 0·318 | .... | — 0·318 | 48 38 3·513 | 9·8753547 | 81593·119 | 15·4532 |
| $\mu^{XVI}$ ..... | 52 48 51·303 | — 0·319 | .... | — 0·319 | 52 48 50·984 | 9·9012836 | Logs. | |
| | 180 0 0·956 | — 0·956 | .... | — 0·956 | 180 0 0·000 | | 4·7957362 | |
| | | | | | | | 4·9116535 | |

**No. 18.—Gurjapahar to $\mu^{XVI}$ = (123519·540 — 81593·119) = 41926·421 Feet...Log. 4·6224878; Miles 7·9406.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XVI}$ ..... | 52 48 51·303 | — 0·129 | .... | — 0·129 | 52 48 51·174 | 9·9012839 | + 49495·311 | 9·3741 |
| Gurjapahar ..... | 73 3 31·446 | — 0·130 | .... | — 0·130 | 73 3 31·316 | 9·9807321 | 41220·738 | 7·8070 |
| $\mu^{XVII}$ ..... | 54 7 37·640 | — 0·130 | .... | — 0·130 | 54 7 37·510 | 9·9086559 | Logs. | |
| | 180 0 0·389 | — 0·389 | .... | — 0·389 | 180 0 0·000 | | 4·6945640 | |
| | | | | | | | 4·6151158 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 19.—Dholpur to $\mu^{XVII} = (110051 \cdot 000 - 41220 \cdot 738) = 68830 \cdot 262$ Feet...Log. 4·8377795; Miles 13·0360.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XVII}$ ..... | 54° 7′ 37″·640 | — 0·593 | .... | — 0·593 | 54° 7′ 37″·047 | 9·9086552 | + 135627·965 | 25·6871 |
| Dholpur ..... | 95 31 59·966 | — 0·594 | .... | — 0·594 | 95 31 59·372 | 9·9979717 | 110416·203 | 20·9122 |
| $\mu^{XVIII}$..... | 30 20 24·174 | — 0·593 | .... | — 0·593 | 30 20 23·581 | 9·7034019 | Logs. 5·1323493 | |
| | 180 0 1·780 | — 1·780 | .... | — 1·780 | 180 0 0·000 | | 5·0430328 | |

No. 20.—Usira to $\mu^{XVIII} = (125660 \cdot 493 - 110416 \cdot 203) = 15244 \cdot 290$ Feet...Log. 4·1821072; Miles 2·8805.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XVIII}$..... | 30 20 24·174 | — 0·008 | .... | — 0·008 | 30 20 24·166 | 9·7034040 | + 13126·215 | 2·4860 |
| Usira..... | 59 39 35·850 | — 0·008 | .... | — 0·008 | 59 39 35·842 | 9·9360323 | 7682·652 | 1·4550 |
| $p^{II}$ ..... | 90 0 0·000 | — 0·008 | .... | — 0·008 | 89 59 59·992 | 10·0000000 | Logs. 4·1181395 | |
| | 180 0 0·024 | — 0·024 | .... | — 0·024 | 180 0 0·000 | | 3·8855112 | |

No. 21.—Usira to $p^{II} = 7682 \cdot 652$ Feet...Log. 3·8855112; Miles 1·4550.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $p^{II}$ ..... | 90 0 0·000 | — 0·007 | .... | — 0·007 | 89 59 59·993 | 10·0000000 | — 11801·057 | 2·2350 |
| Usira..... | 56 56 . 7·150 | — 0·007 | .... | — 0·007 | 56 56 7·143 | 9·9232726 | 14081·481 | 2·6669 |
| $\mu^{XIX}$ ..... | 33 3 52·871 | — 0·007 | .... | — 0·007 | 33 3 52·864 | 9·7368629 | Logs. 4·0719209 | |
| | 180 0 0·021 | — 0·021 | .... | — 0·021 | 180 0 0·000 | | 4·1486483 | |

No. 22.—Madhoni to $\mu^{XIX} = (14081 \cdot 481 + 120977 \cdot 139) = 135058 \cdot 620$ Feet...Log. 5·1305223; Miles 25·5793.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XIX}$ ..... | 33 3 52·871 | — 0·654 | .... | — 0·654 | 33 3 52·217 | 9·7368607 | + 113187·026 | 21·4369 |
| Madhoni ..... | 56 56 9·091 | — 0·654 | .... | — 0·654 | 56 56 8·437 | 9·9232744 | 73685·669 | 13·9556 |
| $p^{III}$..... | 90 0 0·000 | — 0·654 | .... | — 0·654 | 89 59 59·346 | 10·0000000 | Logs. 5·0537967 | |
| | 180 0 1·962 | — 1·962 | .... | — 1·962 | 180 0 0·000 | | 4·8673830 | |

No. 23.—Madhoni to $p^{II} = 73685 \cdot 669$ Feet...Log. 4·8673830; Miles 13·9556.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $p^{III}$..... | 90 0 0·000 | — 0·391 | .... | — 0·391 | 89 59 59·609 | 10·0000000 | — 67674·415 | 12·8171 |
| Madhoni ..... | 42 33 54·579 | — 0·391 | .... | — 0·391 | 42 33 54·188 | 9·8302208 | 100046·921 | 18·9483 |
| $\mu^{XX}$..... | 47 26 6·594 | — 0·391 | .... | — 0·391 | 47 26 6·203 | 9·8671793 | Logs. 4·8304245 | |
| | 180 0 1·173 | — 1·173 | .... | — 1·173 | 180 0 0·000 | | 5·0002037 | |

No. 24.—Rasia to $\mu^{XX} = (100046 \cdot 921 + 111896 \cdot 852) = 211943 \cdot 773$ Feet...Log. 5·3262207; Miles 40·1409.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XX}$..... | 47 26 6·594 | — 2·033 | .... | — 2·033 | 47 26 4·561 | 9·8671761 | + 166113·535 | 31·4609 |
| Rasia..... | 50 51 26·291 | — 2·033 | .... | — 2·033 | 50 51 24·258 | 9·8896210 | 157746·614 | 29·8763 |
| $\mu^{XXI}$ ..... | 81 42 33·215 | — 2·034 | .... | — 2·034 | 81 42 31·181 | 9·9954367 | Logs. 5·2204050 | |
| | 180 0 6·100 | — 6·100 | .... | — 6·100 | 180 0 0·000 | | 5·1979601 | |



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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 25.—Aring to $\mu^{xxi} = (157746 \cdot 614 - 116455 \cdot 886) = 41290 \cdot 728$ Feet...Log. 4·6158526; Miles 7·8202.

| Stations. | Angles Observed. | Corrections. e | Corrections. ϵ | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxi}$ ..... | 81° 42′ 33″·215 | — 0·152 | .... | — 0·152 | 81° 42′ 33″·063 | 9·9954372 | — 47226·000 | 8·9443 |
| Aring..... | 53 34 43·740 | — 0·151 | .... | — 0·151 | 53 34 43·589 | 9·9056199 | 58076·240 | 10·9993 |
| $\mu^{xxii}$ ..... | 44 42 43·499 | — 0·151 | .... | — 0·151 | 44 42 43·348 | 9·8472913 | Logs. 4·6741812 | |
| | 180 0 0·454 | — 0·454 | .... | — 0·454 | 180 0 0·000 | | 4·7639985 | |

No. 26.—Manpur to $\mu^{xxii} = (58076 \cdot 240 + 77729 \cdot 172) = 135805 \cdot 412$ Feet...Log. 5·1329171; Miles 25·7207.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxii}$ ..... | 44 42 43·499 | — 1·315 | .... | — 1·315 | 44 42 42·184 | 9·8472888 | + 175606·648 | 33·2588 |
| Manpur..... | 84 54 28·872 | — 1·316 | .... | — 1·316 | 84 54 27·556 | 9·9982824 | 124035·854 | 23·4916 |
| $\mu^{xxiii}$..... | 50 22 51·576 | — 1·316 | .... | — 1·316 | 50 22 50·260 | 9·8866586 | Logs. 5·2445409 | |
| | 180 0 3·947 | — 3·947 | .... | — 3·947 | 180 0 0·000 | | 5·0935473 | |

No. 27.—No to $\mu^{xxiii} = (124035 \cdot 854 - 120321 \cdot 525) = 3714 \cdot 329$ Feet...Log. 3·5698804; Miles 0·7035.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxiii}$..... | 50 22 51·576 | — 0·001 | .... | — 0·001 | 50 22 51·575 | 9·8866609 | — 4173·574 | 0·7904 |
| No..... | 71 51 56·482 | — 0·001 | .... | — 0·001 | 71 51 56·481 | 9·9778742 | 3382·944 | 0·6407 |
| $\mu^{xxiv}$..... | 57 45 11·945 | — 0·001 | .... | — 0·001 | 57 45 11·944 | 9·9272465 | Logs. 3·6205081 | |
| | 180 0 0·003 | — 0·003 | .... | — 0·003 | 180 0 0·000 | | 3·5292948 | |

No. 28.—Pahera to $\mu^{xxiv} = (3382 \cdot 944 + 135838 \cdot 344) = 139221 \cdot 288$ Feet...Log. 5·1437056; Miles 26·3677.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxiv}$..... | 57 45 11·945 | — 1·259 | .... | — 1·259 | 57 45 10·686 | 9·9272448 | + 136370·500 | 25·8277 |
| Pahera ..... | 60 2 57·487 | — 1·259 | .... | — 1·259 | 60 2 56·228 | 9·9377447 | 133113·000 | 25·2108 |
| $\mu^{xxv}$ ..... | 62 11 54·345 | — 1·259 | .... | — 1·259 | 62 11 53·086 | 9·9467299 | Logs. 5·1347204 | |
| | 180 0 3·777 | — 3·777 | .... | — 3·777 | 180 0 0·000 | | 5·1242205 | |

No. 29.—Karol to $\mu^{xxv} = (133113 \cdot 000 - 95392 \cdot 022) = 37720 \cdot 978$ Feet...Log. 4·5765830; Miles 7·1441.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxv}$ ..... | 62 11 54·345 | — 0·115 | .... | — 0·115 | 62 11 54·230 | 9·9467312 | — 43941·640 | 8·3293 |
| Karol..... | 66 5 53·114 | — 0·115 | .... | — 0·115 | 66 5 52·999 | 9·9610603 | 42515·479 | 8·0522 |
| $\mu^{xxvi}$..... | 51 42 12·886 | — 0·115 | .... | — 0·115 | 51 42 12·771 | 9·8947671 | Logs. 4·6428762 | |
| | 180 0 0·345 | — 0·345 | .... | — 0·345 | 180 0 0·000 | | 4·6285471 | |

No. 30.—Deri to $\mu^{xxvi} = (42515 \cdot 479 + 141645 \cdot 098) = 184160 \cdot 577$ Feet...Log. 5·2651967; Miles 34·8789.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxvi}$..... | 51 42 12·886 | — 1·926 | .... | — 1·926 | 51 42 10·960 | 9·8947641 | + 169946·508 | 32·1868 |
| Deri ..... | 59 24 47·442 | — 1·926 | .... | — 1·926 | 59 24 45·516 | 9·9349297 | 154934·000 | 29·3436 |
| $\mu^{xxvii}$ ..... | 68 53 5·450 | — 1·926 | .... | — 1·926 | 68 53 3·524 | 9·9698141 | Logs. 5·2303123 | |
| | 180 0 5·778 | — 5·778 | .... | — 5·778 | 180 0 0·000 | | 5·1901467 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

**No. 31.—Bostan to $\mu^{XXVII}$ = (154934·000 — 106329·539 = 48604·461 Feet...Log. 4·6866761; Miles 9·2054.**

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXVII}$ ..... | 68° 53′ 5″·450 | — 0·161 | .... | — 0·161 | 68° 53′ 5″·289 | 9·9698155 | — 45109·852 | 8·5435 |
| Bostan ..... | 52 26 43·048 | — 0·160 | .... | — 0·160 | 52 26 42·888 | 9·8991479 | 53080·985 | 10·0532 |
| $\mu^{XXVIII}$ ..... | 58 40 11·983 | — 0·160 | .... | — 0·160 | 58 40 11·823 | 9·9315526 | Logs. 4·6542714 | |
| | 180 0 0·481 | — 0·481 | .... | — 0·481 | 180 0 0·000 | | 4·7249390 | |

**No. 32.—Pir Ghyb to $\mu^{XXVIII}$ = (53080·985 + 112219·439) = 165300·424 Feet...Log. 5·2182740; Miles 31·3069.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXVIII}$ ..... | 58 40 11·983 | — 1·186 | .... | — 1·186 | 58 40 10·797 | 9·9315512 | + 107119·689 | 20·2878 |
| Pir Ghyb ..... | 39 51 24·580 | — 1·186 | .... | — 1·186 | 39 51 23·394 | 9·8067679 | 142774·823 | 27·0407 |
| $\mu^{XXIX}$ ..... | 82 28 26·995 | — 1·186 | .... | — 1·186 | 81 28 25·809 | 9·9951735 | Logs. 5·0298684 | |
| | 180 0 3·558 | — 3·558 | .... | — 3·558 | 180 0 0.000 | | 5·1546517 | |

**No. 33.—Dateri to $\mu^{XXIX}$ = (142774·823 — 140877·894) = 1896·929 Feet...Log. 3·2780511; Miles 0·3593.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXIX}$ ..... | 81 28 26·995 | — 0·001 | .... | — 0·001 | 81 28 26·994 | 9·9951739 | — 2625·507 | 0·4973 |
| Dateri ..... | 59 51 28·489 | — 0·000 | .... | — 0·000 | 59 51 28·489 | 9·9369070 | 3002·480 | 0·5687 |
| $\mu^{XXX}$ ..... | 38 40 4·517 | — 0·000 | .... | — 0·000 | 38 40 4·517 | 9·7957449 | Logs. 3·4192132 | |
| | 180 0 0·001 | — 0·001 | .... | — 0·001 | 180 0 0·000 | | 3·4774801 | |

**No. 34.—Dholri to $\mu^{XXX}$ = (3002·480 + 86607·380) = 89609·860 Feet...Log. 4·9523558; Miles 16·9716.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXX}$ ..... | 38 40 4·517 | — 0·414 | .... | — 0·414 | 38 40 4·103 | 9·7957439 | + 94301·364 | 17·8601 |
| Dholri ..... | 74 49 28·746 | — 0·414 | .... | — 0·414 | 74 49 28·332 | 9·9845852 | 61048·741 | 11·5623 |
| $\mu^{XXXI}$ ..... | 66 30 27·979 | — 0·414 | .... | — 0·414 | 66 30 27·565 | 9·9624230 | Logs. 4·9745180 | |
| | 180 0 1·242 | — 1·242 | .... | — 1·242 | 180 0 0·000 | | 4·7856767 | |

**No. 35.—Saini to $\mu^{XXXI}$ = (108017·597 — 61048·741) = 46968·856 Feet...Log. 4·6718100; Miles 8·8956.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXXI}$ ..... | 66 30 27·979 | — 0·142 | .... | — 0·142 | 66 30 27·837 | 9·9624233 | + 42012·249 | 7·9569 |
| Saini ..... | 51 53 25·962 | — 0·142 | .... | — 0·142 | 51 53 25·820 | 9·8958824 | 48968·511 | 9·2743 |
| $\mu^{XXXII}$ ..... | 61 36 6·485 | — 0·142 | .... | — 0·142 | 61 36 6·343 | 9·9443164 | Logs. 4·6233760 | |
| | 180 0 0·426 | — 0·426 | .... | — 0·426 | 180 0 0·000 | | 4·6899169 | |

**No 36.—Saroli to $\mu^{XXXII}$ = (97016·890 — 48968·511) = 48048·379 Feet...Log. 4·6816787; Miles 9·1001.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXXII}$ ..... | 61 36 6·485 | — 0·264 | .... | — 0·264 | 61 36 6·221 | 9·9443163 | + 79731·035 | 15·1106 |
| Saroli ..... | 81 46 57·828 | — 0·265 | .... | — 0·265 | 81 46 57·563 | 9·9955181 | 70863·980 | 13·4212 |
| $\mu^{XXXIII}$ ..... | 36 36 56·480 | — 0·264 | .... | — 0·264 | 36 36 56·216 | 9·7755694 | Logs. 4·9016274 | |
| | 180 0 0·793 | — 0·793 | .... | — 0·793 | 180 0 0·000 | | 4·8504256 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

**No. 37.—Begarazpur to $\mu^{xxxiii}$ = (95289·767 — 70863·980) = 24425·787 Feet...Log. 4·3878486; Miles 4·6261.**

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxxiii}$ ..... | 36° 36′ 56″·480 | — 0·076 | .... | — 0·076 | 36° 36′ 56″·404 | 9·7755699 | + 66892·315 | 12·6690 |
| Begarazpur ..... | 126 15 38·849 | — 0·077 | .... | — 0·077 | 126 15 38·772 | 9·9065147 | 49480·200 | 9·3713 |
| $\mu^{xxxiv}$ ..... | 17 7 24·900 | — 0·076 | .... | — 0·076 | 17 7 24·824 | 9·4689870 | Logs. 4·8253763 | |
| | 180 0 0·229 | — 0·229 | .... | — 0·229 | 180 0 0·000 | | 4·6944315 | |

**No. 38.—Kaliana to $\mu^{xxxiv}$ = (52873·873 — 49480·200) = 3393·673 Feet...Log. 3·5306700; Miles 0·6427.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxxiv}$ ..... | 17 7 24·900 | — 0·000 | .... | — 0·000 | 17 7 24·900 | 9·4689875 | + 3243·239 | 0·6142 |
| Kaliana ..... | 72 52 35·101 | — 0·000 | .... | — 0·000 | 72 52 35·101 | 9·9803089 | 999·212 | 0·1892 |
| $p^{iv}$ ..... | 90 0 0·000 | — 0·001 | .... | — 0·001 | 89 59 59·999 | 10·0000000 | Logs. 3·5109789 | |
| | 180 0 0·001 | — 0·001 | .... | — 0·001 | 180 0 0·000 | | 2·9996575 | |

**No. 39.—Kaliana to $\mu^{xxxiv}$ = (52873·873 — 49480·200) = 3393·673 Feet...Log. 3·5306700; Miles 0·6427.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxxiv}$ ..... | 17 7 24·900 | — 0·000 | .... | — 0·000 | 17 7 24·900 | 9·4689875 | + 3733·559 | 0·7071 |
| Kaliana ..... | 99 0 50·328 | — 0·001 | .... | — 0·001 | 99 0 50·327 | 9·9946031 | 1113·031 | 0·2108 |
| $\mu^{xxxv}$ ..... | 63 51 44·773 | — 0·000 | .... | — 0·000 | 63 51 44·773 | 9·9531501 | Logs. 3·5721230 | |
| | 180 0 0·001 | — 0·001 | .... | — 0·001 | 180 0 0·000 | | 3·0465074 | |

**No. 40.—Godhna to $\mu^{xxxv}$ = (88174·940 — 1113·031) = 87061·909 Feet...Log. 4·9398281; Miles 16·4890.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxxv}$ ..... | 63 51 44·773 | — 0·884 | .... | — 0·884 | 63 51 43·889 | 9·9531492 | + 144200·863 | 27·3108 |
| Godhna ..... | 79 41 44·000 | — 0·884 | .... | — 0·884 | 79 41 43·116 | 9·9929378 | 131576·788 | 24·9199 |
| $\mu^{xxxvi}$ ..... | 36 26 33·878 | — 0·883 | .... | — 0·883 | 36 26 32·995 | 9·7737980 | Logs. 5·1589679 | |
| | 180 0 2·651 | — 2·651 | .... | — 2·651 | 180 0 0·000 | | 5·1191793 | |

**No. 41.—Nojhili to $\mu^{xxxvi}$ = (131576·788 — 121608·784) = 9968·004 Feet...Log. 3·9986082; Miles 1·8879.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxxvi}$ ..... | 36 26 33·878 | — 0·005 | .... | — 0·005 | 36 26 33·873 | 9·7738004 | — 12355·740 | 2·3401 |
| Nojhili ..... | 89 46 41·390 | — 0·006 | .... | — 0·006 | 89 46 41·384 | 9·9999967 | 7339·600 | 1·3901 |
| $\mu^{xxxvii}$ ..... | 53 46 44·749 | — 0·006 | .... | — 0·006 | 53 46 44·743 | 9·9067362 | Logs. 4·0918687 | |
| | 180 0 0·017 | — 0·017 | .... | — 0·017 | 180 0 0·000 | | 3·8656724 | |

**No. 42.—Dhoiwala to $\mu^{xxxvii}$ = (7339·600 + 141255·391) = 148594·991 Feet...Log. 5·1720042; Miles 28·1430.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{xxxvii}$ ..... | 53 46 44·749 | — 1·792 | .... | — 1·792 | 53 46 42·957 | 9·9067334 | + 190663·966 | 36·1106 |
| Dhoiwala ..... | 76 51 8·616 | — 1·792 | .... | — 1·792 | 76 51 6·824 | 9·9884632 | 157956·980 | 29·9161 |
| $\mu^{xxxviii}$ ..... | 49 22 12·011 | — 1·792 | .... | — 1·792 | 49 22 10·219 | 9·8801988 | Logs. 5·2802686 | |
| | 180 0 5·376 | — 5·376 | .... | — 5·376 | 180 0 0·000 | | 5·1985388 | |

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## COMPUTATION OF MERIDIONAL TRIANGLES.

No. 43.—Amsot to $\mu^{XXXVIII}$ (157956·980 — 144394·996) = 13561·984 Feet...Log. 4·1323232; Miles 2·5686.

| Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Feet. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXXVIII}$ ..... | 49° 22′ 12″·011 | — 0·010 | .... | — 0·010 | 49° 22′ 12″·001 | 9·8802020 | — 12390·997 | 2·3468 |
| Amsot ..... | 59 42 30·820 | — 0·010 | .... | — 0·010 | 59 42 30·810 | 9·9362477 | 10890·820 | 2·0627 |
| $\mu^{XXXIX}$ ..... | 70 55 17·199 | — 0·010 | .... | — 0·010 | 70 55 17·189 | 9·9754646 | Logs. 4·0931063 | |
| | 180 0 0·030 | — 0·030 | .... | — 0·030 | 180 0 0·000 | | 4·0370606 | |

No. 44.—Banog to $\mu^{XXXIX}$ (10890·820 + 109344·203) = 120235·023 Feet...Log. 5·0800310; Miles 22·7718.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\mu^{XXXIX}$ ..... | 70 55 17·199 | — 0·350 | .... | — 0·350 | 70 55 16·849 | 9·9754643 | + 39300·918 | 7·4434 |
| Banog ..... | 19 4 43·851 | — 0·350 | .... | — 0·350 | 19 4 43·501 | 9·5143717 | 113630·603 | 21·5209 |
| $p^{V}$ ..... | 90 0 0·000 | — 0·350 | .... | — 0·350 | 89 59 59·650 | 10·0000000 | Logs. 4·5944027 | |
| | 180 0 1·050 | — 1·050 | .... | — 1·050 | 180 0 0·000 | | 5·0554953 | |
| | | | | | | | Logs. | |
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## Series A. SYNOPSIS

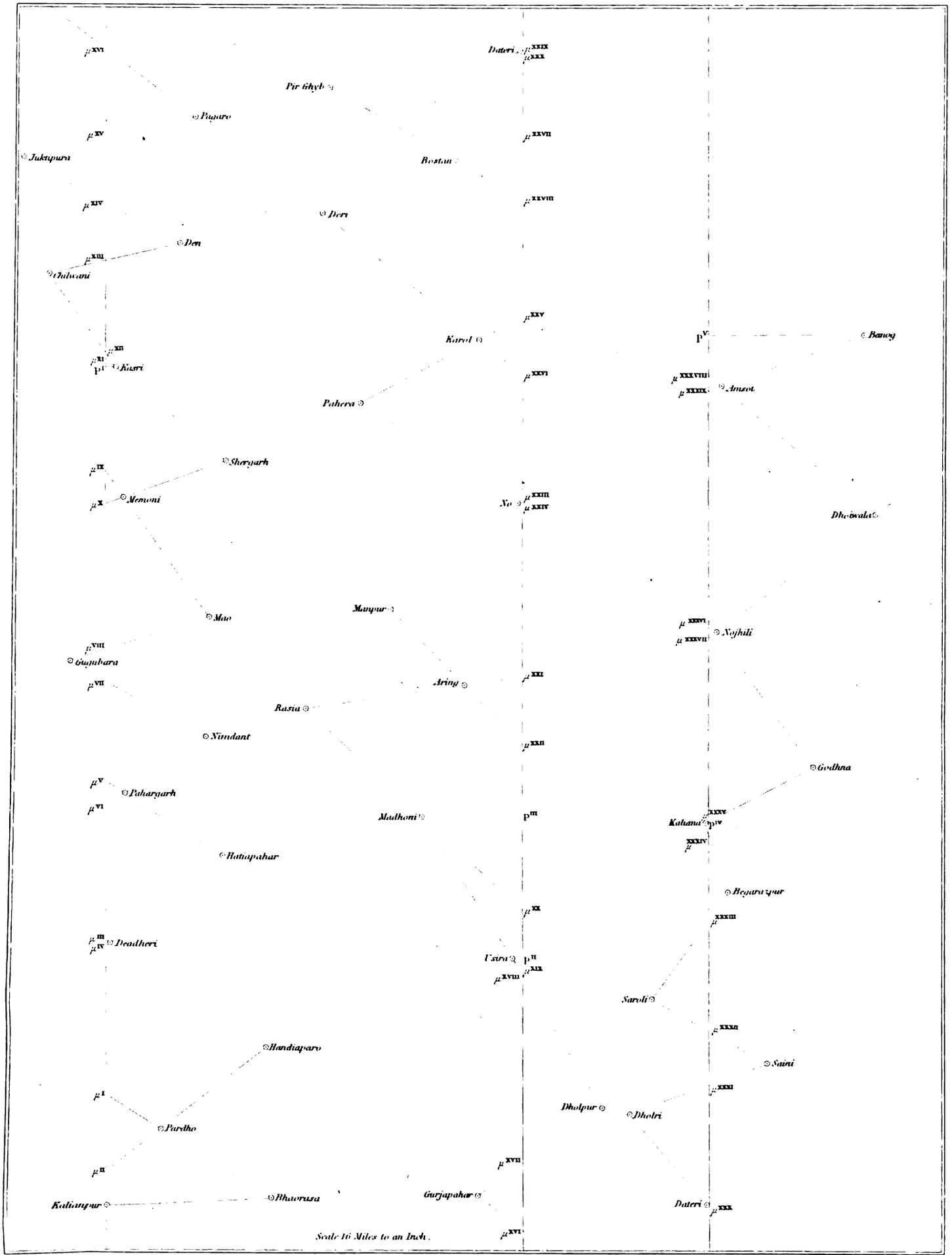
Shewing the length of the Terrestrial Arc in feet, comprised between the parallels of Kalianpur and Kaliana.

| No. | Points of Intersection. | Positive Distances. | Negative Distances. | Results. |
|---|---|---|---|---|
| | | + | − | |
| 1 | Kalianpur to $\mu^{I}$ ..... | 78993·100 | | |
| 2 | $\mu^{I}$ ... $\mu^{II}$ ..... | | 53204·174 | |
| 3 | $\mu^{II}$ ... $\mu^{III}$ ..... | 164528·038 | | 304969·223 |
| 4 | $\mu^{III}$ ... $\mu^{IV}$ ..... | | 4938·479 | |
| 5 | $\mu^{IV}$ ... $\mu^{V}$ ..... | 118890·738 | | |
| 6 | $\mu^{V}$ ... $\mu^{VI}$ ..... | | 17782·494 | |
| 7 | $\mu^{VI}$ ... $\mu^{VII}$ ..... | 90318·962 | | |
| 8 | $\mu^{VII}$ ... $\mu^{VIII}$ ..... | 22495·673 | | |
| 9 | $\mu^{VIII}$ ... $\mu^{IX}$ ..... | 128257·147 | | 297121·144 |
| 10 | $\mu^{IX}$ ... $\mu^{X}$ ..... | | 21907·376 | |
| 11 | $\mu^{X}$ ... $\mu^{XI}$ ..... | 102857·688 | | |
| 12 | $\mu^{XI}$ ... $p^{I}$ ..... | | 7118·456 | |
| 13 | $p^{I}$ ... $\mu^{XII}$ ..... | 11333·694 | | |
| 14 | $\mu^{XII}$ ... $\mu^{XIII}$ ..... | 66071·630 | | |
| 15 | $\mu^{XIII}$ ... $\mu^{XIV}$ ..... | 41598·568 | | |
| 16 | $\mu^{XIV}$ ... $\mu^{XV}$ ..... | 47346·643 | | 427079·326 |
| 17 | $\mu^{XV}$ ... $\mu^{XVI}$ ..... | 62479·300 | | |
| 18 | $\mu^{XVI}$ ... $\mu^{XVII}$ ..... | 49495·311 | | |
| 19 | $\mu^{XVII}$ ... $\mu^{XVIII}$ ..... | 135627·965 | | |
| 20 | $\mu^{XVIII}$ ... $p^{II}$ ..... | 13126·215 | | |
| 21 | $p^{II}$ ... $\mu^{XIX}$ ..... | | 11801·057 | |
| 22 | $\mu^{XIX}$ ... $p^{III}$ ..... | 113187·026 | | |
| 23 | $p^{III}$ ... $\mu^{XX}$ ..... | | 67674·415 | 328205·737 |
| 24 | $\mu^{XX}$ ... $\mu^{XXI}$ ..... | 166113·535 | | |
| 25 | $\mu^{XXI}$ ... $\mu^{XXII}$ ..... | | 47226·000 | |
| 26 | $\mu^{XXII}$ ... $\mu^{XXIII}$ ..... | 175606·648 | | |
| 27 | $\mu^{XXIII}$ ... $\mu^{XXIV}$ ..... | | 4173·574 | |
| 28 | $\mu^{XXIV}$ ... $\mu^{XXV}$ ..... | 136370·500 | | |
| 29 | $\mu^{XXV}$ ... $\mu^{XXVI}$ ..... | | 43941·640 | 320211·631 |
| 30 | $\mu^{XXVI}$ ... $\mu^{XXVII}$ ..... | 169946·508 | | |
| 31 | $\mu^{XXVII}$ ... $\mu^{XXVIII}$ ..... | | 45109·852 | |
| 32 | $\mu^{XXVIII}$ ... $\mu^{XXIX}$ ..... | 107119·689 | | |
| 33 | $\mu^{XXIX}$ ... $\mu^{XXX}$ ..... | | 2625·507 | |
| 34 | $\mu^{XXX}$ ... $\mu^{XXXI}$ ..... | 94301·364 | | |
| 35 | $\mu^{XXXI}$ ... $\mu^{XXXII}$ ..... | 42012·249 | | |
| 36 | $\mu^{XXXII}$ ... $\mu^{XXXIII}$ ..... | 79731·035 | | 283554·681 |
| 37 | $\mu^{XXXIII}$ ... $\mu^{XXXIV}$ ..... | 66892·315 | | |
| 38 | $\mu^{XXXIV}$ ... $p^{IV}$ ..... | 3243·239 | | |
| 39 | $p^{IV}$ ... $p^{IV}_{(1)}$ ..... | | 0·014 | |

| | |
|---|---|
| Length of the Arc deduced from Seronj Base ..... | 1961141·742 |
| Add correction for 24·5 feet difference of height ..... | + 2·295 |
| Add correction $\eta$ as explained in Introduction page clxxi ..... | 13·080 |
| Total Terrestrial Arc from a mean of the two Bases in feet ..... | 1961157·117 |

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*Sketch illustrative of the Projections on the Meridian of Kaliaupur*
*of the principal triangles of the Section Kaliaupur to Kaliana.*




*Drawn at the Field Office of the Survey or General of India at Hattapaon.*

*Engraved by S. Stockley.*

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# DESCRIPTION

OF

# PRINCIPAL STATIONS

OF

# SERIES A.

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# DESCRIPTION OF PRINCIPAL STATIONS.

## SERIES A.

### KALIANPUR.

THE station of observation is situated on a flat elevated ridge of iron-clay formation locally called Bhuri Tori, which skirts the Seronj valley to the S.W. and North, and is bounded by the villages of Kalianpur to the South about a mile; Jelalpur to the S.W. about a mile; Bandera to the N.W. about $1\frac{1}{2}$ miles; and the city of Seronj S.E. about 2 miles.

The site of the station was chosen in 1824 and marked by a circular platform of solid masonry, in the centre of which a stone was fixed having a circle and point inscribed on it. This platform was found entire when revisited in 1836-37. The masonry was subsequently raised 2 feet above the level of the original surface because the material of which this latter was composed had become so exceedingly hard that, in endeavouring to cut out an annulus of separation, the edges of the tools were almost instantaneously blunted, so that it was considered the foundation for a further superstructure, while at the same time the old pile which was circular was enclosed in a square duly oriented of $14\frac{1}{2}$ feet side. There are two meridional pillars connected with this station, one to the North at the distance of 5773·9 feet, and one to the South at the distance of 6056·8 feet, on both of which the direction of the meridian has been accurately laid down.

### KALIANPUR OBSERVATORY.

Besides the platform which defines the principal station of Kalianpur and its two meridional pillars, another site is fixed due West at the distance of 40·591 feet for the astronomical observations. A pillar 4 feet 5 inches in diameter and 4 feet 4 inches deep was built of solid masonry below the ground as a foundation, having a stone pillar 4 feet 1 inch in length, into which a piece of brass marked with a dot has been let in to define the station; above this station a pillar was built 3 feet high and 4 feet in diameter for the astronomical circle to stand on; this pillar is isolated with respect to the floor by means of a groove round it of 12 inches deep and 5 inches broad, and a hollow cylindrical space of 4 inches diameter runs vertically through the pillar in order to allow the instrument to be centered over the dot on the ground below. There are two meridional



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pillars connected with this station at the same distance as those built for the principal station of observation, on which also the direction of the meridian has been accurately laid down.

## KAMKHERA.

This station was originally marked in 1824. On revisiting it in 1837, previous to taking any observations, an isolated pillar was raised 6 feet higher and the old circular pile was enclosed within a square pile of 25 feet side at the base, and a slope of 4 inches per foot raised to a level with the isolated pillar. There are in all 4 stones laid in this platform, which are marked and centered one above the other in the usual manner; the station will be found on the eastern extremity of the elevated lands lying to the East of Kam Khera about $1\frac{1}{2}$ mile, South of Ladhora about 2 miles, North of Kua about 2 miles, and N.W. of Imlani, 2 miles; it is in the pargana of Seronj and in the lands subject to the zemindar of the last-named village.

## S.W. END OF THE BASE.

This was originally marked in December 1824 by a prismatic stone sunk endwise to a level with the ground, over which, after the measurement of the base, was built a cylindrical pile of solid masonry 2 feet high and 4 feet diameter, in the upper surface of which an upper stone was imbedded, each stone having the usual circle and centre engraved on it, and the upper centre normally adjusted above the lower. In the subsequent visit of 1836-37 the masonry was enclosed by a square pile of earth to make room for the observer and tent; the upper mark stone of this station was also taken out and the lower one examined after the observations were concluded; the upper stone was then replaced and adjusted accurately over the lower one.

This station is in the territories of the Nawab of Tonk* and in the pargana of Seronj, and is bounded by the villages of Rusali to the N.N.W. 3·5 miles, Eklaod and Kachpura to the N.E. 3 miles, Bania-dhana, and Ekodia to the S.E. 1·3 miles, Bamankheri to the N.W. 1·2 miles, and Parsora to the West 1·1 miles, perambulator distances. The station is in the cultivated lands of the last-mentioned village.

## N.E. END OF THE BASE.

The North East end of the base line was originally marked in November 1824 by a prismatic stone sunk endwise to a level with the surface of the ground; after the measurement of the base a circular pile of solid masonry was raised over it 2 feet high and $7\frac{1}{4}$ feet in diameter in the centre of which a stone was imbedded, which, as well as that below, had the usual centre and circle inscribed on it, the one placed vertically over the other. On revisiting the spot in January 1837 the centre of the pile 2 feet in diameter was isolated for the instrument, and the whole enclosed in a square pile. After

* The chieftain here spoken of is the son and heir of the celebrated Pindari chief Amir Khan, whose highly interesting autobiographical memoirs have been translated by Mr. H. T. Prinsep.

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the observations the upper centre stone was taken out and the lower one examined and the difference having been duly noticed in the Angle book, the upper mark stone was again imbedded and accurately adjusted over the lower centre mark.

The station is in the territories of the Nawab of Tonk and in the pargana of Seronj and is surrounded by the villages of Tal Barodia to the N.E. 1·5 miles, Thanarpur, Binchakheri to the E.S.E. 1·2 miles, Sialpur to the South 1·7 miles, and Rajpur to the West 0·7 miles, perambulator distances. To the zemindary of the last-mentioned villages the station belongs and lies on the cultivated lands.

## BHAORASA.

This station is on a low ridge of sandstone, and it was here that the operations of the Great Meridional Arc were terminated subsequent to the measurement of the base line near Seronj in 1824. The station was then defined by a circular platform of loose stones, with the usual marked stones, one imbedded in the ground and another in the upper surface of the platform, the centres of which were made to correspond with each other. In the progress of the operations in January 1837, this station was revisited and the upper mark stone was removed in order to examine the dot below, which was found to differ $\frac{3}{4}$ of an inch from the sinking of the platform. The upper stone was again re-adjusted truly over the lower dot and a square pile was raised of hewn stones 9 feet high and 25 feet square at the base, inclining upwards of $\frac{1}{4}$ of an inch to every foot of height. The pillar for the instrument, 4 feet in diameter, was isolated by a groove of 5 inches, in the centre of which another mark stone was laid and made to correspond with the lower centres, marked in the usual manner by a circle and point, to denote the point on which the plummet of the instrument was suspended during the observations. Bhaorasa is a place well known in the neighbourhood as having been the site of an ancient city, but which is now a complete heap of ruins: the eastern part of the hill however though very poorly inhabited, still retains the name, which is that of a pargana subject to Malhargarh in the Gwalior territory. There are several small villages in the vicinity of this station; Bherkheri to the N.W. about 2 miles, Kiria to the N.E. about 2 miles, Salitra to the S.S.W. about 2 miles, and Sarkandi to the West about 2 miles.

## SURANTAL.

This station is also on an extensive range of flat hills running North and South, and apparently connected with that of Kalianpur. On the highest swell this station is marked by a circular platform of solid masonry with a stone fixed in the centre having a circle and point cut on it, around which a square pile of loose stones was built to afford space for the observers. The village of Surantal lies to the N.N.E. about 2 miles, Bimakheri to the S.W. about $1\frac{1}{2}$ mile, and Sorokho to the S.S.W. about 2 miles. The station derives its proper name from a tank (tal) and the ruins of a village a few hundred yards to the S.E. of the station.

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## PARDHO.

This station is on a range of flat hills lying about 2 miles North of the village of that name and about two miles North of Sungai in the Seronj territory, and apparently on the same ridge on which Kalianpur and Surantal are situated. It is marked by a high square platform having stones sunk above and below with the usual circle and point engraved on them; an isolated pillar 4 feet in diameter was constructed in the usual manner.

## HANDIAPARO or JAKLON.

This station is on a long range of flat hills or table lands running North and South and connected with the high lands of Pardho and Surantal in a south westerly direction, and with the Chenderi flats in a north easterly direction. The station is defined by a platform 25 feet square and 7 feet high having a stone imbedded in the ground, and two others above, placed over each other, marked with a circle and point and made to correspond with the dot below. The central pillar 4 feet in diameter is isolated with the usual annulus round it. There are several villages around this hill, viz. Jaklon and Nandenkhera to the East about 2 miles, Bherkheri to the S.E. about 3 miles, Jaroli to the S.S.E. about $2\frac{1}{2}$ miles, Harokheri South about 3 miles, Thamasa and Khar to the West about 2 miles, and Bhansakhera to the N.N.W. about 3 miles. This station is in the territories of Gwalior in the pargana of Mugaoli and in the lands subject to the small village of Jaklon.

## DEADHERI.

This station is on a low detached hill in the Gwalior territories, about 4 miles N.E. of the town of Shadaora and about $6\frac{1}{2}$ miles N.W. of the large village and fort of Puchar. The village from which the station takes its name is on the eastern brow, and well known in the neighbourhood as being the residence of a Mohant and a horde of Saniasis. There are several large Tamarind trees on the top of this hill which could be only partially cleared away from religious objections on the part of the occupants. The station is marked by a square platform about 5 feet high, having a stone sunk in the ground with a point and circle engraved and another fixed above, their centres corresponding with each other and situated a few hundred yards S.W. of the Mohant's building. The central pillar 4 feet in diameter was isolated in the usual manner.

## HATIAPAHAR.

This station is on a commanding eminence, which rises above the high lands or ridge of flat hills lying about 2 miles S.W. of Isagarh, and is marked by a square platform raised of loose stones 20 feet side, and 4 feet high. There are 3 stones laid in this pile, one above the other, all marked with a circle and point engraved on them, and their centres adjusted normally over each other. The pillar 4 feet in diameter in the middle,

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was isolated. The village of Piproda lies to the North about 2 miles, Jamdela to the S.E. about 3 miles, Amjera to the South about 2 miles, and Dhakoni a large village to the S.W. about 5 miles.

## BHERKHERI.

This station is on the highest point of a low mass of hills about 3 miles S.W. of the village of Chandona and about 4 miles South of the fortress of Bijrawan in the Gwalior territories. The station is marked by a square platform having a stone sunk into the ground and another fixed on the top with a circle and point inscribed on them, and derives its name from a ruined village about 1 mile S.E. of the station. An isolated pillar 4 feet in diameter was constructed for the large theodolite.

## PAHARGARH.

This station is on the highest point of a flat sandstone ridge to the N.W. of the village of Barodia about a mile, S.W. of Pironf 2 miles, and about a mile S.E. of Mangrora in the Gwalior territories. The station is marked by a square platform having a marked stone fixed on top and another sunk in the ground. In the centre the pillar for the instrument has been isolated. The station derives its name from a ruined village at the S.E. extremity of this flat.

## NIMDANT or RANOD.

This station is marked by a square platform raised of loose stones 20 feet at the sides and 5 feet high. In the centre the pillar for the instrument 4 feet in diameter has been isolated by a groove of 4 inches. There are 4 stones in this pile one imbedded in the ground and one on the upper surface of the platform and two between, all marked with a circle and point engraved on them and laid vertically, one above the other, and adjusted over the lower centre by a plumb line. The station will be found on the eastern extremity of a range of flat topped hills running S.Westerly and about 2 miles South of the well known fort and town of Ranod sometimes called Narod. The village of Bada Paharo is on the East about $1\frac{1}{2}$ mile, Chota Paharo on the S.E. about $1\frac{1}{2}$ mile, Sakrera on the S.S.E. about 3 miles, Bedmao on the South about $1\frac{1}{2}$ mile, and Karila on the N.N.W. about $\frac{1}{2}$ mile. The station belongs to the village of Karila in the Gwalior territory and pargana of Ranod; a road was cut and cleared of impediments on the North side.

## GUGUBARA.

This station is situated on a low flat range of sandstone about $2\frac{1}{2}$ miles S.W. of the large fortified town of Kolaras, $2\frac{1}{2}$ miles North of the hill fort of Ukawal, and 3 miles East of that of Rai. Its name is that of a village formerly occupying the summit, in the midst of the ruins of which the station is selected. The town of Kolaras is well known, being one of the principal parganas in the Gwalior territory and situated on the great road which passes from that city to Seronj.



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The site of the station is marked on the solid rock in situ in the usual manner, and a square platform has been erected 5 feet high with an isolated pillar of 4 feet diameter in the middle. The approximate site called the Kolaras station is at a distance of 192¼ feet N.W. of that used in the final operations, set off on a ray which makes an angle at the latter of 30° 12′ 23″ with the ray to Memoni.

## MAO.

This station is defined by a square platform 18 feet side and 6 feet high. In the centre the pillar for the instrument 4 feet in diameter has been isolated by an annulus of 4 inches having a stone fixed on a level with the upper surface of the pile and another imbedded in the ground, which are marked and centered in the usual manner. This station will be found on a detached flat topped hill. The small village of Mao lies to the West about a mile; the fort and town of Kenwai to the N.W. about 3 miles, Kundulpur fort situated on the ridge to the West about 2 miles and Machmor to the South about 3 miles. The station is in the dominions of the Raja of Jhansi and in the pargana of Kenwai.

## MEMONI.

This station is defined by a square platform 7½ feet high marked in the usual manner, it is situated on an eminent point in the eastern border of an extensive table land, in which the river Parbati takes its rise. The village of Memoni now nearly deserted is about 2 miles South. The cantonment of Sipri is distant about 7 miles in the same direction.

## SHERGARH.

This station is on a lofty isolated hill of sandstone, being an outlier of the Bindrachel range which runs a little to the West. The ruined fort and village of Shergarh lie 2 miles North in the plains, Narwar is North and 4 miles distant; a platform 6½ feet high has been built over this station marked at top and bottom with the usual centre stones.

## KASRI.

This station is on an eminent part of the range which forms the southern boundary of the valley of the Parbati. It is called after a ruined village about 1½ mile South. The large village of Gopalpur is about 4¾ miles S.W. The upper road from Gwalior *viâ* Sipri to the Dekhan runs through this village and skirts the Kasri hill; a platform is built here and marked in the usual manner.

## DHOBAI.

This station is situated on the eastern edge of the Bindrachel range, Dhobai village is in the plain about 1½ mile S.E., Karaya 4·1 miles S.S.E. The village of Dhobai is

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on the high road between Gwalior and Narwar. A small platform is built here and marked in the usual manner with central stones at top and bottom.

## RAIPUR.

This station is on a lofty conical peak surmounted by a Hindu temple and is in the vicinity of Gwalior being about $9\frac{1}{2}$ miles S.W. of it. The village of Raipur is $1\frac{1}{2}$ mile S.W. A small platform is built over the station marked with central stones in the usual manner. A station belonging to the Budhon meridional series is also on this hill situated East of the Great Arc station, the temple being situated between the two stations.

## DEN.

This station is situated on a lofty detached hill of sandstone, capped with a mass of iron clay about 150 feet thick. The village of Den is $1\frac{1}{2}$ mile N.E. and in the pargana of Rent, the fort of which name is about $2\frac{1}{2}$ miles S.E. The town of Doa is 6·5 miles N.E. The Den hill is locally called Daotora. The station is marked in the usual manner with central stones at top and bottom of the platform.

## CHILWANI.

The station of Chilwani is on the highest point of an extensive ridge of flat land, having the village from which it derives its name about $\frac{3}{4}$ of a mile to the North and Dongarpur about a mile to the South. The platform is 15 feet square and 6 feet in height, having an isolated pillar of 4 feet diameter in the middle. The station belongs to Chilwani village, which is in the pargana of Gaswani in the Gwalior territory. Water is here very scarce, there being only a small well and nala about a mile to the N.W. of the station. The station is marked in the usual manner with centre stones at top, middle and bottom.

## JUKTIPURA.

This station is on the eastern extremity of a range of flat hills running N.E. and S.W. known by the name of the Sabalgarh range. It is marked by a low platform of the usual dimensions having a marked stone with circle and centre engraved on it, embedded and adjusted normally with the mark cut in the rock in situ below. Juktipura, a small village from which the station derives its name, is to the West about a mile. The fortress and town of Sabalgarh is to the N.N.W. about 6 miles, Jelalpur is to the S.E. about a mile and Tailori is to the S.W. about a mile; the ascent to the summit is on the eastern side where a road has been partially cut. This station is in the pargana of Sabalgarh in the Gwalior territory.

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## PAGARO.

This station is on the highest point of a cluster of bluff peaks; on the western brow of that selected lies the small village of Pagaro from which the station is named. It is denoted by a square platform of 15 feet side having the usual central stone at top corresponding to a similar one imbedded below. There is a high temple adjoining the platform on the N.N.Eastern side dedicated to Koradeo; the village of Dararo is about a mile to the N.W. Basai is about 3 miles to the S.W. The ascent is on the S.Western side rugged and steep and not traced in the usual manner.

## DHOLPUR.

This station is situated on the eastern flank of the same range of hills with Gurja station, known by the name of Kalapahar which runs East and West along the northern bank of the Chambal river, and terminates in low ridges and isolated flats from $2\frac{1}{2}$ to 5 miles N.W. of the town of Dholpur. The station will be found on a conspicuous swell of this mass of hills about 5 miles to the S.W. of the town of Dholpur, about 4 miles South of the cantonment of the Dholpur Rana, and about 3 miles North of the river Chambal. It is defined by a square platform of the usual dimensions in the centre of which a stone has been imbedded to the level of the surface, with a circle and centre engraved upon it and another sunk in the ground below, both being adjusted normally one above the other, so that their centres may exactly coincide.

## GURJAPAHAR.

This station is defined by a platform 20 feet square and $3\frac{1}{2}$ feet in height. In the centre a pillar 4 feet in diameter has been isolated by an annulus of 4 inches in width, having a stone imbedded on a level with the platform marked with a centre and circle corresponding to the centre marked on the rock in situ below. The station is situated on an extensive range of hills, running East and West, which overhangs the Chambal in the Dholpur district, and it takes its name from a small village North of it about $\frac{3}{4}$ of a mile called Gurja or Sona Gurja. The villages of Sewar and Pali immediately on the North bank, lie about $3\frac{1}{2}$ miles S.E. of the station; to the West it has the villages of Madarpur, Bejoli, Barwai in the Karoli district. A road has been cut from the village of Gurja to the station.

## NINDHAR.

This station is upon the summit of a high isolated hill of sandstone. The village lies at the North foot of the hill. The river Chambal flows about 3 miles South and a lofty range of sandstone passes about 6 miles to the North, stretching N.E. and S.W. as far as the eye can reach. Nindhar station is on a detached part of this range, the country round is bleak and barren and much intersected by ravines, which feature is common to all the land bordering on the Chambal. The fort of Mandrel on the banks

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of the Chambal bears $3\frac{1}{4}$ miles S.W.; a platform is built over this station with the usual mark stones at top and bottom.

## MACHI.

This station is upon a low sandstone ridge forming the north boundary of the Karoli valley. The hill is easy of ascent on the North, but on the South it is precipitous. The country on all sides is bleak and barren and much intersected with ravines. The town of Karoli lies about 8 miles to the S.E. of the station; a platform is built over the station with the usual marked central stones at top and bottom to denote the station.

## USIRA.

This station is on a shelving range of rocky hills running North-East and South-West. There are several villages on the North and South sides of this range; on the former lies the village of Khand about 2 miles N.N.E., Kheri about a mile N.N.W., and Samli about 2 miles N.W. in the pargana of Rupbas, and subject to the Raja of Bhartpur; on the latter lie the village of Usira close under the station and in a Westerly direction, Nagla about a mile to the South, and Pipret about a mile South-Easterly, subject to the pargana of Jagner. This station is marked by a square platform of $16\frac{1}{2}$ feet side and in height $4\frac{1}{2}$ feet, having an isolated pillar in the middle, of 4 feet in diameter, in the centre of which a marked stone has been placed and made to correspond with the centre marked below on the rock in situ.

## DIMDIMA.

This station is situated on a high range of sandstone which terminates about $2\frac{1}{2}$ miles to the East, where at the foot of the hill is situated the town of Biana. The hill fort called Indargarh is situated on an outlying portion of the range about 2 miles South. The little village of Dimdima is North about 2 miles and in the plains. A platform is built over this station, with the usual centre stones at top corresponding to the centre marked below on the rock in situ, to denote the station.

## MADHONI.

This station is situated on a ridge of sandstone rock $4\frac{1}{4}$ miles N.W. of the celebrated fortress of Bhartpur. The village of Madhoni is the nearest to the station. This station is marked on a central stone inserted in the ground, around which retaining walls of dry stone were erected so that the platform presents a level surface with the station mark.

## ALIPUR.

This station is upon a high mass of sandstone in the Bhartpur territory, and locally known as the black mountain or Kalapahar. The village of Alipur is at the foot of the



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hill, a Hindu temple is built on the top of the hill, which forms a very remarkable object when the hill is seen from any distance; a platform with centre stones at top and bottom marked in the usual manner denotes the station.

## RASIA.

This station is in the Bhartpur territory and stands upon a spine of quartz rock about 500 feet high, which rises abruptly in the midst of a vast plain highly cultivated. On the top of the hill is a small Hindu mandar or temple, a few yards West of the station. The village of Rasia is at the S.W. foot of the hill; Kumber is 15 miles distant in a S.E. direction and the fortress of Dig 9·8 miles E.N.E. A small platform is built here marked in the usual manner to denote the station.

## LADPUR.

This station is in the Alwar Raja's territory and named after a village at the northern foot of the hill. The station is on a peak of remarkable outline, the ascent to which is very abrupt. The hill fortress of Alwar is 14·656 miles N.W., Ramgarh fort 5·1 miles North, and Laswari 7·5 miles N.E. A small platform is built here marked in the usual manner with a circle and centre engraved on stone.

## CHAPRA.

This station is situated on a range of hills forming the eastern boundary of the village of Ferozpur. The village of Chapra is about a mile S.E. but the ascent of the hill from that direction is very steep. The village of Gato lies 1 mile North of the station and from this village the ascent is more gradual. The town and fort of Ferozpur lie about 4 miles to the N.W. of the station. A platform is built here with an isolated pillar in the middle having the usual mark stones with circle and centre engraved at top and bottom.

## MEOLI.

This station is called after a village in the pargana of No in the plains, and about 2 miles East from the foot of the range, but there is now a village called Bai at the very foot of the hill much nearer the station. These villages belong to the E. I. Company, although the table-land of the range belongs to Tijara, and therefore the station is in that Raja's territories. The ascent from Bai is very abrupt and precipitous. To the North of the station about a mile are several domed buildings, belonging to the neighbouring village of Indor; about half a mile to the N.W. of the domes of Indor is the fort, which is garrisoned by a part of the Tijara Raja's people. A platform 13½ feet high is built over this station, having the usual mark stone with circle and centre engraved at top corresponding to the mark stone at bottom.

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## DERI.

This station stands on an extensive flat of sandstone. The small village of Deri is about 2 miles distant to the North, but there is a ghosain's math and tank 1 mile West. The circumjacent land is stony, bleak, and barren.

The Kutub lies N.N.W. distant 7·9 miles. A pile of stones is built here 6 feet high having a mark stone with a circle and centre engraved, embedded to the surface, corresponding to a similar mark stone embedded in the ground to denote the station.

## PIR GHYB.

This station derives its appellation from a small darga of a mahomedan saint of that name, the observations having been taken on the southern dome of the building. Through an aperture in the key of the dome a mark has been normally placed on a piece of brass inserted in a stone buried in the floor of the lower story; this mark is 59 feet below the upper station mark. The darga is strongly reinforced with buttresses and a stage has been adapted to the parapets surrounding the dome so as to isolate the observer from the instrument. The building stands on a ridge of sandstone running N.E. and S.W. between the cantonments and city of Delhi; Delhi cantonment flag-staff lies N.E. 0·8 miles; the Jama masjid S.E. 2·1, and the Kutub minar S.S.E. 10·6 miles.

## BULANDSHEHER.

This station is on the vaulted roof of an old mosque upon the highest part of an elevated mound within the city. Through the centre dome an aperture was cut and a central stone with a dot on brass sunk on a level with the ground floor. The height of the building is 14 feet. The pillar for the instrument is isolated.

## CHANDAOS.

This station is on a high bank of accumulated sand about 400 yards from the village of that name. The village of Umri lies to the S.W. of the station 5·9 miles and Elampur N.W. 2·4 miles. A tower forty feet high is built over this station with a central stone marked and sunk in the manner of the other towers.

## NO.

This station is within a mud redoubt bordering on the low lands of the Jumna. The tower erected here is 60 feet high having a central mark stone sunk to the level of the ground floor. The village of Dhanota is to the N.W. of the station 8·0 miles, Mitholi North 6·9 miles, and Mubarakpur to the N.W. 1·7 miles. The station is in the tahsil and thana of Matra.

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## ARING.

This station is on the vaulted roof of an old castellated building situated within a mud redoubt, the roof of each story is perforated, and a stone with a dot on brass let into it, is sunk endwise into the ground floor of the building to mark the station. A well or hollow cylinder of masonry was erected on the upper roof surmounted by a circular slab of sandstone, and a platform or stage was constructed for the observers to stand on, the rafters sustaining which rested on the parapet walls of the building so that the stage and slab having separate points of support the latter was isolated with respect to the former. This renovated ruin is 32 feet high above the surface of the mound which is itself about 25 feet higher than the surrounding country. The village of Aring lies close South to the station, Ral to the N.E. 5·5 miles, and Govardhan about 4 miles W.S.W. The station is in the tahsil and thana of Matra.

## MANPUR.

This station is on a low sandstone range of hills near the celebrated temples of Barsana and Nandgaon, the former of which lies to the N.E. of the station 1·3 miles and the latter N.E. 5·4 miles. The station is in the tahsil and thana of Matra. No tower has been erected here but a square stone pile 16 feet side and 5 feet high was constructed instead, having an isolated pillar in the middle of 4 feet in diameter, in the centre of which a stone with a circle and centre dot engraved was fixed and made to correspond with a similar mark stone sunk below to a level with the surface of the ground.

## PAHERA.

This station is on a very low sandstone rock cropping out of the plains. The tower is 40 feet high with a central stone and dot on brass to denote the station. The village of Gharab is to the S.W. of the station 1·1 miles, and Atin W.S.W. 3 miles. The station is in the tahsil and thana of Gurgaon.

## KAROL.

This station is on the mound of a ruined redoubt on the high east bank of the Jumna which flows within a quarter of a mile of it, it is situated in the village of the same name; Jewar lies to the S.S.W. of the station 3·2 miles, Begamabad to the North 0·9 miles, Dianatpur to the N.E. 1·4 miles, and Chandat to the S.W. 6·9 miles. A tower 50 feet high is erected over the station with the usual central stone and dot on brass let into it, sunk in the ground to mark the station.

## BOSTAN.

This station is on the high bank which bounds the bed of the Jumna to the East. The village of Garabpur is to the N.W. of the station 3·9 miles and Dadri N.E. 3·5 miles.

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The station is in the tahsil and thana of Bulandsheher. A tower 50 feet high is erected over this station, a central stone sunk in the manner of the other tower stations marks this station.

## DATERI.

This station is situated about a half mile S.E. of the village of that name, 4·6 miles S.E. of Kalchina, 5·8 miles N.E. of Nal, and about 1·5 miles N.N.W. of Pilkua, in the tahsil and thana of Meerut. A tower 50 feet high is built over this station marked in the usual manner by a stone and dot on brass let into it, sunk in the ground-floor.

## DHOLRI.

This station is situated on slightly elevated ground near the village of that name. The tower erected here is 50 feet high having the usual central stone with a piece of dotted brass let into it sunk to the level of the ground-floor to mark the station.

## SAROLI.

This station is 5·9 miles N.W. of Sirdhana, S.S.W. of the village of Chur 1·5, N.N.E. of Goatka 0·7, East of Parsi village 1·6. This station is in the tahsil and thana of Sirdhana. The tower erected here is 50 feet high with the usual central stone sunk to mark the station.

## SAINI.

The station is fixed on a very high mound of mud and broken bricks, the remnants, according to tradition, of a ruined redoubt. The tower erected here is 50 feet high, having a central stone with a piece of dotted brass inserted sunk to the level of the ground-floor.

Saini station is in the village of that name and 5·4 miles N.E. of Meerut cantonments in the tahsil and thana of Meerut.

## SHEOPURI.

This station is on an elevated earthen mound on the high bank which bounds the bed of the Ganges to the western side, apparently the site of a ruined fort. A tower has been erected 50 feet high over this station, the usual central stone being sunk to a level with the ground-floor. The village of Sheopuri lies to the West about half a mile from the station, and Mirapur S.W. about 3 miles. The station is in the tahsil and thana of Muzafarnagar.

## BEGARAZPUR.

This is a station on the summit of one of the sand mounds so common in the Doab, and is close to the high road leading from Meerut to Muzafarnagar, being within 5 miles of the latter place. The tower erected is 50 feet high marked with a



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central stone in the usual manner. The village of Begarazpur lies to the N.W. of the station 0·9 mile; Jaroda to the N.N.W. 1·8 miles, and Mansurpur to the East 2·8 miles. The station is in the tahsil of Muzafarnagar and thana of Meerut.

## GODHNA.

This station is on the high bank which bounds the bed of the Ganges on the West side. The village of Godhna is about $\frac{1}{4}$ of a mile to the West of the station, Kajikapur West about 4 miles, and Thugalpur South about $1\frac{1}{4}$ mile. The station is in the tahsil and thana of Muzafarnagar. A tower 50 feet high is built over this station with a central stone sunk on a level with the ground-floor, being marked as usual with a dotted piece of brass.

## KALIANA.

This station was selected as the northern extremity of the section for determining the arc of amplitude between it and Kalianpur. There are two of the usual station marks in this Observatory, with small pillars built over them lying East and West 8 feet asunder. The eastern station is the point connected with the triangles, and the western station that at which the celestial observations for amplitude were made.

The village of Kacholi is to the N.N.E. of the station 0·8 mile, Kasari to the N.N.W. 1·8 miles, and Seid Nagla to the N.W 0·7 mile. The station is in the tahsil and thana of Muzafarnagar.

## DAHERA.

The village of Rankanda is to the N.W. of the station 1·5 miles, Kasoli to the N.E. 0·5 mile, and Jakwala to the S.S.W. 0·9 mile. The station is in the village of Dahera and in the tahsil and thana of Muzafarnagar. A tower 50 feet high is built over this station, a central stone having a dotted piece of brass let into it sunk to the level of the ground-floor marks the station.

## NOJHILI.

The village of Nojhili lies to the North of the station 0·4 mile, Punder to the North 1 mile, and Barapur to the N.E. 1 mile. The station is in the tahsil and thana of Saharanpur. A tower 50 feet high is built over this station and a central stone sunk to the level of the ground-floor having a dotted piece of brass let into it marks the station.

## DHOIWALA.

This station is on the middle ridge of the Ghati range which bounds the Dun to the South. Dhoiwala is the name of a village in the Dun about 7 miles from the station; Bulawala is the name of another village, but deserted, about 5 miles from it. As the hill which is the site of the station has no known name, it is called Dhoiwala, that

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being the nearest habitable spot to it. Owing to the decomposed and sandy nature of the soil of the range on which the station is situated, a platform of brick and mortar has been built round the summit of the hill, in the middle of which a stone 4 feet long with a dotted piece of brass has been imbedded.

## AMSOT.

This station is on the highest point of the range above adverted to. The nearest village is Timli in the Dun, about 3 miles N.E. of the station; a platform of masonry in the same manner as described in the case of Dhoiwala has been built at this site.

## BANOG.

This station is on a detached peak of the lower range of the Himalaya mountains, being thrown back about a mile to the North of the range, whereon Masuri, Hatipaon, &c., are situated; a platform 14 feet square of stone and mortar was built round a central stone sunk in the soil, which has as usual a dotted piece of brass let into its upper surface to mark the station; above this the superstructure of the platform rises about 12 inches and a square stone is imbedded in the upper surface carrying a similar piece of brass placed perpendicularly above the station stone. Hatipaon, Badraj, and Dudhili are secondary stations on the southernmost range of the Himalayan mountains which lies between Banog and the Dun.

## W. END OF THE BASE.

This station is about two miles to the east of a small village called Sherpur, and about 1 mile south from the Asan river; a stone 5 feet in length and 1 foot square base was sunk to the surface of the ground and lodged in a pile of masonry 14 feet square with a circular pillar of masonry in the middle of 4 feet diameter; the pillar being built disjointed from the rest of the pile in order that the instrument might remain isolated. Into the exposed surface of the central stone a piece of brass was soldered in which was inserted a fine silver wire to receive the small dot which marked the limit of the base line; when the base was concluded the platform was raised and a supplemental stone of 1 foot square and 3 inches thick with a piece of brass and dot soldered into it, was accurately placed over the dot in the lower stone. For protection against cattle and other intruders a thick hedge of cactus was planted round the platform. This station is on the sloping land where the Ghati range falls into the valley.

## E. END OF THE BASE.

This station is on the extremity of one of the spurs of the Ghati range. It is marked exactly in the same manner as the western limit, so that a description of the one will answer for the other. The Asan river winds round the foot of this spur and one branch of it takes its rise in a ravine about 100 yards to the westward. The nearest village is Mohabawala about a mile to the eastward.

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## SUPPLEMENTAL STATION A, or HELIOTROPE-WALA.

This station is 157 sets of bars from the West end. It is marked by a stone 2 feet long sunk into the ground, on the upper surface of which is a piece of brass with a dot engraved on it; a hedge of cactus was planted round it to prevent intrusion.

## SUPPLEMENTAL STATION B, or BARWALA.

This station is at the distance of 389 sets of bars from the West end, or 232 sets from station A, and as the whole base is 622 sets long, the distance of station B from the East end is 233 sets. It was marked and protected exactly in the same manner as station A.

## STATIONS OF TRANSFER $\alpha$. $\beta$. $\gamma$.

These stations are situated on the northern face of the Ghati range above adverted to, which affords spurs and eminences sufficiently favourable for stations. They are in the midst of the Jungle of Sal, and have no village near them or any other token by which they can be described. Each is marked with a stone 2 feet long sunk into the ground into the upper surface of which a piece of brass with a dot engraved on it is soldered.

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# HEIGHTS OF PRINCIPAL STATIONS

OF THE

## SERIES OF TRIANGLES

EXTENDING FROM

# THE SERONJ BASE TO THE DEHRA DUN BASE.



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| D Day Observ. N Night Observ. | Eye Stati | Subtended Angles. | Heights Deduced. | | |
|---|---|---|---|---|---|
| | | | Comparative. | Above the Sea Level. | Mean. |
| D | N. End Seronj<br>S. End Seronj | ° ′ ″<br>4 30 ·5 | Feet<br>N. End Seronj Base. . — 50 ·4 | Feet<br>N. End Seronj Base . . 1594 ·1 | |
| D | Surantal ....<br>N. End Seronj | 17 12 ·0 | Surantal . . . . . + 322 ·2 | Surantal . . . . . 1916 ·3 | 1914 ·8 |
| D | Surantal ....<br>S. End Seronj | 14 31 ·7 | Surantal . . . . . + 268 ·8 | Surantal . . . . . 1913 ·3 | |
| D | Kalianpur ....<br>N. End Seronj | 15 16 ·1 | Kalianpur . . . . . + 284 ·9 | Kalianpur . . . . . 1879 ·0 | 1878 ·2 |
| D | Kalianpur ....<br>Surantal .... | 2 55 ·6 | Kalianpur . . . . . — 37 ·5 | Kalianpur . . . . . 1877 ·3 | |
| D | Kamkhera....<br>S. End Seronj | 25 40 ·1 | Kamkhera . . . . . + 246 ·6 | Kamkhera . . . . . 1891 ·1 | 1891 ·2 |
| D | Kamkhera....<br>N. End Seronj | 14 39 ·1 | Kamkhera . . . . . + 296 ·5 | Kamkhera . . . . . 1890 ·6 | |
| D | Kamkhera....<br>Kalianpur .... | 0 56 ·2 | Kamkhera . . . . . + 13 ·6 | Kamkhera . . . . . 1891 ·8 | |
| D | Kamkhera....<br>Surantal .... | 0 54 ·3 | Kamkhera . . . . . — 23 ·5 | Kamkhera . . . . . 1891 ·3 | |
| D | Bhaorasa ....<br>N. End Seronj | 5 44 ·8 | Bhaorasa . . . . . — 93 ·2 | Bhaorasa . . . . . 1500 ·9 | 1500 ·4 |
| D | Bhaorasa ....<br>Surantal .... | 12 7 ·5 | Bhaorasa . . . . . — 413 ·2 | Bhaorasa . . . . . 1501 ·6 | |
| D | Bhaorasa ....<br>Kalianpur .... | 10 58 ·9 | Bhaorasa . . . . . — 380 ·1 | Bhaorasa . . . . . 1498 ·1 | |
| D | Bhaorasa ....<br>Kamkhera.... | 12 12 ·3 | Bhaorasa . . . . . — 390 ·1 | Bhaorasa . . . . . 1501 ·1 | |
| D | Pardho .....<br>Bhaorasa .... | 13 39 ·3 | Pardho . . . . . + 375 ·5 | Pardho . . . . . 1875 ·9 | 1876 ·2 |
| D | Pardho .....<br>Kamkhera.... | 0 31 ·2 | Pardho . . . . . — 15 ·4 | Pardho . . . . . 1875 ·8 | |
| D | Pardho .....<br>Kalianpur .... | 0 3 ·7 | Pardho . . . . . — 1 ·2 | Pardho . . . . . 1877 ·0 | |
| D | Handiaparo ..<br>Pardho ..... | 3 29 ·9 | Handiaparo . . . . . — 98 ·4 | Handiaparo . . . . . 1777 ·8 | 1776 ·7 |
| D | Handiaparo ..<br>Bhaorasa .... | 8 43 ·0 | Handiaparo . . . . . + 275 ·1 | Handiaparo . . . . . 1775 ·5 | |
| D | Deadheri ....<br>Pardho ..... | 2 41 ·1 | Deadheri . . . . . + 107 ·7 | Deadheri . . . . . 1983 ·9 | 1980 ·8 |
| D | Deadheri ....<br>Handiaparo .. | 5 7 ·3 | Deadheri . . . . . + 200 ·9 | Deadheri . . . . . 1977 ·6 | |
| D | Hatiapahar ..<br>Handiaparo .. | 3 4 ·7 | Hatiapahar . . . . . + 126 ·7 | Hatiapahar . . . . . 1903 ·4 | 1902 ·7 |
| D | Hatiapahar ..<br>Deadheri .... | 2 38 ·1 | Hatiapahar . . . . . — 78 ·9 | Hatiapahar . . . . . 1901 ·9 | |
| D | Pahargarh....<br>Hatiapahar .. | 6 5 ·6 | Pahargarh . . . . . — 147 ·4 | Pahargarh . . . . . 1755 ·3 | 1755 ·3 |
| D | Pahargarh....<br>Deadheri .... | 7 8 ·8 | Pahargarh . . . . . — 225 ·5 | Pahargarh . . . . . 1755 ·3 | |

reckoned as the origin.



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:a 1644 ·5 Feet.

| D Day Observ. | Terrestrial Refraction. Seconds. | Terrestrial Refraction. Decimals of contained Arcs. | Subtended Angles. | Heights Deduced. Comparative. | Heights Deduced. Above the Sea Level. | Mean. |
|---|---|---|---|---|---|---|
| | | | | Feet | Feet | |
| D | 92″ | ·068 | 0° 3′ 51″·6 | Bherkheri ..... — 155·2 | Bherkheri ..... 1825·6 | 1825·4 |
| D | 59 | ·071 | 0 2 50·0 | Bherkheri ..... + 69·9 | Bherkheri ..... 1825·2 | |
| D | 71 | ·069 | 0 0 55·6 | Gugubara ..... — 28·0 | Gugubara ..... 1727·3 | 1728·6 |
| D | 66 | ·068 | 0 3 20·9 | Gugubara ..... — 95·5 | Gugubara ..... 1729·9 | |
| D | 39 | ·056 | 0 1 32·9 | Nimdant ..... + 31·7 | Nimdant ..... 1787·0 | 1787·6 |
| D | 70 | ·063 | 0 1 53·2 | Nimdant ..... + 62·3 | Nimdant ..... 1790·9 | |
| D | 54 | ·065 | 0 4 48·1 | Nimdant ..... — 117·8 | Nimdant ..... 1784·9 | |
| D | 51 | ·060 | 0 3 6·2 | Mao ..... — 78·5 | Mao ..... 1709·1 | 1708·0 |
| D | 58 | ·055 | 0 0 41·9 | Mao ..... — 21·7 | Mao ..... 1706·9 | |
| D | 66 | ·061 | 0 0 7·5 | Memoni ..... + 4·0 | Memoni ..... 1712·0 | 1710·4 |
| N | 382 | ·312 | 0 0 32·9 | Memoni ..... — 19·8 | Memoni ..... 1708·8 | |
| D | 64 | ·058 | 0 3 23·3 | Shergarh ..... — 111·1 | Shergarh ..... 1596·9 | 1595·2 |
| D | 46 | ·059 | 0 5 7·1 | Shergarh ..... — 117·0 | Shergarh ..... 1593·4 | |
| D | 53 | ·059 | 0 4 9·3 | Kasri ..... — 110·9 | Kasri ..... 1599·5 | 1601·6 |
| D | 64 | ·062 | 0 0 16·7 | Kasri ..... + 8·4 | Kasri ..... 1603·6 | |
| D | 62 | ·053 | 0 5 12·9 | Dhobai ..... — 179·3 | Dhobai ..... 1422·3 | 1424·5 |
| D | 80 | ·064 | 0 4 35·9 | Dhobai ..... — 168·6 | Dhobai ..... 1426·6 | |
| D | 57 | ·059 | 0 2 22·8 | Den ..... — 68·3 | Den ..... 1533·3 | 1535·1 |
| D | 41 | ·061 | 0 5 40·3 | Den ..... + 112·3 | Den ..... 1536·8 | |
| D | 55 | ·070 | 0 3 53·8 | Raipur ..... — 90·9 | Raipur ..... 1333·6 | 1332·6 |
| D | 64 | ·067 | 0 7 12·9 | Raipur ..... — 203·5 | Raipur ..... 1331·6 | |
| D | 52 | ·059 | 0 3 42·6 | Pagaro ..... — 95·7 | Pagaro ..... 1236·9 | 1237·7 |
| D | 58 | ·064 | 0 11 3·6 | Pagaro ..... — 296·6 | Pagaro ..... 1238·5 | |
| N | 310 | ·369 | 0 7 22·2 | Chilwani ..... — 183·1 | Chilwani ..... 1418·5 | * |

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| D Day Observ. N Night Observ. | Eye Stations. | ted s. | Heights Deduced. | | |
|---|---|---|---|---|---|
| | | | Comparative. | Above the Sea Level. | Mean. |
| | | " | Feet | Feet | |
| D | Chilwani ..... | 1·9 | Chilwani .....— 66·7 | Chilwani ..... 1468·4 | |
| | Den ..... | | | | |
| D | Juktipura ..... | 3·9 | Juktipura .....— 236·8 | Juktipura ..... 1298·3 | 1300·3 |
| | Den ..... | | | | |
| D | Juktipura ..... | 1·2 | Juktipura .....— 165·5 | Juktipura ..... 1302·9 | |
| | Chilwani ..... | | | | |
| D | Juktipura ..... | 0·2 | Juktipura .....+ 62·0 | Juktipura ..... 1299·7 | |
| | Pagaro ..... | | | | |
| D | Gurjapahar ..... | 2·4 | Gurjapahar .....+ 49·3 | Gurjapahar ..... 1287·0 | 1286·4 |
| | Pagaro ..... | | | | |
| D | Gurgapahar ..... | 9·2 | Gurjapahar .....— 14·6 | Gurjapahar ..... 1285·7 | |
| | Juktipura ..... | | | | |
| D | Nindhar ..... | 9·3 | Nindhar.....+ 162·1 | Nindhar ..... 1462·4 | 1460·2 |
| | Juktipura ..... | | | | |
| D | Nindhar ..... | 7·4 | Nindhar.....+ 171·5 | Nindhar ..... 1457·9 | |
| | Gurjapahar ..... | | | | |
| D | Machi ..... | 6·9 | Machi .....— 48·3 | Machi ..... 1411·9 | 1412·6 |
| | Nindhar ..... | | | | |
| D | Machi ..... | 7·3 | Machi .....+ 126·8 | Machi ..... 1413·2 | |
| | Gurjapahar ..... | | | | |
| D | Dimdima ..... | 7·7 | Dimdima .....— 81·6 | Dimdima ..... 1331·0 | 1330·1 |
| | Machi ..... | | | | |
| D | Dimdima ..... | 7·6 | Dimdima .....+ 42·7 | Dimdima ..... 1329·1 | |
| | Gurjapahar ..... | | | | |
| N | Dholpur ..... | 9·7 | Dholpur .....— 250·6 | Dholpur ..... 1035·8 | |
| | Gurjapahar ..... | | | | |
| D | Dholpur ..... | 7·8 | Dholpur .....— 181·1 | Dholpur ..... 1056·6 | |
| | Pagaro ..... | | | | |
| D | Usira..... | 9·5 | Usira.....— 127·6 | Usira..... 929·0 | 925·4 |
| | Dholpur ..... | | | | |
| D | Usira..... | 5·8 | Usira.....— 360·9 | Usira..... 925·5 | |
| | Gurjapahar ..... | | | | |
| D | Usira..... | 6·4 | Usira.....— 408·4 | Usira..... 921·7 | |
| | Dimdima ..... | | | | |
| D | Madhoni ..... | 3·0 | Madhoni .....— 95·6 | Madhoni ..... 829·8 | 827·6 |
| | Usira..... | | | | |
| D | Madhoni ..... | 6·4 | Madhoni .....— 504·7 | Madhoni ..... 825·4 | |
| | Dimdima ..... | | | | |
| D | Alipur ..... | 0·8 | Alipur .....+ 130·8 | Alipur ..... 1460·9 | 1463·0 |
| | Dimdima ..... | | | | |
| D | Alipur ..... | 2·9 | Alipur .....+ 637·5 | Alipur ..... 1465·1 | |
| | Madhoni ..... | | | | |
| D | Rasia..... | 4·4 | Rasia.....— 295·3 | Rasia ..... 1167·7 | 1169·8 |
| | Alipur ..... | | | | |
| D | Rasia..... | 4·4 | Rasia.....+ 344·2 | Rasia ..... 1171·8 | |
| | Madhoni ..... | | | | |
| D | Ladpur ..... | 7·1 | Ladpur .....— 4·9 | Ladpur..... 1458·1 | 1457·9 |
| | Alipur ..... | | | | |



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of the Sea 1644 ·5 Feet.

| ces. | Terrestrial Refraction. Seconds. | Terrestrial Refraction. Decimals of contained Arcs. | Subtended Angles. | Heights Deduced. Comparative. | Heights Deduced. Above the Sea Level. | Mean. |
|---|---|---|---|---|---|---|
| 7″·38<br>6·80 | 58″ | ·050 | 0° 8′ 20″·3 | Ladpur ..... + 287·9 Feet | Ladpur ..... 1457·7 Feet | |
| 4·62<br>0·33 | 57 | ·048 | 0 4 32·1 | Chapra ..... + 157·8 | Chapra ..... 1327·6 | 1327·6 |
| 7·57<br>8·72 | 41 | ·040 | 0 4 20·6 | Chapra ..... — 130·4 | Chapra ..... 1327·5 | |
| 2·89<br>4·70 | 64 | ·055 | 0 11 23·8 | Manpur ..... — 393·4 | Manpur ..... 934·2 | 933·4 |
| 8·19<br>1·90 | 52 | ·056 | 0 8 40·0 | Manpur ..... — 237·2 | Manpur ..... 932·6 | |
| 6·27<br>9·04 | 82 | ·057 | 0 11 12·7 | Pahera ..... — 475·6 | Pahera ..... 852·0 | 851·0 |
| 0·54<br>8·59 | 89 | ·060 | 0 1 54·0 | Pahera ..... — 83·4 | Pahera ..... 850·0 | |
| 9·74<br>1·02 | 50 | ·042 | 0 3 29·4 | Meoli ..... + 121·8 | Meoli ..... 1449·4 | 1449·5 |
| 5·04<br>3·39 | 60 | ·055 | 0 18 44·2 | Meoli ..... + 598·6 | Meoli ..... 1449·6 | |
| 0·33<br>2·96 | 74 | ·049 | 0 6 46·3 | Deri ..... — 299·9 | Deri ..... 1149·6 | 1151·3 |
| 2·83<br>9·63 | 74 | ·056 | 0 7 41·6 | Deri ..... + 302·0 | Deri ..... 1153·0 | |
| 3·44<br>5·95 | 83 | ·059 | 0 7 41·3 | Karol ..... — 316·8 | Karol ..... 834·5 | 834·4 |
| 8·42<br>0·53 | 46 | ·049 | 0 0 36·1 | Karol ..... — 16·7 | Karol ..... 834·3 | |
| 5·82<br>6·03 | 59 | ·056 | 0 9 30·9 | Bostan ..... — 294·3 | Bostan ..... 857·0 | 858·8 |
| 4·25<br>9·17 | 253 | ·203 | 0 0 42·5 | Bostan ..... + 26·1 | Bostan ..... 860·5 | |
| 2·71<br>6·75 | 58 | ·052 | 0 2 18·0 | Pir Ghyb ..... + 75·1 | Pir Ghyb ..... 933·9 | 937·9 |
| 0·28<br>3·09 | 30 | ·031 | 0 7 26·7 | Pir Ghyb ..... — 209·5 | Pir Ghyb ..... 941·8 | |
| 3·41<br>8·84 | 63 | ·065 | 0 1 47·7 | Aring ..... — 51·2 | Aring ..... 776·4 | 776·1 |
| 9·96<br>1·75 | 58 | ·051 | 0 11 35·9 | Aring ..... — 392·9 | Aring ..... 776·9 | |
| 7·08<br>3·46 | 40 | ·052 | 0 7 0·3 | Aring ..... — 158·4 | Aring ..... 775·0 | |
| 5·01<br>8·47 | 200 | ·148 | 0 0 48·3 | No ..... + 32·2 | No ..... 808·3 | 810·5 |
| 8·09<br>5·18 | 56 | ·047 | 0 3 18·5 | No ..... — 115·8 | No ..... 817·6 | |
| 1·77<br>9·44 | 584 | ·436 | 0 1 23·8 | No ..... — 55·2 | No ..... 795·8 | |
| 7·70<br>6·22 | 124 | ·104 | 0 0 24·3 | No ..... — 14·2 | No ..... 820·2 | |

ns. * Denotes Tower Stations. † Denotes Stations on buildings.

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| D Day Observ. N Night Observ. | Eye Stations. | ided es. | Heights Deduced. Comparative. | Above the Sea Level. | Mean. |
|---|---|---|---|---|---|
| | | " | Feet | Feet | |
| D | Chandaos* ....— 0·0<br>No* .....+ 0·0 | 22·0 | Chandaos.....— 11·8 | Chandaos ..... 798·7 | 800·0 |
| D | Chandaos* ....+ 0·0<br>Karol* .....+ 0·0 | 5·2 | Chandaos.....— 33·1 | Chandaos ..... 801·3 | |
| D | Bulandsheher†..+ 0·0<br>Chandaos* ....+ 0·0 | 30·0 | Bulandsheher.....+ 50·8 | Bulandsheher ..... 850·8 | 846·5 |
| D | Bulandsheher†..+ 0·0<br>Karol* .....+ 0·0 | 11·3 | Bulandsheher.....+ 7·2 | Bulandsheher ..... 841·6 | |
| N | Bulandsheher†..— 0·0<br>Bostan*.....— 0·0 | 20·4 | Bulandsheher.....— 11·8 | Bulandsheher ..... 847·0 | |
| D | Dateri*.....+ 0·0<br>Bulandsheher†..+ 0·0 | 51·5 | Dateri .....+ 34·5 | Dateri ..... 881·0 | 872·4 |
| D | Dateri*.....— 0·0<br>Bostan*.....+ 0·0 | 18·6 | Dateri .....+ 8·2 | Dateri ..... 867·0 | |
| D | Dateri*.....+ 0·0<br>Pir Ghyb†.....— 0·0 | 40·8 | Dateri .....— 68·8 | Dateri ..... 869·1 | |
| D | Dholri*.....+ 0·0<br>Pir Ghyb†..... | 28·6 | Dholri .....— 52·8 | Dholri ..... 885·1 | 889·3 |
| D | Dholri*.....+ 0·0<br>Dateri*.....+ 0·0 | 50·1 | Dholri .....+ 21·0 | Dholri ..... 893·4 | |
| D | Saini* .....+ 0·0<br>Dateri*..... | 51·9 | Saini.....+ 64·8 | Saini..... 937·2 | 946·4 |
| D | Saini* .....<br>Dholri*..... | 6·4 | Saini.....+ 66·2 | Saini..... 955·5 | |
| D | Saroli* .....<br>Saini* .....+ 0·0 | 22·1 | Saroli .....— 10·4 | Saroli ..... 936·0 | 934·6 |
| D | Saroli* .....<br>Dholri*.....+ 0·0 | 40·4 | Saroli .....+ 43·9 | Saroli ..... 933·2 | |
| D | Begarazpur*....+ 0·0<br>Saroli* ..... | 32·9 | Begarazpur.....+ 42·9 | Begarazpur ..... 977·5 | 980·7 |
| N | Begarazpur*.....<br>Saini* ..... | 1·2 | Begarazpur.....+ 37·4 | Begarazpur ..... 983·8 | |
| D | Sheopuri*.....<br>Saini* .....+ 0·0 | 8·1 | Sheopuri .....+ 39·6 | Sheopuri ..... 986·0 | 985·5 |
| D | Sheopuri*.....<br>Begarazpur*....+ 0·0 | 9·0 | Sheopuri .....+ 4·2 | Sheopuri ..... 984·9 | |
| D | Godhna* .....<br>Sheopuri*..... | 57·4 | Godhna .....+ 31·9 | Godhna .....1017·4 | 1015·7 |
| D | Godhna* .....<br>Begarazpur*....+ 0·0 | 2·4 | Godhna .....+ 33·2 | Godhna .....1013·9 | |
| D | Kaliana**.....+ 0·0<br>Begarazpur*..... | 24·9 | Kaliana .....— 37·1 | Kaliana..... 943·6 | 942·3** |
| D | Kaliana**.....<br>Godhna* .....+ 0·0 | 54·8 | Kaliana .....— 74·7 | Kaliana..... 941·0 | |
| D | Dahera* .....<br>Godhna* .....+ 0·0 | 11·8 | Dahera.....— 5·2 | Dahera.....1010·5 | 1007·9 |
| D | Dahera* .....+ 0·0<br>Begarazpur*..... | 0·4 | Dahera.....+ 27·9 | Dahera.....1008·6 | |

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the Sea 1644·5 Feet.

| s. | Terrestrial Refraction. Seconds. | Terrestrial Refraction. Decimals of contained Arcs. | Subtended Angles. | Heights Deduced. Comparative. | Heights Deduced. Above the Sea Level. | Mean. |
|---|---|---|---|---|---|---|
| ″ ·36 3·97 | — 9″ | —·021 | ° ′ ″ 0 5 2·2 | Dahera ..... + Feet 62·3 | Dahera ..... Feet 1004·6 | |
| 3·79 3·82 | 64 | ·067 | 0 1 30·0 | Nojhili ..... + 42·6 | Nojhili ..... 1050·5 | 1043·9 |
| 3·07 ·82 | 391 | ·326 | 0 0 36·6 | Nojhili ..... + 21·6 | Nojhili ..... 1037·3 | |
| 3·58 3·14 | 115 | ·063 | 0 37 57·9 | Dhoiwala ..... + 2054·8 | Dhoiwala ..... 3070·5 | 3064·3 |
| 3·23 3·12 | 90 | ·065 | 0 49 0·7 | Dhoiwala ..... + 2014·2 | Dhoiwala ..... 3058·1 | |
| 3·47 2·01 | 75 | ·053 | 0 4 34·2 | Amsot ..... + 192·0 | Amsot ..... 3256·3 | 3252·3 |
| 4·66 3·43 | 101 | ·058 | 0 42 40·5 | Amsot ..... + 2204·4 | Amsot ..... 3248·3 | |
| 3·71 4·82 | 86 | ·067 | 1 58 39·3 | Banog ..... + 4487·0 | Banog ..... 7551·3 | 7548·7 |
| 3·72 7·02 | 62 | ·058 | 2 14 53·4 | Banog ..... + 4293·7 | Banog ..... 7546·0 | |
| 1·00 3·49 | 48 | ·050 | 0 41 50·7 | E. End Dun Base.. — 1180·5 | E. End Dun Base .... 2071·8 | 2072·6 |
| 4·00 4·75 | 38 | ·055 | 4 25 14·4 | E. End Dun Base.. — 5475·4 | E. End Dun Base .... 2073·3 | |
| 5·54 5·93 | 25 | ·044 | 1 21 5·7 | W. End Dun Base.. — 1365·7 | W. End Dun Base.... 1886·6 | 1886·4 |
| 3·20 9·63 | 55 | ·077 | 4 27 46·4 | W. End Dun Base.. — 5664·2 | W. End Dun Base.... 1884·5 | |
| 4·82 6·43 | 17 | ·044 | 0 16 10·6 | W. End Dun Base.. — 184·4 | W. End Dun Base.... 1888·2 | |

** Denotes Top of Observatory.

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# PARTICULARS OF A BASE LINE,

MEASURED WITH COMPENSATION BARS IN

# THE PLAIN OF SERONJ

IN THE

MONTHS OF DECEMBER, 1837, AND JANUARY, 1838,

BY

LIEUT.-COL. G. EVEREST,

SURVEYOR-GENERAL OF INDIA, AND HIS ASSISTANTS.

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# RECAPITULATION

## OF CERTAIN PARTICULARS DETAILED IN THE INTRODUCTORY PAGES.

THE Base Line in the plains of Seronj was originally measured in the year 1824 with the old or measuring chain of the Great Trigonometrical Survey, of which operation a description will be found in my printed book on the Great Arc of India. The base of verification for the section north of Seronj was measured in the valley called the Dehra Dun with the new apparatus or compensation bars in 1834-35, and as in completing the connection between these two bases there appeared to be a discrepancy of nearly $3\frac{1}{2}$ feet, it was thought advisable to measure the Seronj Base also with the compensation bars which had been employed in that of the Dehra Dun.

The measurement of which mention is now made was commenced on the morning of the 1st December 1837, and concluded on the forenoon of the 18th January following.

The bars were compared with the iron standard A, 79 times before the measurement, and the mean excess at the temperature of 62° was found to be 0·0325596 of an inch in excess to six lengths or 60 feet, a like series of trials 61 in number after the operation, gave a mean length of 0·0297795 parts of an inch in excess, of which the mean is used as the true value during the measurement.

The compound microscopes were compared on eleven different occasions during the measurement, and the bar levels examined four times, the small errors of the former amounted in the aggregate to 3·6809382 inches, in excess to the regulated quantity of 6 inches each.

The line of measurement was precisely that taken up in 1824, and of course could not be comprised in entire sets of bars; the measurement having been commenced at the south end, the north limit fell nearly midway between the two ends of bar *E*, and the excess beyond the limit of bar *D*, measured in the usual manner and referred to the brass standard scale by Cary at the temperature of 67·7, was found to be 64·281 inches when reduced to the temperature of 62°.

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The small correction of 0·005 of a foot which is applied to this measurement is due to the circumstance that the angles about the base were observed in the years 1836-37 with the upper marks of the platform in their existing positions, which upper marks, on subsequent reference to the lower ones embedded in the earth, shewed small discrepancies, and it was found to involve less computation to reduce the measured base to the positions used in 1836-37 than to correct the angles about the base.

The total length of the measured base, after all reductions, is 38413·3675260 feet, which must be substituted for 38411·89912 given in my printed book, page 126, by the chain measurement.

Each individual comparison in this instance has been reduced to the temperature of 62° by the formula $A-b=nb.\ (t-62)-s+a$ of which an explanation is given in the introductory pages; the value of $n$ being taken at 0·0000068007.



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RESULTS of Comparisons of the compensation bars with the iron standard A. at Seronj before the measurement of the Base.

| A. | | B. | | C. | | D. | | E. | | H. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ·0054252 | ·0046825 | ·0040015 | ·0030696 | ·0047233 | ·0041100 | ·0067245 | ·0064795 | ·0039070 | ·0041100 | ·0042455 | ·0041100 |
| ·0051372 | ·0064800 | ·0038230 | ·0052405 | ·0044602 | ·0063008 | ·0065509 | ·0086355 | ·0040769 | ·0055840 | ·0041615 | ·0052355 |
| ·0049829 | ·0062717 | ·0034149 | ·0053757 | ·0045747 | ·0063215 | ·0065659 | ·0086811 | ·0041018 | ·0056744 | ·0039774 | ·0052762 |
| ·0048547 | ·0063826 | ·0035455 | ·0051531 | ·0042075 | ·0065917 | ·0064476 | ·0086625 | ·0038690 | ·0056160 | ·0038491 | ·0053422 |
| ·0042576 | ·0065258 | ·0029185 | ·0053211 | ·0044667 | ·0067697 | ·0063633 | ·0085667 | ·0040087 | ·0056248 | ·0042078 | ·0055750 |
| ·0047284 | ·0066043 | ·0032948 | ·0053200 | ·0047284 | ·0066591 | ·0067395 | ·0088991 | ·0042256 | ·0059074 | ·0043302 | ·0057083 |
| ·0048957 | ·0067898 | ·0036064 | ·0054259 | ·0048957 | ·0068048 | ·0071407 | ·0086566 | ·0045771 | ·0059237 | ·0047613 | ·0058191 |
| ·0061857 | ·0067595 | ·0051055 | ·0055598 | ·0058870 | ·0066749 | ·0084357 | ·0086013 | ·0054340 | ·0057440 | ·0053444 | ·0055698 |
| ·0062172 | ·0070064 | ·0049727 | ·0058167 | ·0061276 | ·0066032 | ·0081736 | ·0088483 | ·0055104 | ·0060108 | ·0053511 | ·0058565 |
| ·0063434 | ·0071916 | ·0055171 | ·0058027 | ·0067715 | ·0070970 | ·0085487 | ·0090334 | ·0058606 | ·0060815 | ·0056167 | ·0058575 |
| ·0064728 | ·0052738 | ·0051935 | ·0038750 | ·0066968 | ·0044226 | ·0085984 | ·0070311 | ·0055370 | ·0030746 | ·0054872 | ·0045620 |
| ·0067387 | ·0051747 | ·0058177 | ·0037510 | ·0068631 | ·0045923 | ·0088095 | ·0065685 | ·0057779 | ·0038008 | ·0057829 | ·0040796 |
| ·0070035 | ·0050201 | ·0058238 | ·0034670 | ·0070284 | ·0041191 | ·0089047 | ·0065583 | ·0062120 | ·0037259 | ·0059233 | ·0039797 |
| ·0054872 | ·0045353 | ·0040983 | ·0031165 | ·0049396 | ·0039728 | ·0069805 | ·0061730 | ·0041182 | ·0035446 | ·0045015 | ·0037239 |
| ·0054109 | ·0045001 | ·0040271 | ·0028723 | ·0047738 | ·0037584 | ·0069690 | ·0060034 | ·0040868 | ·0034199 | ·0043407 | ·0037036 |
| ·0054764 | ·0044748 | ·0038337 | ·0030312 | ·0047994 | ·0043205 | ·0068802 | ·0060678 | ·0040428 | ·0036783 | ·0043415 | ·0036783 |
| ·0050686 | ·0043737 | ·0038341 | ·0028803 | ·0045260 | ·0041198 | ·0066715 | ·0062304 | ·0039337 | ·0036120 | ·0041726 | ·0037166 |
| ·0052648 | ·0046678 | ·0032438 | ·0028658 | ·0042742 | ·0042497 | ·0066089 | ·0064002 | ·0040203 | ·0030560 | ·0041099 | ·0040107 |
| ·0052165 | ·0049467 | ·0036684 | ·0033338 | ·0046690 | ·0044738 | ·0066402 | ·0067089 | ·0041463 | ·0043344 | ·0042757 | ·0044240 |
| ·0051397 | ·0061863 | ·0035069 | ·0050812 | ·0044577 | ·0061366 | ·0067426 | ·0085160 | ·0042039 | ·0055691 | ·0044976 | ·0053202 |
| ·0051211 | ·0062965 | ·0034485 | ·0049575 | ·0043446 | ·0063911 | ·0065199 | ·0086511 | ·0037821 | ·0058933 | ·0040310 | ·0055449 |
| ·0053580 | ·0066552 | ·0037004 | ·0053510 | ·0052883 | ·0066502 | ·0071650 | ·0088853 | ·0044819 | ·0061325 | ·0045317 | ·0057044 |
| ·0061410 | ·0066077 | ·0049065 | ·0055125 | ·0064546 | ·0066724 | ·0082915 | ·0090469 | ·0053097 | ·0062542 | ·0052002 | ·0060053 |
| ·0060550 | ·0069790 | ·0049599 | ·0058838 | ·0061048 | ·0069840 | ·0082354 | ·0091494 | ·0052984 | ·0062970 | ·0052486 | ·0059585 |
| ·0062799 | ·0068800 | ·0050504 | ·0059242 | ·0062351 | ·0071687 | ·0084852 | ·0092147 | ·0054934 | ·0064320 | ·0054943 | ·0060337 |
| ·0064509 | ·0054271 | ·0051666 | ·0036600 | ·0063513 | ·0043220 | ·0085416 | ·0066567 | ·0055549 | ·0042374 | ·0054653 | ·0043668 |
| ·0068902 | ·0053147 | ·0055014 | ·0036023 | ·0065965 | ·0045680 | ·0087569 | ·0065841 | ·0058448 | ·0040055 | ·0058050 | ·0042992 |
| ·0067308 | ·0050995 | ·0053868 | ·0034916 | ·0067806 | ·0042034 | ·0087270 | ·0062304 | ·0060538 | ·0036808 | ·0058597 | ·0039595 |
| ·0068915 | ·0046659 | ·0055972 | ·0029236 | ·0066476 | ·0035856 | ·0087931 | ·0061592 | ·0059457 | ·0032870 | ·0057117 | ·0034363 |
| ·0068199 | ·0045337 | ·0057695 | ·0028412 | ·0068248 | ·0039363 | ·0089554 | ·0058280 | ·0060931 | ·0033091 | ·0058193 | ·0034634 |
| ·0050331 | ·0043626 | ·0039379 | ·0027348 | ·0048439 | ·0038449 | ·0069247 | ·0058859 | ·0042565 | ·0034068 | ·0045005 | ·0036209 |
| ·0055673 | ·0040888 | ·0038848 | ·0024561 | ·0047260 | ·0036956 | ·0069213 | ·0059904 | ·0043079 | ·0034168 | ·0045120 | ·0035612 |
| ·0053013 | ·0043025 | ·0036486 | ·0024756 | ·0045546 | ·0038544 | ·0067350 | ·0060945 | ·0039473 | ·0037499 | ·0043107 | ·0037499 |
| ·0052319 | ·0046021 | ·0034308 | ·0028051 | ·0041865 | ·0043483 | ·0065958 | ·0061951 | ·0038430 | ·0040098 | ·0040372 | ·0038107 |
| ·0046266 | ·0065143 | ·0031730 | ·0050608 | ·0039795 | ·0064198 | ·0062743 | ·0086200 | ·0036310 | ·0057627 | ·0039247 | ·0054291 |
| ·0045111 | ·0065822 | ·0027091 | ·0052431 | ·0039138 | ·0067714 | ·0062235 | ·0090065 | ·0034011 | ·0060794 | ·0036748 | ·0055767 |
| ·0046010 | ·0067134 | ·0029732 | ·0054390 | ·0040236 | ·0067532 | ·0059700 | ·0091775 | ·0035606 | ·0062256 | ·0036652 | ·0060613 |
| ·0044405 | ·0069730 | ·0027928 | ·0055394 | ·0038979 | ·0073364 | ·0061231 | ·0091185 | ·0036490 | ·0064354 | ·0037884 | ·0061317 |
| ·0045483 | ·0073737 | ·0029006 | ·0059450 | ·0040406 | ·0071845 | ·0063454 | ·0092254 | ·0037469 | ·0064776 | ·0038663 | ·0061441 |
| | ·0072009 | | ·0059116 | | ·0073403 | | ·0091970 | | ·0063994 | | ·0062003 |
| Sum ..... = | 79)4479268 | Sum ..... = | 79)3363116 | Sum ..... = | 79)4237940 | Sum ..... = | 79)5924172 | Sum ..... = | 79)3772255 | Sum ..... = | 79)3771311 |
| Mean .... = | ·0056700 | Mean .... = | ·0042571 | Mean .... = | ·0053645 | Mean .... = | ·0074990 | Mean .... = | ·0047750 | Mean .... = | ·0047738 |
| Correction* = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 |
| Corr$^{d}$ Mean = | ·0057067 | Corr$^{d}$ Mean = | ·0042938 | Corr$^{d}$ Mean = | ·0054012 | Corr$^{d}$ Mean = | ·0075357 | Corr$^{d}$ Mean = | ·0048117 | Corr$^{d}$ Mean = | ·0048105 |

Mean excess of 1 set of bars..... 0·0325596

* This correction arises from the error of the two thermometers ($\alpha$ and $\beta$) attached to the standard bar A. with which the foregoing comparisons had been computed, and of which the correction for the mean is + ·0454 determined in June, 1833.

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RESULTS of Comparisons of the compensation bars with the iron standard A. at Seronj after the measurement of the Base.

| A. | | B. | | C. | | D. | | E. | | H. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ·0047472 | ·0070006 | ·0028943 | ·0056557 | ·0033924 | ·0069458 | ·0057483 | ·0089431 | ·0031483 | ·0063530 | ·0035866 | ·0055611 |
| ·0042378 | ·0047867 | ·0024896 | ·0030683 | ·0033313 | ·0038204 | ·0055827 | ·0059273 | ·0030026 | ·0033173 | ·0031520 | ·0039300 |
| ·0041890 | ·0049668 | ·0024457 | ·0028947 | ·0033323 | ·0041748 | ·0057380 | ·0058583 | ·0031430 | ·0033928 | ·0031679 | ·0038112 |
| ·0039406 | ·0046875 | ·0023368 | ·0026951 | ·0030341 | ·0036863 | ·0056341 | ·0060273 | ·0028946 | ·0031036 | ·0029544 | ·0032729 |
| ·0039898 | ·0043327 | ·0021569 | ·0022905 | ·0029488 | ·0034361 | ·0052450 | ·0056675 | ·0031431 | ·0029330 | ·0027048 | ·0029828 |
| ·0039515 | ·0039067 | ·0021982 | ·0016404 | ·0034435 | ·0029653 | ·0056251 | ·0053113 | ·0030998 | ·0029155 | ·0030500 | ·0027263 |
| ·0041120 | ·0037499 | ·0026726 | ·0021112 | ·0036189 | ·0032119 | ·0059500 | ·0053537 | ·0036638 | ·0029679 | ·0033151 | ·0027587 |
| ·0058406 | ·0037622 | ·0044958 | ·0020737 | ·0059452 | ·0032591 | ·0081966 | ·0055005 | ·0053475 | ·0031196 | ·0046153 | ·0029005 |
| ·0059986 | ·0040799 | ·0047783 | ·0001400 | ·0059637 | ·0033825 | ·0081404 | ·0056140 | ·0052564 | ·0033277 | ·0048629 | ·0031285 |
| ·0063692 | ·0066494 | ·0045362 | ·0052149 | ·0061202 | ·0073567 | ·0083715 | ·0096977 | ·0056769 | ·0060318 | ·0051439 | ·0052199 |
| ·0063541 | ·0063899 | ·0051737 | ·0051397 | ·0062993 | ·0068432 | ·0082967 | ·0093187 | ·0057564 | ·0059616 | ·0052832 | ·0053091 |
| ·0065622 | ·0065634 | ·0052074 | ·0053332 | ·0063978 | ·0068573 | ·0086741 | ·0090190 | ·0058948 | ·0059608 | ·0053668 | ·0053880 |
| ·0065985 | ·0066853 | ·0051541 | ·0054649 | ·0065935 | ·0069144 | ·0085809 | ·0089715 | ·0060556 | ·0061722 | ·0053433 | ·0054799 |
| ·0067861 | ·0068002 | ·0054462 | ·0053956 | ·0066317 | ·0068998 | ·0086340 | ·0090416 | ·0060340 | ·0060730 | ·0055807 | ·0055251 |
| ·0048516 | ·0070253 | ·0028692 | ·0054663 | ·0036562 | ·0067813 | ·0057482 | ·0088732 | ·0031182 | ·0061686 | ·0036562 | ·0056456 |
| ·0047505 | ·0072176 | ·0026635 | ·0057333 | ·0037642 | ·0069586 | ·0058064 | ·0089062 | ·0031466 | ·0063211 | ·0035550 | ·0057632 |
| ·0046846 | ·0050281 | ·0027719 | ·0031453 | ·0035938 | ·0040369 | ·0059398 | ·0058699 | ·0031555 | ·0034292 | ·0033497 | ·0034940 |
| ·0043888 | ·0048023 | ·0025360 | ·0031138 | ·0033429 | ·0039207 | ·0057337 | ·0059628 | ·0029543 | ·0034674 | ·0031984 | ·0037613 |
| ·0041081 | ·0047173 | ·0021855 | ·0026352 | ·0031319 | ·0036912 | ·0051741 | ·0055291 | ·0026388 | ·0029341 | ·0027533 | ·0034720 |
| ·0038724 | ·0043285 | ·0021640 | ·0022863 | ·0031402 | ·0034867 | ·0051874 | ·0055239 | ·0029161 | ·0028442 | ·0027617 | ·0031878 |
| ·0039482 | ·0039925 | ·0019857 | ·0021994 | ·0030317 | ·0031308 | ·0054474 | ·0053822 | ·0030167 | ·0028967 | ·0027627 | ·0027921 |
| ·0037519 | ·0040306 | ·0020833 | ·0021130 | ·0031293 | ·0031689 | ·0056745 | ·0055398 | ·0031392 | ·0030095 | ·0028404 | ·0028103 |
| ·0041463 | ·0038752 | ·0021489 | ·0020572 | ·0035536 | ·0030982 | ·0057949 | ·0053246 | ·0034490 | ·0028840 | ·0031501 | ·0028790 |
| ·0058799 | ·0037274 | ·0047144 | ·0021385 | ·0064129 | ·0032791 | ·0080964 | ·0055703 | ·0052623 | ·0029803 | ·0046148 | ·0028308 |
| ·0061105 | ·0058916 | ·0048703 | ·0048008 | ·0065389 | ·0061805 | ·0083619 | ·0084767 | ·0055776 | ·0053985 | ·0050397 | ·0047560 |
| ·0061860 | ·0059851 | ·0051002 | ·0047797 | ·0064401 | ·0059951 | ·0086067 | ·0083460 | ·0057876 | ·0055767 | ·0051899 | ·0048345 |
| ·0065350 | ·0061038 | ·0051603 | ·0050728 | ·0065798 | ·0063080 | ·0086917 | ·0084199 | ·0058327 | ·0056705 | ·0052848 | ·0050080 |
| ·0065913 | ·0063517 | ·0053361 | ·0050367 | ·0065863 | ·0063816 | ·0087331 | ·0086827 | ·0055005 | ·0057390 | ·0053859 | ·0050815 |
| ·0068406 | ·0065447 | ·0054409 | ·0051999 | ·0068007 | ·0064501 | ·0087881 | ·0085919 | ·0061532 | ·0059869 | ·0055107 | ·0053144 |
| ·0069484 | ·0066906 | ·0056683 | ·0051964 | ·0068289 | ·0065362 | ·0087615 | ·0084489 | ·0062162 | ·0058439 | ·0054293 | ·0053508 |
| | ·0068057 | | ·0054708 | | ·0068107 | | ·0088030 | | ·0060785 | | ·0056751 |
| Sum ..... = | 61 ) 3247505 | Sum ..... = | 61 ) 2252476 | Sum ..... = | 61 ) 2995523 | Sum ..... = | 61 ) 4314658 | Sum ..... = | 61 ) 2688402 | Sum ..... = | 61 ) 2532599 |
| Mean .... = | ·0053238 | Mean .... = | ·0036926 | Mean .... = | ·0049107 | Mean .... = | ·0070732 | Mean .... = | ·0044072 | Mean .... = | ·0041518 |
| Correction* = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 |
| Corr^d Mean = | ·0053605 | Corr^d Mean = | ·0037293 | Corr^d Mean = | ·0049474 | Corr^d Mean = | ·0071099 | Corr^d Mean = | ·0044439 | Corr^d Mean = | ·0041885 |

Mean excess of 1 set of bars..... 0 ·0297795.

* This correction arises from the error of the two thermometers ($\alpha$ and $\beta$) attached to the standard bar A. with which the foregoing comparisons had been computed, and of which the correction for the mean is + ·0454, determined in June, 1833.

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## DEDUCTION of the WHOLE BASE.

| | | |
|---|---|---|
| The excess of 6 Bars above the stand$^{d}$ A reduced to 62° before the meas$^{t}$ is in parts of an inch | | 0·0325596 |
| The like excess after the measurement is | | 0·0297795 |
| Whence the mean excess to be used is | | 0·03116955 |
| The mean error of the Microscopes as registered between the 29$^{th}$ November and 6$^{th}$ December is +0·0069276, which comprises all the errors of the intermediate Microscopes, added to half those of the external ones: 62 sets were measured with that mean error and 62 × 0·0069276 in parts of an inch | = | +0·4295112 |
| The mean error for the next 71 sets is 0·00669525 giving | | +0·4753628 |
| ,, ,, ,, 48 sets is 0·00597785 giving | | +0·2869368 |
| ,, ,, ,, 13 sets is 0·0060698 giving | | +0·0789074 |
| ,, ,, ,, 58 sets is 0·00512985 giving | | +0·2975313 |
| ,, ,, ,, 79 sets is 0·00552195 giving | | +0·4362341 |
| ,, ,, ,, 37 sets is 0·00542235 giving | | +0·2006288 |
| ,, ,, ,, 87 sets is 0·0063801 giving | | +0·5550687 |
| ,, ,, ,, 84 sets is 0·00615855 giving | | +0·5173182 |
| ,, ,, ,, 70 sets is 0·0056931 giving | | +0·3985170 |
| for the last partial set | | +0·0049219 |
| The sum of which gives for the total Microscope error in inches | | +3·6809382 |
| The correction for the compensation bars due to 609 sets is +0·03116955 × 609 = | | +18·9822560 |
| Do. do. for the partial set | | +0·0220423 |
| The residual portion measured by Cary's scale and reduced to 62 of Fahrenheit is | | +64·2807765 |
| Therefore the total correction for Bars, Microscopes, &c. in inches is | | +86·9660130 |
| Which reduced to feet is in terms of standard A | | +7·2471678 |
| The value of 609 sets of bars and microscopes at 63 feet each is 609 × 63 = | 38367 | |
| Also the partial set of 4 Bars at the termination is | 42 | |
| Therefore the total length of the Base at the level it was measured is in terms of Standard A. and Scale A. in feet | 38416·2471678 | |
| The correction for the height above the level of the Sea is | | −2·9295975 |
| Whence the total length of the Base at the level of the Sea is in feet | | 38413·3175703 |
| To this must be applied the correction for the ends of the Base as explained in page 277 | | +0·005 |
| Giving for the length of the Base as used in the triangulation | | 38413·3225703 |
| To which must be further applied the correction for 24·5 feet difference of height | | +0·0449557 |
| Whence the true length of the Base is | | 38413·3675260 |

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# PARTICULARS OF A BASE LINE,

MEASURED WITH COMPENSATION BARS

IN

# THE VALLEY DENOMINATED DEHRA DUN,

IN THE

MONTHS OF DECEMBER, 1834, AND JANUARY, 1835.

BY LIEUT.-COL. G. EVEREST,

SURVEYOR-GENERAL OF INDIA, AND HIS ASSISTANTS.



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# RECAPITULATION

## OF CERTAIN PARTICULARS DETAILED IN THE INTRODUCTORY PAGES.

THIS Base Line was measured with the compensation bars in an open part of the Valley called the Dehra Dun, which lies between the River Asan and the skirts of a low range of hills covered with forests, which bound the valley on the South and separate it from the plains of the Doab included between the Jumna and the Ganges.

The line chosen presented several irregularities in consequence of the numerous small rivers which flow from those hills into the Asan, but the measurement was nevertheless satisfactorily accomplished between the 1st December and 31st January.

Several permanent register heads were left at divers parts of the alignment, of which two characterized $A$ and $B$ (the former being to the West) were selected as most appropriate for a symmetrical triangulation, of which mention will presently be made.

The end proposed by these intermediate points may be thus explained: the apparatus being but of recent introduction, its capability of fulfilling the design proposed by it required to be tested by practical trial with extreme severity and the object of the two Stations $A$ and $B$ was that the whole distance might be thereby divided into 3 sections, whereof the middle one or the part $A\ B$ used as an independent base might serve, by connection with other points on the elevated ridge to the South, to deduce by triangulation the length of each of the other sections to its East and West.

Accordingly 3 points $\alpha$, $\beta$, $\gamma$ ($\alpha$ being to the West) were chosen on the range, in such wise as to admit of as symmetrical a triangulation as could be obtained, and the results given by that process as well as the particulars of the triangles will be found subjoined.

But besides this trial which was certainly satisfactory both as to severity and accordance, it was determined to re-measure the whole line in reverse order *i. e.* from East to West, during the progress of which, as each intermediate register head left in the measurement came successively under the leading microscope, the excess or defect of the one measurement with respect to the other was susceptible of easy detection: these results are also subjoined and it may be presumed that this second test combined with the first will be sufficiently decisive as to the merits of the apparatus.

The bars were compared 50 times before the measurement, between the 12th and 15th November; 61 times after the measurement, between the 11th and 16th February, and 66 times after the re-measurement, between the 31st March and 2nd April. The

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first of these comparisons was made under a thatched building at Dehra, the other two at the Base Line itself under the same tents which gave shelter to it in working order and in fact under precisely the same circumstances to which it was subject in the measurement itself, a practice which has been rigorously abided by in all bases subsequently measured; the results of these comparisons are subjoined.

The bar levels were examined 7 times during the measurement and 3 times during the re-measurement: the microscopes were compared with their scales 13 times during the former process, and the aggregate of their errors was found to be +0·973 inches: in the latter process they were compared 5 times and the aggregate amounted to −0·038 inches.

The result given by triangulation has not been used as correctional but the mean of the lengths derived from the two measurements has been taken both in the whole base and in the three sections into which it was divided.

The values thus given after all reductions are as follows:—

| | | |
|---|---|---|
| By the measurement | Feet | 39183·97329 |
| By the re-measurement | | 39183·77357 |
| Mean | | 39183·87343 |
| Value deduced from computation originating from the Seronj Base | | 39183·273 |
| Error measurement in excess of computation | | 0·600 |

It is proper in this place to remark that when the apparatus was originally constructed there were two iron standards of 10 feet length marked *A* and *B* and two brass 6 inch scales similarly characterized, of each of which the one marked *B* was left in England for the purpose of undergoing a rigorous comparison with the national standard.

The Bar* and Scale so left arrived in India in 1834 and were compared as early after their reaching Dehra Dun as circumstances permitted with the similar implements marked *A* which had come out to India in 1831.

The iron bars were compared 45 times at my office at Dehra before the measurement and 56 times at the site of the base line after the measurement; the brass scales were compared 50 times at the station of Hatipaon after all the season's work was at an end, and the results of these comparisons will be found in the Appendix.

The brass scale *B* was subsequently on the 30th June compared with the Great Trigonometrical Survey Scale by Cary which is that used for reference throughout all prior operations by Colonel Lambton and myself, and the following results for *A*−*B* were obtained, in which *A* implies Cary's scale.

* The Bar and Scale herein adverted to were brought by me to England in 1844, and have since been subjected to a course of comparisons at Southampton at the Ordnance Map Office, under the direction of the Superintendent of the Ordnance Survey of Great Britain; the results of these comparisons will also be given in the Appendix.

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| | | | | | |
|---|---|---|---|---|---|
| 12 comparisons referred to part | | | | 12 to 18 of scale | −0·00066199 |
| 12 | do. | ... | ... | 13 to 19 of do. | +0·00018684 |
| 12 | do. | ... | ... | 14 to 20 of do. | +0·00269907 |
| 12 | do. | ... | ... | 15 to 21 of do. | +0·00273689 |
| | | | | Mean | +0·00124020 |

It is to be remarked however that all my measurements, whether those on the Great Arc Series comprised between the bases of Beder and the Dehra Dun; those on the Calcutta Longitudinal Series and the Meridional Series emanating from it; or those on the Bombay Longitudinal Series are referable to the 10 feet iron standard *A* and the 6 inch standard scale *A* of the H. E. I. C., so that the means of reduction to any other which may be assumed as the universal standard of comparison are now available.

The inconvenience which was experienced in the measurement at Calcutta, from having no certain mode of determining the amount of the various deviations of the microscopes, induced me to have a micrometer scale applied for such purposes, and that such comparisons might be effected speedily so as not to involve delay to the progress of the work, I had 7 scales with a micrometer to each cast in the workshop of the mathematical instrument maker at Calcutta, and the dots set off at 6 inches asunder as nearly as possible at the temperature of 62 Fahrenheit: the new scales were marked *M*, *N*, *P*, *R*, *S*, *T*, *U*, and they were compared with the standard scale *A* between the 11th and 13th June, whence the following results were obtained:

| | | |
|---|---|---|
| $A-M=$ | in parts of an inch | +·0000206 |
| $A-N=$ | ..... | −·0003629 |
| $A-P=$ | ..... | −·0003503 |
| $A-R=$ | ..... | −·0000928 |
| $A-S=$ | ..... | +·0000750 |
| $A-T=$ | ..... | +·0000974 |
| $A-U=$ | ..... | −·0002831 |

The re-measurement and the small triangulation were effected at the same time, and the whole was concluded by the 2nd April, 1835, immediately subsequent to which the observation of the angles of the principal triangles with the large theodolite by Troughton and Simms were commenced upon.

The formulæ and methods employed in comparing the computation bars with the iron standard *A* are in all respects the same with those used in the Seronj Base.

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RESULTS of Comparisons of the Compensation Bars with the iron Standard A at Dehra Dun before the measurement of the Base.

| A. | | B. | | C. | | D. | | E. | | H. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ·0049324 | ·0051869 | ·0037813 | ·0041838 | ·0044517 | ·0051422 | ·0062145 | ·0069497 | ·0044268 | ·0049733 | ·0041537 | ·0049137 |
| ·0048609 | ·0052976 | ·0039174 | ·0042150 | ·0049354 | ·0049847 | ·0062016 | ·0069561 | ·0043643 | ·0049599 | ·0044885 | ·0050642 |
| ·0048435 | ·0052452 | ·0039993 | ·0043116 | ·0048435 | ·0052452 | ·0063580 | ·0068838 | ·0045952 | ·0050813 | ·0046697 | ·0050416 |
| ·0047977 | ·0052478 | ·0038294 | ·0042050 | ·0048474 | ·0052627 | ·0063371 | ·0068269 | ·0046984 | ·0048853 | ·0048722 | ·0051187 |
| ·0050091 | ·0052891 | ·0041153 | ·0041669 | ·0052326 | ·0052742 | ·0067719 | ·0068334 | ·0050091 | ·0048968 | ·0047608 | ·0049564 |
| ·0052261 | ·0053272 | ·0041486 | ·0042546 | ·0054496 | ·0053470 | ·0069641 | ·0071198 | ·0049778 | ·0049994 | ·0047792 | ·0051732 |
| ·0050758 | ·0053425 | ·0040826 | ·0044289 | ·0054730 | ·0054717 | ·0065903 | ·0070458 | ·0046785 | ·0050496 | ·0047282 | ·0052234 |
| ·0046233 | ·0052858 | ·0037047 | ·0044664 | ·0048716 | ·0055241 | ·0062620 | ·0070834 | ·0041317 | ·0050921 | ·0042857 | ·0051318 |
| ·0046291 | ·0051097 | ·0036112 | ·0036547 | ·0048774 | ·0052189 | ·0062182 | ·0065597 | ·0042071 | ·0040818 | ·0043809 | ·0044492 |
| ·0047848 | ·0048464 | ·0035334 | ·0035106 | ·0046060 | ·00492$^{08}$ | ·0063291 | ·0063162 | ·0042982 | ·0040717 | ·0045067 | ·0041810 |
| ·0050667 | ·0048089 | ·0040984 | ·0034632 | ·0053547 | ·0049777 | ·0067153 | ·0063185 | ·0051760 | ·0041584 | ·0052008 | ·0043372 |
| ·0049684 | ·0046211 | ·0042484 | ·0036528 | ·0055345 | ·0045864 | ·0068206 | ·0061456 | ·0053408 | ·0039955 | ·0050330 | ·0041395 |
| ·0053440 | ·0044708 | ·0042863 | ·0033535 | ·0053142 | ·0045403 | ·0068536 | ·0063826 | ·0050659 | ·0041877 | ·0050411 | ·0043268 |
| ·0052097 | ·0048370 | ·0041917 | ·0035856 | ·0053587 | ·0046433 | ·0066646 | ·0063366 | ·0049465 | ·0042312 | ·0048820 | ·0044993 |
| ·0051741 | ·0047020 | ·0042604 | ·0035748 | ·0050996 | ·0045282 | ·0067383 | ·0063556 | ·0048762 | ·0041856 | ·0047918 | ·0045232 |
| ·0052604 | ·0049145 | ·0041927 | ·0040653 | ·0051958 | ·0048151 | ·0069040 | ·0064737 | ·0049972 | ·0046761 | ·0047539 | ·0047109 |
| ·0052980 | ·0049826 | ·0041757 | ·0040341 | ·0052682 | ·0047839 | ·0069019 | ·0064723 | ·0051639 | ·0046250 | ·0047021 | ·0047343 |
| ·0051350 | ·0047005 | ·0039135 | ·0038563 | ·0053784 | ·0049040 | ·0069028 | ·0066073 | ·0044845 | ·0045167 | ·0045342 | ·0045813 |
| ·0052348 | ·0049364 | ·0040082 | ·0040972 | ·0051801 | ·0049165 | ·0064762 | ·0067787 | ·0042218 | ·0047725 | ·0043211 | ·0046385 |
| ·0049161 | ·0049163 | ·0038534 | ·0040224 | ·0050899 | ·0051149 | ·0063810 | ·0068032 | ·0043947 | ·0049411 | ·0042457 | ·0048319 |
| ·0049139 | ·0049154 | ·0036825 | ·0039868 | ·0048146 | ·0048757 | ·0063540 | ·0066137 | ·0040102 | ·0049303 | ·0041989 | ·0047317 |
| ·0047075 | ·0051360 | ·0036300 | ·0044309 | ·0046132 | ·0050268 | ·0061376 | ·0068889 | ·0039924 | ·0048629 | ·0040520 | ·0043663 |
| ·0045427 | ·0052929 | ·0033907 | ·0042700 | ·0042590 | ·0052284 | ·0059679 | ·0071104 | ·0039716 | ·0050893 | ·0041355 | ·0053029 |
| ·0052740 | ·0053600 | ·0040177 | ·0043569 | ·0049860 | ·0050323 | ·0068630 | ·0070335 | ·0046185 | ·0051018 | ·0049611 | ·0049777 |
| ·0050184 | ·0051361 | ·0038614 | ·0044260 | ·0052916 | ·0051957 | ·0069451 | ·0070429 | ·0049489 | ·0050318 | ·0049738 | ·0050318 |
| Sum ..... = | 50 ) 2507461 | Sum ..... = | 50 ) 1991075 | Sum ..... = | 50 ) 2519874 | Sum ..... = | 50 ) 3318110 | Sum ..... = | 50 ) 2329933 | Sum ..... = | 50 ) 2344391 |
| Mean .... = | ·0050149 | Mean .... = | ·0039822 | Mean .... = | ·0050397 | Mean .... = | ·0066362 | Mean .... = | ·0046599 | Mean .... = | ·0046888 |
| Correction* = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 |
| Corr$^{d}$ Mean = | ·0050516 | Corr$^{d}$ Mean = | ·0040189 | Corr$^{d}$ Mean = | ·0050764 | Corr$^{d}$ Mean = | ·0066729 | Corr$^{d}$ Mean = | ·0046966 | Corr$^{d}$ Mean = | ·0047255 |

Mean excess of 1 set of Bars..... 0 ·0302419.

* This correction arises from the error of the two Thermometers ($\alpha$ and $\beta$) attached to the Standard Bar A, with which the foregoing comparisons had been computed, and of which the correction for the mean is + ·0454.



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RESULTS of Comparisons of the Compensation Bars with the iron Standard A at Dehra Dun after the measurement of the Base.

| A. | | B. | | C. | | D. | | E. | | H. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ·0042845 | ·0042538 | ·0027326 | ·0031779 | ·0038135 | ·0042290 | ·0054547 | ·0054834 | ·0032185 | ·0035002 | ·0033921 | ·0037976 |
| ·0040602 | ·0038497 | ·0025479 | ·0028531 | ·0034900 | ·0037505 | ·0052501 | ·0053124 | ·0031925 | ·0033440 | ·0035098 | ·0036514 |
| ·0035744 | ·0038177 | ·0023051 | ·0027368 | ·0032471 | ·0034359 | ·0049081 | ·0052655 | ·0029744 | ·0035302 | ·0034950 | ·0037285 |
| ·0035026 | ·0035165 | ·0022383 | ·0025199 | ·0030217 | ·0031694 | ·0049058 | ·0050040 | ·0030812 | ·0034173 | ·0034283 | ·0036900 |
| ·0036649 | ·0036757 | ·0024254 | ·0027337 | ·0031443 | ·0038046 | ·0051028 | ·0049649 | ·0032187 | ·0033782 | ·0037244 | ·0038493 |
| ·0036551 | ·0036913 | ·0026089 | ·0027939 | ·0031295 | ·0033591 | ·0051623 | ·0053424 | ·0035014 | ·0034583 | ·0041459 | ·0040384 |
| ·0035446 | ·0045709 | ·0027017 | ·0037776 | ·0031975 | ·0048238 | ·0051808 | ·0059840 | ·0036636 | ·0044916 | ·0042288 | ·0039462 |
| ·0041487 | ·0044721 | ·0031769 | ·0038027 | ·0037421 | ·0047398 | ·0062063 | ·0064851 | ·0046197 | ·0044969 | ·0051651 | ·0047944 |
| ·0043951 | ·0046476 | ·0034035 | ·0040625 | ·0043208 | ·0050888 | ·0065271 | ·0066308 | ·0045687 | ·0047517 | ·0052876 | ·0046971 |
| ·0048350 | ·0049770 | ·0038879 | ·0042085 | ·0046168 | ·0054480 | ·0068430 | ·0066776 | ·0049589 | ·0049571 | ·0053506 | ·0047439 |
| ·0046572 | ·0053333 | ·0037300 | ·0043665 | ·0048654 | ·0057002 | ·0066751 | ·0070191 | ·0047662 | ·0049069 | ·0048158 | ·0048474 |
| ·0049810 | ·0050504 | ·0040885 | ·0043662 | ·0051049 | ·0056057 | ·0066717 | ·0066965 | ·0049066 | ·0049116 | ·0050355 | ·0048818 |
| ·0052115 | ·0051189 | ·0044083 | ·0043256 | ·0054446 | ·0058031 | ·0069717 | ·0070278 | ·0048645 | ·0047916 | ·0048893 | ·0045884 |
| ·0055543 | ·0044795 | ·0045627 | ·0031259 | ·0055146 | ·0039986 | ·0070318 | ·0055406 | ·0048602 | ·0033490 | ·0046618 | ·0036217 |
| ·0045752 | ·0043720 | ·0032761 | ·0028795 | ·0044314 | ·0038712 | ·0055420 | ·0053388 | ·0037075 | ·0032861 | ·0037075 | ·0036828 |
| ·0043198 | ·0041114 | ·0031298 | ·0027132 | ·0040223 | ·0035114 | ·0064270 | ·0051476 | ·0035265 | ·0033676 | ·0036752 | ·0036651 |
| ·0042021 | ·0039700 | ·0030270 | ·0024131 | ·0038253 | ·0035386 | ·0056102 | ·0050756 | ·0034831 | ·0034890 | ·0038996 | ·0037072 |
| ·0037496 | ·0037881 | ·0027481 | ·0025684 | ·0036157 | ·0035650 | ·0053610 | ·0051714 | ·0033778 | ·0034410 | ·0038488 | ·0038426 |
| ·0037243 | ·0035927 | ·0025840 | ·0025514 | ·0035508 | ·0033943 | ·0054349 | ·0049562 | ·0035012 | ·0033200 | ·0038037 | ·0035927 |
| ·0038322 | ·0038160 | ·0025828 | ·0027698 | ·0034257 | ·0035978 | ·0054536 | ·0053729 | ·0036141 | ·0037614 | ·0039215 | ·0040094 |
| ·0036400 | ·0040229 | ·0026285 | ·0030462 | ·0034317 | ·0038940 | ·0051126 | ·0056145 | ·0035210 | ·0039238 | ·0039672 | ·0042659 |
| ·0048479 | ·0050200 | ·0038910 | ·0037259 | ·0042926 | ·0049308 | ·0069799 | ·0065124 | ·0045752 | ·0046680 | ·0047240 | ·0049903 |
| ·0047165 | ·0050931 | ·0040918 | ·0039874 | ·0046670 | ·0051674 | ·0065709 | ·0065805 | ·0044438 | ·0046617 | ·0047612 | ·0051873 |
| ·0047471 | ·0049320 | ·0040034 | ·0040842 | ·0048116 | ·0047337 | ·0065321 | ·0065930 | ·0046182 | ·0049320 | ·0048413 | ·0051304 |
| ·0047799 | ·0049916 | ·0038676 | ·0040198 | ·0048543 | ·0051304 | ·0066392 | ·0065286 | ·0043535 | ·0047932 | ·0046956 | ·0050659 |
| ·0048183 | ·0045836 | ·0040498 | ·0037456 | ·0054381 | ·0044348 | ·0066776 | ·0062743 | ·0046497 | ·0042662 | ·0047935 | ·0045488 |
| ·0050076 | ·0046425 | ·0041648 | ·0037401 | ·0055283 | ·0046128 | ·0069661 | ·0062985 | ·0046457 | ·0044640 | ·0046358 | ·0044938 |
| ·0053991 | ·0046190 | ·0043331 | ·0036918 | ·0053743 | ·0043364 | ·0069858 | ·0062552 | ·0046306 | ·0046091 | ·0047546 | ·0045347 |
| ·0054604 | ·0048689 | ·0043498 | ·0038971 | ·0055596 | ·0047003 | ·0072156 | ·0063563 | ·0046919 | ·0045714 | ·0049051 | ·0045763 |
| ·0042300 | ·0047865 | ·0030748 | ·0039188 | ·0042697 | ·0049699 | ·0057274 | ·0063979 | ·0035260 | ·0044691 | ·0038780 | ·0044642 |
| | ·0050630 | | ·0036995 | | ·0047407 | | ·0065306 | | ·0044631 | | ·0045077 |
| Sum ..... = | 61 ) 2698468 | Sum ..... = | 61 ) 2069227 | Sum ..... = | 61 ) 2638372 | Sum ..... = | 61 ) 3665656 | Sum ..... = | 61 ) 2490322 | Sum ..... = | 61 ) 2630838 |
| Mean .... = | ·0044237 | Mean .... = | ·0033922 | Mean .... = | ·0043252 | Mean .... = | ·0060093 | Mean .... = | ·0040825 | Mean .... = | ·0043128 |
| Correction* = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 |
| Corr$^{d}$ Mean = | ·0044604 | Corr$^{d}$ Mean = | ·0034289 | Corr$^{d}$ Mean = | ·0043619 | Corr$^{d}$ Mean = | ·0060460 | Corr$^{d}$ Mean = | ·0041192 | Corr$^{d}$ Mean = | ·0043495 |

Mean excess of 1 set of Bars..... 0 ·0267659

* This correction arises from the error of the two Thermometers ($\alpha$ and $\beta$) attached to the Standard Bar A, with which the foregoing comparisons had been computed and of which the correction for the mean is + ·0454.

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RESULTS of Comparisons of the Compensation Bars with the iron Standard A at Dehra Dun after the remeasurement of the Base.

| A. | | B. | | C. | | D. | | E. | | H. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ·0046941 | ·0052954 | ·0030174 | ·0052361 | ·0038929 | ·0060620 | ·0054854 | ·0078524 | ·0040808 | ·0055180 | ·0036159 | ·0055872 |
| ·0042557 | ·0053529 | ·0029994 | ·0053529 | ·0040134 | ·0060503 | ·0055367 | ·0081078 | ·0034644 | ·0052837 | ·0037067 | ·0057832 |
| ·0042860 | ·0056597 | ·0027923 | ·0052640 | ·0036430 | ·0062037 | ·0054235 | ·0079694 | ·0032572 | ·0058476 | ·0036826 | ·0058476 |
| ·0040418 | ·0056509 | ·0027163 | ·0053097 | ·0034285 | ·0057548 | ·0051744 | ·0081832 | ·0031960 | ·0058043 | ·0034483 | ·0057449 |
| ·0039052 | ·0058185 | ·0027825 | ·0055168 | ·0031979 | ·0060460 | ·0050922 | ·0078661 | ·0032672 | ·0059768 | ·0036629 | ·0059224 |
| ·0036803 | ·0057715 | ·0030274 | ·0054203 | ·0034379 | ·0061375 | ·0054855 | ·0078240 | ·0034231 | ·0057962 | ·0038831 | ·0057319 |
| ·0038355 | ·0057091 | ·0028315 | ·0053085 | ·0035140 | ·0056349 | ·0053885 | ·0077517 | ·0034794 | ·0056794 | ·0038355 | ·0055261 |
| ·0035925 | ·0057276 | ·0029595 | ·0052726 | ·0032068 | ·0060986 | ·0052989 | ·0078989 | ·0035579 | ·0057672 | ·0040426 | ·0053913 |
| ·0039295 | ·0058618 | ·0029057 | ·0052732 | ·0036130 | ·0061239 | ·0055073 | ·0081418 | ·0038801 | ·0056392 | ·0042807 | ·0056392 |
| ·0038053 | ·0060194 | ·0030337 | ·0053715 | ·0033156 | ·0059255 | ·0057341 | ·0081066 | ·0038992 | ·0058265 | ·0043444 | ·0057128 |
| ·0038795 | ·0061357 | ·0032761 | ·0056510 | ·0038102 | ·0063978 | ·0058875 | ·0080943 | ·0038201 | ·0059527 | ·0043493 | ·0054334 |
| ·0051749 | ·0065425 | ·0054123 | ·0054742 | ·0059563 | ·0065672 | ·0077467 | ·0081252 | ·0055409 | ·0057413 | ·0060008 | ·0057413 |
| ·0057678 | ·0043770 | ·0053424 | ·0031850 | ·0059112 | ·0041248 | ·0078895 | ·0056926 | ·0056985 | ·0036648 | ·0058667 | ·0036598 |
| ·0053499 | ·0044759 | ·0049592 | ·0035411 | ·0057950 | ·0041989 | ·0074914 | ·0059052 | ·0052262 | ·0038725 | ·0056961 | ·0040752 |
| ·0055885 | ·0043813 | ·0052077 | ·0033773 | ·0058259 | ·0041884 | ·0074778 | ·0059492 | ·0055193 | ·0036939 | ·0056924 | ·0038818 |
| ·0060281 | ·0038589 | ·0053257 | ·0032160 | ·0059539 | ·0040123 | ·0076256 | ·0057928 | ·0057016 | ·0036957 | ·0057857 | ·0038589 |
| ·0059236 | ·0041149 | ·0057406 | ·0030812 | ·0063193 | ·0036599 | ·0080355 | ·0055640 | ·0059384 | ·0037044 | ·0059137 | ·0039319 |
| ·0062241 | ·0040420 | ·0054031 | ·0030924 | ·0064071 | ·0034980 | ·0080442 | ·0054714 | ·0061598 | ·0038293 | ·0056207 | ·0040321 |
| ·0065851 | ·0042157 | ·0058878 | ·0030336 | ·0066198 | ·0038744 | ·0082222 | ·0057440 | ·0059471 | ·0041118 | ·0059075 | ·0040970 |
| ·0063051 | ·0035951 | ·0055236 | ·0029274 | ·0065078 | ·0032488 | ·0081894 | ·0056575 | ·0057412 | ·0038424 | ·0058105 | ·0040155 |
| ·0060361 | ·0036649 | ·0053338 | ·0029428 | ·0061252 | ·0033434 | ·0080540 | ·0057274 | ·0054228 | ·0034819 | ·0052745 | ·0040903 |
| ·0062649 | ·0035506 | ·0055774 | ·0029125 | ·0060720 | ·0032538 | ·0075607 | ·0057070 | ·0054785 | ·0038325 | ·0054933 | ·0041490 |
| ·0044993 | ·0056188 | ·0029661 | ·0053171 | ·0039602 | ·0062816 | ·0055825 | ·0081858 | ·0035052 | ·0059749 | ·0039207 | ·0061134 |
| ·0044406 | ·0056603 | ·0029766 | ·0051657 | ·0037630 | ·0063033 | ·0055435 | ·0081876 | ·0033030 | ·0061054 | ·0033970 | ·0057147 |
| ·0043393 | ·0057462 | ·0026527 | ·0053456 | ·0039337 | ·0066760 | ·0053828 | ·0082983 | ·0031671 | ·0058995 | ·0037161 | ·0058599 |
| ·0042052 | ·0058186 | ·0030577 | ·0053190 | ·0038589 | ·0063577 | ·0055801 | ·0081629 | ·0031171 | ·0060510 | ·0040222 | ·0059620 |
| ·0040301 | ·0057376 | ·0024573 | ·0058958 | ·0036443 | ·0060541 | ·0052468 | ·0080671 | ·0033327 | ·0060195 | ·0038273 | ·0056931 |
| ·0037371 | ·0061308 | ·0026292 | ·0054878 | ·0034156 | ·0064819 | ·0051120 | ·0082130 | ·0033909 | ·0059824 | ·0036678 | ·0057005 |
| ·0035974 | ·0060961 | ·0029100 | ·0054036 | ·0032364 | ·0064027 | ·0054769 | ·0079903 | ·0034342 | ·0060021 | ·0037903 | ·0056163 |
| ·0034170 | ·0063991 | ·0023932 | ·0056622 | ·0034813 | ·0067453 | ·0055585 | ·0082142 | ·0037236 | ·0059292 | ·0040204 | ·0057413 |
| ·0037966 | ·0062279 | ·0029607 | ·0056492 | ·0033514 | ·0068610 | ·0055969 | ·0077759 | ·0037026 | ·0061685 | ·0039647 | ·0055256 |
| ·0034349 | ·0064164 | ·0030837 | ·0056053 | ·0033459 | ·0062284 | ·0056853 | ·0082612 | ·0038998 | ·0057635 | ·0039938 | ·0057190 |
| ·0037855 | ·0063150 | ·0031475 | ·0055187 | ·0035036 | ·0066513 | ·0056204 | ·0082835 | ·0039438 | ·0059688 | ·0043246 | ·0058353 |
| Sum ..... = | 66 ) 3284246 | Sum ..... = | 66 ) 2794202 | Sum ..... = | 66 ) 3275092 | Sum ..... = | 66 ) 4495090 | Sum ..... = | 66 ) 3126466 | Sum ..... = | 66 ) 3198927 |
| Mean .... = | ·0049761 | Mean .... = | ·0042336 | Mean .... = | ·0049623 | Mean .... = | ·0068107 | Mean .... = | ·0047371 | Mean .... = | ·0048469 |
| Correction* = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 | Correction = | + ·0000367 |
| Corr$^{d}$ Mean = | ·0050128 | Corr$^{d}$ Mean = | ·0042703 | Corr$^{d}$ Mean = | ·0049990 | Corr$^{d}$ Mean = | ·0068474 | Corr$^{d}$ Mean = | ·0047738 | Corr$^{d}$ Mean = | ·0048836 |

Mean excess of 1 set of Bars..... 0 ·0307869.

* This correction arises from the error of the two Thermometers ($\alpha$ and $\beta$) attached to the Standard Bar A, with which the foregoing comparisons had been computed and of which the correction for the mean is + ·0454.

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## MEASUREMENT.

### DEDUCTION OF THE WHOLE BASE.

| | | |
|---|---|---|
| The excess of 6 Bars above the stand$^{d}$ A red$^{d}$ to 62° before the meas$^{t}$, is in parts of an inch .... | | 0·0302419 |
| The like excess after the measurement is..... | | 0·0267659 |
| Whence the mean excess to be used is ..... | | 0·0285039 |
| The mean error of the Microscopes as registered between the 1$^{st}$ December and 4$^{th}$ December is +0·00245795, with which 22 sets were measured; and 22×0·00245795 in parts of an inch ..... | | =+0·0540749 |
| The mean error for the next | 27 sets is 0·0023564 giving ..... | +0·0636228 |
| ,, ,, ,, | 22 sets is 0·0014882 giving ..... | +0·0327404 |
| ,, ,, ,, | 58 sets is 0·0009257 giving ..... | +0·0536906 |
| ,, ,, ,, | 37 sets is 0·0009051 giving ..... | +0·0334887 |
| ,, ,, ,, | 43 sets is 0·0010009 giving ..... | +0·0430387 |
| ,, ,, ,, | 74 sets is 0·0019373 giving ..... | +0·0883357 |
| ,, ,, ,, | 14 sets is 0·0011487 giving ..... | +0·0160811 |
| ,, ,, ,, | 91 sets is 0·0014630 giving ..... | +0·1331330 |
| ,, ,, ,, | 7 sets is 0·0021526 giving ..... | +0·0150682 |
| ,, ,, ,, | 76 sets is 0·0018702 giving ..... | +0·1421352 |
| ,, ,, ,, | 46 sets is 0·0023433 giving ..... | +0·1077941 |
| ,, ,, ,, | 104 sets is 0·00181775 giving..... | +0·1890460 |
| ,, ,, ,, | 1 set ..... | +0·0010923 |
| The sum of which gives for the total Microscope error in parts of an inch..... | | +0·9733417 |
| The correction for the compensation bars due to 622 sets is +0·0285039×622 ..... | | =+17·7294258 |
| Therefore the total correction for Bars, Microscopes, &c. is..... | | +18·7027675 |
| Which in the denomination of the standard A assumed to be 10 feet is..... | | +1·5585639 |
| The value of 622 sets of Bars and Microscopes at 63 feet each is 622×63 ..... | | =39186· |
| Therefore the total measured length of the Base in term of standard A and scale A in feet is | | 39187·5585639 |

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## RE-MEASUREMENT.

| | |
|---|---|
| The excess of 6 Bars above the stand$^{d}$ A red$^{d}$ to 62° before the re-meas$^{t}$ is in parts of an inch .. | +0·0267659 |
| The like excess after the re-measurement is ..... | +0·0307869 |
| Whence the mean excess to be used is..... | +0·0287764 |
| The mean error of the Microscopes as registered on the 17$^{th}$ February in parts of an inch is +0·0019085 with which the first set was measured ..... | +0·0019085 |
| The mean error for the next 114 sets is +0·00163745 giving..... | +0·1866693 |
| ,, ,, ,, 118 sets is −0·0002976 giving ..... | −0·0351168 |
| ,, ,, ,, 232 sets is −0·0006383 giving ..... | −0·1480740 |
| ,, ,, ,, 25 sets is −0·0005079 giving ..... | −0·0126975 |
| ,, ,, ,, 132 sets is −0·00022935 giving..... | −0·0302742 |
| The sum of which gives for the total Microscope error in parts of an inch ..... | −0·0375847 |
| The correction for the compensation bars due to 622 sets is ..... | +17·8989208 |
| The excess found in the re-measurement applied with a negative sign is ..... | −1·5552000 |
| Therefore the total correction for Bars and Microscopes, &c. is ..... | +16·3061361 |
| Which in the denomination of the standard A assumed to be 10 feet is..... | +1·3588447 |
| The value of 622 sets of Bars and Microscopes at 63 feet each is 622×63 ..... | =+39186· |
| Therefore the total length of the Base as re-meas$^{d}$ in terms of stand$^{d}$ A and scale A in feet is | 39187·3588447 |
| And as the like length given in the measurement is ..... | 39187·5585639 |
| Therefore the mean of the two measurements at the level of the site is ..... | 39187·4587043 |
| The correction for the height above the level of the sea is ..... | −3·6333640 |
| Whence the total length of the Base at the level of the sea in feet is ..... | 39183·8253403 |
| To which must be further applied the correction for 25·7 feet of height ..... | =+0·04809 |
| Whence the true length of the Base is..... | 39183·87343 |



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## DEDUCTION OF THE PARTIAL BASES.

MEASUREMENT. REMEASUREMENT.

### 1st. WEST END BASE to the FIRST PLAIN REGISTER.

| From 1st to 66th set. | | From 557th to 622nd set. | |
|---|---|---|---|
| Microscope corrn for the first 22 sets | +0·0540749 | Microscope correction for 66 sets | −0·0151371 |
| Ditto ..... next 27 sets | +0·0636228 | Bar correction for 66 sets | +1·8992424 |
| Ditto ..... next 17 sets | +0·0252994 | Remeasurement error | −0·1287 |
| Bar correction for 66 sets | +1·8812574 | | |
| | | Total correction in inches | +1·7554053 |
| Total correction in inches | +2·0242545 | | +2·0242545 |
| | | Mean correction in inches | +1·8898299 |
| | | Add 66 × 63 × 12 | 49896· |
| | | Mean distance in inches | 49897·8898299 |

### 2nd. FIRST PLAIN REGISTER to SECOND PLAIN REGISTER or REGISTER A.

| From 67th to 157th set. | | From 466th to 556th set. | |
|---|---|---|---|
| Microscope corrn for the first 5 sets | +0·0074410 | Microscope corrn for the first 25 sets | −0·0126975 |
| Ditto ..... next 58 sets | +0·0536906 | Ditto ..... next 66 sets | −0·0151371 |
| Ditto ..... next 28 sets | +0·0153428 | Bar correction for 91 sets | +2·6186524 |
| Bar correction for 91 sets | +2·5938549 | Remeasurement error | −0·0690 |
| | | Total correction in inches | +2·5218178 |
| Total correction in inches | +2·6803293 | | +2·6803293 |
| | | Mean correction in inches | +2·6010736 |
| | | Add 91 × 63 × 12 | 68796· |
| | | Mean distance in inches | 68798·6010736 |

### 3rd. REGISTER A. to THIRD PLAIN REGISTER.

| From 158th to 219th set. | | From 404th to 465th set. | |
|---|---|---|---|
| Microscope corrn for the first 9 sets | +0·0081459 | Microscope correction for 62 sets | −0·0395715 |
| Ditto ..... next 43 sets | +0·0430387 | Bar correction for 62 sets | +1·7841368 |
| Ditto ..... next 10 sets | +0·0119373 | Remeasurement error | −0·2310 |
| Bar correction for 62 sets | +1·7672418 | | |
| | | Total correction in inches | +1·5135653 |
| Total correction in inches | +1·8303637 | | +1·8303637 |
| | | Mean correction in inches | +1·6719645 |
| | | Add 62 × 63 × 12 | 46872· |
| | | Mean distance in inches | 46873·6719645 |

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## DEDUCTION OF THE PARTIAL BASES—*continued.*

MEASUREMENT. REMEASUREMENT.

### 4th. THIRD PLAIN REGISTER to FOURTH PLAIN REGISTER or REGISTER B.

| From 220th to 389th set. | | From 234th to 403rd set. | |
|---|---|---|---|
| Microscope corrn for the first 64 sets | +0·0763984 | Microscope correction for 170 sets | −0·1085025 |
| Ditto ..... next 14 sets | +0·0160811 | Bar correction for 170 sets | +4·8919880 |
| Ditto ..... next 91 sets | +0·1331330 | Remeasurement error | −0·5350 |
| Ditto ..... next 1 set | +0·0021526 | | |
| Bar correction for 170 sets | +4·8456630 | Total correction in inches | +4·2484855 |
| Total correction in inches | +5·0734281 | | +5·0734281 |
| | | Mean correction in inches | +4·6609568 |
| | | Add 170 × 63 × 12 | 128520· |
| | | Mean distance in inches | 128524·6609568 |

### 5th. REGISTER B. to FIFTH PLAIN REGISTER.

| From 390th to 520th set. | | From 103rd to 233rd set. | |
|---|---|---|---|
| Microscope corrn for the first 6 sets | +0·0129156 | Microscope corrn for the first 13 sets | +0·0212868 |
| Ditto ..... next 76 sets | +0·1421352 | Ditto ..... next 118 sets | −0·0351168 |
| Ditto ..... next 46 sets | +0·1077941 | Bar correction for 131 sets | +3·7697084 |
| Ditto ..... next 3 sets | +0·0054533 | Remeasurement error | −0·0815 |
| Bar correction for 131 sets | +3·7340109 | Total correction in inches | +3·6743784 |
| Total correction in inches | +4·0023091 | | +4·0023091 |
| | | Mean correction in inches | +3·8383437 |
| | | Add 131 × 63 × 12 | 99036· |
| | | Mean distance in inches | 99039·8383437 |

### 6th. FIFTH PLAIN REGISTER to EAST END BASE.

| From 521st to 622nd set. | | From 1st to 102nd set. | |
|---|---|---|---|
| Microscope corrn for the first 101 sets | +0·1835927 | Microscope corrn for the first 1 set | +0·0019085 |
| Ditto ..... next 1 set | +0·0010923 | Ditto ..... next 101 sets | +0·1653825 |
| Bar correction for 102 sets | +2·9073978 | Bar correction for 102 sets | +2·9351928 |
| | | Remeasurement error | −0·510 |
| | | Total correction in inches | +2·5924838 |
| Total correction in inches | +3·0920828 | | +3·0920828 |
| | | Mean correction in inches | +2·8422833 |
| | | Add 102 × 63 × 12 | 77112· |
| | | Mean distance in inches | 77114·8422833 |

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## WEST END BASE to REGISTER A. Deduced.

| | | Inches. |
|---|---|---|
| West End Base to the First Plain Register | Mean | 49897 ·8898299 |
| First Plain Register to Register A. | | 68798 ·6010736 |
| West End Base to Register A. at the level it was measured | | 118696 ·4909035 |
| Correction for the height above the sea | | −10 ·74183 |
| West End Base to Register A. at the level of the sea | | 118685 ·7490735 |

## REGISTER A. to REGISTER B. Computed.

| | |
|---|---|
| Register A. to the Third Plain Register | 46873 ·6719645 |
| Third Plain Register to Register B. | 128524 ·6609568 |
| Register A. to Register B. at the level it was measured | 175398 ·3329213 |
| Correction for the height above the sea | −16 ·02485 |
| Register A. to Register B. at the level of the sea | 175382 ·3080713 |

## REGISTER B. to EAST END BASE. Computed.

| | |
|---|---|
| Register B. to the Fifth Plain Register | 99039 ·8383437 |
| Fifth Plain Register to the East End Base | 77114 ·8422833 |
| Register B. to the East End Base at the level it was measured | 176154 ·6806270 |
| Correction for the height above the sea | −16 ·83369 |
| Register B. to the East End Base at the level of the sea | 176137 ·8469370 |

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## OBSERVED ANGLES OF PARTIAL TRIANGLES.

### At REGISTER A.

| Zero. | Register B and Station $\beta$. | Station $\beta$ and Station $\alpha$. | Station $\alpha$ and West End Base. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 344 | 74 22 24·22 (2) | 34 3 1·75 (2) | 71 34 36·06 (2) |
| 164 | 22·02 (2) | 3·32 (2) | 34·83 (2) |
| 350 | 21·58 (2) | 2·51 (2) | 35·40 (2) |
| 170 | 23·44 (2) | 2·72 (2) | 33·44 (2) |
| 356 | 20·03 (2) | 2·33 (2) | 35·44 (2) |
| 176 | 18·60 (2) | 5·00 (2) | 33·13 (2) |
| 2 | 21·05 (2) | 3·70 (2) | 34·94 (2) |
| 182 | 20·36 (2) | 4·07 (2) | 34·91 (2) |
| 8 | 21·11 (2) | 2·04 (2) | 35·29 (2) |
| 188 | 19·55 (2) | 4·37 (2) | 31·93 (2) |
| 14 | 22·44 (2) | 1·55 (2) | 35·70 (3) |
| 194 | 21·06 (3) | 4·613 (3) | 35·073 (3) |
| Means | 74 22 21·288 | 34 3 3·164 | 71 34 34·679 |
| | Prob. = 0·441 | Prob. = 0·325 | Prob. = 0·336 |

### At EAST END BASE.

| Zero. | Station $\gamma$ and Register B. | | |
|---|---|---|---|
| | ° ′ ″ | | |
| 0 | 86 24 49·96 (2) | | |
| 180 | 47·87 (2) | | |
| 5 | 51·37 (2) | | |
| 185 | 50·04 (2) | | |
| 11 | 51·97 (2) | | |
| 191 | 50·09 (2) | | |
| 17 | 51·57 (2) | | |
| 197 | 49·98 (3) | | |
| 23 | 50·58 (3) | | |
| 203 | 48·51 (2) | | |
| 29 | 49·97 (3) | | |
| 209 | 49·67 (3) | | |
| Mean | 86 24 50·132 | | |
| | Prob. = 0·325 | | |

### At STATION $\gamma$.

| Zero. | Station $\beta$ and Register B. | Register B and East End Base. | |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | |
| 0 | 49 7 58·34 (2) | 45 3 17·08 (2) | |
| 180 | 58·59 (3) | 15·69 (2) | |
| 6 | 62·160 (3) | 14·17 (2) | |
| 186 | 60·953 (3) | 14·147 (3) | |
| 12 | 62·227 (3) | 14·68 (3) | |
| 192 | 58·500 (3) | 17·46 (2) | |
| 18 | 59·62 (2) | 16·48 (2) | |
| 198 | 62·25 (3) | 14·00 (3) | |
| 24 | 60·83 (3) | 15·55 (3) | |
| 204 | 61·27 (3) | 14·36 (3) | |
| 30 | 59·24 (3) | 16·65 (3) | |
| 210 | 60·44 (3) | 16·22 (2) | |
| Means | 49 8 0·368 | 45 3 15·541 | |
| | Prob. = 0·410 | Prob. = 0·343 | |



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## OBSERVED ANGLES OF PARTIAL TRIANGLES.

### At REGISTER B.

| Zero. | Station γ and East End Base. | Station γ and Station β. | Station β and Register A. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 48 31 55·747 (3) | 74 23 43·820 (3) | 57 4 20·733 (3) |
| 180 | 53·207 (3) | 44·873 (3) | 21·187 (3) |
| 9 | 53·365 (4) | 44·480 (4) | 20·673 (4) |
| 189 | 54·627 (3) | 43·280 (3) | 21·780 (3) |
| 18 | 53·440 (3) | 45·047 (3) | 19·440 (3) |
| 198 | 53·607 (3) | 43·793 (3) | 21·253 (3) |
| 27 | 55·147 (3) | 43·720 (3) | 21·307 (3) |
| 207 | 53·780 (3) | 43·827 (3) | 20·580 (3) |
| | Prob. = 0·311 | Prob. = 0·205 | Prob. = 0·232 |
| Means | 48 31 54·115 | 74 23 44·105 | 57 4 20·869 |

### At STATION β.

| Zero. | Station α and Register A. | Register A and Register B. | Register B and Station γ. |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° ′ ″ |
| 0 | 67 45 31·033 (3) | 48 33 17·627 (3) | 56 28 15·140 (3) |
| 180 | 30·560 (3) | 16·067 (3) | 14·247 (3) |
| 9 | 31·067 (3) | 18·320 (3) | 14·820 (4) |
| 189 | 30·547 (3) | 17·473 (3) | 13·435 (4) |
| 18 | 33·613 (3) | 15·200 (3) | 14·287 (3) |
| 198 | 32·260 (3) | 16·767 (3) | 13·407 (3) |
| 27 | 31·427 (3) | 18·493 (3) | 14·623 (6) |
| 207 | 29·660 (3) | 19·800 (3) | 13·697 (6) |
| | Prob. = 0·399 | Prob. = 0·482 | Prob. = 0·214 |
| Means | 67 45 31·271 | 48 33 17·468 | 56 28 14·207 |

### At STATION α.

| Zero. | Register A and West End Base. | Register A and Station β. | |
|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | |
| 0 | 37 13 41·907 (3) | 78 11 28·153 (3) | |
| 180 | 41·160 (3) | 28·027 (3) | |
| 9 | 40·453 (3) | 28·200 (3) | |
| 189 | 43·313 (3) | 26·787 (3) | |
| 18 | 42·867 (3) | 26·653 (3) | |
| 198 | 43·933 (3) | 27·487 (3) | |
| 27 | 42·847 (3) | 25·573 (3) | |
| 207 | 42·573 (3) | 28·333 (3) | |
| | Prob. = 0·379 | Prob. = 0·325 | |
| Means | 37 13 42·382 | 78 11 27·402 | |

### At WEST END BASE.

| Zero. | Station α and Register A. | | |
|---|---|---|---|
| | ° ′ ″ | | |
| 0 | 71 11 39·427 (3) | | |
| 180 | 40·047 (3) | | |
| 9 | 42·860 (3) | | |
| 189 | 39·927 (3) | | |
| 18 | 41·593 (3) | | |
| 198 | 40·893 (3) | | |
| 27 | 39·180 (3) | | |
| 207 | 41·527 (3) | | |
| | Prob. = 0·417 | | |
| Mean | 71 11 40·682 | | |

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## COMPUTATION OF PARTIAL TRIANGLES ABOUT THE BASE.

**No. 1.—Register A to Register B = 175382·3080713 Inches...Log. 5·2439858; Miles 2·7680.**

| Prob. of Error. | Stations. | Angles Observed. | Corrections. e | Corrections. ε | Corrections. Total. | Angles for Computation. | Log. Sines. | Distances in Inches. | Distances in Miles. |
|---|---|---|---|---|---|---|---|---|---|
| 0·441 | Register A .... | 74° 22′ 21″·288 | — 0·018 | + 0·164 | + 0·146 | 74° 22′ 21″·434 | 9·9836416 | 196385·541 | 3·0995 |
| 0·232 | Register B .... | 57 4 20·869 | — 0·018 | + 0·086 | + 0·068 | 57 4 20·937 | 9·9239477 | 225321·983 | 3·5562 |
| 0·482 | Station β ..... | 48 33 17·468 | — 0·018 | + 0·179 | + 0·161 | 48 33 17·629 | 9·8748239 | Logs. | |
| | | 179 59 59·625 | — 0·054 | + 0·429 | + 0·375 | 180 0 0·000 | | 5·2931096 | |
| | | | | | | | | 5·3528035 | |

**No. 2.—Register A to Station β = 196385·541 Inches...Log. 5·2931096; Miles 3·0995.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·325 | Register A .... | 34 3 3·164 | — 0·011 | — 0·559 | — 0·570 | 34 3 2·594 | 9·7481311 | 185704·386 | 2·9309 |
| 0·399 | Station β ..... | 67 45 31·271 | — 0·011 | — 0·686 | — 0·697 | 67 45 30·574 | 9·9664218 | 112339·260 | 1·7730 |
| 0·325 | Station α ..... | 78 11 27·402 | — 0·011 | — 0·559 | — 0·570 | 78 11 26·832 | 9·9907092 | Logs. | |
| | | 180 0 1·837 | — 0·033 | — 1·804 | — 1·837 | 180 0 0·000 | | 5·2688222 | |
| | | | | | | | | 5·0505315 | |

**No. 3.—Register A to Station α = 185704·386 Inches...Log. 5·2688222; Miles 2·9309.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·336 | Register A .... | 71 34 34·679 | — 0·012 | + 0·680 | + 0·668 | 71 34 35·347 | 9·9771501 | 118686·082 | 1·8732 |
| 0·379 | Station α ..... | 37 13 42·382 | — 0·011 | + 0·767 | + 0·756 | 37 13 43·138 | 9·7817535 | 186121·469 | 2·9375 |
| 0·417 | W. End Base .. | 71 11 40·682 | — 0·011 | + 0·844 | + 0·833 | 71 11 41·515 | 9·9761759 | Logs. | |
| | | 179 59 57·743 | — 0·034 | + 2·291 | + 2·257 | 180 0 0·000 | | 5·0743998 | |
| | | | | | | | | 5·2697964 | |

**No. 4.—Register B to Station β = 225321·983 Inches...Log. 5·3528035; Miles 3·5562.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·205 | Register B .... | 74 23 44·105 | — 0·030 | + 0·348 | + 0·318 | 74 23 44·423 | 9·9836905 | 248373·229 | 3·9200 |
| 0·214 | Station β ..... | 56 28 14·207 | — 0·029 | + 0·363 | + 0·334 | 56 28 14·541 | 9·9209596 | 286969·466 | 4·5292 |
| 0·410 | Station γ ..... | 49 8 0·368 | — 0·029 | + 0·697 | + 0·668 | 49 8 1·036 | 9·8786583 | Logs. | |
| | | 179 59 58·680 | — 0·088 | + 1·408 | + 1·320 | 180 0 0·000 | | 5·3951048 | |
| | | | | | | | | 5·4578357 | |

**No. 5.—Register B to Station γ = 248373·229 Inches...Log. 5·3951048; Miles 3·9200.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0·311 | Register B .... | 48 31 54·115 | — 0·018 | + 0·085 | + 0·067 | 48 31 54·182 | 9·8746687 | 176137·769 | 2·7800 |
| 0·343 | Station γ ..... | 45 3 15·541 | — 0·018 | + 0·093 | + 0·075 | 45 3 15·616 | 9·8498965 | 186476·730 | 2·9431 |
| 0·325 | E. End Base .. | 86 24 50·132 | — 0·018 | + 0·088 | + 0·070 | 86 24 50·202 | 9·9991488 | Logs. | |
| | | 179 59 59·788 | — 0·054 | + 0·266 | + 0·212 | 180 0 0·000 | | 5·2458525 | |
| | | | | | | | | 5·2706247 | |

| | By Measurement. Inches. | By Triangulation. Inches. | Diff. |
|---|---|---|---|
| Register A to Register B ..... | 175382·308 | ..... | ..... |
| W. End Base to Register A ..... | 118685·749 | 118686·082 | + 0·333 |
| E. End Base to Register B..... | 176137·847 | 176137·769 | — 0·078 |
| Total Dehra Dun Base.... | 470205·904 | 470206·159 | + 0·255 |

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# RESULTS

OF

# CIRCUMPOLAR STAR OBSERVATIONS—

## SECTION KALIANPUR TO KALIANA.

---

## SERIES A.



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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 24th 0° & 180° | R | δ Ursæ Minoris | ° ′ ″ 3 24 43·52 | W. ° ′ ″ 3 44 20·16 | h. m. s. 18 24 34·84 | h. m. s. 5 53 52·87 | h. m. s. 0 18 27·71 | h. m. s. 39 17 | h. m. s. 25 22·58 | h. m. s. 37 35·07 | ° ′ ″ 10 13 9·60 | ″ 214·107 | ° ′ ″ 40 40·12 | ″ — 5·933 | ″ π + 0° 0′ | | h. m. s. 23 59 55·83 | | | |
| R | | | | | | | | 41 32 | 27 37·53 | 39 50·38 | 9 39 19·95 | 191·138 | 41 0·16 | — 8·862 | | | | | | |
| L | | | | | | | | 52 44 | 38 49·25 | 51 3·94 | 6 50 56·55 | 96·159 | 42 32·76 | — 11·241 | | | | | | |
| L | | | | | | | | 56 6 | 42 11·17 | 54 26·41 | 6 0 19·50 | 73·920 | 42 37·52 | — 8·720 | | | | | | |
| R | | | | | | | | 69 45 | 55 49·83 | 68 7·31 | 2 35 6·00 | 13·684 | 44 1·38 | — 5·096 | | | | | | |
| R | | | | | | | | 72 16 | 58 20·77 | 70 38·66 | 1 57 15·75 | 7·820 | 44 6·30 | — 6·040 | | | | | | |
| L | | | | | | | | 82 35 | 68 39·51 | 80 59·10 | 0 37 50·85 | 0·814 | 44 7·24 | — 12·106 | | | | | | |
| L | | | | | | | | 84 59 | 71 3·45 | 83 23·43 | 1 13 55·80 | 3·104 | 44 7·04 | — 10·016 | | | | | | |
| R | | | | | | | | 97 2 | 83 6·15 | 95 28·11 | 4 15 6·00 | 36·890 | 43 38·06 | — 5·210 | | | | | | |
| R | | | | | | | | 99 19 | 85 23·09 | 97 45·43 | 4 49 25·80 | 47·469 | 43 28·32 | — 4·371 | | | | | | |
| L | | | | | | | | 111 52 | 97 55·78 | 110 20·18 | 7 58 7·05 | 129·219 | 42 0·84 | — 10·101 | | | | | | |
| L | | | | | | | | 114 57 | 101 0·70 | 113 25·61 | 8 44 28·50 | 155·386 | 41 36·44 | — 8·334 | | | | | | |
| Dec. 24th 0° & 180° | L | δ Ursæ Minoris | ° ′ ″ 3 24 43·69 | E. ° ′ ″ 3 44 20·35 | h. m. s. 18 24 34·80 | h. m. s. 5 53 52·86 | h. m. s. 12 30 41·94 | h. m. s. 49 53 | h. m. s. 35 40·44 | h. m. s. 49 52·89 | ° ′ ″ 10 12 15·75 | ″ 211·473 | ° ′ ″ 40 57·90 | ″ — 9·023 | ″ π + 0° 0′ | | | | | |
| L | | | | | | | | 53 22 | 39 9·35 | 53 22·38 | 9 19 53·40 | 176·988 | 41 28·08 | — 4·718 | | | | | | |
| R | | | | | | | | 67 41 | 53 28·00 | 67 43·37 | 5 44 38·55 | 67·263 | 43 14·48 | — 1·393 | | | | | | |
| R | | | | | | | | 70 42 | 56 28·92 | 70 44·79 | 4 59 17·25 | 50·752 | 43 31·76 | — 2·162 | | | | | | |
| L | | | | | | | | 81 51 | 67 37·65 | 81 55·35 | 2 11 38·85 | 9·838 | 44 21·84 | — 11·328 | | | | | | |
| L | | | | | | | | 84 0 | 69 46·59 | 84 4·65 | 1 39 19·35 | 5·601 | 44 23·06 | — 8·311 | | | | | | |
| R | | | | | | | | 94 39 | 80 25·33 | 94 45·13 | 1 0 47·85 | 2·102 | 44 21·40 | — 3·152 | | | | | | |
| R | | | | | | | | 97 27 | 83 13·26 | 97 33·52 | 1 42 53·70 | 6·021 | 44 18·38 | — 4·051 | | | | | | |
| L | | | | | | | | 106 7 | 91 53·04 | 106 14·73 | 3 53 11·85 | 30·947 | 43 57·38 | — 7·977 | | | | | | |
| L | | | | | | | | 108 42 | 94 27·98 | 108 50·09 | 4 32 2·25 | 42·122 | 43 45·38 | — 7·152 | | | | | | |
| R | | | | | | | | 116 32 | 102 17·78 | 116 41·18 | 6 29 48·60 | 86·520 | 42 54·40 | — 0·570 | | | | | | |
| R | | | | | | | | 118 44 | 104 29·73 | 118 53·49 | 7 2 53·25 | 101·834 | 42 41·10 | — 2·584 | | | | | | |
| Dec. 25th 9° & 189° | L | δ Ursæ Minoris | ° ′ ″ 3 24 43·86 | W. ° ′ ″ 3 44 20·54 | h. m. s. 18 24 34·76 | h. m. s. 5 53 52·86 | h. m. s. 0 18 27·62 | h. m. s. 39 52 | h. m. s. 25 21·81 | h. m. s. 41 30·85 | ° ′ ″ 9 14 11·55 | ″ 174·914 | ° ′ ″ 41 15·06 | ″ — 10·566 | ″ π + 0° 0′ | | | | | |
| L | | | | | | | | 42 25 | 27 54·74 | 44 4·20 | 8 35 51·30 | 151·549 | 41 37·68 | — 11·311 | | | | | | |
| R | | | | | | | | 53 16 | 38 45·47 | 54 56·72 | 5 52 43·50 | 70·835 | 43 4·24 | — 5·465 | | | | | | |
| R | | | | | | | | 55 53 | 41 22·41 | 57 34·08 | 5 13 23·10 | 55·908 | 43 17·82 | — 6·812 | | | | | | |
| L | | | | | | | | 66 15 | 51 44·15 | 67 57·53 | 2 37 31·35 | 14·115 | 43 53·06 | — 13·365 | | | | | | |
| L | | | | | | | | 68 44 | 54 13·09 | 70 26·87 | 2 0 11·25 | 8·216 | 44 0·62 | — 11·704 | | | | | | |
| R | | | | | | | | 78 24 | 63 52·85 | 80 8·22 | 0 25 9·00 | 0·359 | 44 14·70 | — 5·481 | | | | | | |
| R | | | | | | | | 80 40 | 66 8·79 | 82 24·53 | 0 59 13·65 | 1·993 | 44 12·36 | — 6·187 | | | | | | |
| L | | | | | | | | 91 59 | 77 27·51 | 93 45·11 | 3 49 22·35 | 29·834 | 43 38·68 | — 12·026 | | | | | | |
| L | | | | | | | | 94 26 | 79 54·45 | 96 12·45 | 4 26 12·45 | 40·169 | 43 28·50 | — 11·871 | | | | | | |
| R | | | | | | | | 106 5 | 91 33·16 | 107 53·08 | 7 21 21·90 | 110·176 | 42 26·00 | — 4·364 | | | | | | |
| R | | | | | | | | 109 33 | 95 1·08 | 111 21·56 | 8 13 29·10 | 137·633 | 41 58·16 | — 4·747 | | | | | | |
| Dec. 25th 9° & 189° | L | δ Ursæ Minoris | ° ′ ″ 3 24 44·03 | E. ° ′ ″ 3 44 20·72 | h. m. s. 18 24 34·71 | h. m. s. 5 53 52·85 | h. m. s. 12 30 41·86 | h. m. s. 46 2 | h. m. s. 31 13·77 | h. m. s. 49 22·05 | ° ′ ″ 10 19 57·15 | ″ 216·798 | ° ′ ″ 40 54·84 | ″ — 10·918 | ″ π + 0° 0′ | | h. m. s. 0 0 25·69 | h. m. s. (0 14 48·15 − 0·339) = 0 14 47·811 | | |
| L | | | | | | | | 48 43 | 33 54·71 | 52 3·43 | 9 39 36·45 | 189·620 | 41 19·64 | — 8·540 | | | | | | |
| L | | | | | | | | 59 37 | 44 48·44 | 62 58·95 | 6 55 43·65 | 97·784 | 42 42·82 | + 0·116 | | | | | | |
| R | | | | | | | | 62 20 | 47 31·37 | 65 42·33 | 6 14 52·95 | 79·556 | 43 2·44 | — 1·276 | | | | | | |
| R | | | | | | | | 78 50 | 64 0·96 | 82 14·63 | 2 6 48·45 | 9·128 | 44 20·96 | — 9·368 | | | | | | |
| L | | | | | | | | 81 32 | 66 42·89 | 84 57·00 | 1 26 12·90 | 4·221 | 44 23·54 | — 7·041 | | | | | | |
| R | | | | | | | | 91 40 | 76 50·64 | 95 6·41 | 1 6 8·25 | 2·487 | 44 20·70 | — 2·467 | | | | | | |
| R | | | | | | | | 93 51 | 79 1·58 | 97 17·72 | 1 38 57·90 | 5·570 | 44 16·24 | — 1·090 | | | | | | |
| L | | | | | | | | 109 10 | 94 20·20 | 112 38·85 | 5 29 14·85 | 61·716 | 43 29·18 | — 10·176 | | | | | | |
| L | | | | | | | | 111 37 | 96 47·14 | 115 6·19 | 6 6 4·95 | 76·305 | 43 12·90 | — 8·485 | | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 24th 0° & 180° | | | | | | | | h. 5+ | h 5+ | h. 23+ | | | 3°+ | | | | | | | |
| | | | | | | | | m. s. | m. s. | m. s. | | | | | | | | | | |
| | | | | | | | | 25 17 | 12 58·58 | 20 35·07 | 10 13 9·60 | 214·107 | 40 40·12 | — 5·933 | | | | | | |
| | | | | | | | | 27 32 | 14 37·53 | 22 50·38 | 9 39 19·95 | 191·138 | 41 0·16 | — 8·862 | | | | | | |
| | | | | | | | | 38 44 | 25 49·25 | 34 3·94 | 6 50 56·55 | 96·159 | 42 32·76 | — 11·241 | | | | | | |
| | | | | | | | | 42 6 | 29 11·17 | 37 26·41 | 6 0 19·50 | 73·920 | 42 37·52 | — 8·720 | | | | | | |
| | | | | | | | | 55 45 | 42 49·83 | 51 7·31 | 2 35 6·00 | 13·684 | 44 1·38 | — 5·096 | | | | | | |
| | | | | | | | | 58 20 | 45 20·77 | 53 38·66 | 1 57 15·75 | 7·820 | 44 6·30 | — 6·040 | | | | | | |
| | | | | | | | | 68 35 | 55 39·51 | 66 59·10 | 0 37 50·85 | 0·814 | 44 7·24 | — 12·106 | | | | | | |
| | | | | | | | | 71 59 | 58 3·45 | 69 23·43 | 1 13 55·80 | 3·104 | 44 7·04 | — 10·016 | | | | | | |
| | | | | | | | | 83 2 | 69 6·15 | 80 28·11 | 4 15 6·00 | 36·890 | 43 38·06 | — 5·210 | | | | | | |
| | | | | | | | | 85 19 | 71 23·09 | 82 45·43 | 4 49 25·80 | 47·469 | 43 28·32 | — 4·371 | | | | | | |
| | | | | | | | | 97 52 | 83 55·78 | 95 20·18 | 7 58 7·05 | 129·219 | 42 0·84 | — 10·101 | | | | | | |
| | | | | | | | | 100 57 | 87 0·70 | 98 25·61 | 8 44 28·50 | 155·386 | 41 36·44 | — 8·334 | | | | | | |
| Dec. 24th 0° & 180° | | | | | | | | h. 17+ | h. 17+ | h. 11+ | | | 3°+ | | | | | | | |
| | | | | | | | | m. s. | m. s. | m. s. | | | | | | | | | | |
| | | | | | | | | 49 53 | 35 40·44 | 49 52·89 | 10 12 15·75 | 211·473 | 40 57·90 | — 9·023 | | | | | | |
| | | | | | | | | 53 22 | 39 9·35 | 53 22·38 | 9 19 53·40 | 176·988 | 41 28·08 | — 4·718 | | | | | | |
| | | | | | | | | 67 41 | 53 28·00 | 67 43·37 | 5 44 38·55 | 67·263 | 43 14·48 | — 1·393 | | | | | | |
| | | | | | | | | 70 42 | 56 28·92 | 70 44·79 | 4 59 17·25 | 50·752 | 43 31·76 | — 2·162 | | | | | | |
| | | | | | | | | 81 51 | 67 37·65 | 81 55·35 | 2 11 38·85 | 9·838 | 44 21·84 | — 11·328 | | | | | | |
| | | | | | | | | 84 0 | 69 46·59 | 84 4·65 | 1 39 19·35 | 5·601 | 44 23·06 | — 8·311 | | | | | | |
| | | | | | | | | 94 39 | 80 25·33 | 94 45·13 | 1 0 47·85 | 2·102 | 44 21·40 | — 3·152 | | | | | | |
| | | | | | | | | 97 27 | 83 13·26 | 97 33·52 | 1 42 53·70 | 6·021 | 44 18·38 | — 4·051 | | | | | | |
| | | | | | | | | 106 7 | 91 53·04 | 106 14·73 | 3 53 11·85 | 30·947 | 43 57·38 | — 7·977 | | | | | | |
| | | | | | | | | 108 42 | 94 27·98 | 108 50·09 | 4 32 2·25 | 42·122 | 43 45·38 | — 7·152 | | | | | | |
| | | | | | | | | 116 32 | 102 17·78 | 116 41·18 | 6 29 48·60 | 86·520 | 42 54·40 | — 0·570 | | | | | | |
| | | | | | | | | 118 44 | 104 29·73 | 118 53·49 | 7 2 53·25 | 101·834 | 42 41·10 | — 2·584 | | | | | | |
| Dec. 25th 9° & 189° | | | | | | | | h. 5+ | h. 5+ | h. 23+ | | | 3°+ | | | | | | | |
| | | | | | | | | m. s. | m. s. | m. s. | | | | | | | | | | |
| | | | | | | | | 39 52 | 25 21·81 | 41 30·85 | 9 14 11·55 | 174·914 | 41 15·06 | — 10·566 | | | | | | |
| | | | | | | | | 42 25 | 27 54·74 | 44 4·20 | 8 35 51·30 | 151·549 | 41 37·68 | — 11·311 | | | | | | |
| | | | | | | | | 53 16 | 38 45·47 | 54 56·72 | 5 52 43·50 | 70·835 | 43 4·24 | — 5·465 | | | | | | |
| | | | | | | | | 55 53 | 41 22·41 | 57 34·08 | 5 13 23·10 | 55·908 | 43 17·82 | — 6·812 | | | | | | |
| | | | | | | | | 66 15 | 51 44·15 | 67 57·53 | 2 37 31·35 | 14·115 | 43 53·06 | — 13·365 | | | | | | |
| | | | | | | | | 68 44 | 54 13·09 | 70 26·87 | 2 0 11·25 | 8·216 | 44 0·62 | — 11·704 | | | | | | |
| | | | | | | | | 78 24 | 63 52·85 | 80 8·22 | 0 25 9·00 | 0·359 | 44 14·70 | — 5·481 | | | | | | |
| | | | | | | | | 80 40 | 66 8·79 | 82 24·53 | 0 59 13·65 | 1·993 | 44 12·36 | — 6·187 | | | | | | |
| | | | | | | | | 91 59 | 77 27·51 | 93 45·11 | 3 49 22·35 | 29·834 | 43 38·68 | — 12·026 | | | | | | |
| | | | | | | | | 94 26 | 79 54·45 | 96 12·45 | 4 26 12·45 | 40·169 | 43 28·50 | — 11·871 | | | | | | |
| | | | | | | | | 106 5 | 91 33·16 | 107 53·08 | 7 21 21·90 | 110·176 | 42 26·00 | — 4·364 | | | | | | |
| | | | | | | | | 109 33 | 95 1·08 | 111 21·56 | 8 13 29·10 | 137·633 | 41 58·16 | — 4·747 | | | | | | |
| Dec. 25th 9° & 189° | | | | | | | | h. 17+ | h. 17+ | h. 11+ | | | 3°+ | | | | | | | |
| | | | | | | | | m. s. | m. s. | m. s. | | | | | | | | | | |
| | | | | | | | | 46 2 | 31 13·77 | 49 22·05 | 10 19 57·15 | 216·798 | 40 54·84 | — 10·918 | | | | | | |
| | | | | | | | | 48 43 | 33 54·71 | 52 3·43 | 9 39 36·45 | 189·620 | 41 19·64 | — 8·540 | | | | | | |
| | | | | | | | | 59 37 | 44 48·44 | 62 58·95 | 6 55 43·65 | 97·784 | 42 42·82 | + 0·116 | | | | | | |
| | | | | | | | | 62 20 | 47 31·37 | 65 42·33 | 6 14 52·95 | 79·556 | 43 2·44 | — 1·276 | | | | | | |
| | | | | | | | | 78 50 | 64 0·96 | 82 14·63 | 2 6 48·45 | 9·128 | 44 20·96 | — 9·368 | | | | | | |
| | | | | | | | | 81 32 | 66 42·89 | 84 57·00 | 1 26 12·90 | 4·221 | 44 23·54 | — 7·041 | | | | | | |
| | | | | | | | | 91 40 | 76 50·64 | 95 6·41 | 1 6 8·25 | 2·487 | 44 20·70 | — 2·467 | | | | | | |
| | | | | | | | | 93 51 | 79 1·58 | 97 17·72 | 1 38 57·90 | 5·570 | 44 16·24 | — 1·090 | | | | | | |
| | | | | | | | | 109 10 | 94 20·20 | 112 38·85 | 5 29 14·85 | 61·716 | 43 29·18 | — 10·176 | | | | | | |
| | | | | | | | | 111 37 | 96 47·14 | 115 6·19 | 6 6 4·95 | 76·305 | 43 12·90 | — 8·485 | | | | | | |

Dec. 24th ⊙'s Transit M.S. Time 0 0 55·83 | Dec. 25th ⊙'s Transit M.S. Time 0 0 55·47. Chronom. Time (0 15 53·10 + 0·275) = 0 15 53·375. Error 0 14 57·91. Rate 34″·90.

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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 27th 18° & 198° | L | δ Ursæ Minoris | 3° 24′ 44″·54 | W. 3° 44′ 21″·28 | h. m. s. 18 24 34·60 | h. m. s. 5 53 52·84 | h. m. s. 0 18 27·44 | h. m. s. 33 54 | h. m. s. 18 13·33 | h. m. s. 42 14·32 | ° ′ ″ 9 3 16·80 | ″ 168·103 | 3°+ ′ ″ 41 19·78 | π + 0° 0′ — 13·397 | π+(0° 0′)−{ L 11″·232 R 4·993 } | F.R. 7 ..... F.L. 6 | h. m. s. 0 1 25·13 | h. m. s. (0 16 58·35−0·412)=0 16 57·938 | h. m. s. 0 15 32·81 | s. 35·75 |
| | L | | | | | | | 36 43 | 21 2·26 | 45 3·71 | 8 20 55·95 | 142·915 | 41 47·44 | — 10·925 | | | | | | |
| | R | | | | | | | 43 52 | 28 11·08 | 52 13·71 | 6 33 25·95 | 88·143 | 42 47·82 | — 5·317 | | | | | | |
| | R | | | | | | | 46 21 | 30 40·02 | 54 43·05 | 4 2 50·10 | 72·201 | 43 3·92 | — 5·159 | | | | | | |
| | L | | | | | | | 53 53 | 38 11·83 | 62 16·10 | 5 56 5·85 | 33·562 | 43 34·68 | — 13·038 | | | | | | |
| | L | | | | | | | 56 18 | 40 36·77 | 64 41·44 | 3 26 30·00 | 24·266 | 43 46·32 | — 10·694 | | | | | | |
| | R | | | | | | | 64 57 | 49 15·56 | 73 21·64 | 1 16 27·00 | 3·323 | 44 13·90 | — 4·057 | | | | | | |
| | R | | | | | | | 68 31 | 52 49·47 | 76 56·14 | 0 22 49·50 | 0·296 | 44 16·36 | — 4·624 | | | | | | |
| | R | | | | | | | 70 18 | 54 36·43 | 78 43·39 | 0 3 59·25 | 0·009 | 44 15·76 | — 5·511 | | | | | | |
| | L | | | | | | | 83 42 | 68 0·09 | 92 9·26 | 3 25 27·30 | 23·944 | 43 47·48 | — 9·856 | | | | | | |
| | L | | | | | | | 87 15 | 71 33·01 | 95 42·75 | 4 18 49·65 | 37·978 | 43 33·82 | — 9·482 | | | | | | |
| | R | | | | | | | 96 46 | 81 3·77 | 105 15·08 | 6 41 54·60 | 91·413 | 42 45·14 | — 4·727 | | | | | | |
| | R | | | | | | | 103 31 | 87 48·60 | 112 1·02 | 8 23 23·70 | 143·203 | 41 52·52 | — 5·557 | | | | | | |
| Dec. 27th 18° & 198° | R | δ Ursæ Minoris | 3° 24′ 44″·71 | E. 3° 44′ 21″·47 | h. m. s. 18 24 34·56 | h. m. s. 5 53 52·83 | h. m. s. 12 30 41·73 | h. m. s. 45 56 | h. m. s. 29 57·17 | h. m. s. 55 58·36 | ° ′ ″ 8 40 50·55 | ″ 153·27 | 3°+ ′ ″ 41 50·12 | π + 0° 0′ — 1·92 | π+(0° 0′)−{ R 2″·681 L 10·267 } | F.R. 8 ..... F.L. 6 | h. m. s. 0 1 25·13 | h. m. s. (0 16 58·35−0·412)=0 16 57·938 | h. m. s. 0 15 32·81 | s. 35·75 |
| | R | | | | | | | 49 2 | 33 3·09 | 59 4·79 | 7 54 14·10 | 127·15 | 42 17·54 | — 3·22 | | | | | | |
| | L | | | | | | | 59 2 | 43 2·84 | 69 6·19 | 5 23 53·10 | 59·42 | 43 33·16 | — 11·11 | | | | | | |
| | L | | | | | | | 62 12 | 46 12·76 | 72 16·63 | 4 36 16·50 | 43·26 | 43 48·42 | — 10·21 | | | | | | |
| | R | | | | | | | 73 18 | 57 18·49 | 83 24·18 | 1 49 23·25 | 6·79 | 44 18·18 | — 3·50 | | | | | | |
| | R | | | | | | | 76 39 | 60 39·41 | 86 45·64 | 0 59 1·35 | 1·98 | 44 23·06 | — 3·57 | | | | | | |
| | R | | | | | | | 79 5 | 63 5·35 | 89 11·98 | 0 22 26·25 | 0·29 | 44 24·14 | — 2·96 | | | | | | |
| | R | | | | | | | 81 22 | 65 22·29 | 91 29·30 | 0 11 53·55 | 0·01 | 44 24·02 | — 2·56 | | | | | | |
| | L | | | | | | | 89 0 | 73 0·10 | 99 8·36 | 2 6 39·45 | 9·13 | 44 22·06 | — 9·72 | | | | | | |
| | L | | | | | | | 91 11 | 75 11·05 | 101 19·67 | 2 39 29·10 | 14·47 | 44 15·62 | — 8·62 | | | | | | |
| | R | | | | | | | 101 43 | 85 42·78 | 111 53·14 | 5 17 51·15 | 57·52 | 43 26·14 | — 2·19 | | | | | | |
| | R | | | | | | | 103 45 | 87 44·73 | 113 55·42 | 5 48 25·35 | 69·12 | 43 13·88 | — 1·53 | | | | | | |
| | L | | | | | | | 111 31 | 95 30·54 | 121 42·50 | 7 45 11·55 | 123·25 | 42 30·94 | — 12·72 | | | | | | |
| | L | | | | | | | 113 53 | 97 52·48 | 124 4·83 | 8 20 46·50 | 142·83 | 42 7·86 | — 9·22 | | | | | | |
| Dec. 28th 27° & 207° | L | δ Ursæ Minoris | 3° 24′ 44″·88 | W. 3° 44′ 21″·66 | h. m. s. 18 24 34·52 | h. m. s. 5 53 52·83 | h. m. s. 0 18 27·35 | h. m. s. 34 9 | h. m. s. 17 52·82 | h. m. s. 45 50·31 | ° ′ ″ 8 9 15·60 | ″ 136·33 | 3°+ ′ ″ 41 50·76 | π + 0° 0′ — 14·57 | π+(0° 0′)−{ L 14″·950 R 3·544 } | F.R. 7 ..... F.L. 6 | h. m. s. 0 1 54·65 | h. m. s. (0 18 2·75+0·46)=0 18 3·21 | h. m. s. 0 16 8·56 | s. 34·73 |
| | L | | | | | | | 36 24 | 20 7·77 | 48 5·62 | 7 35 25·95 | 118·13 | 42 9·06 | — 14·47 | | | | | | |
| | R | | | | | | | 45 38 | 29 21·55 | 57 20·92 | 5 16 36·45 | 57·07 | 43 21·70 | — 2·89 | | | | | | |
| | R | | | | | | | 48 21 | 32 4·48 | 60 4·30 | 4 35 45·75 | 43·29 | 43 35·54 | — 2·83 | | | | | | |
| | L | | | | | | | 55 51 | 39 34·30 | 67 35·35 | 2 43 0·00 | 15·12 | 43 51·10 | — 15·44 | | | | | | |
| | L | | | | | | | 57 52 | 41 35·25 | 69 36·63 | 2 12 40·80 | 10·01 | 43 57·34 | — 14·31 | | | | | | |
| | R | | | | | | | 65 49 | 49 32·06 | 77 34·74 | 0 13 9·15 | 0·10 | 44 18·22 | — 3·34 | | | | | | |
| | R | | | | | | | 67 57 | 51 40·01 | 79 43·04 | 0 18 55·35 | 0·20 | 44 17·28 | — 4·18 | | | | | | |
| | R | | | | | | | 69 37 | 53 19·97 | 81 23·28 | 0 43 58·95 | 1·10 | 44 16·40 | — 4·16 | | | | | | |
| | L | | | | | | | 78 25 | 62 7·76 | 90 12·51 | 2 56 17·40 | 17·63 | 43 48·02 | — 16·01 | | | | | | |
| | L | | | | | | | 80 13 | 63 55·71 | 92 0·76 | 3 23 21·15 | 23·46 | 43 43·30 | — 14·90 | | | | | | |
| | R | | | | | | | 91 25 | 75 7·44 | 103 14·33 | 6 11 44·70 | 78·24 | 42 59·72 | — 3·70 | | | | | | |
| | R | | | | | | | 93 55 | 77 37·38 | 105 44·68 | 6 49 19·95 | 94·81 | 42 43·14 | — 3·71 | | | | | | |
| Dec. 28th 27° & 207° | R | δ Ursæ Minoris | 3° 24′ 45″·05 | E. 3° 44′ 21″·84 | h. m. s. 18 24 34·48 | h. m. s. 5 53 52·82 | h. m. s. 12 30 41·66 | h. m. s. 38 56 | h. m. s. 22 22·36 | h. m. s. 52 18·86 | ° ′ ″ 9 35 42·00 | ″ 187·10 | 3°+ ′ ″ 41 12·64 | π + 0° 0′ + 2·10 | π+(0° 0′)−{ R + 2″·441 L −11·735 } | F.R. 10 ..... F.L. 6 | h. m. s. 0 1 54·65 | h. m. s. (0 18 2·75+0·46)=0 18 3·21 | h. m. s. 0 16 8·56 | s. 34·73 |
| | R | | | | | | | 41 31 | 24 57·29 | 54 54·22 | 8 56 51·60 | 162·80 | 41 37·46 | + 1·58 | | | | | | |
| | L | | | | | | | 58 2 | 41 27·90 | 71 27·53 | 4 48 31·95 | 47·18 | 43 46·52 | — 11·86 | | | | | | |
| | L | | | | | | | 61 24 | 44 49·81 | 74 50·00 | 3 57 54·90 | 32·10 | 44 1·00 | — 11·26 | | | | | | |
| | R | | | | | | | 72 18 | 55 43·55 | 85 45·53 | 1 14 1·95 | 3·11 | 44 16·88 | + 1·85 | | | | | | |
| | R | | | | | | | 74 8 | 57 33·51 | 87 35·79 | 0 46 28·05 | 1·23 | 44 17·18 | + 3·43 | | | | | | |
| | R | | | | | | | 76 34 | 59 59·45 | 90 2·13 | 0 9 52·95 | 0·06 | 44 18·70 | + 3·08 | | | | | | |
| | R | | | | | | | 78 27 | 61 52·40 | 91 55·39 | 0 18 25·95 | 0·19 | 44 19·32 | + 2·33 | | | | | | |
| | L | | | | | | | 86 30 | 69 55·21 | 99 59·52 | 2 19 27·90 | 11·06 | 44 23·24 | — 12·46 | | | | | | |
| | L | | | | | | | 89 41 | 73 6·13 | 103 10·97 | 3 7 19·65 | 19·97 | 44 12·54 | — 10·67 | | | | | | |
| | R | | | | | | | 99 6 | 82 30·91 | 112 37·29 | 5 28 54·45 | 61·59 | 43 16·42 | + 3·83 | | | | | | |
| | R | | | | | | | 101 56 | 85 20·84 | 115 27·68 | 6 11 30·30 | 78·59 | 42 59·94 | + 3·31 | | | | | | |
| | L | | | | | | | 109 50 | 93 14·65 | 123 22·79 | 8 10 16·95 | 136·91 | 42 18·08 | — 13·15 | | | | | | |
| | L | | | | | | | 111 44 | 95 8·60 | 125 17·06 | 8 38 51·00 | 153·33 | 41 59·52 | — 11·01 | | | | | | |
| | R | | | | | | | 120 5 | 103 29·40 | 133 39·22 | 10 44 23·40 | 236·49 | 40 24·24 | + 1·11 | | | | | | |
| | R | | | | | | | 122 47 | 106 11·33 | 136 21·60 | 11 24 59·10 | 267·21 | 39 52·84 | + 1·79 | | | | | | |



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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | Computed Terms. ✱'s Elongation. | Computed Terms. ✱'s A.R. | Computed Terms. ✱'s Horary Angle. | Computed Terms. ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29th 0° & 180° | R | δ Ursæ Minoris | ° ′ ″ 3 24 45·22 | ° ′ ″ W. 3 44 22·03 | h. m. s. 18 24 34·45 | h. m. s. 5 53 52·82 | h. m. s. 0 18 27·27 | h. m. s. 36 10 | h. m. s. 19 18·87 | h. m. s. 51 13·14 | ° ′ ″ 6 48 31·95 | ″ 95·047 | ° ′ ″ 42 46·06 | π + 0° 0′ — ″ 0·92 | Vide Dec. 24th A.M. | | | | | |
| | R | | | | | | | 38 10 | 21 18·82 | 53 13·41 | 6 18 27·90 | 81·570 | 42 58·34 | — 2·12 | | | | | | |
| | L | | | | | | | 45 58 | 29 6·62 | 61 2·50 | 4 21 11·55 | 38·830 | 43 27·88 | — 15·32 | | | | | | |
| | L | | | | | | | 48 2 | 31 10·57 | 63 6·79 | 3 50 7·20 | 30·140 | 43 35·56 | — 16·33 | | | | | | |
| | R | | | | | | | 56 31 | 39 39·36 | 71 36·97 | 1 42 34·50 | 5·984 | 44 14·70 | — 1·35 | | | | | | |
| | R | | | | | | | 59 3 | 42 11·30 | 74 9·33 | 1 4 29·10 | 2·364 | 44 18·62 | — 1·05 | | | | | | |
| | R | | | | | | | 61 12 | 44 20·25 | 76 18·63 | 0 32 9·60 | 0·588 | 44 19·50 | — 1·94 | | | | | | |
| | R | | | | | | | 63 12 | 46 20·20 | 78 18·91 | 0 2 5·40 | 0·002 | 44 19·98 | — 2·05 | | | | | | |
| | L | | | | | | | 73 59 | 57 6·93 | 89 7·41 | 2 40 2·10 | 14·540 | 43 52·86 | — 14·63 | | | | | | |
| | L | | | | | | | 76 12 | 59 19·87 | 91 20·72 | 3 13 21·75 | 21·210 | 43 46·52 | — 14·30 | | | | | | |
| | R | | | | | | | 84 38 | 67 45·67 | 99 47·89 | 5 20 9·30 | 58·070 | 43 23·32 | — 0·64 | | | | | | |
| | R | | | | | | | 87 46 | 70 53·59 | 102 56·33 | 6 7 15·90 | 76·370 | 43 4·18 | — 1·48 | | | | | | |
| | L | | | | | | | 96 28 | 79 35·37 | 111 39·55 | 8 18 4·20 | 140·210 | 41 45·22 | — 16·60 | | | | | | |
| | L | | | | | | | 98 37 | 81 44·31 | 113 48·85 | 8 50 23·70 | 158·920 | 41 28·38 | — 14·73 | | | | | | |
| Dec. 29th 0° & 180° | L | δ Ursæ Minoris | ° ′ ″ 3 24 45·39 | ° ′ ″ E. 3 44 22·21 | h. m. s. 18 24 34·42 | h. m. s. 5 53 52·81 | h. m. s. 12 30 41·61 | h. m. s. 46 23 | h. m. s. 29 13·80 | h. m. s. 3 7·97 | ° ′ ″ 6 53 24·60 | ″ 96·711 | ° ′ ″ 42 55·52 | π + 0° 0′ — ″ 9·50 | Vide Dec. 24th A.M. | | | | | |
| | L | | | | | | | 48 56 | 31 46·73 | 5 41·33 | 6 15 4·20 | 79·644 | 43 12·32 | — 9·75 | | | | | | |
| | R | | | | | | | 57 25 | 40 15·52 | 14 11·51 | 4 7 31·50 | 34·740 | 43 46·64 | + 0·81 | | | | | | |
| | R | | | | | | | 59 24 | 42 14·47 | 16 10·79 | 3 37 42·30 | 26·883 | 43 53·46 | + 1·87 | | | | | | |
| | L | | | | | | | 68 43 | 51 33·24 | 25 31·09 | 1 17 37·80 | 3·423 | 44 28·74 | — 9·95 | | | | | | |
| | L | | | | | | | 70 58 | 53 48·19 | 27 46·40 | 0 43 48·15 | 1·090 | 44 31·54 | — 10·42 | | | | | | |
| | L | | | | | | | 73 33 | 56 23·12 | 30 21·76 | 0 4 57·75 | 0·013 | 44 34·36 | — 12·16 | | | | | | |
| | L | | | | | | | 75 15 | 58 5·08 | 32 4·00 | 0 20 35·85 | 0·241 | 44 32·30 | — 10·33 | | | | | | |
| | R | | | | | | | 84 55 | 67 44·84 | 41 45·35 | 2 45 56·10 | 15·666 | 44 5·06 | + 1·48 | | | | | | |
| | R | | | | | | | 87 8 | 69 57·79 | 43 58·66 | 3 19 15·75 | 22·595 | 43 56·68 | + 2·93 | | | | | | |
| | L | | | | | | | 96 47 | 79 36·55 | 53 39·00 | 5 44 20·85 | 67·517 | 43 24·28 | — 9·59 | | | | | | |
| | L | | | | | | | 99 31 | 82 20·48 | 56 23·38 | 6 25 26·55 | 84·603 | 43 7·72 | — 10·11 | | | | | | |
| | R | | | | | | | 108 2 | 90 51·27 | 64 55·57 | 8 33 29·40 | 150·182 | 41 50·02 | + 2·01 | | | | | | |
| | R | | | | | | | 110 23 | 93 12·21 | 67 16·90 | 9 8 49·35 | 171·562 | 41 27·62 | + 3·03 | | | | | | |

Observations at Kalianpur—*continued*.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | Computed Terms. ✱'s Elongation. | Computed Terms. ✱'s A.R. | Computed Terms. ✱'s Horary Angle. | Computed Terms. ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 30th 18° & 198° | R | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 41·54 | ° ′ ″ E. 1 2 6·96 | h. m. s. 6 40 37·74 | h. m. s. 5 58 18·46 | h. m. s. 0 42 19·28 | h. m. s. 2 27 | h. m. s. 44 59·72 | h. m. s. 20 54·77 | ° ′ ″ 5 21 7·65 | ″ 16·231 | ° ′ ″ 1 53·08 | π + 0° 0′ — ″ 2·35 | π + (0° 0′) − { R 7·547 / L 10·626 } | F.R. 10 ..... F.L. 10 | h. m. s. 0 2 53·12 | h. m. s. (0 20 12·70 − 0·63) = 0 20 12·07 | | |
| | R | | | | | | | 10 27 | 52 59·52 | 28 55·88 | 3 20 51·00 | 6·355 | 2 4·02 | — 3·42 | | | | | | |
| | L | | | | | | | 19 23 | 61 55·31 | 37 53·13 | 1 6 32·25 | 0·698 | 2 20·80 | — 14·54 | | | | | | |
| | L | | | | | | | 28 5 | 70 37·10 | 46 36·35 | 1 4 16·05 | 0·651 | 2 20·24 | — 13·93 | | | | | | |
| | R | | | | | | | 37 56 | 80 27·86 | 56 28·73 | 3 32 21·75 | 7·109 | 2 2·50 | — 2·65 | | | | | | |
| | R | | | | | | | 46 40 | 89 11·64 | 65 13·95 | 5 43 40·05 | 18·613 | 1 49·98 | — 1·63 | | | | | | |
| | L | | | | | | | 56 37 | 99 8·40 | 75 12·34 | 8 13 15·90 | 38·325 | 1 42·98 | — 14·35 | | | | | | |
| | L | | | | | | | 64 10 | 106 41·22 | 82 46·40 | 10 6 46·80 | 57·955 | 1 20·08 | — 11·07 | | | | | | |
| Dec. 30th 18° & 198° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 41·38 | ° ′ ″ W. 1 2 6·79 | h. m. s. 6 40 37·82 | h. m. s. 5 58 18·46 | h. m. s. 12 38 56·28 | h. m. s. 13 15 | h. m. s. 55 31·39 | h. m. s. 33 16·59 | ° ′ ″ 16 24 55·35 | ″ 152·190 | ° ′ ″ 59 25·84 | π + 0° 0′ — ″ 8·76 | π + (0° 0′) − { L − 4·891 / R + 0·243 } | F.R. 10 ..... F.L. 10 | h. m. s. 0 2 53·12 | h. m. s. (0 20 12·70 − 0·63) = 0 20 12·07 | | |
| | L | | | | | | | 21 55 | 64 11·18 | 41 57·80 | 14 14 37·20 | 114·744 | 60 3·02 | — 9·03 | | | | | | |
| | R | | | | | | | 32 6 | 74 21·93 | 52 10·22 | 11 41 30·90 | 77·413 | 60 52·82 | + 3·44 | | | | | | |
| | R | | | | | | | 43 6 | 85 21·66 | 63 11·76 | 8 56 7·80 | 45·266 | 61 24·74 | + 3·22 | | | | | | |
| | L | | | | | | | 54 47 | 97 2·38 | 74 54·40 | 6 0 28·20 | 20·477 | 61 38·36 | — 7·95 | | | | | | |
| | L | | | | | | | 65 6 | 107 21·13 | 85 14·84 | 3 25 21·60 | 6·648 | 61 50·48 | — 9·66 | | | | | | |
| | R | | | | | | | 77 4 | 119 18·84 | 97 14·51 | 0 25 26·55 | 0·102 | 62 12·40 | + 5·71 | | | | | | |
| | R | | | | | | | 80 8 | 122 22·76 | 100 18·94 | 0 20 39·90 | 0·067 | 62 11·84 | + 5·12 | | | | | | |
| | R | | | | | | | 89 12 | 131 26·54 | 109 24·21 | 2 36 58·95 | 3·881 | 62 7·68 | + 4·77 | | | | | | |

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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1836-37.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31st 27° & 207° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 41·23 | ° ′ ″ E. 1 2 6·58 | h. m. s. 6 40 37·90 | h. m. s. 5 58 18·47 | h. m. s. 0 42 19·43 | h. m. s. 6 58 | h. m. s. 48 55·48 | h. m. s. 28 47·72 | ° ′ ″ 3 22 55·65 | ″ 6·486 | ° ′ ″ 2 15·26 | π + 0° 0′ — 15″·17 | π + (0° 0′) − { L 10″·243 R 8·449 } | F.R. 10 ..... F.L. 10 | h. m. s. 0 3 22·01 | h. m. s. (0 21 16·8 − 0·76) = 0 21 16·04 | h. m. s. 0 17 54·03 | s. 35·41 |
| | L | | | | | | | 14 14 | 56 11·30 | 36 4·73 | 1 33 40·50 | 1·382 | 2 18·66 | — 13·46 | | | | | | |
| | R | | | | | | | 25 57 | 67 54·01 | 47 49·37 | 1 22 29·10 | 1·073 | 2 10·32 | — 4·81 | | | | | | |
| | R | | | | | | | 34 4 | 76 0·81 | 55 57·50 | 3 24 31·05 | 6·595 | 2 2·92 | — 2·94 | | | | | | |
| | L | | | | | | | 43 10 | 85 6·59 | 65 4·77 | 5 41 20·10 | 18·362 | 2 3·12 | — 14·90 | | | | | | |
| | L | | | | | | | 45 54 | 87 50·52 | 67 49·15 | 6 22 25·80 | 23·047 | 1 57·64 | — 14·11 | | | | | | |
| | R | | | | | | | 58 23 | 100 19·21 | 80 19·90 | 9 30 7·05 | 51·179 | 1 18·30 | — 2·90 | | | | | | |
| | R | | | | | | | 60 41 | 102 37·16 | 82 38·22 | 10 4 41·85 | 57·561 | 1 10·78 | — 1·76 | | | | | | |
| Dec. 31st 27° & 207° | R | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 41·07 | ° ′ ″ W. 1 2 6·45 | h. m. s. 6 40 37·98 | h. m. s. 5 58 18·47 | h. m. s. 12 38 56·45 | h. m. s. 43 7 | h. m. s. 24 47·37 | h. m. s. 6 33·93 | ° ′ ″ 8 5 37·80 | ″ 37·149 | ° ′ ″ 1 29·94 | π + 0° 0′ + 0″·64 | π + (0° 0′) − { R 4″·740 L 6·481 } | F.R. 8 ..... F.L. 9 | h. m. s. 0 3 22·01 | h. m. s. (0 21 16·8 − 0·76) = 0 21 16·04 | h. m. s. 0 17 54·03 | s. 35·41 |
| | L | | | | | | | 56 40 | 38 20·04 | 20 8·82 | 4 41 54·45 | 12·525 | 1 42·02 | — 11·90 | | | | | | |
| | L | | | | | | | 67 8 | 48 47·78 | 30 38·28 | 2 4 32·55 | 2·445 | 1 50·62 | — 13·38 | | | | | | |
| | R | | | | | | | 87 38 | 69 17·28 | 51 11·15 | 3 3 40·50 | 5·314 | 2 1·80 | + 0·66 | | | | | | |
| | L | | | | | | | 98 45 | 80 24·00 | 62 19·69 | 5 50 48·60 | 19·365 | 1 34·78 | — 12·30 | | | | | | |
| Jan. 1st 27° & 207° | R | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·92 | ° ′ ″ E. 1 2 6·29 | h. m. s. 6 40 38·06 | h. m. s. 5 58 18·48 | h. m. s. 0 42 19·58 | h. m. s. 9 25 | h. m. s. 50 47·08 | h. m. s. 34 36·19 | ° ′ ″ 1 55 50·85 | ″ 2·114 | ° ′ ″ 62 13·80 | π + 0° 0′ — 9″·62 | Vide Dec. 31st A.M. | Vide Dec. 31st A.M. | h. m. s. 0 3 50·61 | h. m. s. (0 22 19·55 + 0·5) = 0 22 20·05 | h. m. s. 0 18 29·44 | s. 35·20 |
| | L | | | | | | | 17 33 | 58 54·88 | 42 45·32 | 0 6 26·10 | 0·007 | 62 16·42 | — 10·14 | | | | | | |
| | L | | | | | | | 24 14 | 65 35·72 | 49 27·26 | 1 46 55·20 | 1·803 | 62 12·58 | — 8·09 | | | | | | |
| | R | | | | | | | 33 7 | 74 28·50 | 58 21·50 | 4 0 28·80 | 9·115 | 62 9·10 | — 11·93 | | | | | | |
| | R | | | | | | | 40 13 | 81 34·33 | 65 28·49 | 5 47 13·65 | 19·002 | 61 58·60 | — 11·31 | | | | | | |
| | L | | | | | | | 50 34 | 91 55·08 | 75 50·94 | 8 22 50·40 | 39·824 | 61 33·94 | — 7·47 | | | | | | |
| | L | | | | | | | 57 48 | 99 8·90 | 83 5·95 | 10 11 35·55 | 58·880 | 61 13·16 | — 5·75 | | | | | | |
| | R | | | | | | | 67 2 | 108 22·68 | 92 21·24 | 12 30 24·90 | 88·547 | 60 51·42 | — 13·68 | | | | | | |
| | R | | | | | | | 73 12 | 114 32·52 | 98 32·10 | 14 3 7·80 | 111·691 | 60 27·08 | — 12·48 | | | | | | |
| | L | | | | | | | 82 39 | 123 59·29 | 108 0·43 | 16 25 12·75 | 152·272 | 59 40·60 | — 6·58 | | | | | | |
| | L | | | | | | | 85 5 | 126 25·23 | 110 26·77 | 17 1 47·85 | 163·725 | 59 29·32 | — 6·76 | | | | | | |
| | R | | | | | | | 91 45 | 133 5·07 | 117 7·70 | 18 42 1·80 | 197·170 | 59 2·18 | — 13·06 | | | | | | |
| Jan. 1st 27° & 207° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·77 | ° ′ ″ W. 1 2 6·12 | h. m. s. 6 40 38·14 | h. m. s. 5 58 18·48 | h. m. s. 12 38 56·62 | h. m. s. 11 49 | h. m. s. 52 54·90 | h. m. s. 38 32·78 | ° ′ ″ 15 5 57·60 | ″ 128·88 | ° ′ ″ 59 53·32 | π + 0° 0′ — 3″·92 | Vide Dec. 31st A.M. | Vide Dec. 31st A.M. | h. m. s. 0 3 50·61 | h. m. s. (0 22 19·55 + 0·5) = 0 22 20·05 | h. m. s. 0 18 29·44 | s. 35·20 |
| | L | | | | | | | 20 24 | 61 29·69 | 47 8·98 | 12 56 54·60 | 94·89 | 60 27·00 | — 4·23 | | | | | | |
| | R | | | | | | | 32 57 | 74 2·39 | 59 43·73 | 9 48 13·35 | 54·48 | 61 3·66 | — 7·98 | | | | | | |
| | R | | | | | | | 41 11 | 82 16·19 | 67 58·89 | 7 44 25·95 | 33·98 | 61 26·94 | — 5·20 | | | | | | |
| | L | | | | | | | 50 12 | 91 16·96 | 77 1·15 | 5 28 52·05 | 17·05 | 61 45·90 | — 3·17 | | | | | | |
| | L | | | | | | | 56 34 | 97 38·81 | 83 24·04 | 3 53 8·70 | 8·57 | 61 53·88 | — 3·67 | | | | | | |
| | R | | | | | | | 66 50 | 107 54·56 | 93 41·47 | 1 18 47·25 | 0·98 | 61 58·70 | — 6·44 | | | | | | |
| | R | | | | | | | 73 59 | 115 3·38 | 100 51·47 | 0 28 42·75 | 0·13 | 62 0·52 | — 5·47 | | | | | | |
| | L | | | | | | | 82 14 | 123 18·18 | 109 7·62 | 2 32 45·00 | 3·68 | 61 59·76 | — 2·68 | | | | | | |
| | L | | | | | | | 88 55 | 129 59·02 | 115 49·56 | 4 13 14·10 | 10·10 | 61 52·94 | — 3·08 | | | | | | |
| | R | | | | | | | 97 51 | 138 54·80 | 124 46·81 | 6 27 32·85 | 23·63 | 61 35·84 | — 6·65 | | | | | | |
| | R | | | | | | | 103 53 | 144 56·65 | 130 49·65 | 7 58 15·45 | 35·96 | 61 22·68 | — 7·48 | | | | | | |



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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 47′ 41″·18 Long. in time 5ᵐ·180. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✻'s N. P. D. | Computed Terms. ✻'s Elongation. | Computed Terms. ✻'s A.R. | Computed Terms. ✻'s Horary Angle. | Computed Terms. ✻'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observe. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 2nd 18° & 198° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·63 | ° ′ ″ E. 1 2 5·97 | h. m. s. 6 40 38·24 | h. m. s. 5 58 18·48 | h. m. s. 0 42 19·76 | h. m. s. 1 59 | h. m. s. 42 45·80 | h. m. s. 30 30·14 | ° ′ ″ 2 57 24·30 | ″ 4·96 | ° ′ ″ 62 9·50 | π + 0° 0′ — 8·49 | Vide Dec. 30th A.M. | Vide Dec. 30th A.M. | h. m. s. 0 4 18·93 | h. m. s. (0 23 23·10+0·47)=0 23 23·57 | h. m. s. 0 19 4·64 | m. s. 36·43 |
| | R | | | | | | | 11 51 | 52 37·55 | 40 23·51 | 0 29 3·75 | 0·13 | 62 16·00 | — 10·16 | | | | | | |
| | R | | | | | | | 20 22 | 61 8·34 | 48 55·69 | 1 38 58·95 | 1·54 | 62 16·14 | — 11·71 | | | | | | |
| | L | | | | | | | 31 58 | 72 44·04 | 60 33·31 | 4 33 23·25 | 11·78 | 62 1·42 | — 7·23 | | | | | | |
| | L | | | | | | | 40 40 | 81 25·83 | 69 16·52 | 6 44 11·40 | 25·74 | 61 49·80 | — 9·57 | | | | | | |
| | R | | | | | | | 53 8 | 93 53·51 | 81 46·25 | 9 51 37·35 | 55·11 | 61 22·82 | — 11·96 | | | | | | |
| | R | | | | | | | 61 4 | 101 49·31 | 89 43·35 | 11 50 53·85 | 79·50 | 60 57·40 | — 10·93 | | | | | | |
| | L | | | | | | | 70 22 | 111 7·07 | 99 2·64 | 14 10 43·20 | 113·71 | 60 22·16 | — 9·90 | | | | | | |
| | L | | | | | | | 77 4 | 117 48·90 | 105 45·57 | 15 51 27·15 | 142·08 | 59 53·76 | — 9·87 | | | | | | |
| | R | | | | | | | 87 12 | 127 56·65 | 115 54·98 | 18 23 48·30 | 190·86 | 59 5·84 | — 10·73 | | | | | | |
| | R | | | | | | | 89 40 | 130 24·58 | 118 23·32 | 19 0 53·40 | 203·80 | 58 52·10 | — 9·93 | | | | | | |
| | L | | | | | | | 97 3 | 137 47·40 | 125 47·35 | 20 51 53·85 | 245·00 | 58 8·28 | — 7·31 | | | | | | |
| Jan. 2nd 18° & 198° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·48 | ° ′ ″ W. 1 2 5·81 | h. m. s. 6 40 38·34 | h. m. s. 5 58 18·48 | h. m. s. 12 38 56·82 | h. m. s. 12 17 | h. m. s. 52 46·86 | h. m. s. 42 21·26 | ° ′ ″ 14 8 53·40 | ″ 113·22 | ° ′ ″ 0 10·46 | π + 0° 0′ — 2·13 | Vide Dec. 30th A.M. | Vide Dec. 30th A.M. | h. m. s. 0 4 18·93 | h. m. s. (0 23 23·10+0·47)=0 23 23·57 | h. m. s. 0 19 4·64 | m. s. 36·43 |
| | L | | | | | | | 22 54 | 63 23·59 | 52 59·74 | 11 29 16·20 | 74·74 | 0 47·84 | — 3·23 | | | | | | |
| | R | | | | | | | 33 1 | 73 30·33 | 63 8·14 | 8 57 10·20 | 45·44 | 1 17·76 | — 2·61 | | | | | | |
| | R | | | | | | | 39 56 | 80 25·16 | 70 4·10 | 7 13 10·80 | 29·56 | 1 32·66 | — 3·59 | | | | | | |
| | L | | | | | | | 50 47 | 91 15·88 | 80 56·61 | 4 30 3·15 | 11·50 | 1 54·48 | + 0·17 | | | | | | |
| | L | | | | | | | 57 40 | 98 8·71 | 87 50·57 | 2 46 33·75 | 4·37 | 1 57·62 | — 3·82 | | | | | | |
| | R | | | | | | | 66 41 | 107 9·48 | 96 52·82 | 0 31 0·00 | 0·15 | 2 2·42 | — 3·24 | | | | | | |
| | R | | | | | | | 78 30 | 118 58·18 | 108 43·46 | 2 26 39·60 | 3·39 | 1 57·62 | — 4·80 | | | | | | |
| | L | | | | | | | 88 10 | 128 37·94 | 118 24·80 | 4 51 59·70 | 13·42 | 1 50·46 | — 1·93 | | | | | | |
| | L | | | | | | | 94 59 | 135 26·76 | 125 14·75 | 6 34 28·95 | 24·48 | 1 38·76 | — 2·57 | | | | | | |
| | R | | | | | | | 103 29 | 143 56·55 | 133 45·93 | 8 42 16·65 | 42·86 | 1 17·36 | — 5·59 | | | | | | |
| Jan. 3rd 9° & 189° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·34 | ° ′ ″ E. 1 2 5·65 | h. m. s. 6 40 38·46 | h. m. s. 5 58 18·49 | h. m. s. 0 42 19·97 | h. m. s. 11 36 | h. m. s. 51 46·49 | h. m. s. 43 28·87 | ° ′ ″ 0 17 13·50 | ″ 0·05 | ° ′ ″ 2 13·42 | π + 0° 0′ — 7·82 | π+(0° 0′)−{L 7″·083 R 10·573} | F.R. 3 ..... F.L. 4 | h. m. s. 0 4 46·92 | h. m. s. (0 24 27·6+0·39)=0 24 27·99 | h. m. s. 0 19 41·07 | m. s. 35·04 |
| | L | | | | | | | 19 29 | 59 39·30 | 51 22·97 | 2 15 45·00 | 2·91 | 2 8·88 | — 6·14 | | | | | | |
| | R | | | | | | | 30 25 | 70 35·03 | 62 20·50 | 5 0 7·95 | 14·20 | 2 1·66 | — 10·21 | | | | | | |
| | R | | | | | | | 37 18 | 77 27·86 | 69 14·46 | 6 43 37·35 | 25·67 | 1 51·72 | — 11·74 | | | | | | |
| | L | | | | | | | 47 58 | 88 7·60 | 79 55·95 | 9 23 59·70 | 50·09 | 1 22·48 | — 6·92 | | | | | | |
| | L | | | | | | | 55 40 | 95 49·42 | 87 39·03 | 11 19 45·90 | 72·70 | 1 0·40 | — 7·45 | | | | | | |
| | R | | | | | | | 65 40 | 105 49·17 | 97 40·43 | 13 50 6·90 | 108·28 | 0 27·14 | — 9·77 | | | | | | |
| Jan. 3rd 9° & 189° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·19 | ° ′ ″ W. 1 2 5·49 | h. m. s. 6 40 38·59 | h. m. s. 5 58 18·50 | h. m. s. 12 38 57·09 | h. m. s. 11 7 | h. m. s. 51 1·45 | h. m. s. 44 32·13 | ° ′ ″ 13 36 14·40 | ″ 104·70 | ° ′ ″ 0 17·40 | π + 0° 0′ — 3·39 | π+(0° 0′)−{L 3·045 R 3·580} | F.R. 3 ..... F.L. 4 | h. m. s. 0 4 46·92 | h. m. s. (0 24 27·6+0·39)=0 24 27·99 | h. m. s. 0 19 41·07 | m. s. 35·04 |
| | L | | | | | | | 17 2 | 56 56·31 | 50 27·96 | 12 7 16·95 | 83·19 | 0 37·04 | — 5·26 | | | | | | |
| | R | | | | | | | 55 29 | 95 22·37 | 89 0·34 | 2 29 11·25 | 3·51 | 1 58·40 | — 3·58 | | | | | | |
| | R | | | | | | | 62 27 | 102 20·20 | 95 59·31 | 0 44 26·70 | 0·31 | 2 1·58 | — 3·60 | | | | | | |
| | L | | | | | | | 71 30 | 111 22·98 | 105 3·58 | 1 31 37·35 | 1·32 | 2 3·38 | — 0·79 | | | | | | |
| | L | | | | | | | 79 7 | 118 59·80 | 112 41·64 | 3 26 8·25 | 6·69 | 1 56·06 | — 2·74 | | | | | | |
| | R | | | | | | | 102 6 | 141 58·24 | 135 43·86 | 9 11 41·55 | 47·81 | 1 14·12 | — 3·56 | | | | | | |

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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Tranait. M.S. Time. | ⊙'s Tranait. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 4th 0° & 180° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 40·04 | E. ° ′ ″ 1 2 5·33 | h. m. s. 6 40 38·74 | h. m. s. 5 58 18·50 | h. m. s. 0 42 20·24 | h. m. s. 8 21 | h. m. s. 47 56·17 | h. m. s. 43 34·48 | ° ′ ″ 0 18 33·60 | ″ 0·05 | ° ′ ″ 62 10·62 | π + 0° 0′ — 5·34 | | | h. m. s. 0 5 14·51 | h. m. s. (0 25 30·30+0·32)=0 25 30·62 | | |
| L | | | | | | | | 14 12 | 53 47·02 | 49 26·29 | 1 46 30·75 | 1·79 | 62 9·76 | — 6·22 | | | | | | |
| R | | | | | | | | 21 49 | 61 23·83 | 57 4·35 | 3 41 1·65 | 7·70 | 62 6·78 | — 9·15 | | | | | | |
| R | | | | | | | | 29 3 | 68 37·64 | 64 19·35 | 5 29 46·65 | 17·14 | 61 57·34 | — 9·15 | | | | | | |
| L | | | | | | | | 37 40 | 77 14·42 | 72 57·55 | 7 39 19·65 | 33·24 | 61 38·60 | — 6·51 | | | | | | |
| L | | | | | | | | 44 7 | 83 41·26 | 79 25·44 | 9 16 1·80 | 48·68 | 61 23·02 | — 6·37 | | | | | | |
| R | | | | | | | | 52 13 | 91 47·05 | 87 32·57 | 11 18 4·95 | 72·34 | 61 4·42 | — 11·43 | | | | | | |
| R | | | | | | | | 60 10 | 99 43·85 | 95 30·67 | 13 17 36·45 | 100·00 | 60 35·24 | — 9·91 | | | | | | |
| L | | | | | | | | 67 31 | 107 4·66 | 102 52·69 | 15 8 6·75 | 129·48 | 60 4·12 | — 8·27 | | | | | | |
| L | | | | | | | | 70 42 | 110 15·58 | 106 4·13 | 15 55 58·35 | 143·42 | 59 50·42 | — 8·51 | | | | | | |
| R | | | | | | | | 79 0 | 118 33·37 | 114 23·28 | 18 0 45·60 | 183·03 | 59 12·94 | — 10·64 | | | | | | |
| R | | | | | | | | 82 3 | 121 36·29 | 117 26·71 | 18 46 37·05 | 198·78 | 58 56·06 | — 9·51 | | | | | | |
| Jan. 4th 0° & 180° | L | 4 Ursæ Minoris (Bode) | ° ′ ″ 0 56 39·90 | W. ° ′ ″ 1 2 5·17 | h. m. s. 6 40 38·89 | h. m. s. 5 58 18·51 | h. m. s. 12 38 57·40 | h. m. s. 9 1 | h. m. s. 48 19·36 | h. m. s. 45 46·16 | ° ′ ″ 13 17 48·60 | ″ 100·05 | ° ′ ″ 0 19·84 | π + 0° 0′ — 5·28 | | | h. m. s. 0 5 14·51 | h. m. s. (0 25 30·30+0·32)=0 25 30·62 | | |
| L | | | | | | | | 16 35 | 55 53·17 | 53 21·21 | 11 24 2·85 | 73·62 | 0 46·86 | — 4·69 | | | | | | |
| R | | | | | | | | 24 53 | 64 10·96 | 61 40·36 | 9 19 15·60 | 49·25 | 1 8·16 | — 7·76 | | | | | | |
| L | | | | | | | | 31 19 | 70 36·79 | 68 7·25 | 7 42 32·25 | 33·70 | 1 26·60 | — 4·87 | | | | | | |
| L | | | | | | | | 39 12 | 78 29·59 | 76 1·34 | 5 44 0·90 | 18·65 | 1 42·94 | — 3·58 | | | | | | |
| R | | | | | | | | 46 5 | 85 22·42 | 82 55·30 | 4 0 31·50 | 9·12 | 1 52·80 | — 3·25 | | | | | | |
| R | | | | | | | | 56 29 | 95 46·15 | 93 20·74 | 1 24 9·90 | 1·12 | 2 0·42 | — 3·63 | | | | | | |
| R | | | | | | | | 63 52 | 103 8·97 | 100 44·77 | 0 26 50·55 | 0·11 | 1 59·92 | — 5·14 | | | | | | |
| L | | | | | | | | 74 0 | 113 16·71 | 110 54·17 | 2 59 11·55 | 5·06 | 1 55·74 | — 4·37 | | | | | | |
| L | | | | | | | | 81 3 | 120 19·53 | 117 58·15 | 4 45 11·25 | 12·81 | 1 51·56 | — 0·80 | | | | | | |
| R | | | | | | | | 90 56 | 130 12·28 | 127 52·52 | 7 13 46·80 | 29·59 | 1 27·28 | — 8·30 | | | | | | |
| R | | | | | | | | 98 42 | 137 58·08 | 135 39·60 | 9 10 33·00 | 47·62 | 1 14·22 | — 3·33 | | | | | | |

Observations at Kalianpur—*continued.* A.D. 1836-37.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Tranait. M.S. Time. | ⊙'s Tranait. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 30th 18° & 198° | R | 51 Cephei | ° ′ ″ 2 44 3·56 | E. ° ′ ″ 2 59 46·02 | h. m. s. 6 22 15·55 | h. m. s. 5 55 5·92 | h. m. s. 0 27 9·62 | h. m. s. 5 26 | h. m. s. 47 58·65 | h. m. s. 23 54·18 | ° ′ ″ 0 48 51·60 | ″ 1·09 | ° ′ ″ 59 44·98 | π + 0° 0′ — 0·05 | | | h. m. s. 0 2 53·12 | h. m. s. (0 20 12·70—0·63)=0 20 12·07 | | |
| R | | | | | | | | 8 5 | 50 37·58 | 26 33·55 | 0 9 1·05 | 0·04 | 59 45·70 | + 0·28 | | | | | | |
| L | | | | | | | | 22 42 | 65 14·23 | 41 12·60 | 3 30 44·70 | 20·26 | 59 35·30 | — 9·54 | | | | | | |
| L | | | | | | | | 24 57 | 67 29·17 | 43 27·91 | 4 4 34·35 | 27·29 | 59 27·60 | — 8·87 | | | | | | |
| R | | | | | | | | 40 51 | 83 22·78 | 59 24·14 | 8 3 37·80 | 106·74 | 57 58·24 | + 1·04 | | | | | | |
| R | | | | | | | | 43 35 | 86 6·72 | 62 8·52 | 8 44 43·50 | 125·64 | 57 39·70 | + 0·68 | | | | | | |
| L | | | | | | | | 59 17 | 101 48·34 | 77 52·71 | 12 40 46·35 | 263·93 | 55 30·96 | — 8·87 | | | | | | |
| L | | | | | | | | 61 27 | 103 58·28 | 80 3·02 | 13 13 21·00 | 286·98 | 55 5·88 | — 6·84 | | | | | | |
| Dec. 30th 18° & 198° | L | 51 Cephei | ° ′ ″ 2 44 3·40 | W. ° ′ ″ 2 59 45·85 | h. m. s. 6 22 15·59 | h. m. s. 5 55 5·94 | h. m. s. 12 17 21·53 | h. m. s. 16 2 | h. m. s. 58 18·32 | h. m. s. 36 3·98 | ° ′ ″ 10 19 23·25 | ″ 175·03 | ° ′ ″ 56 38·80 | π + 0° 0′ — 12·02 | | | h. m. s. 0 2 53·12 | h. m. s. (0 20 12·70—0·63)=0 20 12·07 | | |
| L | | | | | | | | 19 21 | 61 37·24 | 39 23·44 | 9 29 31·35 | 147·99 | 57 4·28 | — 13·57 | | | | | | |
| R | | | | | | | | 36 18 | 78 33·83 | 56 22·81 | 5 14 40·80 | 45·18 | 58 58·16 | — 2·51 | | | | | | |
| R | | | | | | | | 39 46 | 82 1·74 | 59 51·30 | 4 22 33·45 | 31·45 | 59 13·18 | — 1·22 | | | | | | |
| L | | | | | | | | 57 44 | 99 59·31 | 77 51·81 | 0 7 34·20 | 0·03 | 59 33·10 | — 12·72 | | | | | | |
| L | | | | | | | | 61 33 | 103 48·21 | 81 41·34 | 1 4 57·15 | 1·92 | 59 30·64 | — 13·29 | | | | | | |
| R | | | | | | | | 83 5 | 125 19·69 | 103 16·35 | 6 28 42·30 | 68·62 | 58 38·12 | + 0·89 | | | | | | |
| R | | | | | | | | 85 43 | 127 57·63 | 105 54·72 | 7 18 17·85 | 87·19 | 58 22·28 | + 3·62 | | | | | | |

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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1836-37.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31st 27° & 207° | L | 51 Cephei | ° ′ ″ 2 44 3·23 | ° ′ ″ E. 2 59 45·66 | h. m. s. 6 22 15·63 | h. m. s. 5 55 5·94 | h. m. s. 0 27 9·69 | h. 5+ m. s. 43 59 | h. 5+ m. s. 25 57·04 | h. 0+ m. s. 5 45·51 | ° ′ ″ 5 21 2·70 | ″ 46·84 | 2°+ ° ′ ″ 59 7·52 | π + 0° 0′ — ″ 8·70 | π + (0° 0′) − { L 7·492 R 2·681 } | F.R. 10 ..... F.L. 10 | h. m. s. 0 3 22·01 | h. m. s. (0 21 16·80 − 0·76) = 0 21 16·04 | h. m. s. 0 17 54·03 | s. 35·41 |
| | L | | | | | | | 46 18 | 28 15·98 | 8 4·83 | 4 46 12·90 | 37·24 | 59 20·08 | — 11·66 | | | | | | |
| | R | | | | | | | 56 27 | 38 24·73 | 18 15·25 | 2 13 36·60 | 8·13 | 59 36·72 | + 0·81 | | | | | | |
| | R | | | | | | | 59 0 | 40 57·67 | 20 48·61 | 1 35 16·20 | 4·13 | 59 41·08 | + 0·45 | | | | | | |
| | L | | | | | | | 69 17 | 51 14·42 | 31 7·04 | 0 59 20·25 | 1·61 | 59 55·86 | — 11·81 | | | | | | |
| | L | | | | | | | 71 36 | 53 33·36 | 33 26·37 | 1 34 10·20 | 4·04 | 59 53·12 | — 11·50 | | | | | | |
| | R | | | | | | | 88 20 | 70 16·95 | 50 12·70 | 5 45 45·15 | 54·55 | 58 49·68 | + 1·43 | | | | | | |
| | R | | | | | | | 90 52 | 72 48·89 | 52 45·06 | 6 23 50·55 | 67·23 | 58 34·56 | + 3·87 | | | | | | |
| Dec. 31st 27° & 207° | R | 51 Cephei | ° ′ ″ 2 24 3·07 | ° ′ ″ W. 2 59 45·49 | h. m. s. 6 22 15·67 | h. m. s. 5 55 5·95 | h. m. s. 12 17 21·62 | h. 17+ m. s. 34 42 | h. 17+ m. s. 16 22·58 | h. 11+ m. s. 58 7·75 | ° ′ ″ 4 48 28·05 | ″ 37·97 | 2°+ ° ′ ″ 59 4·10 | π + 0° 0′ — ″ 3·42 | π + (0° 0′) − { R 7·535 L 11·090 } | F.R. 10 ..... F.L. 10 | h. m. s. 0 3 22·01 | h. m. s. (0 21 16·80 − 0·76) = 0 21 16·04 | h. m. s. 0 17 54·03 | s. 35·41 |
| | R | | | | | | | 39 17 | 20 57·46 | 62 43·39 | 3 39 33·45 | 21·99 | 59 18·60 | — 4·90 | | | | | | |
| | L | | | | | | | 60 7 | 41 46·95 | 83 36·30 | 1 33 40·20 | 4·00 | 59 25·24 | — 16·25 | | | | | | |
| | L | | | | | | | 63 19 | 44 58·87 | 86 48·75 | 2 21 46·95 | 9·15 | 59 19·96 | — 16·38 | | | | | | |
| | R | | | | | | | 82 14 | 63 53·41 | 105 46·39 | 7 6 11·55 | 82·45 | 58 19·26 | — 3·78 | | | | | | |
| | R | | | | | | | 85 9 | 66 48·34 | 108 41·79 | 7 50 25·50 | 100·40 | 58 2·32 | — 2·77 | | | | | | |
| | L | | | | | | | 102 25 | 84 3·91 | 126 0·21 | 12 9 38·85 | 240·62 | 55 29·28 | — 15·59 | | | | | | |
| | L | | | | | | | 104 59 | 86 37·85 | 128 34·56 | 12 48 14·10 | 266·58 | 55 4·42 | — 14·50 | | | | | | |
| Jan. 1st 27° & 207° | R | 51 Cephei | ° ′ ″ 2 44 2·90 | ° ′ ″ E. 2 59 45·30 | h. m. s. 6 22 15·71 | h. m. s. 5 55 5·95 | h. m. s. 0 27 9·76 | h. 5+ m. s. 42 3 | h. 5+ m. s. 23 25·75 | h. 0+ m. s. 7 10·36 | ° ′ ″ 4 59 50·94 | ″ 40·87 | 2°+ ° ′ ″ 59 9·86 | π + 0° 0′ — ″ 5·43 | Vide Dec. 31st A.M. | Vide Dec. 31st A.M. | h. m. s. 0 3 50·61 | h. m. s. (0 22 19·55 + 0·50) = 0 22 20·05 | h. m. s. 0 18 29·44 | s. 35·00 |
| | R | | | | | | | 44 48 | 26 10·68 | 9 55·75 | 4 18 30·18 | 30·39 | 59 21·12 | — 6·21 | | | | | | |
| | L | | | | | | | 55 22 | 36 44·43 | 20 31·23 | 1 39 38·01 | 4·52 | 59 46·12 | — 5·34 | | | | | | |
| | L | | | | | | | 57 21 | 38 43·38 | 22 20·50 | 1 12 18·87 | 2·38 | 59 48·76 | — 5·84 | | | | | | |
| | R | | | | | | | 67 10 | 48 32·14 | 32 20·87 | 1 17 44·01 | 2·75 | 59 48·84 | — 6·29 | | | | | | |
| | L | | | | | | | 79 55 | 61 16·83 | 45 7·66 | 4 29 28·46 | 33·13 | 59 17·34 | — 5·17 | | | | | | |
| | L | | | | | | | 81 55 | 63 16·78 | 47 7·94 | 4 59 32·66 | 40·94 | 59 8·44 | — 4·08 | | | | | | |
| | R | | | | | | | 95 33 | 76 54·44 | 60 47·84 | 8 24 31·23 | 116·15 | 57 56·68 | — 7·53 | | | | | | |
| | R | | | | | | | 97 57 | 79 18·39 | 63 12·18 | 9 0 36·27 | 133·35 | 57 38·68 | — 6·73 | | | | | | |
| | L | | | | | | | 112 49 | 94 10·02 | 78 6·26 | 12 44 7·43 | 266·24 | 55 22·60 | — 3·54 | | | | | | |
| | L | | | | | | | 115 21 | 96 41·96 | 80 38·61 | 13 22 12·77 | 293·39 | 54 53·72 | — 1·81 | | | | | | |
| | R | | | | | | | 129 37 | 110 57·61 | 94 56·61 | 16 56 42·68 | 470·59 | 52 1·36 | — 6·65 | | | | | | |
| Jan. 1st 27° & 207° | L | 51 Cephei | ° ′ ″ 2 44 2·75 | ° ′ ″ W. 2 59 45·13 | h. m. s. 6 22 15·75 | h. m. s. 5 55 5·96 | h. m. s. 12 17 21·71 | h. 17+ m. s. 14 41 | h. 16+ m. s. 55 46·83 | h. 11+ m. s. 41 25·18 | ° ′ ″ 8 59 7·92 | ″ 132·62 | 2°+ ° ′ ″ 57 24·56 | π + 0° 0′ — ″ 7·95 | Vide Dec. 31st A.M. | Vide Dec. 31st A.M. | h. m. s. 0 3 50·61 | h. m. s. (0 22 19·55 + 0·50) = 0 22 20·05 | h. m. s. 0 18 29·44 | s. 35·00 |
| | L | | | | | | | 17 25 | 58 30·77 | 44 9·56 | 8 18 2·19 | 113·18 | 57 44·44 | — 7·51 | | | | | | |
| | R | | | | | | | 35 45 | 76 50·32 | 62 32·13 | 3 42 23·76 | 22·56 | 59 10·84 | — 11·73 | | | | | | |
| | R | | | | | | | 38 47 | 79 52·24 | 65 34·55 | 2 56 47·40 | 14·25 | 59 21·58 | — 9·30 | | | | | | |
| | L | | | | | | | 52 17 | 93 21·91 | 79 6·44 | 0 26 10·92 | 0·31 | 59 36·22 | — 8·60 | | | | | | |
| | L | | | | | | | 54 12 | 95 16·87 | 81 1·71 | 0 54 59·94 | 1·38 | 59 34·76 | — 8·99 | | | | | | |
| | R | | | | | | | 69 14 | 110 18·50 | 96 5·81 | 4 41 1·46 | 35·90 | 59 0·68 | — 8·55 | | | | | | |
| | R | | | | | | | 71 20 | 112 24·45 | 98 12·10 | 5 12 35·85 | 44·41 | 58 51·92 | — 8·80 | | | | | | |
| | L | | | | | | | 84 37 | 125 41·12 | 111 30·96 | 8 32 18·71 | 119·00 | 57 38·80 | — 7·33 | | | | | | |
| | L | | | | | | | 86 39 | 127 43·07 | 113 33·24 | 9 2 52·98 | 133·57 | 57 23·76 | — 7·80 | | | | | | |
| | R | | | | | | | 100 11 | 141 14·74 | 127 7·13 | 12 26 21·36 | 251·69 | 55 22·10 | — 11·34 | | | | | | |
| | R | | | | | | | 102 2 | 143 5·70 | 128 58·39 | 12 54 10·23 | 270·67 | 55 3·70 | — 10·76 | | | | | | |

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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | #'s N. P. D. | #'s Elongation. | #'s A.R. | #'s Horary Angle. | #'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | M.S. Time. | Chronom. Time. | Error. | Rate. |
| Jan. 2nd 18° & 19° | R | 51 Cephei | ° ′ ″ 2 44 2·58 | ° ′ ″ E. 2 59 44·95 | h. m. s. 6 22 15·78 | h. m. s. 5 55 5·96 | h. m. s. 0 27 9·82 | H. 5+ M. S. 43 11 | H. 5+ M. S. 23 58·28 | H. 0+ M. S. 11 39·53 | ° ′ ″ 3 52 34·37 | ″ 24·60 | ° ′ ″ 59 25·46 | ″ — 5·11 | | | | | | |
| | R | | | | | | | 46 51 | 27 38·18 | 15 20·04 | 2 57 26·75 | 14·33 | 59 37·90 | — 7·28 | | | | | | |
| | L | | | | | | | 57 37 | 38 23·91 | 26 7·53 | 0 15 34·31 | 0·11 | 59 47·60 | — 2·76 | | | | | | |
| | L | | | | | | | 59 46 | 40 32·86 | 28 16·83 | 0 16 43·40 | 0·13 | 59 48·10 | — 3·28 | | | | | | |
| | R | | | | | | | 74 24 | 55 10·49 | 42 56·87 | 3 56 45·68 | 25·57 | 59 26·90 | — 7·52 | | | | | | |
| | R | | | | | | | 77 10 | 57 56·42 | 45 43·25 | 4 38 21·45 | 35·35 | 59 16·68 | — 7·08 | | | | | | |
| | L | | | | | | | 95 47 | 76 32·95 | 64 22·84 | 9 18 15·26 | 142·19 | 57 25·82 | — 3·06 | | | | | | |
| | L | | | | | | | 98 18 | 79 3·88 | 66 54·19 | 9 56 5·49 | 162·11 | 57 5·78 | — 2·94 | | | | | | |
| | R | | | | | | | 116 18 | 97 3·43 | 84 56·69 | 14 26 43·01 | 342·34 | 54 10·66 | — 8·05 | | | | | | |
| | R | | | | | | | 118 29 | 99 14·37 | 87 7·99 | 14 59 32·55 | 368·68 | 53 44·36 | — 8·09 | | | | | | |
| | L | | | | | | | 132 35 | 113 20·02 | 101 15·95 | 18 31 32·95 | 561·99 | 50 26·54 | — 3·58 | | | | | | |
| | L | | | | | | | 134 41 | 115 25·96 | 103 22·24 | 19 3 6·33 | 594·17 | 49 54·90 | — 4·12 | | | | | | |
| Jan. 2nd 18° & 19° | L | 51 Cephei | ° ′ ″ 2 44 2·42 | ° ′ ″ W. 2 59 44·77 | h. m. s. 6 22 15·81 | h. m. s. 5 55 5·97 | h. m. s. 12 17 21·78 | H. 17+ M. S. 17 37 | H. 16+ M. S. 58 6·72 | H. 11+ M. S. 47 42·00 | ° ′ ″ 7 24 56·64 | ″ 90·33 | ° ′ ″ 58 8·50 | ″ — 5·94 | Vide Dec. 30th A.M. | Vide Dec. 30th A.M. | h. m. s. 0 4 18·93 | h. m. s. (0 23 23·10+0·47)=0 23 23·57 | h. m. s. 0 19 4·64 | s. 36·43 |
| | L | | | | | | | 20 0 | 60 29·66 | 50 5·34 | 6 49 6·68 | 76·37 | 58 20·30 | — 8·10 | | | | | | |
| | R | | | | | | | 35 9 | 75 38·28 | 65 16·44 | 3 1 20·10 | 15·00 | 59 21·74 | — 8·03 | | | | | | |
| | R | | | | | | | 37 17 | 77 46·22 | 67 24·74 | 2 29 15·65 | 10·16 | 59 25·82 | — 8·79 | | | | | | |
| | L | | | | | | | 52 59 | 93 27·83 | 83 8·92 | 1 26 47·06 | 3·43 | 59 34·96 | — 6·38 | | | | | | |
| | L | | | | | | | 55 8 | 95 36·77 | 85 18·22 | 1 59 6·56 | 6·46 | 59 31·92 | — 6·39 | | | | | | |
| | R | | | | | | | 69 43 | 110 11·40 | 99 55·24 | 5 38 21·93 | 52·02 | 58 44·02 | — 8·73 | | | | | | |
| | R | | | | | | | 72 26 | 112 54·34 | 102 38·62 | 6 19 12·59 | 65·30 | 58 29·66 | — 9·81 | | | | | | |
| | L | | | | | | | 90 43 | 131 10·87 | 120 58·16 | 10 54 5·69 | 193·59 | 56 24·16 | — 7·02 | | | | | | |
| | L | | | | | | | 92 43 | 133 10·82 | 122 58·44 | 11 24 9·86 | 211·70 | 56 4·50 | — 8·57 | | | | | | |
| | R | | | | | | | 105 41 | 146 8·50 | 135 58·24 | 14 39 6·89 | 348·38 | 53 47·64 | — 8·75 | | | | | | |
| | R | | | | | | | 108 5 | 148 32·43 | 138 22·57 | 15 15 11·90 | 377·31 | 53 18·38 | — 9·08 | | | | | | |
| Jan. 3rd 9° & 189° | L | 51 Cephei | ° ′ ″ 2 44 2·25 | ° ′ ″ E. 2 59 44·59 | h. m. s. 6 22 15·84 | h. m. s. 5 55 5·97 | h. m. s. 0 27 9·87 | H. 5+ M. S. 46 41 | H. 5+ M. S. 26 52·09 | H. 0+ M. S. 18 30·38 | ° ′ ″ 2 9 52·35 | ″ 7·68 | ° ′ ″ 59 39·24 | ″ — 2·33 | π + (° ′) − { L 3″·733 R 6·297 } | F.R.6 ..... F.L.6 | h. m. s. 0 4 46·92 | h. m. s. (0 24 27·60+0·39)=0 24 27·99 | h. m. s. 0 19 41·07 | s. 35·04 |
| | L | | | | | | | 49 0 | 29 11·04 | 20 49·71 | 1 35 2·40 | 4·11 | 59 43·94 | — 3·46 | | | | | | |
| | R | | | | | | | 57 7 | 37 17·84 | 28 57·84 | 0 26 57·75 | 0·33 | 59 51·28 | — 7·02 | | | | | | |
| | R | | | | | | | 59 47 | 39 57·78 | 31 38·22 | 1 7 5·25 | 2·05 | 59 48·42 | — 5·88 | | | | | | |
| | L | | | | | | | 74 32 | 54 42·42 | 46 25·28 | 4 48 51·15 | 38·06 | 59 10·48 | — 3·95 | | | | | | |
| | L | | | | | | | 76 46 | 56 56·36 | 48 39·59 | 5 22 25·80 | 47·43 | 58 59·12 | — 1·96 | | | | | | |
| | R | | | | | | | 92 28 | 72 37·98 | 64 23·79 | 9 18 28·80 | 142·30 | 57 29·16 | — 6·87 | | | | | | |
| | R | | | | | | | 95 3 | 75 12·92 | 66 59·15 | 9 57 19·20 | 162·77 | 57 8·68 | — 6·86 | | | | | | |
| | L | | | | | | | 113 14 | 93 23·48 | 85 12·69 | 14 30 42·30 | 345·48 | 54 3·38 | — 4·27 | | | | | | |
| | R | | | | | | | 127 29 | 107 38·13 | 99 29·69 | 18 4 57·30 | 535·54 | 50 55·48 | — 6·43 | | | | | | |
| | R | | | | | | | 130 21 | 110 30·06 | 102 22·09 | 18 48 3·30 | 578·69 | 50 13·02 | — 7·12 | | | | | | |
| | L | | | | | | | 141 44 | 121 52·78 | 113 46·68 | 21 39 12·15 | 766·16 | 47 2·46 | — 4·03 | | | | | | |
| Jan. 3rd 9° & 189° | L | 51 Cephei | ° ′ ″ 2 44 2·09 | ° ′ ″ W. 2 59 44·41 | h. m. s. 6 22 15·87 | h. m. s. 5 55 5·97 | h. m. s. 12 17 21·84 | H. 17+ M. S. 13 3 | H. 16+ M. S. 52 57·41 | H. 11+ M. S. 46 28·40 | ° ′ ″ 7 43 21·60 | ″ 97·96 | ° ′ ″ 57 59·72 | ″ — 6·73 | π + (° ′) − { L 7″·290 R 9·568 } | F.R. 6 ..... F.L. 6 | h. m. s. 0 4 46·92 | h. m. s. (0 24 27·60+0·39)=0 24 27·99 | h. m. s. 0 19 41·07 | s. 35·04 |
| | L | | | | | | | 15 15 | 55 9·35 | 48 40·71 | 7 10 16·95 | 84·48 | 58 12·08 | — 7·85 | | | | | | |
| | R | | | | | | | 28 30 | 68 24·03 | 61 57·56 | 3 51 4·20 | 24·35 | 59 9·92 | — 10·14 | | | | | | |
| | R | | | | | | | 34 43 | 74 36·88 | 68 11·43 | 2 17 36·15 | 8·63 | 59 25·74 | — 10·04 | | | | | | |
| | L | | | | | | | 44 45 | 84 38·64 | 78 14·84 | 0 13 15·00 | 0·08 | 59 36·84 | — 7·49 | | | | | | |
| | L | | | | | | | 46 27 | 86 20·59 | 79 57·08 | 0 38 48·60 | 0·69 | 59 37·00 | — 6·72 | | | | | | |
| | R | | | | | | | 57 42 | 97 35·32 | 91 13·65 | 3 27 57·15 | 19·67 | 59 16·14 | — 8·60 | | | | | | |
| | R | | | | | | | 59 53 | 99 46·27 | 93 24·95 | 4 0 46·65 | 26·37 | 59 8·92 | — 9·12 | | | | | | |
| | L | | | | | | | 73 56 | 113 48·93 | 107 29·92 | 7 32 1·20 | 92·71 | 58 4·68 | — 7·02 | | | | | | |
| | L | | | | | | | 76 41 | 116 33·86 | 110 15·30 | 8 13 21·90 | 110·38 | 57 46·10 | — 7·93 | | | | | | |
| | R | | | | | | | 87 17 | 127 9·60 | 120 52·79 | 10 52 44·25 | 192·78 | 56 21·58 | — 10·05 | | | | | | |
| | R | | | | | | | 89 11 | 129 3·56 | 122 47·05 | 11 21 18·15 | 209·93 | 56 5·02 | — 9·46 | | | | | | |



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G. T. Station Kalianpur Lat. 24° 7′ 11″·84 Long. 77° 41′ 47″·18 Long. in time 5ᵐ·180. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 4th 0° & 180° | L | 51 Cephei | ° ′ ″ 2 44 1·93 | ° ′ ″ E. 2 59 44·24 | h. m. s. 6 22 15·90 | h. m. s. 5 55 5·98 | h. m. s. 0 27 9·92 | H.5+ M. S. 47 47 | H.5+ M. S. 27 22·69 | H.0+ M. S. 22 57·62 | ° ′ ″ 1 3 4·50 | ″ 1·81 | 2°+ ′ ″ 59 44·26 | π + 0° 0′ — 1·83 | π+(0° 0′)−{ L 3·078 R 5·065 } | F.R. 6 ..... F.L. 6 | h. m. s. 0 5 14·51 | h. m. s. (0 26 30·3+0·32)=0 25 30·62 | h. m. s. 0 20 16·11 | s. 36·66 |
| | L | | | | | | | 50 30 | 30 5·62 | 25 41·00 | 0 22 13·80 | 0·23 | 59 47·12 | — 3·11 | | | | | | |
| | R | | | | | | | 57 35 | 37 10·44 | 32 46·98 | 1 24 15·90 | 3·24 | 59 46·46 | — 5·46 | | | | | | |
| | R | | | | | | | 59 40 | 39 15·39 | 34 52·27 | 1 55 35·25 | 6·09 | 59 42·90 | — 4·75 | | | | | | |
| | L | | | | | | | 70 15 | 49 50·12 | 45 28·74 | 4 34 42·30 | 34·42 | 59 11·90 | — 2·08 | | | | | | |
| | L | | | | | | | 72 11 | 51 46·07 | 47 25·01 | 5 3 46·35 | 42·10 | 59 6·42 | — 4·28 | | | | | | |
| | R | | | | | | | 84 53 | 64 27·75 | 60 8·77 | 8 14 42·75 | 111·67 | 57 57·70 | — 5·13 | | | | | | |
| | R | | | | | | | 87 4 | 66 38·69 | 62 20·08 | 8 47 32·40 | 126·97 | 57 41·20 | — 3·93 | | | | | | |
| | L | | | | | | | 100 3 | 79 37·36 | 75 20·88 | 12 2 44·40 | 238·20 | 55 48·88 | — 2·84 | | | | | | |
| | L | | | | | | | 101 53 | 81 27·32 | 77 11·13 | 12 30 18·15 | 256·69 | 55 31·88 | — 4·33 | | | | | | |
| | R | | | | | | | 114 24 | 93 58·00 | 89 43·87 | 15 38 29·25 | 401·17 | 53 8·66 | — 5·59 | | | | | | |
| | R | | | | | | | 117 4 | 96 37·93 | 92 24·24 | 16 18 34·80 | 436·05 | 52 33·72 | — 5·53 | | | | | | |
| Jan. 4th 0° & 180° | L | 51 Cephei | ° ′ ″ 2 44 1·77 | ° ′ ″ W. 2 59 44·06 | h. m. s. 6 22 15·92 | h. m. s. 5 55 5·98 | h. m. s. 12 17 21·90 | H.17+ M. S. 11 30 | H.16+ M. S. 50 48·30 | H.11+ M. S. 48 15·50 | ° ′ ″ 7 16 36·00 | ″ 86·97 | 2°+ ′ ″ 58 8·86 | π + 0° 0′ — 8·23 | π+(0° 0′)−{ L 8·067 R 9·245 } | F.R. 6 ..... F.L. 6 | h. m. s. 0 5 14·51 | h. m. s. (0 25 30·3+0·32)=0 25 30·62 | h. m. s. 0 20 18·11 | s. 36·66 |
| | L | | | | | | | 13 37 | 52 55·24 | 50 22·80 | 6 44 46·50 | 74·75 | 58 20·82 | — 8·49 | | | | | | |
| | R | | | | | | | 27 23 | 66 40·89 | 64 10·71 | 3 17 47·85 | 17·84 | 59 16·68 | — 9·54 | | | | | | |
| | R | | | | | | | 29 21 | 68 38·84 | 66 8·98 | 2 48 13·80 | 12·91 | 59 21·40 | — 9·75 | | | | | | |
| | L | | | | | | | 41 21 | 80 38·54 | 78 10·64 | 0 12 11·10 | 0·07 | 59 37·30 | — 6·69 | | | | | | |
| | L | | | | | | | 43 22 | 82 39·49 | 80 11·92 | 0 42 30·30 | 0·82 | 59 34·80 | — 8·44 | | | | | | |
| | R | | | | | | | 59 23 | 98 40·08 | 96 15·15 | 4 43 18·75 | 36·49 | 58 58·14 | — 9·43 | | | | | | |
| | R | | | | | | | 61 56 | 101 13·02 | 98 48·50 | 5 21 39·00 | 47·01 | 58 48·18 | — 8·87 | | | | | | |
| | L | | | | | | | 76 37 | 115 53·64 | 113 31·54 | 9 2 24·60 | 133·33 | 57 22·36 | — 8·37 | | | | | | |
| | L | | | | | | | 78 43 | 117 59·59 | 115 37·83 | 9 33 58·95 | 149·24 | 57 6·64 | — 8·18 | | | | | | |
| | R | | | | | | | 93 4 | 132 20·22 | 130 0·82 | 13 9 43·80 | 281·56 | 54 52·94 | — 9·56 | | | | | | |
| | R | | | | | | | 95 34 | 134 50·16 | 132 31·17 | 13 47 19·05 | 308·80 | 54 26·94 | — 8·32 | | | | | | |

H. M. S. H. M. S. S. H. M. S. H. M. S.
Jan. 5th ⊙'s Transit M.S. Time 0 5 41·72. Chronom. Time (0 26 34·05 + 0·44) = 0 26 34·49. Error 0 20 52·77.

G. T. Station Pahargarh Lat. 24° 56′ 1″ Long. 77° 44′ 21″ In time 5ᵐ·183. A.D. 1836.

| Dec. 6th 9° & 189° | Face. | ε Ursæ Minoris | ° ′ ″ 7 42 27·44 | ° ′ ″ W. 8 30 19·53 | h. m. s. 17 2 47·55 | h. m. s. 5 45 34·22 | h. m. s. 22 48 21·77 | H.5+ M. S. 19 18 | H.5+ M. S. 16 5·60 | H.22+ M. S. 17 18·45 | ° ′ ″ 7 45 49·80 | ″ 280·11 | 7°+ ′ ″ 51 32·22 | π−0° 34′ ″ 7·20 | −(0° 34′)−{ R 8·028 L 12·937 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 51 19·25 | h. m. s. (23 54 22·+1·77)=23 54 23·77 | h. m. s. 0 3 4·52 | s. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | | | | | | | 22 14 | 19 1·53 | 20 14·86 | 7 1 43·65 | 229·45 | 52 24·64 | 5·44 | | | | | | |
| | R | | | | | | | 33 49 | 30 36·25 | 31 51·48 | 4 7 34·35 | 78·88 | 54 46·06 | 14·59 | | | | | | |
| | L | | | | | | | 36 42 | 33 29·18 | 34 44·88 | 3 24 13·35 | 53·64 | 55 14·74 | 11·15 | | | | | | |
| | L | | | | | | | 46 46 | 43 32·94 | 44 50·29 | 0 52 52·20 | 3·59 | 56 5·18 | 10·76 | | | | | | |
| | R | | | | | | | 48 52 | 45 38·88 | 46 56·59 | 0 21 17·70 | 0·58 | 56 9·34 | 9·61 | | | | | | |
| | L | | | | | | | 58 1 | 54 47·66 | 56 6·87 | 1 56 16·50 | 17·29 | 55 48.88 | 13·36 | | | | | | |
| | L | | | | | | | 60 37 | 57 23·60 | 58 43·23 | 2 35 21·90 | 30·84 | 55 36·34 | 12·35 | | | | | | |
| | R | | | | | | | 71 39 | 68 25·33 | 69 46·77 | 5 21 15·00 | 131·40 | 54 0·22 | 7·91 | | | | | | |
| | R | | | | | | | 75 4 | 71 50·25 | 73 12·25 | 6 12 37·20 | 176·58 | 53 15·70 | 7·25 | | | | | | |
| | L | | | | | | | 86 1 | 82 46·98 | 84 10·79 | 8 57 15·30 | 365·66 | 50 0·48 | 13·39 | | | | | | |
| | L | | | | | | | 89 10 | 85 55·91 | 87 20·23 | 9 44 36·90 | 432·45 | 48 54·30 | 12·78 | | | | | | |
| Dec. 6th 9° & 189° | L | ε Ursæ Minoris | ° ′ ″ 7 42 27·63 | ° ′ ″ E. 8 30 19·74 | h. m. s. 17 2 47·54 | h. m. s. 5 45 34·22 | h. m. s. 11 17 13·32 | H.17+ M. S. 31 2 | H.17+ M. S. 27 31·86 | H.10+ M. S. 30 44·86 | ° ′ ″ 11 37 6·90 | ″ 613·12 | 8°+ ′ ″ 54 17·72 | π−0° 34′ ″ 11·10 | −(0° 34′)−{ L 13·863 R 9·807 } | F.R. 4 ..... F.L. 6 | h. m. s. 23 51 19·25 | h. m. s. (23 54 22·+1·77)=23 54 23·77 | h. m. s. 0 3 4·52 | s. |
| | L | | | | | | | 35 11 | 31 40·76 | 34 54·44 | 10 34 43·20 | 509·11 | 56 7·02 | 16·39 | | | | | | |
| | R | | | | | | | 48 22 | 44 51·44 | 48 7·29 | 7 16 30·45 | 241·97 | 60 27·50 | 9·73 | | | | | | |
| | R | | | | | | | 52 36 | 49 5·33 | 52 21·88 | 6 12 51·60 | 176·81 | 61 30·60 | 7·67 | | | | | | |
| | L | | | | | | | 65 36 | 62 5·02 | 65 23·70 | 2 57 24·30 | 40·20 | 63 51·58 | 12·04 | | | | | | |
| | L | | | | | | | 68 36 | 65 4·95 | 68 24·12 | 2 12 18·00 | 22·38 | 64 10·76 | 13·40 | | | | | | |
| | R | | | | | | | 80 28 | 76 56·66 | 80 17·78 | 0 46 6·90 | 2·73 | 64 28·32 | 11·31 | | | | | | |
| | R | | | | | | | 84 11 | 80 39·57 | 84 1·30 | 1 41 59·70 | 13·36 | 64 16·90 | 10·52 | | | | | | |
| | L | | | | | | | 94 5 | 90 33·33 | 93 56·68 | 4 10 50·40 | 80·98 | 63 15·26 | 16·50 | | | | | | |
| | L | | | | | | | 96 33 | 93 1·27 | 96 25·03 | 4 47 55·65 | 106·75 | 62 46·74 | 13·75 | | | | | | |

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G. T. Station Pahargarh Lat. 24° 56′ 1″ Long. 77° 44′ 21″ In time $5_{h}\cdot183$. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A. R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 7th 18° & 198° | R | ε Ursæ Minoris | ° ′ ″ 7 42 27·80 | ° ′ ″ W. 8 30 19·93 | h. m. s. 17 2 47·53 | h. m. s. 5 45 34·21 | h. m. s. 22 48 21·74 | H. 5+ M. S. 16 30 | H. 5+ M. S. 12 42·75 | H. 22+ M. S. 17 51·60 | ° ′ ″ 7 37 32·10 | ″ 270·19 | 7°+ ′ ″ 51 41·24 | π−0° 34′ ″ 8·50 | ″ 8·497 | F.R. 6 ..... F.L. 6 | | | | |
| | R | | | | | | | 19 43 | 15 55·67 | 21 5·05 | 6 49 10·35 | 215·96 | 52 35·74 | 8·23 | L 14·693 | | | | | |
| | L | | | | | | | 28 50 | 25 2·45 | 30 13·33 | 4 32 6·15 | 95·32 | 54 34·38 | 10·23 | | | | | | |
| | L | | | | | | | 31 19 | 27 31·39 | 32 42·68 | 3 54 45·90 | 70·92 | 54 51·96 | 17·05 | | | | | | |
| | R | | | | | | | 40 7 | 36 19·18 | 41 31·91 | 1 42 27·45 | 13·48 | 55 58·18 | 8·27 | | | | | | |
| | L | | | | | | | 42 19 | 38 31·12 | 43 44·21 | 1 9 22·95 | 6·18 | 56 6·68 | 7·07 | | | | | | |
| | L | | | | | | | 51 45 | 47 56·90 | 53 11·54 | 1 12 27·00 | 6·72 | 55 58·84 | 14·37 | | | | | | |
| | R | | | | | | | 54 17 | 50 28·83 | 55 43·89 | 1 50 32·25 | 15·63 | 55 48·00 | 16·30 | | | | | | |
| | R | | | | | | | 64 25 | 60 36·59 | 65 53·31 | 4 22 53·55 | 88·11 | 54 42·36 | 9·46 | | | | | | |
| | L | | | | | | | 67 4 | 63 15·52 | 68 32·68 | 5 2 44·10 | 116·74 | 54 13·74 | 9·45 | | | | | | |
| | L | | | | | | | 78 24 | 74 35·25 | 79 54·27 | 7 53 7·95 | 284·03 | 51 22·02 | 13·88 | | | | | | |
| | L | | | | | | | 80 47 | 76 58·19 | 82 17·60 | 8 28 57·90 | 328·40 | 50 35·20 | 16·33 | | | | | | |
| Dec. 7th 18° & 198° | L | ε Ursæ Minoris | ° ′ ″ 7 42 27·99 | ° ′ ″ E. 8 30 20·14 | h. m. s. 17 2 47·53 | h. m. s. 5 45 34·20 | h. m. s. 11 17 13·33 | H. 17+ M. S. 26 59 | H. 17+ M. S. 22 54·04 | H. 10+ M. S. 30 2·84 | ° ′ ″ 11 47 37·35 | ″ 631·57 | 8°+ ′ ″ 54 2·46 | π−0° 34′ ″ 13·89 | ″ 14·315 | F.R. 6 ..... F.L. 6 | | | | |
| | L | | | | | | | 30 0 | 25 54·96 | 33 4·26 | 11 2 16·05 | 553·87 | 55 22·12 | 15·85 | R 10·482 | | | | | |
| | R | | | | | | | 43 5 | 38 59·65 | 46 11·09 | 7 45 33·60 | 275·06 | 59 56·02 | 10·94 | | | | | | |
| | L | | | | | | | 46 9 | 42 3·57 | 49 15·52 | 6 59 27·15 | 223·52 | 60 46·18 | 9·56 | | | | | | |
| | R | | | | | | | 59 54 | 55 48·24 | 63 2·45 | 3 32 43·20 | 57·75 | 63 36·08 | 13·69 | | | | | | |
| | R | | | | | | | 62 27 | 58 21·18 | 65 35·80 | 2 54 22·95 | 38·84 | 63 56·88 | 15·58 | | | | | | |
| | L | | | | | | | 73 28 | 69 21·91 | 76 38·35 | 0 8 44·70 | 0·10 | 64 28·86 | 8·82 | | | | | | |
| | R | | | | | | | 76 21 | 72 14·84 | 79 31·75 | 0 34 36·30 | 1·54 | 64 29·28 | 10·68 | | | | | | |
| | L | | | | | | | 86 10 | 82 3·60 | 89 22·12 | 3 2 11·85 | 42·68 | 63 51·22 | 13·76 | | | | | | |
| | L | | | | | | | 88 17 | 84 10·55 | 91 29·42 | 3 34 1·35 | 58·92 | 63 34·34 | 13·12 | | | | | | |
| | R | | | | | | | 98 3 | 93 56·31 | 101 16·79 | 6 0 51·90 | 167·87 | 61 45·00 | 12·73 | | | | | | |
| | R | | | | | | | 103 5 | 98 58·19 | 106 19·49 | 7 16 32·40 | 245·90 | 60 24·40 | 10·16 | | | | | | |
| Dec. 8th 27° & 207° | L | ε Ursæ Minoris | ° ′ ″ 7 42 28·17 | ° ′ ″ W. 8 30 20·34 | h. m. s. 17 2 47·52 | h. m. s. 5 45 34·20 | h. m. s. 22 48 21·72 | H. 5+ M. S. 13 40 | H. 5+ M. S. 9 17·90 | H. 22+ M. S. 18 22·75 | ° ′ ″ 7 29 44·55 | ″ 261·05 | 7°+ ′ ″ 51 42·62 | π−0° 34′ ″ 16·67 | ″ L 16·253 | F.R. 6 ..... F.L. 6 | | | | |
| | L | | | | | | | 16 35 | 12 12·83 | 21 18·16 | 6 45 53·40 | 212·50 | 52 30·90 | 16·94 | R 7·825 | | | | | |
| | R | | | | | | | 25 20 | 20 57·62 | 30 4·38 | 4 34 20·10 | 96·89 | 54 35·24 | 8·21 | | | | | | |
| | R | | | | | | | 28 3 | 23 40·55 | 32 47·76 | 3 53 29·40 | 70·15 | 55 2·16 | 8·03 | | | | | | |
| | L | | | | | | | 36 45 | 32 22·34 | 41 30·98 | 1 42 41·10 | 13·54 | 55 49·80 | 17·00 | | | | | | |
| | L | | | | | | | 39 17 | 34 54·28 | 44 3·34 | 1 4 35·70 | 5·35 | 55 58·64 | 16·35 | | | | | | |
| | R | | | | | | | 49 14 | 44 51·04 | 54 1·73 | 1 25 0·15 | 9·25 | 56 3·56 | 7·53 | | | | | | |
| | R | | | | | | | 51 36 | 47 12·98 | 56 24·06 | 2 0 35·10 | 18·59 | 55 54·96 | 6·79 | | | | | | |
| | L | | | | | | | 62 35 | 58 11·71 | 67 24·60 | 4 45 43·20 | 104·03 | 54 22·92 | 13·39 | | | | | | |
| | L | | | | | | | 65 54 | 61 30·63 | 70 44·06 | 5 35 35·10 | 143·35 | 53 39·82 | 17·17 | | | | | | |
| | R | | | | | | | 76 33 | 72 9·38 | 81 24·55 | 8 15 42·45 | 311·61 | 50 59·38 | 9·35 | | | | | | |
| | R | | | | | | | 79 18 | 74 54·31 | 84 9·94 | 8 57 3·30 | 365·40 | 50 7·90 | 7·04 | | | | | | |
| Dec. 8th 27° & 207° | R | ε Ursæ Minoris | ° ′ ″ 7 42 28·36 | ° ′ ″ E. 8 30 20·55 | h. m. s. 17 2 47·51 | h. m. s. 5 45 34·19 | h. m. s. 11 17 13·32 | H. 17+ M. S. 24 26 | H. 17+ M. S. 19 46·18 | H. 10+ M. S. 30 51·03 | ° ′ ″ 11 35 34·35 | ″ 610·45 | 8°+ ′ ″ 54 18·90 | π−0° 34′ ″ 8·80 | ″ R 10·677 | F.R. 6 ..... F.L. 6 | | | | |
| | R | | | | | | | 27 39 | 22 59·10 | 34 4·48 | 10 47 12·60 | 529·19 | 55 40·96 | 9·60 | L 15·575 | | | | | |
| | L | | | | | | | 39 7 | 34 26·82 | 45 34·08 | 7 54 48·60 | 286·04 | 59 49·48 | 14·97 | | | | | | |
| | L | | | | | | | 42 14 | 37 33·75 | 48 41·52 | 7 7 57·00 | 232·63 | 60 42·46 | 14·54 | | | | | | |
| | R | | | | | | | 54 14 | 49 33·46 | 60 43·20 | 4 7 31·80 | 78·14 | 63 14·48 | 12·07 | | | | | | |
| | R | | | | | | | 58 2 | 53 21·37 | 64 31·73 | 3 10 23·85 | 46·29 | 63 46·62 | 12·36 | | | | | | |
| | L | | | | | | | 70 7 | 65 26·07 | 76 38·42 | 0 8 43·50 | 0·10 | 64 33·98 | 13·53 | | | | | | |
| | L | | | | | | | 72 42 | 68 1·01 | 79 13·78 | 0 30 6·90 | 1·16 | 64 33·84 | 14·45 | | | | | | |
| | R | | | | | | | 84 33 | 79 51·72 | 91 6·44 | 3 28 16·80 | 55·80 | 63 37·38 | 12·63 | | | | | | |
| | R | | | | | | | 87 36 | 82 54·65 | 94 9·87 | 4 14 8·25 | 83·13 | 63 6·02 | 8·60 | | | | | | |
| | L | | | | | | | 99 20 | 94 38·36 | 105 55·51 | 7 10 32·85 | 239·18 | 60 39·52 | 18·15 | | | | | | |
| | L | | | | | | | 101 48 | 97 6·30 | 108 23·86 | 7 47 38·10 | 282·30 | 59 56·06 | 17·81 | | | | | | |

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G. T. Station Pahargarh Lat. 24° 56′ 1″ Long. 77° 44′ 21″ In time 5ˢ·183. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | | Chronom. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | M.S. Time. | Chronom. Time. | Error. |
| | | | | | | | | | | | | | | | | | | | Rate. |
| Dec. 9th 0° & 180° | R | ε Ursæ Minoris | ° ′ ″ 7 42 28·53 | W. 8° 30′ 20″·73 | H. M. S. 17 2 47·50 | H. M. S. 5 45 34·19 | H. M. S. 22 48 21·69 | H.5+ M. S. 11 35 | H.5+ M. S. 6 38·03 | H.22+ M. S. 19 39·02 | ° ′ ″ 7 10 40·05 | ″ 239·32 | 7°+ ′ ″ 52 9·62 | π−0° 34′ ″ 11·79 | R 10″·900 L 12·668 | F.R. 8 ..... F.L. 6 | H. M. S. 23 52 38·68 | H. M. S. (23 57 26·25+1·78)=23 57 28·03 | H. M. S. 0 4 49·36 |
| | R | | | | | | | 14 24 | 9 26·96 | 22 28·41 | 6 28 19·20 | 194·46 | 52 55·94 | 10·33 | | | | | |
| | L | | | | | | | 23 25 | 18 27·75 | 31 30·67 | 4 12 45·30 | 82·22 | 54 47·02 | 11·49 | | | | | |
| | L | | | | | | | 25 43 | 20 45·69 | 33 48·99 | 3 38 10·50 | 61·23 | 55 6·12 | 13·38 | | | | | |
| | R | | | | | | | 35 45 | 30 47·45 | 43 52·40 | 1 7 19·35 | 5·82 | 56 3·22 | 11·69 | | | | | |
| | R | | | | | | | 38 39 | 33 41·38 | 46 46·80 | 0 23 43·35 | 0·72 | 56 9·20 | 10·81 | | | | | |
| | R | | | | | | | 40 53 | 35 55·32 | 49 1·12 | 0 9 51·45 | 0·12 | 56 9·74 | 10·87 | | | | | |
| | R | | | | | | | 43 49 | 38 51·25 | 51 57·53 | 0 53 57·60 | 3·73 | 56 7·14 | 9·86 | | | | | |
| | L | | | | | | | 56 5 | 51 6·95 | 64 15·24 | 3 58 23·25 | 72·49 | 54 56·84 | 11·40 | | | | | |
| | L | | | | | | | 58 21 | 53 22·90 | 66 31·56 | 4 32 28·05 | 94·63 | 54 33·96 | 12·14 | | | | | |
| | R | | | | | | | 69 33 | 64 34·63 | 77 45·13 | 7 20 51·60 | 246·80 | 52 1·74 | 12·19 | | | | | |
| | R | | | | | | | 72 0 | 67 1·57 | 80 12·47 | 7 57 41·70 | 289·51 | 51 21·56 | 9·66 | | | | | |
| | L | | | | | | | 82 55 | 77 56·30 | 91 9·00 | 10 41 49·65 | 520·50 | 47 25·94 | 14·29 | | | | | |
| | L | | | | | | | 85 59 | 81 0·23 | 94 13·43 | 11 27 56·10 | 597·24 | 46 10·18 | 13·31 | | | | | |
| Dec. 9th 0° & 180° | R | ε Ursæ Minoris | ° ′ ″ 7 42 28·72 | E. 8° 30′ 20″·94 | H. M. S. 17 2 47·50 | H. M. S. 5 45 34·18 | H. M. S. 11 17 13·32 | H.17+ M. S. 13 36 | H.17+ M. S. 8 21·52 | H.10+ M. S. 23 21·07 | ° ′ ″ 13 28 3·75 | ″ 821·36 | 8°+ ′ ″ 50 52·76 | π−0° 34′ ″ 13·18 | R 13″·130 L 15·942 | F.R. 8 ..... F.L. 8 | H. M. S. 23 52 38·68 | H. M. S. (23 57 26·25+1·78)=23 57 28·03 | H. M. S. 0 4 49·35 |
| | R | | | | | | | 16 51 | 11 36·45 | 26 36·52 | 12 39 12·00 | 726·01 | 52 26·02 | 11·09 | | | | | |
| | L | | | | | | | 26 55 | 21 40·20 | 36 41·93 | 10 7 50·85 | 467·25 | 56 49·82 | 16·13 | | | | | |
| | L | | | | | | | 30 26 | 25 11·12 | 40 13·42 | 9 14 58·50 | 390·02 | 58 8·82 | 17·90 | | | | | |
| | R | | | | | | | 41 34 | 36 18·85 | 51 22·98 | 6 27 35·10 | 190·99 | 61 23·32 | 13·37 | | | | | |
| | R | | | | | | | 45 24 | 40 8·75 | 55 13·52 | 5 29 57·00 | 138·59 | 62 14·00 | 11·65 | | | | | |
| | L | | | | | | | 58 22 | 53 6·44 | 68 13·33 | 2 14 59·85 | 23·30 | 64 13·10 | 15·46 | | | | | |
| | L | | | | | | | 61 24 | 56 8·37 | 71 15·76 | 1 29 23·40 | 10·22 | 64 25·16 | 14·44 | | | | | |
| | R | | | | | | | 70 12 | 64 56·15 | 80 4·99 | 0 42 55·05 | 2·36 | 64 33·84 | 15·26 | | | | | |
| | R | | | | | | | 72 45 | 67 29·09 | 82 38·35 | 1 21 15·45 | 8·47 | 64 25·90 | 13·43 | | | | | |
| | L | | | | | | | 80 23 | 75 6·91 | 90 17·41 | 3 16 1·35 | 49·41 | 63 46·50 | 14·97 | | | | | |
| | L | | | | | | | 82 57 | 77 40·84 | 92 51·77 | 3 54 36·75 | 70·83 | 63 26·94 | 16·83 | | | | | |
| | R | | | | | | | 91 15 | 85 58·64 | 101 10·94 | 5 59 24·30 | 166·51 | 61 48·72 | 14·29 | | | | | |
| | R | | | | | | | 93 44 | 88 27·58 | 103 40·28 | 6 36 44·40 | 203·01 | 61 10·70 | 12·77 | | | | | |
| | L | | | | | | | 102 31 | 97 14·37 | 112 28·51 | 8 48 47·85 | 361·24 | 58 35·24 | 15·54 | | | | | |
| | L | | | | | | | 104 54 | 99 37·31 | 114 51·85 | 9 24 37·95 | 412·03 | 57 45·18 | 16·27 | | | | | |

Observations at Pahargarh—*continued.* A.D. 1837.

| Jan. 22nd 0° & 180° | R | λ Ursæ Minoris | ° ′ ″ 1 10 56·22 | E. 1° 18′ 13″·76 | H. M. S. 20 22 55·86 | H. M. S. 5 57 48·07 | H. M. S. 14 25 7·79 | H.19+ M. S. 21 46 | H.17+ M. S. 53 26·21 | H.14+ M. S. 2 1·74 | ° ′ ″ 5 46 30·75 | ″ 23·80 | 1°+ ′ ″ 52 4·28 | π−0° 34′ ″ 14·32 | R 12″·800 L 9·170 | F.R. 5 ..... F.L. 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | | | | | | | 25 18 | 56 58·09 | 5 34·20 | 4 53 23·85 | 17·07 | 52 9·40 | 12·71 | | | | | |
| | L | | | | | | | 35 25 | 67 4·73 | 15 42·51 | 2 21 19·20 | 3·96 | 52 19·64 | 9·84 | | | | | |
| | L | | | | | | | 40 40 | 72 19·55 | 20 58·19 | 1 2 24·00 | 0·77 | 52 20·08 | 7·09 | | | | | |
| | R | | | | | | | 50 23 | 82 2·21 | 31 42·44 | 1 38 39·75 | 1·93 | 52 23·52 | 11·69 | | | | | |
| Jan. 23rd 0° & 180° | R | λ Ursæ Minoris | ° ′ ″ 1 10 56·39 | W. 1° 18′ 13″·95 | H. M. S. 20 22 55·75 | H. M. S. 5 57 48·06 | H. M. S. 2 20 43·81 | H.7+ M. S. 32 45 | H.6+ M. S. 3 59·65 | H.2+ M. S. 14 35·20 | ° ′ ″ 1 32 9·15 | ″ 1·69 | 0°+ ′ ″ 43 56·90 | π−0° 34′ ″ 15·36 | R 12″·405 L 11·523 | F.R. 4 ..... F.L. 4 | H. M. S. 0 12 10·56 | H. M. S. (1 40 43·55+0·05)=1 40 43·6 | H. M. S. 0 26 33·04 |
| | R | | | | | | | 37 28 | 8 42·49 | 19 18·81 | 0 21 15·00 | 0·09 | 44 2·60 | 11·26 | | | | | |
| | L | | | | | | | 46 42 | 17 56·16 | 28 34·00 | 1 57 32·85 | 2·74 | 43 57·70 | 13·51 | | | | | |
| | L | | | | | | | 49 14 | 20 28·08 | 31 6·33 | 2 35 37·80 | 4·81 | 43 57·14 | 12·00 | | | | | |
| | R | | | | | | | 59 30 | 30 43·72 | 41 23·66 | 5 9 57·75 | 19·05 | 43 42·28 | 12·62 | | | | | |
| | R | | | | | | | 61 52 | 33 5·63 | 43 45·96 | 5 45 32·25 | 23·67 | 43 39·90 | 10·38 | | | | | |
| | L | | | | | | | 70 44 | 41 57·32 | 52 39·11 | 7 58 49·50 | 45·39 | 43 18·16 | 10·40 | | | | | |
| | L | | | | | | | 73 20 | 44 33·23 | 55 15·44 | 8 37 54·45 | 53·09 | 43 10·68 | 10·18 | | | | | |

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G. T. Station Pahargarh Lat. 24° 56′ 1″ Long. 77° 44′ 21″ In time 5ᵐ·183. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Hourly Angle. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | M.S. Time. | Chronom. Time. | Error. | Rate. |
| Jan. 23rd 0° & 180° | R | λ Ursæ Minoris | ° ′ ″ 1 10 56·57 | E. 1° 18′ 14″·14 | h. m. s. 20 22 55·64 | h. m. s. 5 57 48·05 | h. m. s. 14 25 7·59 | h. m. s. 47 55 | h. m. s. 18 43·95 | h. m. s. 31 20·19 | ° ′ ″ 1 33 9·00 | ″ 1·72 | 1°+ ′ ″ 52 24·92 | π−0° 34′ ″ 12·50 | Vide Jan. 22nd A.M. | Vide Jan. 22nd A.M. | h. m. s. 0 12 10·56 | h. m. s. (1 40 43·55+0·05)=1 40 43·6 | h. m. s. 1 28 33·04 | |
| | R | | | | | | | 50 42 | 21 30·85 | 34 7·55 | 2 14 59·40 | 3·62 | 52 23·30 | 12·78 | | | | | | |
| | L | | | | | | | 60 50 | 31 38·49 | 44 16·86 | 4 47 19·05 | 16·40 | 52 8·32 | 10·58 | | | | | s. 50·39 | |
| Jan. 24th 9° & 189° | R | λ Ursæ Minoris | ° ′ ″ 1 10 56″·75 | W. 1° 18′ 14″·34 | h. m. s. 20 22 55·53 | h. m. s. 5 57 48·05 | h. m. s. 2 20 43·58 | h. m. s. 26 0 | h. m. s. 56 25·04 | h. m. s. 10 55·90 | ° ′ ″ 2 26 55·20 | ″ 4·29 | 0°+ ′ ″ 44 0·80 | π−0° 34′ ″ 9·25 | π−(0° 34′)−{ R 10″·853 L 15·492 } | F.R. 6 ..... F.L. 6 | h. m. s. 0 12 25·36 | h. m. s. (1 41 48·70+0·09)=1 41 48·79 | h. m. s. 1 29 23·43 | |
| | R | | | | | | | 28 12 | 58 36·97 | 13 8·18 | 1 53 51·00 | 2·57 | 44 2·72 | 9·05 | | | | | | |
| | L | | | | | | | 35 42 | 66 6·72 | 20 39·16 | 0 1 6·30 | 0·00 | 44 0·30 | 14·04 | | | | | s. 50·39 | |
| | L | | | | | | | 39 2 | 69 26·60 | 23 59·60 | 0 49 0·30 | 0·48 | 43 58·34 | 15·52 | | | | | | |
| | R | | | | | | | 47 32 | 77 56·32 | 32 30·71 | 2 56 46·95 | 6·20 | 43 56·14 | 12·00 | | | | | | |
| | R | | | | | | | 49 54 | 80 18·24 | 34 53·02 | 3 32 21·60 | 8·95 | 43 55·06 | 10·33 | | | | | | |
| | L | | | | | | | 57 57 | 88 20·97 | 42 57·07 | 5 33 22·35 | 22·03 | 43 34·54 | 17·77 | | | | | | |
| | L | | | | | | | 61 24 | 91 47·86 | 46 24·52 | 6 25 14·10 | 29·41 | 43 27·66 | 17·27 | | | | | | |
| Jan. 24th 9° & 189° | R | λ Ursæ Minoris | ° ′ ″ 1 10 56″·93 | E. 1° 18′ 14″·54 | h. m. s. 20 22 55·44 | h. m. s. 5 57 48·04 | h. m. s. 14 25 7·40 | h. m. s. 19 8 | h. m. s. 49 9·15 | h. m. s. 5 37·09 | ° ′ ″ 4 52 34·65 | ″ 16·97 | 1°+ ′ ″ 52 9·18 | π−0° 34′ ″ 11·61 | π−(0° 34′)−{ R 11″·186 L 12·414 } | F.R. 5 ..... F.L. 5 | h. m. s. 0 12 25·36 | h. m. s. (1 41 48·70+0·09)=1 41 48·79 | h. m. s. 1 29 23·43 | |
| | R | | | | | | | 22 44 | 52 45·03 | 9 13·56 | 3 58 27·60 | 11·28 | 52 17·92 | 14·66 | | | | | | |
| | L | | | | | | | 32 15 | 62 15·71 | 18 45·81 | 1 35 23·85 | 1·81 | 52 22·70 | 9·97 | | | | | s. 50·39 | |
| | L | | | | | | | 54 30 | 84 29·97 | 41 3·72 | 3 59 4·80 | 11·35 | 52 10·54 | 7·35 | | | | | | |
| Jan. 25th 18° & 198° | R | λ Ursæ Minoris | ° ′ ″ 1 10 57″·11 | W. 1° 18′ 14″·74 | h. m. s. 20 22 55·34 | h. m. s. 5 57 48·04 | h. m. s. 2 20 43·38 | h. m. s. 25 12 | h. m. s. 54 49·27 | h. m. s. 13 16·41 | ° ′ ″ 1 51 44·55 | ″ 2·48 | 0°+ ′ ″ 44 0·47 | π−0° 34′ ″ 11·79 | π−(0° 34′)−{ R 11″·948 L 14·435 } | F.R. 4 ..... F.L. 4 | h. m. s. 0 12 39·38 | h. m. s. {0 43 59·90−(1 8·79+0·03)}=1 42 51·08 | h. m. s. 1 30 11·70 | |
| | R | | | | | | | 27 50 | 57 27·18 | 15 54·76 | 1 12 9·30 | 1·03 | 44 1·98 | 11·73 | | | | | | |
| | L | | | | | | | 36 19 | 65 55·91 | 24 24·88 | 0 55 22·50 | 0·61 | 43 58·96 | 15·17 | | | | | s. 48·27 | |
| | L | | | | | | | 38 34 | 68 10·84 | 26 40·18 | 1 29 12·00 | 1·58 | 44 0·12 | 13·04 | | | | | | |
| | R | | | | | | | 48 35 | 78 11·52 | 36 42·50 | 3 59 46·80 | 11·40 | 43 50·42 | 12·92 | | | | | | |
| | R | | | | | | | 51 12 | 80 48·43 | 39 19·84 | 4 39 6·90 | 15·45 | 43 47·94 | 11·35 | | | | | | |
| | L | | | | | | | 58 59 | 88 35·18 | 47 7·87 | 6 36 7·35 | 31·09 | 43 28·74 | 14·91 | | | | | | |
| | L | | | | | | | 61 38 | 91 14·10 | 49 47·22 | 7 15 57·60 | 37·64 | 43 22·48 | 14·62 | | | | | | |



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G. T. Station Pahargarh Lat. 24° 56′ 1″ Long. 77° 44′ 21″ In time 5ˢ·183. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | *'s Elongation. | *'s A.R. | *'s Horary Angle. | *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 25th 18° & 198° | R | λ Ursæ Minoris | ° ′ ″ 1 10 57·29 | ° ′ ″ E. 1 18 14·94 | h. m. s. 20 22 55·26 | h. m. s. 5 57 48·03 | h. m. s. 14 25 7·23 | h. m. s. 13 30 | h. m. s. 42 44·45 | h. m. s. 3 7·88 | ° ′ ″ 5 29 50·25 | ″ 21·57 | ° ′ ″ 52 9·14 | ″ 15·77 | π−(° ′ 34) − { R 13·385 / L 11·398 } | F.R. 4 ..... F.L. 4 | h. m. s. 0 12 39·38 | h. m. s. {1 43 59·90−(1 8·79+0·03)}=1 42 51·08 | h. m. s. 1 30 11·70 | h. m. s. 48·27 |
| | R | | | | | | | 15 55 | 45 9·37 | 5 33·20 | 4 53 30·45 | 17·08 | 52 10·46 | 12·60 | | | | | | |
| | L | | | | | | | 31 8 | 60 21·88 | 20 48·21 | 1 4 45·30 | 0·83 | 52 24·86 | 10·75 | | | | | | |
| | L | | | | | | | 33 38 | 62 51·80 | 23 18·54 | 0 27 10·35 | 0·15 | 52 26·16 | 11·37 | | | | | | |
| | R | | | | | | | 43 11 | 72 24·49 | 32 52·80 | 1 56 23·55 | 2·69 | 52 24·24 | 11·99 | | | | | | |
| | R | | | | | | | 46 7 | 75 20·40 | 35 49·19 | 2 40 29·40 | 5·12 | 52 23·00 | 13·18 | | | | | | |
| | L | | | | | | | 55 15 | 84 28·10 | 44 58·39 | 4 57 47·40 | 17·61 | 52 9·48 | 12·15 | | | | | | |
| | L | | | | | | | 57 50 | 87 3·02 | 47 33·73 | 5 36 37·50 | 22·50 | 52 3·48 | 11·04 | | | | | | |
| Jan. 26th 27° & 207° | R | λ Ursæ Minoris | ° ′ ″ 1 10 57·46 | ° ′ ″ W. 1 18 15·13 | h. m. s. 20 22 55·17 | h. m. s. 5 57 48·02 | h. m. s. 2 20 43·20 | h. m. s. 22 9 | h. m. s. 50 59·03 | h. m. s. 13 22·10 | ° ′ ″ 1 50 16·50 | ″ 2·42 | ° ′ ″ 44 1·54 | ″ 11·17 | π−(° ′ 34) − { R 12·463 / L 13·283 } | F.R. 4 ..... F.L. 4 | h. m. s. 0 12 52·60 | h. m. s. (1 43 50·65+0·08)=1 43 50·73 | h. m. s. 1 30 58·13 | h. m. s. 46·43 |
| | R | | | | | | | 24 57 | 53 46·93 | 16 10·46 | 1 8 11·10 | 0·92 | 44 2·44 | 11·77 | | | | | | |
| | L | | | | | | | 29 33 | 58 22·77 | 20 47·05 | 0 0 57·75 | 0·00 | 44 1·96 | 13·17 | | | | | | |
| | L | | | | | | | 35 23 | 64 12·56 | 26 37·81 | 1 28 39·15 | 1·56 | 43 59·42 | 14·15 | | | | | | |
| | R | | | | | | | 41 6 | 69 55·36 | 32 21·55 | 2 54 35·25 | 6·05 | 43 55·86 | 13·22 | | | | | | |
| | R | | | | | | | 43 58 | 72 47·26 | 35 13·92 | 3 37 40·80 | 9·40 | 43 52·04 | 13·69 | | | | | | |
| | L | | | | | | | 51 30 | 80 19·00 | 42 46·89 | 5 30 55·35 | 21·71 | 43 40·68 | 12·74 | | | | | | |
| | L | | | | | | | 53 32 | 82 20·93 | 44 49·15 | 6 1 29·25 | 25·90 | 43 36·16 | 13·07 | | | | | | |
| Jan. 26th 27° & 207° | R | λ Ursæ Minoris | ° ′ ″ 1 10 57·65 | ° ′ ″ W. 1 18 15·34 | h. m. s. 20 22 55·10 | h. m. s. 5 57 48·02 | h. m. s. 14 25 7·08 | h. m. s. 4 10 | h. m. s. 32 35·45 | h. m. s. 5 53·78 | ° ′ ″ 7 3 19·50 | ″ 35·50 | ° ′ ″ 51 51·92 | ″ 12·08 | π−(° ′ 34) − { R 12·670 / L 11·800 } | F.R. 4 ..... F.L. 4 | h. m. s. 0 12 52·60 | h. m. s. (1 43 50·65+0·08)=1 43 50·73 | h. m. s. 1 30 58·13 | h. m. s. 46·43 |
| | R | | | | | | | 6 38 | 35 3·36 | 59 22·10 | 6 26 14·70 | 29·56 | 51 55·44 | 9·66 | | | | | | |
| | L | | | | | | | 17 10 | 45 34·99 | 69 55·46 | 3 47 54·30 | 10·30 | 52 16·74 | 11·70 | | | | | | |
| | L | | | | | | | 19 53 | 48 17·90 | 72 38·81 | 3 7 4·05 | 6·94 | 52 20·28 | 11·88 | | | | | | |
| | R | | | | | | | 28 7 | 56 31·61 | 80 53·87 | 1 3 18·15 | 0·80 | 52 28·10 | 13·56 | | | | | | |
| | R | | | | | | | 38 22 | 66 46·25 | 91 10·19 | 1 30 46·65 | 1·64 | 52 29·08 | 15·38 | | | | | | |
| | L | | | | | | | 45 58 | 74 21·99 | 98 47·18 | 3 25 1·50 | 8·35 | 52 19·10 | 12·11 | | | | | | |
| | L | | | | | | | 48 24 | 76 47·90 | 101 13·49 | 4 1 36·15 | 11·59 | 52 15·26 | 11·51 | | | | | | |
| Jan. 27th 9° & 189° | R | λ Ursæ Minoris | ° ′ ″ 1 10 57·82 | ° ′ ″ W. 1 18 15·52 | h. m. s. 20 22 55·03 | h. m. s. 5 57 48·02 | h. m. s. 2 20 43·05 | h. m. s. 27 33 | h. m. s. 55 33·64 | h. m. s. 21 54·02 | ° ′ ″ 0 17 44·55 | ″ 0·06 | ° ′ ″ 44 4·00 | ″ 11·46 | Vide Jan. 24th A.N. | Vide Jan. 24th A.N. | h. m. s. 0 13 5·03 | h. m. s. (1 44 53·55+0·06)=1 44 53·61 | h. m. s. 1 31 48·68 | h. m. s. 50·45 |
| | R | | | | | | | 30 25 | 58 25·55 | 24 46·40 | 1 0 50·25 | 0·73 | 44 1·76 | 13·03 | | | | | | |
| | L | | | | | | | 39 40 | 67 40·26 | 34 2·62 | 3 19 53·55 | 7·93 | 43 53·58 | 14·01 | | | | | | |
| | L | | | | | | | 42 44 | 70 44·16 | 37 7·03 | 4 5 59·70 | 12·00 | 43 49·18 | 14·34 | | | | | | |

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G. T. Station Pahargarh Lat. 24° 56′ 1″ Long. 77° 44′ 21″ In time 5ᵐ·183. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 27th 9° & 189° | R | λ Ursæ Minoris | ° ′ ″ 1 10 58·01 | ° ′ ″ E. 1 18 15·73 | H. M. S. 20 22 54·96 | H. M. S. 5 57 48·01 | H. M. S. 14 25 6·95 | H. 19+ M. S. 11 42 | H. 17+ M. S. 39 20·49 | H. 14+ M. S. 7 36·48 | ° ′ ″ 4 22 37·05 | ″ 13·68 | 1°+ ′ ″ 52 10·40 | π−0° 34′ ″ 8·35 | Vide Jan. 24th A.M. | Vide Jan. 24th A.M. | H. M. S. 0 13 5·03 | H. M. S. (1 44 53·55+0·06)=1 44 53·61 | M. S. 1 31 48·58 | S. 50·45 |
| | R | | | | | | | 22 46 | 50 24·14 | 18 41·95 | 1 36 15·00 | 1·84 | 52 24·18 | 10·29 | | | | | | |
| | R | | | | | | | 24 49 | 52 27·08 | 20 45·22 | 1 5 25·95 | 0·85 | 52 25·90 | 11·02 | | | | | | |
| | L | | | | | | | 32 20 | 59 57·84 | 28 17·22 | 0 47 34·05 | 0·45 | 52 29·88 | 14·60 | | | | | | |
| | L | | | | | | | 42 55 | 70 32·51 | 38 53·62 | 3 26 40·05 | 8·48 | 52 22·86 | 15·61 | | | | | | |
| | L | | | | | | | 46 28 | 74 5·40 | 42 27·09 | 4 20 2·10 | 13·43 | 52 16·84 | 14·54 | | | | | | |

Jan. 28th ⊙'s Transit M.S. Time H. M. S. 0 13 16·66. Chronom. Time (H. M. S. 1 45 50·55 + S. 0·02) = H. M. S. 1 45 50·57. Error H. M. S. 1 32 33·91. Rate 45″·33.

G. T. Station Kasri Lat. 25° 46′ 30″ Long. 77° 43′ 24″. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 24th 9° & 189° | R | δ Ursæ Minoris | ° ′ ″ 3 24 43·52 | ° ′ ″ W. 3 47 22·53 | H. M. S. 18 24 34·84 | H. M. S. 5 53 24·05 | H. M. S. 0 17 58·88 | H. 6+ M. S. 48 45 | H. 5+ M. S. 44 2·17 | H. 23+ M. S. 56 17·69 | ° ′ ″ 5 25 17·85 | ″ 61·07 | 3°+ ′ ″ 45 54·70 | π − 0° 0′ ″ — 26·76 | π−(0° 0′)−{ R 27″·727 L 26·397 } | F.R. 6.....F.L. 6 | H. M. S. 23 59 55·82 | H. M. S. (1 4 27·3−0·04)=1 4 27·26 | M. S. 1 4 31·44 | S. 47·70 |
| | R | | | | | | | 50 36 | 45 53·11 | 58 8·93 | 4 57 29·25 | 51·07 | 46 4·48 | — 26·98 | | | | | | |
| | L | | | | | | | 56 41 | 51 57·91 | 64 14·73 | 3 26 2·25 | 24·49 | 46 31·52 | — 26·52 | | | | | | |
| | L | | | | | | | 58 36 | 53 52·84 | 66 9·98 | 2 57 13·50 | 18·11 | 46 36·28 | — 28·14 | | | | | | |
| | R | | | | | | | 68 34 | 63 50·51 | 76 9·29 | 0 27 23·85 | 0·43 | 46 53·80 | — 28·30 | | | | | | |
| | R | | | | | | | 70 58 | 66 14·44 | 78 33·60 | 0 8 40·80 | 0·04 | 46 54·50 | — 27·99 | | | | | | |
| | L | | | | | | | 79 15 | 74 31·16 | 86 51·69 | 2 13 12·15 | 10·21 | 46 45·02 | — 27·30 | | | | | | |
| | L | | | | | | | 81 5 | 76 21·10 | 88 41·93 | 2 40 45·75 | 14·86 | 46 41·92 | — 25·75 | | | | | | |
| | R | | | | | | | 87 20 | 82 35·89 | 94 57·75 | 4 14 43·05 | 37·27 | 46 16·64 | — 28·62 | | | | | | |
| | R | | | | | | | 89 10 | 84 25·83 | 96 47·99 | 4 42 16·65 | 45·76 | 46 9·06 | — 27·71 | | | | | | |
| | L | | | | | | | 98 32 | 93 47·52 | 106 11·22 | 7 3 5·10 | 102·61 | 45 16·40 | — 23·52 | | | | | | |
| | L | | | | | | | 100 1 | 95 16·47 | 107 40·41 | 7 25 22·95 | 113·68 | 45 1·70 | — 27·15 | | | | | | |
| Dec. 24th 9° & 189° | R | δ Ursæ Minoris | ° ′ ″ 3 24 43·69 | ° ′ ″ E. 3 47 22·72 | H. M. S. 18 24 34·80 | H. M. S. 5 53 24·04 | H. M. S. 12 31 10·76 | H. 19+ M. S. 5 22 | H. 18+ M. S. 0 14·79 | H. 12+ M. S. 14 31·25 | ° ′ ″ 4 9 52·65 | ″ 35·87 | 3°+ ′ ″ 47 11·74 | π − 0° 0′ ″ — 24·89 | π−(0° 0′)−{ R 25″·010 L 23·920 } | F.R. 4.....F.L. 4 | H. M. S. 23 59 55·82 | H. M. S. (1 4 27·3−0·04)=1 4 27·26 | M. S. 1 4 31·44 | S. 47·70 |
| | R | | | | | | | 7 39 | 2 31·72 | 16 48·55 | 3 35 33·15 | 26·71 | 47 21·80 | — 25·79 | | | | | | |
| | L | | | | | | | 14 31 | 9 23·49 | 23 41·45 | 1 52 19·65 | 7·26 | 47 39·58 | — 24·12 | | | | | | |
| | L | | | | | | | 16 23 | 11 15·43 | 25 33·70 | 1 24 15·90 | 4·09 | 47 42·58 | — 23·95 | | | | | | |
| | R | | | | | | | 23 7 | 17 59·21 | 32 18·58 | 0 16 57·30 | 0·17 | 47 48·22 | — 25·67 | | | | | | |
| | R | | | | | | | 25 50 | 20 42·12 | 35 1·94 | 0 57 47·70 | 1·93 | 47 44·48 | — 23·69 | | | | | | |
| | L | | | | | | | 33 53 | 28 44·85 | 43 5·99 | 2 58 48·45 | 18·44 | 47 28·50 | — 24·22 | | | | | | |
| | L | | | | | | | 35 43 | 30 34·79 | 44 56·23 | 3 26 22·05 | 24·57 | 47 21·54 | — 23·39 | | | | | | |
| Dec. 25th 18° & 198° | L | δ Ursæ Minoris | ° ′ ″ 3 24 43·86 | ° ′ ″ W. 3 47 22·91 | H. M. S. 18 24 34·76 | H. M. S. 5 53 24·04 | H. M. S. 0 17 58·79 | H. 6+ M. S. 47 31 | H. 5+ M. S. 42 0·58 | H. 23+ M. S. 58 12·33 | ° ′ ″ 4 56 36·90 | ″ 50·77 | 3°+ ′ ″ 46 5·66 | π − 0° 0′ ″ — 26·48 | π−(0° 0′)−{ L 29″·473 R 25·845 } | F.R. 4.....F.L. 4 | H. M. S. 0 0 25·68 | H. M. S. (1 5 44·85−0·03)=1 5 44·82 | M. S. 1 5 19·13 | S. 47·59 |
| | L | | | | | | | 49 10 | 43 39·53 | 59 51·55 | 4 31 48·60 | 42·63 | 46 15·32 | — 24·96 | | | | | | |
| | R | | | | | | | 56 15 | 50 44·29 | 66 57·47 | 2 45 19·80 | 15·76 | 46 40·92 | — 26·23 | | | | | | |
| | R | | | | | | | 58 2 | 52 31·23 | 68 44·71 | 2 18 31·20 | 11·06 | 46 45·72 | — 26·13 | | | | | | |
| | L | | | | | | | 67 15 | 61 43·93 | 77 58·92 | 0 0 1·95 | 0·00 | 46 50·64 | — 32·27 | | | | | | |
| | L | | | | | | | 68 59 | 63 27·87 | 79 43·14 | 0 26 5·25 | 0·39 | 46 48·34 | — 34·18 | | | | | | |
| | R | | | | | | | 76 23 | 70 51·63 | 87 8·11 | 2 17 19·80 | 10·85 | 46 45·94 | — 26·12 | | | | | | |
| | R | | | | | | | 78 1 | 72 29·57 | 88 46·33 | 2 41 53·10 | 15·07 | 46 42·94 | — 24·90 | | | | | | |

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G. T. Station Kasri Lat. 25° 46′ 30″ Long. 77° 43′ 24″. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 25th 18° & 198° | R | δ Ursæ Minoris | ° ′ ″ 3 24 44·03 | ° ′ ″ E. 3 47 23·10 | ″ 18 24 34·71 | ″ 5 53 24·03 | ″ 12 31 10·68 | H. M. S. 18+ 58 39 | H. M. S. 17+ 52 44·44 | H. M. S. 12+ 10 56·23 | ° ′ ″ 5 3 36·75 | ″ 52·93 | ° ′ ″ 3° + 46 59·16 | ″ π — 0° 0′ — 28·99 | ″ — (0° 0′) — { R 27·590 L 22·683 } | F.R. 4 ..... F.L. 4 | M. S. 0 0 26·68 | M. S. (1 5 44·85 — 0·03) = 1 5 44·82 | M. S. 1 5 19·13 | ″ 47·69 |
| | R | | | | | | | 60 50 | 54 55·37 | 13 7·51 | 4 30 47·55 | 42·12 | 47 7·08 | — 26·10 | | | | | | |
| | L | | | | | | | 70 31 | 64 36·05 | 22 49·78 | 2 5 13·50 | 9·02 | 47 38·30 | — 24·22 | | | | | | |
| | L | | | | | | | 72 49 | 66 53·97 | 25 8·08 | 1 30 39·00 | 4·73 | 47 41·32 | — 22·95 | | | | | | |
| | R | | | | | | | 79 44 | 73 48·74 | 32 3·99 | 0 13 19·65 | 0·10 | 47 52·00 | — 29·00 | | | | | | |
| | R | | | | | | | 81 43 | 75 47·68 | 34 3·25 | 0 43 8·55 | 1·07 | 47 48·30 | — 26·27 | | | | | | |
| | L | | | | | | | 90 8 | 84 12·40 | 42 29·36 | 2 49 40·20 | 16·60 | 47 29·56 | — 23·06 | | | | | | |
| | L | | | | | | | 95 30 | 89 34·22 | 47 52·06 | 4 10 20·70 | 36·16 | 47 7·44 | — 20·50 | | | | | | |
| Dec. 26th 27° & 207° | R | δ Ursæ Minoris | ° ′ ″ 3 24 44·20 | ° ′ ″ W. 3 47 23·29 | ″ 18 24 34·67 | ″ 5 53 24·02 | ″ 0 17 58·69 | H. M. S. 6+ 45 13 | H. M. S. 5+ 38 54·89 | H. M. S. 23+ 59 2·68 | ° ′ ″ 4 44 0·15 | ″ 46·54 | ° ′ ″ 3° + 46 8·88 | ″ π — 0° 0′ — 27·87 | ″ — (0° 0′) — { R 26·576 L 25·671 } | F.R. 8 ..... F.L. 8 | M. S. 0 0 55·46 | M. S. (1 7 2·30 — 0·11) = 1 7 2·19 | M. S. 1 6 6·73 | ″ 48·54 |
| | R | | | | | | | 47 10 | 40 51·82 | 60 59·94 | 4 14 41·25 | 37·43 | 46 19·78 | — 26·08 | | | | | | |
| | L | | | | | | | 54 14 | 47 55·58 | 68 4·86 | 2 28 27·45 | 12·71 | 46 43·30 | — 27·28 | | | | | | |
| | L | | | | | | | 56 3 | 49 44·52 | 69 54·10 | 2 1 8·85 | 8·46 | 46 48·86 | — 25·97 | | | | | | |
| | R | | | | | | | 64 0 | 57 41·25 | 77 52·13 | 0 1 38·40 | 0·00 | 46 56·36 | — 26·93 | | | | | | |
| | R | | | | | | | 66 11 | 59 52·18 | 80 3·42 | 0 31 10·95 | 0·56 | 46 54·44 | — 28·29 | | | | | | |
| | L | | | | | | | 74 45 | 68 25·89 | 88 38·54 | 2 39 57·75 | 14·71 | 46 42·72 | — 25·85 | | | | | | |
| | L | | | | | | | 77 10 | 70 50·81 | 91 3·85 | 3 16 17·40 | 22·15 | 46 34·06 | — 27·08 | | | | | | |
| Dec. 26th 27° & 207° | R | δ Ursæ Minoris | ° ′ ″ 3 24 44·37 | ° ′ ″ E. 3 47 23·48 | ″ 18 24 34·63 | ″ 5 53 24·02 | ″ 12 31 10·61 | H. M. S. 18+ 58 36 | H. M. S. 17+ 51 53·19 | H. M. S. 12+ 14 1·39 | ° ′ ″ 4 17 18·30 | ″ 38·04 | ° ′ ″ 3° + 47 12·68 | ″ π — 0° 0′ — 27·24 | ″ — (0° 0′) — { R 27·486 L 22·793 } | F.R. 7 ..... F.L. 6 | M. S. 0 0 55·46 | M. S. (1 7 2·30 — 0·11) = 1 7 2·19 | M. S. 1 6 6·73 | ″ 48·54 |
| | R | | | | | | | 61 20 | 54 37·09 | 16 45·75 | 3 36 12·90 | 26·87 | 47 25·08 | — 28·47 | | | | | | |
| | L | | | | | | | 70 45 | 64 1·78 | 26 11·98 | 1 14 39·45 | 3·21 | 47 40·24 | — 19·97 | | | | | | |
| | L | | | | | | | 72 55 | 66 11·70 | 28 22·26 | 0 42 5·25 | 1·02 | 47 47·18 | — 24·72 | | | | | | |
| | R | | | | | | | 86 21 | 79 37·25 | 41 50·01 | 2 39 51·00 | 14·74 | 47 34·80 | — 26·06 | | | | | | |
| Dec. 27th 27° & 207° | R | δ Ursæ Minoris | ° ′ ″ 3 24 44·54 | ° ′ ″ W. 3 47 23·66 | ″ 18 24 34·60 | ″ 5 53 24·01 | ″ 0 17 58·61 | H. M. S. 6+ 42 59 | H. M. S. 5+ 35 52·46 | H. M. S. 23+ 59 56·32 | ° ′ ″ 4 30 34·35 | ″ 42·25 | ° ′ ″ 3° + 46 18·08 | ″ π — 0° 0′ — 23·33 | Vide Dec. 26th A.M. | Vide Dec. 26th A.M. | | | | |
| | R | | | | | | | 45 2 | 37 55·39 | 61 59·59 | 3 59 45·30 | 33·16 | 46 25·96 | — 24·54 | | | | | | |
| | L | | | | | | | 51 40 | 44 33·17 | 68 38·46 | 2 20 2·25 | 11·31 | 46 47·40 | — 24·95 | | | | | | |
| | L | | | | | | | 53 5 | 45 58·12 | 70 3·64 | 1 58 44·55 | 8·13 | 46 50·72 | — 24·81 | | | | | | |
| | R | | | | | | | 60 50 | 53 42·86 | 77 49·65 | 0 2 14·40 | 0·00 | 46 55·50 | — 28·16 | | | | | | |
| | R | | | | | | | 63 7 | 55 59·78 | 80 6·95 | 0 32 5·10 | 0·59 | 46 55·66 | — 27·41 | | | | | | |
| | L | | | | | | | 70 6 | 62 58·55 | 87 6·86 | 2 17 3·75 | 10·81 | 46 48·82 | — 24·03 | | | | | | |
| | L | | | | | | | 73 26 | 66 18·44 | 90 27·29 | 3 7 10·20 | 20·14 | 46 38·12 | — 25·40 | | | | | | |
| Dec. 27th 27° & 207° | L | δ Ursæ Minoris | ° ′ ″ 3 24 44·71 | ° ′ ″ E. 3 47 23·86 | ″ 18 24 34·56 | ″ 5 53 24·01 | ″ 12 31 10·55 | H. M. S. 18+ 54 2 | H. M. S. 17+ 47 30·84 | H. M. S. 12+ 13 34·89 | ° ′ ″ 4 23 54·90 | ″ 40·01 | ° ′ ″ 3° + 47 3·78 | ″ π — 0° 0′ — 19·93 | Vide Dec. 26th A.M. | Vide Dec. 26th A.M. | | | | |
| | L | | | | | | | 56 40 | 50 8·75 | 16 13·23 | 3 44 19·80 | 28·92 | 47 15·26 | — 20·32 | | | | | | |
| | R | | | | | | | 65 23 | 58 51·46 | 24 57·37 | 1 33 17·70 | 5·01 | 47 43·54 | — 24·69 | | | | | | |
| | R | | | | | | | 72 16 | 65 44·23 | 31 51·27 | 0 10 10·80 | 0·60 | 47 46·90 | — 23·10 | | | | | | |
| | L | | | | | | | 82 28 | 75 55·88 | 42 4·60 | 2 43 30·75 | 15·42 | 47 34·40 | — 25·96 | | | | | | |
| | L | | | | | | | 84 28 | 77 55·82 | 44 4·86 | 3 13 34·65 | 21·62 | 47 28·10 | — 25·86 | | | | | | |
| | R | | | | | | | 92 11 | 85 38·56 | 51 48·87 | 5 9 34·80 | 55·31 | 47 0·02 | — 31·47 | | | | | | |
| | R | | | | | | | 94 30 | 87 57·48 | 54 8·17 | 5 44 24·30 | 68·47 | 46 46·76 | — 31·37 | | | | | | |

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## G. T. Station Kasri Lat. 25° 46′ 30″ Long. 77° 43′ 24″. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. #'s N. P. D. | Computed Terms. #'s Elongation. | Computed Terms. #'s A.R. | Computed Terms. #'s Horary Angle. | Computed Terms. #'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 28th 0° & 180° | R | δ Ursæ Minoris | ° ′ ″ 3 24 44·88 | ° ′ ″ W. 3 47 24·04 | h. m. s. 18 24 34·52 | h. m. s. 5 53 24·00 | h. m. s. 0 17 58·52 | h. m. s. | h. m. s. | h. m. s. | ° ′ ″ | ″ | ° ′ ″ | ″ | | | h. m. s. | h. m. s. | h. m. s. | s. |
| | R | | | | | | | h. 6+ | h. 5+ | h. 24+ | | | 3°+ | π — 0° 0′ | | | | | | |
| | R | | | | | | | m. s. 40 37 | m. s. 32 42·02 | m. s. 0 41·91 | 4 19 9·15 | 38·75 | 46 21·52 | — 23·77 | | | | | | |
| | L | | | | | | | 42 35 | 34 39·95 | 2 40·16 | 3 49 35·40 | 30·41 | 46 29·08 | — 24·55 | π — (0° 0′) — { R 26·555 L 24·435 } | | | | | |
| | L | | | | | | | 51 22 | 43 26·66 | 11 28·31 | 1 37 33·15 | 5·49 | 46 52·96 | — 25·59 | | F.R. 4 ..... F.L. 4 | 0 1 54·65 | (1 9 38·60 — 0·14) = 1 9 38·46 | 1 7 43·81 | |
| | R | | | | | | | 57 45 | 49 49·44 | 17 52·14 | 0 1 35·70 | 0·00 | 47 0·08 | — 23·96 | | | | | | |
| | R | | | | | | | 67 14·5 | 59 18·62 | 27 22·88 | 2 21 5·40 | 11·45 | 46 41·16 | — 31·43 | | | | | | 48·65 |
| | L | | | | | | | 69 42 | 61 46·04 | 29 50·70 | 2 58 2·70 | 18·23 | 46 39·34 | — 26·47 | | | | | | |
| | L | | | | | | | 79 58 | 72 1·69 | 40 8·04 | 5 32 22·80 | 63·42 | 46 57·80 | — 22·82 | | | | | | |
| | | | | | | | | 82 16·5 | 74 20·11 | 42 26·84 | 6 7 4·80 | 77·31 | 46 41·36 | — 25·37 | | | | | | |
| Dec. 28th 0° & 180° | R | δ Ursæ Minoris | ° ′ ″ 3 24 45·05 | ° ′ ″ E. 3 47 24·23 | h. m. s. 18 24 34·48 | h. m. s. 5 53 24·00 | h. m. s. 12 31 10·49 | h. m. s. | h. m. s. | h. m. s. | ° ′ ″ | ″ | ° ′ ″ | ″ | | | h. m. s. | h. m. s. | h. m. s. | s. |
| | R | | | | | | | h. 18+ | h. 17+ | h. 12+ | | | 3°+ | π — 0° 0′ | | | | | | |
| | R | | | | | | | m. s. 50 38 | m. s. 42 18·38 | m. s. 12 18·12 | 4 43 5·55 | 46·05 | 47 4·16 | — 25·98 | | | | | | |
| | L | | | | | | | 53 4 | 44 44·30 | 14 44·44 | 4 6 30·75 | 34·92 | 47 13·00 | — 23·69 | π — (0° 0′) — { R 26·203 L 20·243 } | | | | | |
| | L | | | | | | | 62 44 | 54 23·97 | 24 25·70 | 1 41 11·85 | 5·89 | 47 40·40 | — 22·06 | | F.R. 4 ..... F.L. 4 | 0 1 54·65 | (1 9 38·60 — 0·14) = 1 9 38·46 | 1 7 43·81 | |
| | R | | | | | | | 69 8 | 60 47·76 | 30 50·54 | 0 4 59·25 | 0·01 | 47 45·36 | — 21·14 | | | | | | |
| | R | | | | | | | 79 20 | 70 59·41 | 41 3·87 | 2 28 20·70 | 12·69 | 47 38·86 | — 27·32 | | | | | | 48·65 |
| | L | | | | | | | 81 48 | 73 27·33 | 43 32·19 | 3 5 25·50 | 19·83 | 47 32·22 | — 27·82 | | | | | | |
| | L | | | | | | | 89 31·5 | 81 10·57 | 51 16·70 | 5 1 33·15 | 52·48 | 46 49·14 | — 17·39 | | | | | | |
| | | | | | | | | 92 9 | 83 47·98 | 53 54·54 | 5 41 0·75 | 67·13 | 46 37·48 | — 20·38 | | | | | | |

Dec. 29th ⊙'s Transit M.S. Time 0 2 23·99. Chronom. Time (1 10 56·50 — 0·05) = 1 10 56·45. Error 1 8 32·46.

## G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ˢ·178. A.D. 1838.

| Feb. 13th 0° & 180° | Face. | 29 Camelopardali Hev. | ° ′ ″ 4 55 57·53 | ° ′ ″ E. 5 32 7·57 | h. m. s. 10 5 13·08 | h. m. s. 5 49 56·38 | h. m. s. 4 15 16·70 | h. 13+ | h. 6+ | h. 3+ | | | 16°+ | π — 11° 3′ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | | | | | | | m. s. 33 25 | m. s. 1 55·92 | m. s. 34 21·99 | ° ′ ″ 10 13 40·65 | ″ 312·90 | ′ ″ 30 45·86 | ″ 51·19 | | | | | | |
| | R | | | | | | | 35 16 | 3 46·85 | 36 13·23 | 9 45 52·05 | 285·35 | 31 12·66 | 50·44 | | | | | | |
| | L | | | | | | | 43 0 | 11 30·60 | 43 58·25 | 7 49 36·75 | 183·76 | 33 3·10 | 59·29 | | | | | | |
| | L | | | | | | | 44 50 | 13 20·54 | 45 48·49 | 7 22 3·15 | 162·91 | 33 21·28 | 56·62 | | | | | | |
| | R | | | | | | | 53 39 | 22 9·24 | 54 38·64 | 5 9 30·90 | 80·05 | 34 42·26 | 54·74 | π — (11° 3′) — { R 53·706 L 57·931 } | | | | | |
| | R | | | | | | | 55 24 | 23 54·19 | 56 23·87 | 4 43 12·45 | 67·05 | 34 53·94 | 53·42 | | F.R. 8 ..... F.L. 8 | 0 14 32·11 | (7 45 50·00 — 0·35) = 7 45 49·65 | 7 31 17·54 | |
| | R | | | | | | | 62 20 | 30 49·96 | 63 20·78 | 2 58 58·80 | 26·82 | 35 38·92 | 58·17 | | | | | | |
| | L | | | | | | | 64 8 | 32 37·90 | 65 9·02 | 2 31 55·20 | 19·33 | 35 45·38 | 57·14 | | | | | | |
| | L | | | | | | | 71 11 | 39 40·66 | 72 12·94 | 0 45 56·40 | 1·77 | 36 1·48 | 55·68 | | | | | | |
| | R | | | | | | | 73 54 | 42 23·57 | 74 56·29 | 0 5 6·15 | 0·02 | 36 1·66 | 54·11 | | | | | | 47·85 |
| | L | | | | | | | 80 40 | 49 9·35 | 81 43·18 | 1 36 37·20 | 7·85 | 35 58·26 | 58·54 | | | | | | |
| | L | | | | | | | 82 14 | 50 43·29 | 83 17·39 | 2 0 10·35 | 12·14 | 35 52·74 | 57·31 | | | | | | |
| | R | | | | | | | 90 59 | 59 28·00 | 92 3·53 | 4 11 42·45 | 53·34 | 35 9·72 | 55·49 | | | | | | |
| | R | | | | | | | 93 13 | 61 41·93 | 94 17·82 | 4 45 16·80 | 68·53 | 34 53·62 | 54·58 | | | | | | |
| | L | | | | | | | 100 26 | 68 54·69 | 101 31·77 | 6 33 46·05 | 130·68 | 33 55·34 | 58·45 | | | | | | |
| | L | | | | | | | 102 21 | 70 49·63 | 103 27·02 | 7 2 34·80 | 150·54 | 33 34·96 | 57·93 | | | | | | |

| Feb. 14th 9° & 189° | Face. | 29 Camelopardali Hev. | ° ′ ″ 4 55 57·07 | ° ′ ″ W. 5 32 7·05 | h. m. s. 10 5 13·12 | h. m. s. 5 49 46·39 | h. m. s. 15 55 9·51 | h. 1+ | h. 17+ | h. 15+ | | | 5°+ | π — 11° 3′ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | | | | | | | m. s. 5 17 | m. s. 32 38·07 | m. s. 10 54·16 | ° ′ ″ 11 3 50·25 | ″ 371·97 | ′ ″ 38 3·78 | ″ 58·86 | | | | | | |
| | L | | | | | | | 7 33 | 34 54·00 | 13 10·46 | 10 29 45·75 | 334·72 | 37 25·66 | 57·99 | | | | | | |
| | R | | | | | | | 17 46 | 45 6·67 | 23 24·81 | 7 56 10·50 | 191·21 | 35 0·64 | 56·48 | | | | | | |
| | R | | | | | | | 20 9 | 47 29·59 | 25 48·12 | 7 20 20·85 | 163·48 | 34 32·34 | 55·91 | π — (11° 3′) — { L 58·770 R 56·917 } | | | | | |
| | R | | | | | | | 30 56 | 58 16·24 | 36 36·55 | 4 38 14·40 | 65·19 | 32 57·18 | 59·04 | | F.R. 7 ..... F.L. 6 | 0 14 30·24 | (7 46 36·00 — 0·37) = 7 46 35·63 | 7 32 5·39 | |
| | L | | | | | | | 33 23 | 60 43·16 | 39 3·87 | 4 1 24·60 | 49·05 | 32 42·00 | 60·00 | | | | | | 47·85 |
| | L | | | | | | | 41 11 | 68 30·91 | 46 52·90 | 2 4 9·15 | 12·96 | 32 2·34 | 56·43 | | | | | | |
| | R | | | | | | | 43 3 | 70 22·85 | 48 45·14 | 1 36 5·55 | 7·76 | 31 57·20 | 56·49 | | | | | | |
| | L | | | | | | | 52 14 | 79 33·56 | 57 57·36 | 0 41 57·75 | 1·48 | 31 52·44 | 58·01 | | | | | | |
| | L | | | | | | | 53 54 | 81 13·50 | 59 37·58 | 1 7 1·05 | 3·77 | 31 55·44 | 58·72 | | | | | | |
| | R | | | | | | | 59 53 | 87 12·31 | 65 37·36 | 2 36 57·75 | 20·64 | 32 12·36 | 58·77 | | | | | | |
| | R | | | | | | | 61 37 | 88 56·25 | 67 21·59 | 3 3 1·20 | 28·05 | 32 17·98 | 56·98 | | | | | | |
| | R | | | | | | | 63 0 | 90 19·21 | 68 44·78 | 3 23 49·05 | 34·77 | 32 25·08 | 57·36 | | | | | | |



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G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ᵐ·178. A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 15th 18° & 198° | R | 29 Camelopardali Hev. | ° ′ ″ 4 55 56·91 | ° ′ ″ E. 5 32 6·87 | M. S. 10 5 13·13 | M. S. 5 49 56·40 | M. S. 4 15 16·73 | H. 13+ M. S. 32 12 | H. 5+ M. S. 59 8·82 | H. 3+ M. S. 39 27·54 | ° ′ ″ 8 57 17·85 | ″ 240·22 | ° ′ ″ 32 10·46 | ″ 63·81 | π−(11° 3′)−{ R 59·982 / L 60·973 } | F.R. 6 ..... F.L. 6 | M. S. 0 14 27·63 | H. M. S. (7 47 19·86−0·31)=7 47 19·54 | H. M. S. 7 32 51·91 | H. M. S. 46·63 |
| | R | | | | | | | 34 2 | 60 58·76 | 41 17·78 | 8 29 44·25 | 216·33 | 32 31·66 | 61·12 | | | | | | |
| | L | | | | | | | 44 23 | 71 19·42 | 51 40·14 | 5 54 8·85 | 104·72 | 34 22·80 | 60·65 | | | | | | |
| | L | | | | | | | 46 56 | 73 52·34 | 54 13·48 | 5 15 48·75 | 83·33 | 34 44·26 | 60·72 | | | | | | |
| | R | | | | | | | 60 46 | 87 41·89 | 68 5·30 | 1 47 51·45 | 9·75 | 35 57·10 | 59·98 | | | | | | |
| | R | | | | | | | 62 33 | 89 28·83 | 69 52·53 | 1 21 3·00 | 5·51 | 35 59·12 | 57·76 | | | | | | |
| | L | | | | | | | 75 30 | 102 25·41 | 82 51·23 | 1 53 37·50 | 10·85 | 35 57·70 | 61·68 | | | | | | |
| | L | | | | | | | 77 10 | 104 5·35 | 84 31·45 | 2 18 40·80 | 16·17 | 35 50·56 | 59·86 | | | | | | |
| | R | | | | | | | 88 19 | 115 13·99 | 95 41·92 | 5 6 17·85 | 79·01 | 34 45·66 | 57·80 | | | | | | |
| | R | | | | | | | 90 4 | 116 58·93 | 97 27·15 | 5 32 36·30 | 93·19 | 34 33·10 | 59·42 | | | | | | |
| | L | | | | | | | 101 59 | 128 53·54 | 109 23·72 | 8 31 44·85 | 220·89 | 32 26·70 | 60·72 | | | | | | |
| | L | | | | | | | 103 58 | 130 52·48 | 111 22·98 | 9 1 33·75 | 247·42 | 32 1·66 | 62·21 | | | | | | |
| Feb. 15th 0° & 180° | R | 29 Camelopardali Hev. | ° ′ ″ 4 55 56·76 | ° ′ ″ W. 5 32 6·71 | M. S. 10 5 13·15 | M. S. 5 49 56·40 | M. S. 15 55 9·55 | H. 1+ M. S. 5 7 | H. 17+ M. S. 31 41·18 | H. 15+ M. S. 13 53 66 | ° ′ ″ 10 18 58·35 | ″ 323·33 | ° ′ ″ 37 13·70 | ″ 57·08 | π−(11° 3′)−{ R 56·881 / L 57·438 } | F.R. 8 ..... F.L. 4 | M. S. 0 14 27·63 | H. M. S. (7 47 19·85−0·31)=7 47 19·54 | H. M. S. 7 32 51·91 | H. M. S. 46·63 |
| | R | | | | | | | 7 4 | 33 38·11 | 15 50·92 | 9 49 39·45 | 293·39 | 36 44·46 | 57·78 | | | | | | |
| | L | | | | | | | 18 58 | 45 31·72 | 27 46·48 | 6 50 46·05 | 142·22 | 34 14·26 | 58·75 | | | | | | |
| | L | | | | | | | 20 54 | 47 27·66 | 29 42·74 | 6 21 42·15 | 122·78 | 33 54·22 | 58·15 | | | | | | |
| | R | | | | | | | 27 59 | 54 32·43 | 36 48·67 | 4 35 13·20 | 63·78 | 32 54·58 | 57·51 | | | | | | |
| | R | | | | | | | 30 9 | 56 42·36 | 38 58·95 | 4 2 38·85 | 49·56 | 32 40·22 | 57·37 | | | | | | |
| | L | | | | | | | 37 1 | 63 34·13 | 45 51·86 | 2 19 25·35 | 16·34 | 32 5·64 | 56·01 | | | | | | |
| | L | | | | | | | 39 8 | 65 41·07 | 47 59·14 | 1 47 36·15 | 9·73 | 31 59·86 | 56·84 | | | | | | |
| | R | | | | | | | 47 6 | 73 48·80 | 56 8·21 | 0 14 39·90 | 0·18 | 31 50·80 | 57·33 | | | | | | |
| | R | | | | | | | 49 3 | 75 35·74 | 57 55·44 | 0 41 28·35 | 1·44 | 31 51·86 | 57·13 | | | | | | |
| | R | | | | | | | 51 3 | 77 35·68 | 59 55·70 | 1 11 32·25 | 4·29 | 31 53·10 | 55·52 | | | | | | |
| | R | | | | | | | 53 29 | 80 1·60 | 62 22·02 | 1 48 7·05 | 9·80 | 31 58·42 | 55·33 | | | | | | |
| Feb. 16th 27° & 207° | L | 29 Camelopardali Hev. | ° ′ ″ 4 55 56·61 | ° ′ ″ E. 5 32 6·54 | M. S. 10 5 13·16 | M. S. 5 49 56·41 | M. S. 4 15 16·75 | H. 13+ M. S. 34 58 | H. 6+ M. S. 1 6·76 | H. 3+ M. S. 45 22·36 | ° ′ ″ 7 28 35·85 | ″ 167·74 | ° ′ ″ 33 15·74 | ″ 56·94 | π−(11° 2′)−{ L 57·393 / R 58·063 } | F.R. 6 ..... F.L. 6 | M. S. 0 14 24·31 | H. M. S. (7 48 3·65−0·35)=7 48 3·30 | H. M. S. 7 33 38·99 | H. M. S. 47·08 |
| | L | | | | | | | 37 11 | 3 19·69 | 47 35·64 | 6 55 16·65 | 143·84 | 33 39·22 | 56·52 | | | | | | |
| | R | | | | | | | 49 29 | 15 37·25 | 59 55·23 | 3 50 22·80 | 44·41 | 35 21·78 | 59·65 | | | | | | |
| | R | | | | | | | 51 43 | 17 51·17 | 62 9·51 | 3 16 48·60 | 32·42 | 35 31·50 | 57·38 | | | | | | |
| | L | | | | | | | 61 28 | 27 35·83 | 71 55·77 | 0 50 14·70 | 2·12 | 36 2·92 | 58·50 | | | | | | |
| | L | | | | | | | 63 7 | 29 14·77 | 73 34·98 | 0 25 26·55 | 0·54 | 36 1·98 | 55·98 | | | | | | |
| | R | | | | | | | 72 51 | 38 58·43 | 83 20·24 | 2 0 52·35 | 12·28 | 35 51·22 | 56·96 | | | | | | |
| | R | | | | | | | 75 34 | 41 41·33 | 86 3·59 | 2 41 42·60 | 21·99 | 35 42·24 | 57·69 | | | | | | |
| | L | | | | | | | 88 18 | 54 24·88 | 98 49·23 | 5 53 7·20 | 105·06 | 34 18·80 | 57·32 | | | | | | |
| | L | | | | | | | 90 28 | 56 34·80 | 100 59·51 | 6 25 41·40 | 125·36 | 34 0·28 | 59·10 | | | | | | |
| | R | | | | | | | 103 8 | 69 14·36 | 113 41·14 | 9 36 5·85 | 280·03 | 31 24·64 | 58·13 | | | | | | |
| | R | | | | | | | 105 18 | 71 24·28 | 115 51·42 | 10 8 40·05 | 312·63 | 30 52·48 | 58·57 | | | | | | |
| Feb. 16th 27° & 207° | L | 29 Camelopardali Hev. | ° ′ ″ 4 55 56·48 | ° ′ ″ W. 5 32 6·39 | M. S. 10 5 13·17 | M. S. 5 49 56·41 | M. S. 15 55 9·58 | H. 0+ M. S. 55 53 | H. 17+ M. S. 21 37·73 | H. 15+ M. S. 7 45·11 | ° ′ ″ 11 51 7·05 | ″ 426·89 | ° ′ ″ 39 1·32 | ″ 60·82 | π−(11° 3′)−{ L 59·866 / R 58·341 } | F.R. 8 ..... F.L. 8 | M. S. 0 14 24·31 | H. M. S. (7 48 3·65−0·36)=7 48 3·30 | H. M. S. 7 33 38·99 | H. M. S. 47·08 |
| | L | | | | | | | 57 59 | 23 43·65 | 9 51·38 | 11 19 33·00 | 389·80 | 38 24·24 | 60·84 | | | | | | |
| | R | | | | | | | 65 40 | 31 24·38 | 17 33·37 | 9 24 3·15 | 268·42 | 36 21·34 | 59·31 | | | | | | |
| | R | | | | | | | 67 53 | 33 37·30 | 19 46·66 | 8 50 43·80 | 237·60 | 35 48·34 | 57·13 | | | | | | |
| | L | | | | | | | 75 45 | 41 29·03 | 27 39·67 | 6 52 28·65 | 143·41 | 34 17·34 | 60·32 | | | | | | |
| | L | | | | | | | 78 35 | 44 18·93 | 30 30·04 | 6 9 53·10 | 115·28 | 33 50·24 | 61·35 | | | | | | |
| | R | | | | | | | 87 9 | 52 52·62 | 39 5·14 | 4 1 6·60 | 48·93 | 32 41·32 | 58·78 | | | | | | |
| | R | | | | | | | 89 20 | 55 3·55 | 41 16·42 | 3 28 17·40 | 36·50 | 32 29·24 | 59·13 | | | | | | |
| | L | | | | | | | 99 19 | 65 2·19 | 51 16·71 | 0 58 13·05 | 2·85 | 31 55·30 | 58·84 | | | | | | |
| | L | | | | | | | 101 26 | 67 9·12 | 53 23·98 | 0 26 24·00 | 0·59 | 31 53·86 | 59·66 | | | | | | |
| | L | | | | | | | 103 19 | 69 2·05 | 55 17·22 | 0 1 54·60 | 0·00 | 31 52·12 | 58·51 | | | | | | |
| | L | | | | | | | 104 45 | 70 28·00 | 56 43·41 | 0 23 27·45 | 0·46 | 31 52·66 | 58·59 | | | | | | |
| | R | | | | | | | 111 57 | 77 39·75 | 63 56·34 | 2 11 41·40 | 14·53 | 32 7·82 | 59·68 | | | | | | |
| | R | | | | | | | 113 40 | 79 22·69 | 65 39·56 | 2 37 29·70 | 20·78 | 32 13·94 | 59·55 | | | | | | |
| | R | | | | | | | 116 9 | 81 51·60 | 68 8·88 | 3 14 49·50 | 31·77 | 32 24·82 | 59·44 | | | | | | |
| | R | | | | | | | 118 43 | 84 25·51 | 70 43·21 | 3 53 24·45 | 45·58 | 32 32·90 | 53·71 | | | | | | |

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G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ᵐ·178. A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | Computed Terms. ✱'s Elongation. | Computed Terms. ✱'s A. R. | Computed Terms. ✱'s Horary Angle. | Computed Terms. ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 17ᵗʰ 9° & 189° | | 29 Camelopardali Hev. | ° ′ ″ 4 55 56·33 | ° ′ ″ E. 5 32 6·92 | h. m. s. 10 5 13·18 | h. m. s. 5 49 56·42 | h. m. s. 4 15 16·76 | H.13+ M. S. | H.6+ M. S. | H.3+ M. S. | | | 16°+ ′ ″ | π−11° 3′ ″ | | | | | | |
| | R | | | | | | | 35 52 | 1 10·60 | 49 22·76 | 6° 28′ 30″·00 | 125″·94 | 33′ 57″·92 | 57″·64 | | | | | | |
| | R | | | | | | | 37 34 | 2 52·54 | 51 4·98 | 6 2 56·70 | 109·97 | 34 12·08 | 55·83 | | | | | | |
| | L | | | | | | | 47 46 | 13 4·20 | 61 18·31 | 3 29 36·75 | 36·77 | 35 28·84 | 59·39 | | | | | | |
| | L | | | | | | | 49 49 | 15 7·13 | 63 21·58 | 2 58 47·70 | 26·77 | 35 39·28 | 59·83 | | | | | | |
| | R | | | | | | | 59 33 | 24 50·81 | 73 6·86 | 0 32 28·50 | 0·88 | 36 0·82 | 55·48 | | | | | | |
| | R | | | | | | | 61 32 | 26 49·74 | 75 6·12 | 0 2 39·60 | 0·01 | 36 2·54 | 56·33 | | | | | | |
| | L | | | | | | | 71 0 | 36 17·43 | 84 35·36 | 2 19 39·00 | 16·40 | 35 48·52 | 58·70 | | | | | | |
| | L | | | | | | | 73 24 | 38 41·35 | 86 59·67 | 2 55 43·65 | 25·97 | 35 39·04 | 58·79 | | | | | | |
| | R | | | | | | | 84 47 | 50 3·97 | 98 24·16 | 5 46 51·00 | 101·35 | 34 22·92 | 58·05 | | | | | | |
| | R | | | | | | | 86 21 | 51 37·91 | 99 58·37 | 6 10 24·15 | 115·61 | 34 7·72 | 57·11 | | | | | | |
| | L | | | | | | | 97 41 | 62 57·54 | 111 19·85 | 9 0 46·35 | 246·69 | 31 58·98 | 59·45 | | | | | | |
| | L | | | | | | | 99 52 | 65 8·46 | 113 31·13 | 9 33 35·55 | 277·59 | 31 25·96 | 57·33 | | | | | | |
| Feb. 17ᵗʰ 18° & 198° | | 29 Camelopardali Hev. | ° ′ ″ 4 55 56·20 | ° ′ ″ W. 5 32 6·08 | h. m. s. 10 5 13·19 | h. m. s. 5 49 56·42 | h. m. s. 15 55 9·61 | H.0+ M. S. | H.17+ M. S. | H.15+ M. S. | | | 5°+ ′ ″ | π−11° 3′ ″ | | | | | | |
| | L | | | | | | | 55 21 | 20 16·97 | 10 20·69 | 11° 12′ 13″·80 | 381″·43 | 38′ 14″·62 | 59″·27 | | | | | | |
| | L | | | | | | | 57 46 | 22 41·89 | 12 46·01 | 10 35 54·00 | 341·27 | 37 35·60 | 60·41 | | | | | | |
| | R | | | | | | | 66 2 | 30 57·62 | 21 3·09 | 8 31 37·80 | 220·78 | 35 33·84 | 59·14 | | | | | | |
| | R | | | | | | | 67 59 | 32 54·55 | 23 0·35 | 8 2 18·90 | 196·17 | 35 14·20 | 64·11 | | | | | | |
| | L | | | | | | | 77 45 | 42 40·23 | 32 47·63 | 5 35 29·70 | 94·82 | 33 29·28 | 60·54 | | | | | | |
| | L | | | | | | | 79 58 | 44 53·15 | 35 0·92 | 5 2 10·35 | 76·90 | 33 12·42 | 61·60 | | | | | | |
| | R | | | | | | | 86 25 | 51 19·94 | 41 28·76 | 3 25 12·75 | 35·43 | 32 28·94 | 59·59 | | | | | | |
| | R | | | | | | | 88 35 | 53 29·86 | 43 39·04 | 2 52 38·55 | 25·07 | 32 18·64 | 59·65 | | | | | | |
| | L | | | | | | | 99 2 | 63 56·52 | 54 7·41 | 0 15 33·00 | 0·20 | 31 56·18 | 62·06 | | | | | | |
| | L | | | | | | | 101 13 | 66 7·44 | 56 18·70 | 0 17 16·35 | 0·25 | 31 57·16 | 62·99 | | | | | | |
| | R | | | | | | | 108 44 | 73 38·19 | 63 50·68 | 2 10 16·05 | 14·22 | 32 8·94 | 60·80 | | | | | | |
| | R | | | | | | | 110 44 | 75 38·13 | 65 50·94 | 2 40 19·95 | 21·53 | 32 14·76 | 59·31 | | | | | | |
| | L | | | | | | | 116 52 | 81 45·92 | 71 59·75 | 4 12 32·10 | 53·34 | 32 48·32 | 61·06 | | | | | | |
| | L | | | | | | | 118 36 | 83 29·87 | 73 43·97 | 4 38 35·40 | 64·88 | 33 0·72 | 61·92 | | | | | | |
| | R | | | | | | | 125 0 | 89 53·65 | 80 8·81 | 6 14 48·00 | 117·24 | 33 51·30 | 60·14 | | | | | | |
| | R | | | | | | | 127 50 | 92 43·56 | 82 59·18 | 6 57 23·55 | 145·29 | 34 17·30 | 58·08 | | | | | | |

Observations at Usira—*continued.*

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | Computed Terms. ✱'s Elongation. | Computed Terms. ✱'s A. R. | Computed Terms. ✱'s Horary Angle. | Computed Terms. ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 18ᵗʰ 0° & 180° | | 30 Camelopardali Hev. | ° ′ ″ 6 37 25·11 | ° ′ ″ E. 7 26 6·01 | h. m. s. 10 10 53·30 | h. m. s. 5 46 27·62 | h. m. s. 4 24 25·68 | H.13+ M. S. | H.6+ M. S. | H.3+ M. S. | | | 18°+ ′ ″ | π−11° 3′ ″ | | | | | | |
| | L | | | | | | | 35 55 | 0 25·71 | 52 34·31 | 7° 57′ 50″·55 | 254″·11 | 25′ 45″·58 | 53″·68 | | | | | | |
| | L | | | | | | | 37 37 | 2 7·65 | 54 16·53 | 7 32 17·25 | 227·79 | 26 12·26 | 54·04 | | | | | | |
| | R | | | | | | | 47 18 | 11 48·33 | 63 58·80 | 5 6 43·20 | 105·09 | 28 17·24 | 56·32 | | | | | | |
| | R | | | | | | | 48 49 | 13 19·28 | 65 30·00 | 4 43 55·20 | 90·09 | 28 32·48 | 56·56 | | | | | | |
| | L | | | | | | | 59 59 | 24 28·91 | 76 41·46 | 1 56 3·30 | 15·10 | 29 46·20 | 55·29 | | | | | | |
| | L | | | | | | | 61 35 | 26 4·86 | 78 17·67 | 1 32 0·15 | 9·50 | 29 52·56 | 56·05 | | | | | | |
| | R | | | | | | | 73 11 | 37 40·48 | 89 55·19 | 1 22 22·65 | 7·64 | 29 53·36 | 54·99 | | | | | | |
| | R | | | | | | | 75 25 | 39 54·40 | 92 9·49 | 1 55 57·15 | 15·14 | 29 48·10 | 57·23 | | | | | | |
| | L | | | | | | | 85 30 | 49 59·07 | 102 15·81 | 4 27 31·95 | 80·76 | 28 41·60 | 56·35 | | | | | | |
| | L | | | | | | | 87 5 | 51 34·02 | 103 51·02 | 4 51 20·10 | 95·80 | 28 25·82 | 55·61 | | | | | | |
| | R | | | | | | | 97 41 | 62 9·66 | 114 28·40 | 7 30 40·80 | 229·71 | 26 13·22 | 56·92 | | | | | | |
| | R | | | | | | | 99 16 | 63 44·61 | 116 3·61 | 7 54 28·95 | 254·68 | 25 48·40 | 57·07 | | | | | | |
| Feb. 18ᵗʰ 0° & 180° | | 30 Camelopardali Hev. | ° ′ ″ 6 37 24·95 | ° ′ ″ W. 7 26 5·83 | h. m. s. 10 10 53·31 | h. m. s. 5 46 27·62 | h. m. s. 15 57 20·93 | H.0+ M. S. | H.17+ M. S. | H.15+ M. S. | | | 3°+ ′ ″ | π−11° 3′ ″ | | | | | | |
| | R | | | | | | | 58 39 | 22 47·10 | 16 47·79 | 10° 8′ 17″·10 | 419″·13 | 44′ 56″·06 | 62″·76 | | | | | | |
| | R | | | | | | | 60 23 | 24 31·04 | 18 32·02 | 9 42 13·65 | 383·90 | 44 18·66 | 60·59 | | | | | | |
| | L | | | | | | | 66 56 | 31 3·83 | 25 5·88 | 8 3 45·75 | 264·76 | 42 18·16 | 59·23 | | | | | | |
| | L | | | | | | | 69 19 | 33 26·75 | 27 29·19 | 7 27 56·10 | 226·91 | 41 37·60 | 56·52 | | | | | | |
| | R | | | | | | | 76 49 | 40 56·50 | 35 0·17 | 5 35 11·40 | 126·88 | 40 1·00 | 59·95 | | | | | | |
| | R | | | | | | | 78 40 | 42 47·44 | 36 51·42 | 5 7 22·65 | 106·66 | 39 41·06 | 60·23 | | | | | | |
| | L | | | | | | | 85 9 | 49 16·22 | 43 21·27 | 3 29 54·90 | 49·68 | 38 43·06 | 59·21 | | | | | | |
| | L | | | | | | | 86 56 | 51 3·16 | 45 8·50 | 3 3 6·45 | 37·79 | 38 32·02 | 60·06 | | | | | | |
| | R | | | | | | | 93 34 | 57 40·94 | 51 47·37 | 1 23 23·40 | 7·82 | 38 3·04 | 61·05 | | | | | | |
| | R | | | | | | | 95 53 | 59 59·87 | 54 6·67 | 0 48 33·90 | 2·65 | 37 55·46 | 58·64 | | | | | | |
| | L | | | | | | | 103 1 | 67 7·63 | 61 15·61 | 0 53 40·20 | 3·86 | 37 57·28 | 59·25 | | | | | | |
| | L | | | | | | | 104 48 | 68 54·57 | 63 2·84 | 1 25 28·65 | 8·20 | 38 0·68 | 58·31 | | | | | | |
| | R | | | | | | | 110 56 | 75 2·37 | 69 11·65 | 2 57 40·80 | 35·36 | 38 28·34 | 58·81 | | | | | | |
| | R | | | | | | | 112 40 | 76 46·31 | 70 55·87 | 3 23 44·10 | 46·47 | 38 39·18 | 58·54 | | | | | | |
| | L | | | | | | | 119 14 | 83 20·09 | 77 30·73 | 5 2 27·00 | 102·20 | 39 34·70 | 58·33 | | | | | | |
| | L | | | | | | | 121 17 | 85 23·03 | 79 34·00 | 5 33 16·05 | 124·00 | 39 57·58 | 59·41 | | | | | | |

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G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ˢ·178. A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | Chronom. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Hour Angle. | ✱'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | M.S. Time. | Chronom. Time. |
| Feb. 19th 18° & 198° | L | 30 Camelopardali Hev. | 6° 37′ 24″·81 | E. 7° 26′ 5″·68 | H. M. S. 10 10 53·34 | H. M. S. 5 46 27·63 | H. M. S. 4 24 25·71 | H. M. S. 37 4 | H. 13+ M. S. 0 47·42 | H. 6+ M. S. 56 52·64 | 6° 53′ 16″·05 | 190″·35 | 18°+ 26′ 52″·06 | π−11° 3′ 56″·73 | π−(11° 3′)−{L 56″·132 R 56·646} | F.R. 8 ..... F.L. 6 | H. M. S. 0 14 10·18 | H. M. S. (7 50 16·10−0·39)=7 50 15·71 |
| | L | | | | | | | 38 40 | 2 23·37 | 58 28·85 | 6 29 12·90 | 168·92 | 27 10·92 | 54·16 | | | | |
| | R | | | | | | | 44 41 | 8 24·18 | 64 30·65 | 4 58 45·90 | 99·73 | 28 23·96 | 58·01 | | | | |
| | R | | | | | | | 46 15 | 9 58·13 | 66 4·85 | 4 35 12·90 | 84·67 | 28 37·38 | 56·37 | | | | |
| | L | | | | | | | 52 16 | 15 58·94 | 72 6·65 | 3 4 45·90 | 38·23 | 29 23·54 | 56·09 | | | | |
| | R | | | | | | | 53 52 | 17 34·89 | 73 42·86 | 2 40 42·75 | 28·94 | 29 32·68 | 55·94 | | | | |
| | R | | | | | | | 59 41 | 23 23·70 | 79 32·63 | 1 13 16·20 | 6·02 | 29 56·40 | 56·74 | | | | |
| | R | | | | | | | 61 15 | 24 57·65 | 81 6·84 | 0 49 43·05 | 2·78 | 29 59·26 | 56·36 | | | | |
| | R | | | | | | | 62 25 | 26 7·61 | 82 16·99 | 0 32 10·80 | 1·16 | 30 1·26 | 56·74 | | | | |
| | R | | | | | | | 63 43 | 27 25·57 | 83 35·17 | 0 12 38·10 | 0·18 | 30 2·32 | 56·82 | | | | |
| | L | | | | | | | 69 34 | 33 16·39 | 89 26·94 | 1 15 18·45 | 6·38 | 29 56·00 | 56·70 | | | | |
| | L | | | | | | | 71 11 | 34 53·33 | 91 4·15 | 1 39 36·60 | 11·17 | 29 51·68 | 57·17 | | | | |
| | R | | | | | | | 77 11 | 40 53·14 | 97 4·95 | 3 9 48·60 | 40·61 | 29 21·96 | 56·89 | | | | |
| | R | | | | | | | 78 57 | 42 39·09 | 98 51·18 | 3 36 22·45 | 52·78 | 29 8·14 | 55·24 | | | | |
| Feb. 19th 18° & 198° | R | 30 Camelopardali Hev. | 6° 37′ 24″·69 | W. 7° 26′ 5″·54 | H. M. S. 10 10 53·36 | H. M. S. 5 46 27·63 | H. M. S. 15 57 20·99 | H. 1+ M. S. 3 50 | H. 17+ M. S. 27 11·54 | H. 15+ M. S. 25 9·52 | 8° 2′ 52″·05 | 263″·78 | 3°+ 42′ 15″·68 | π−11° 3′ 57″·44 | π−(11° 3′)−{R 57″·965 L 61·143} | F.R. 6 ..... F.L. 6 | H. M. S. 0 14 10·18 | H. M. S. (7 50 16·10−0·39)=7 50 15·71 |
| | R | | | | | | | 6 13 | 29 34·46 | 27 32·83 | 7 27 2·40 | 226·00 | 41 39·10 | 58·64 | | | | |
| | L | | | | | | | 13 16 | 36 37·24 | 34 36·77 | 5 41 3·30 | 131·37 | 40 7·14 | 61·31 | | | | |
| | R | | | | | | | 15 11 | 38 32·18 | 36 32·02 | 5 12 14·55 | 110·07 | 39 46·26 | 61·73 | | | | |
| | R | | | | | | | 23 32 | 46 52·91 | 44 54·12 | 3 6 43·05 | 39·29 | 38 31·94 | 58·19 | | | | |
| | L | | | | | | | 25 49 | 49 9·84 | 47 11·43 | 2 32 23·40 | 26·16 | 38 18·76 | 58·14 | | | | |
| | L | | | | | | | 33 53 | 57 13·58 | 55 16·49 | 0 31 7·50 | 1·09 | 37 55·86 | 60·31 | | | | |
| | L | | | | | | | 35 59 | 59 19·52 | 57 22·77 | 0 0 26·70 | 0·00 | 37 56·42 | 61·96 | | | | |
| | R | | | | | | | 43 5 | 66 25·29 | 64 29·71 | 1 47 10·80 | 12·88 | 38 4·52 | 57·18 | | | | |
| | R | | | | | | | 45 23 | 68 43·22 | 66 48·02 | 2 21 45·45 | 22·52 | 38 15·18 | 58·20 | | | | |
| | L | | | | | | | 53 8 | 76 27·97 | 74 34·04 | 4 18 15·75 | 74·58 | 39 9·74 | 60·70 | | | | |
| | L | | | | | | | 55 34 | 78 53·89 | 77 0·36 | 4 54 50·55 | 97·13 | 39 32·44 | 60·85 | | | | |
| Feb. 20th 9° & 189° | L | 30 Camelopardali Hev. | 6° 37′ 24″·55 | E. 7° 26′ 5″·38 | H. M. S. 10 10 53·39 | H. M. S. 5 46 27·64 | H. M. S. 4 24 25·75 | H. 13+ M. S. 38 57 | H. 6+ M. S. 1 53·98 | H. 4+ M. S. 1 55·94 | 5° 37′ 27″·15 | 127″·12 | 18°+ 27′ 54″·70 | π−11° 3′ 56″·44 | π−(11° 3′)−{L 56″·143 R 58·832} | F.R. 6 ..... F.L. 6 | H. M. S. 0 14 4·13 | H. M. S. (7 50 55·85−0·39)=7 50 55·66 |
| | L | | | | | | | 40 46 | 3 42·92 | 3 45·18 | 5 10 8·55 | 107·44 | 28 13·26 | 55·32 | | | | |
| | R | | | | | | | 47 35 | 10 31·69 | 10 35·07 | 3 27 40·20 | 48·27 | 29 15·70 | 58·59 | | | | |
| | R | | | | | | | 48 58 | 11 54·65 | 11 58·25 | 3 6 52·50 | 39·11 | 29 24·62 | 58·35 | | | | |
| | L | | | | | | | 56 1 | 18 57·41 | 19 2·17 | 1 20 53·70 | 7·34 | 29 52·46 | 54·42 | | | | |
| | L | | | | | | | 57 34 | 20 30·36 | 20 35·38 | 0 57 35·55 | 3·72 | 29 58·68 | 57·02 | | | | |
| | R | | | | | | | 64 49 | 27 45·12 | 27 51·33 | 0 51 23·70 | 2·97 | 30 0·84 | 58·43 | | | | |
| | R | | | | | | | 67 9 | 30 5·04 | 30 11·63 | 1 26 28·20 | 8·41 | 29 57·02 | 60·05 | | | | |
| | L | | | | | | | 73 33 | 36 28·83 | 36 36·47 | 3 2 40·80 | 37·61 | 29 23·98 | 56·21 | | | | |
| | L | | | | | | | 75 29 | 38 24·76 | 38 32·72 | 3 31 44·55 | 50·55 | 29 12·28 | 57·45 | | | | |
| | R | | | | | | | 82 53 | 45 48·52 | 45 57·69 | 5 22 59·10 | 117·79 | 28 6·94 | 59·35 | | | | |
| | R | | | | | | | 85 29 | 48 24·43 | 48 34·03 | 6 2 4·20 | 148·10 | 27 35·50 | 58·22 | | | | |
| Feb. 20th 9° & 189° | R | 30 Camelopardali Hev. | 6° 37′ 24″·41 | W. 7° 26′ 5″·23 | H. M. S. 10 10 53·41 | H. M. S. 5 46 27·64 | H. M. S. 15 57 21·05 | H. 1+ M. S. 1 42 | H. 17+ M. S. 24 16·24 | H. 15+ M. S. 26 10·30 | 7° 47′ 41″·25 | 247″·41 | 3°+ 41′ 59″·02 | π−11° 3′ 56″·84 | π−(11° 3′)−{R 57″·450 L 61·525} | F.R. 6 ..... F.L. 6 | H. M. S. 0 14 4·13 | H. M. S. (7 50 55·85−0·39)=7 50 55·66 |
| | R | | | | | | | 4 44 | 27 18·14 | 29 12·70 | 7 2 5·25 | 201·41 | 41 14·60 | 58·42 | | | | |
| | R | | | | | | | 13 39 | 36 12·84 | 38 8·86 | 4 48 2·85 | 93·64 | 39 31·52 | 63·11 | | | | |
| | L | | | | | | | 15 23 | 37 56·79 | 39 53·09 | 4 21 59·40 | 77·44 | 39 15·20 | 62·99 | | | | |
| | R | | | | | | | 23 13 | 45 46·53 | 47 44·11 | 2 24 14·10 | 23·43 | 38 15·10 | 56·90 | | | | |
| | R | | | | | | | 25 48 | 48 21·44 | 50 19·45 | 1 45 24·00 | 12·50 | 38 5·56 | 58·29 | | | | |
| | L | | | | | | | 33 23 | 55 56·19 | 57 55·45 | 0 8 36·00 | 0·08 | 37 55·46 | 60·61 | | | | |
| | L | | | | | | | 35 23 | 57 56·12 | 59 55·71 | 0 38 39·90 | 1·68 | 37 56·80 | 60·35 | | | | |
| | R | | | | | | | 43 29 | 66 1·85 | 68 2·77 | 2 40 25·80 | 28·84 | 38 20·10 | 56·49 | | | | |
| | R | | | | | | | 45 40 | 68 12·78 | 70 14·05 | 3 13 15·00 | 41·81 | 38 34·34 | 57·76 | | | | |
| | L | | | | | | | 53 25 | 75 57·52 | 78 0·07 | 5 9 45·30 | 107·17 | 39 43·58 | 61·64 | | | | |
| | L | | | | | | | 55 13 | 77 45·46 | 79 48·30 | 5 36 48·75 | 126·64 | 40 1·86 | 60·45 | | | | |

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G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ᵐ·178. A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. #'s N. P. D. | Computed Terms. #'s Elongation. | Computed Terms. #'s A.R. | Computed Terms. #'s Horary Angle. | Computed Terms. #'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 21st 27° & 207° | R | 30 Camelopardali Hev. | ° ′ ″ 6 37 24·27 | ° ′ ″ E. 7 26 5·07 | h. m. s. 10 10 53·44 | h. m. s. 5 46 27·65 | h. m. s. 4 24 25·79 | h. 13+ m. s. 40 21 | h. 6+ m. s. 2 30·11 | h. 4+ m. s. 6 28·73 | ° ′ ″ 4 29 15·90 | ″ 81·05 | 18°+ ′ ″ 28 39·26 | π−11° 3′ ″ 55·24 | | | h. m. s. 0 13 57·42 | h. m. s. (7 51 37·10−0·27)=7 51 36·83 | h. m. s. 7 37 39·41 | h. m. s. 47·98 |
| | R | | | | | | | 42 8 | 4 17·06 | 8 15·97 | 4 2 27·30 | 65·75 | 28 53·74 | 54·42 | | | | | | |
| | L | | | | | | | 47 59 | 10 7·86 | 14 7·74 | 2 34 30·75 | 26·75 | 29 37·00 | 58·68 | | | | | | |
| | L | | | | | | | 49 21 | 11 29·82 | 15 29·91 | 2 13 58·20 | 20·12 | 29 43·26 | 58·31 | | | | | | |
| | R | | | | | | | 55 3 | 17 11·63 | 21 12·66 | 0 48 16·95 | 2·62 | 29 58·38 | 55·93 | | | | | | |
| | R | | | | | | | 56 36 | 18 44·58 | 22 45·87 | 0 24 58·80 | 0·70 | 29 59·40 | 55·03 | | | | | | |
| | R | | | | | | | 58 11 | 20 19·53 | 24 21·07 | 0 1 10·80 | 0·00 | 30 0·96 | 55·89 | | | | | | |
| | R | | | | | | | 59 28 | 21 36·48 | 25 38·24 | 0 18 6·75 | 0·37 | 30 0·94 | 56·24 | | | | | | |
| | L | | | | | | | 66 17 | 28 25·26 | 32 28·14 | 2 0 35·25 | 16·37 | 29 47·28 | 58·58 | | | | | | |
| | L | | | | | | | 67 58 | 30 6·20 | 34 9·36 | 2 25 53·55 | 23·97 | 29 40·20 | 59·10 | | | | | | |
| | L | | | | | | | 69 1 | 31 9·17 | 35 12·50 | 2 41 40·65 | 29·45 | 29 33·48 | 57·86 | | | | | | |
| | R | | | | | | | 75 39 | 37 46·95 | 41 51·37 | 4 21 23·70 | 77·09 | 28 43·50 | 55·52 | | | | | | |
| | R | | | | | | | 79 7 | 41 14·84 | 45 19·82 | 5 13 30·45 | 110·96 | 28 9·46 | 55·35 | | | | | | |
| | L | | | | | | | 86 3 | 48 10·61 | 52 16·73 | 6 57 44·10 | 197·27 | 26 45·84 | 58·04 | | | | | | |
| | L | | | | | | | 88 4 | 50 11·54 | 54 18·00 | 7 28 3·15 | 227·02 | 26 17·30 | 59·25 | | | | | | |
| | L | | | | | | | 89 35 | 51 42·49 | 55 49·20 | 7 50 51·15 | 250·78 | 25 51·96 | 57·67 | | | | | | |
| Feb. 21st 27° & 207° | R | 30 Camelopardali Hev. | ° ′ ″ 6 37 24·12 | ° ′ ″ W. 7 26 4·90 | h. m. s. 10 10 53·46 | h. m. s. 5 46 27·65 | h. m. s. 15 57 21·11 | h. 0+ m. s. 57 36 | h. 17+ m. s. 19 22·83 | h. 15+ m. s. 25 12·64 | ° ′ ″ 8 2 7·05 | ″ 262·95 | 3°+ ′ ″ 42 18·26 | π−11° 3′ ″ 60·21 | | | h. m. s. 0 13 57·42 | h. m. s. (7 51 37·10−0·27)=7 51 36·83 | h. m. s. 7 37 39·41 | h. m. s. 47·98 |
| | R | | | | | | | 59 42 | 21 28·76 | 27 18·92 | 7 30 32·85 | 229·56 | 41 43·62 | 58·96 | | | | | | |
| | R | | | | | | | 67 7 | 28 53·51 | 34 44·89 | 5 39 3·30 | 129·83 | 40 7·24 | 62·31 | | | | | | |
| | L | | | | | | | 68 56 | 30 42·45 | 36 34·13 | 5 11 44·70 | 109·72 | 39 45·14 | 60·32 | | | | | | |
| | L | | | | | | | 77 13 | 38 59·18 | 44 52·22 | 3 7 13·35 | 39·50 | 38 31·44 | 56·84 | | | | | | |
| | R | | | | | | | 79 48 | 41 34·10 | 47 27·55 | 2 28 23·40 | 24·80 | 38 19·42 | 59·52 | | | | | | |
| | L | | | | | | | 88 13 | 49 58·82 | 55 53·66 | 0 21 51·75 | 0·54 | 37 54·62 | 58·98 | | | | | | |
| | L | | | | | | | 90 25 | 52 10·75 | 58 5·95 | 0 11 12·60 | 0·14 | 37 55·16 | 59·92 | | | | | | |
| | R | | | | | | | 97 35 | 59 20·51 | 65 16·89 | 1 58 56·70 | 15·86 | 38 9·40 | 58·44 | | | | | | |
| | R | | | | | | | 99 39 | 61 24·44 | 67 21·16 | 2 30 0·75 | 25·22 | 38 16·44 | 56·12 | | | | | | |
| | L | | | | | | | 112 20 | 74 5·03 | 80 3·83 | 5 40 40·80 | 129·55 | 40 6·56 | 61·91 | | | | | | |
| | L | | | | | | | 114 5 | 75 49·97 | 81 49·06 | 6 6 59·25 | 150·25 | 40 23·26 | 57·91 | | | | | | |

Feb. 22nd ⊙'s Transit M.S. Time h. m. s. 0 13 50·06. Chronom. Time h. m. s. (7 52 17·25−0·37)=7 52 16·8. Error h. m. s. 7 38 26·82. Rate 47″·41.

## Observations at Usira—*continued*.

| Date and Zero. | Face. | Star Observed. | Computed Terms. #'s N. P. D. | Computed Terms. #'s Elongation. | Computed Terms. #'s A.R. | Computed Terms. #'s Horary Angle. | Computed Terms. #'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 15th 18° & 198° | R | 32 Cephei Hev. | ° ′ ″ 4 42 38·74 | ° ′ ″ W. 5 17 10·62 | h. m. s. 22 24 49·69 | h. m. s. 5 50 23·67 | h. m. s. 4 15 13·36 | h. 13+ m. s. 36 5 | h. 6+ m. s. 3 1·69 | h. 3+ m. s. 43 21·05 | ° ′ ″ 7 58 4·65 | ″ 184·09 | 5°+ ′ ″ 49 56·78 | π−11° 3′ ″ 63·31 | | | h. m. s. 0 14 27·63 | h. m. s. (7 47 19·85−0·31)=7 47 19·54 | h. m. s. 7 32 51·91 | h. m. s. 46·52 |
| | R | | | | | | | 42 17 | 9 13·49 | 49 33·87 | 6 24 52·35 | 119·24 | 48 48·80 | 60·18 | | | | | | |
| | L | | | | | | | 51 50 | 18 46·18 | 59 8·12 | 4 1 18·60 | 46·82 | 47 36·20 | 60·00 | | | | | | |
| | L | | | | | | | 58 49 | 25 44·95 | 66 8·04 | 2 16 19·80 | 14·93 | 47 6·46 | 62·15 | | | | | | |
| | R | | | | | | | 64 19 | 31 14·77 | 71 38·76 | 0 53 39·00 | 2·31 | 46 49·72 | 58·03 | | | | | | |
| | R | | | | | | | 65 49 | 32 44·72 | 73 8·96 | 0 31 6·00 | 0·78 | 46 48·22 | 58·06 | | | | | | |
| | L | | | | | | | 73 45 | 40 40·46 | 81 6·00 | 1 28 9·60 | 6·23 | 46 53·16 | 57·55 | | | | | | |
| | L | | | | | | | 78 42 | 45 37·30 | 86 3·65 | 2 42 34·35 | 21·15 | 47 11·76 | 61·23 | | | | | | |
| | R | | | | | | | 86 9 | 53 4·06 | 93 31·63 | 4 34 34·05 | 60·23 | 47 49·22 | 59·61 | | | | | | |
| | R | | | | | | | 91 57 | 58 51·87 | 99 20·40 | 6 1 45·60 | 104·40 | 48 36·62 | 62·84 | | | | | | |
| | L | | | | | | | 99 36 | 66 30·62 | 107 0·40 | 7 56 45·60 | 180·96 | 49 50·96 | 60·62 | | | | | | |
| | L | | | | | | | 106 5 | 72 59·41 | 113 30·26 | 9 34 13·50 | 262·03 | 51 11·86 | 60·45 | | | | | | |
| Feb. 16th 27° & 207° | L | 32 Cephei Hev. | ° ′ ″ 4 42 39·04 | ° ′ ″ W. 5 17 10·96 | h. m. s. 22 24 49·66 | h. m. s. 5 50 23·66 | h. m. s. 4 15 13·32 | h. 13+ m. s. 29 12 | h. 5+ m. s. 55 20·97 | h. 3+ m. s. 39 35·61 | ° ′ ″ 8 54 25·65 | ″ 230·12 | 5°+ ′ ″ 50 37·62 | π−11° 3′ ″ 58·46 | | | h. m. s. 0 14 24·31 | h. m. s. (7 48 3·65−0·35)=7 48 3·30 | h. m. s. 7 33 38·99 | h. m. s. 47·08 |
| | L | | | | | | | 40 56 | 67 4·55 | 51 21·12 | 5 58 3·00 | 103·18 | 48 30·08 | 57·86 | | | | | | |
| | R | | | | | | | 47 14 | 73 22·33 | 57 39·94 | 4 23 20·70 | 55·77 | 47 44·76 | 59·95 | | | | | | |
| | R | | | | | | | 53 15 | 79 23·12 | 63 41·71 | 2 52 54·15 | 24·02 | 47 11·52 | 58·46 | | | | | | |
| | L | | | | | | | 59 45 | 85 52·89 | 70 12·55 | 1 15 11·55 | 4·54 | 46 52·66 | 59·08 | | | | | | |
| | L | | | | | | | 64 50 | 90 57·71 | 75 18·20 | 0 1 13·20 | 0·00 | 46 47·10 | 58·06 | | | | | | |
| | R | | | | | | | 70 44 | 96 51·50 | 81 12·97 | 1 29 54·75 | 6·48 | 46 55·56 | 60·04 | | | | | | |
| | R | | | | | | | 77 57 | 104 4·25 | 88 26·90 | 3 18 23·70 | 31·48 | 47 21·18 | 60·66 | | | | | | |
| | L | | | | | | | 85 26 | 111 32·98 | 95 56·86 | 5 10 53·10 | 77·17 | 48 6·74 | 60·53 | | | | | | |
| | L | | | | | | | 92 11 | 118 17·74 | 102 42·73 | 6 52 21·15 | 135·53 | 49 6·68 | 62·11 | | | | | | |
| | R | | | | | | | 100 31 | 126 37·45 | 111 3·80 | 8 57 37·20 | 229·85 | 50 39·22 | 60·33 | | | | | | |
| | R | | | | | | | 107 20 | 133 26·21 | 117 53·68 | 10 40 5·40 | 325·16 | 52 12·20 | 58·00 | | | | | | |



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G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ᵐ·178. A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | *'s Elongation. | *'s A.R. | *'s Horary Angle. | *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 17th 9° & 189° | R | 32 Cephei Hev. | ° ′ ″ 4 42 39·33 | ° ′ ″ W. 5 17 11·29 | h. m. s. 22 24 49·64 | h. m. s. 5 50 23·65 | h. m. s. 4 15 13·29 | h. 13+ m. s. 33 42 | h. 5+ m. s. 59 0·67 | h. 3+ m. s. 47 12·47 | ° ′ ″ 7 0 12·30 | ″ 142·17 | 5°+ ′ ″ 49 6·78 | π−11° 3′ ″ 55·90 | π−(11° 3′)−{R 56″·112 L 59·802} | F.R. 6.....F.L. 6 | h. m. s. 0 14 20·29 | h. m. s. (7 48 50′·50−0′·36)=7 48 50·14 | h. m. s. 7 34 29·86 | s. 60·06 |
| | R | | | | | | | 39 37 | 64 55·47 | 53 8·25 | 5 31 15·60 | 88·30 | 48 12·26 | 55·25 | | | | | | |
| | L | | | | | | | 45 20 | 70 38·28 | 58 52·00 | 4 5 19·35 | 48·39 | 47 38·40 | 61·30 | | | | | | |
| | L | | | | | | | 51 28 | 76 46·08 | 65 0·81 | 2 33 7·20 | 18·84 | 47 6·64 | 59·09 | | | | | | |
| | R | | | | | | | 58 4 | 83 21·86 | 71 37·66 | 0 53 54·45 | 2·33 | 46 46·42 | 55·38 | | | | | | |
| | R | | | | | | | 63 4 | 88 21·69 | 76 38·32 | 0 21 15·45 | 0·36 | 46 44·22 | 55·15 | | | | | | |
| | L | | | | | | | 69 1 | 94 18·49 | 82 36·10 | 1 50 42·15 | 9·81 | 46 57·72 | 59·20 | | | | | | |
| | L | | | | | | | 75 28 | 100 45·28 | 89 3·94 | 3 27 39·75 | 34·49 | 47 24·06 | 60·86 | | | | | | |
| | R | | | | | | | 83 5 | 108 22·02 | 96 41·94 | 5 22 9·65 | 82·86 | 48 9·68 | 58·11 | | | | | | |
| | R | | | | | | | 88 4 | 113 20·86 | 101 41·59 | 6 37 4·50 | 125·71 | 48 51·30 | 56·88 | | | | | | |
| | L | | | | | | | 94 7 | 119 23·66 | 107 45·38 | 8 8 1·35 | 189·58 | 49 57·66 | 59·37 | | | | | | |
| | L | | | | | | | 102 13 | 127 29·39 | 115 52·44 | 10 9 47·25 | 295·29 | 51 43·00 | 59·00 | | | | | | |
| Feb. 18th 0° & 180° | L | 32 Cephei Hev. | ° ′ ″ 4 42 39·62 | ° ′ ″ W. 5 17 11·61 | h. m. s. 22 24 49·61 | h. m. s. 5 50 23·64 | h. m. s. 4 15 13·25 | h. 13+ m. s. 31 51 | h. 5+ m. s. 56 21·84 | h. 3+ m. s. 48 29·78 | ° ′ ″ 6 40 52·05 | ″ 129·37 | 5°+ ′ ″ 48 54·18 | π−11° 3′ ″ 56·42 | π−(11° 3′)−{L 56″·788 R 58·932} | F.R. 6.....F.L. 6 | h. m. s. 0 14 15·57 | h. m. s. (7 49 33′·75−0′·36)=7 49 33·39 | h. m. s. 7 35 17·82 | s. 47·97 |
| | R | | | | | | | 39 38 | 64 8·59 | 56 17·80 | 4 43 51·75 | 64·82 | 47 49·64 | 56·43 | | | | | | |
| | R | | | | | | | 45 22 | 69 52·40 | 62 2·55 | 3 17 40·50 | 31·41 | 47 19·60 | 59·80 | | | | | | |
| | L | | | | | | | 50 52 | 75 22·21 | 67 33·27 | 1 54 59·70 | 10·62 | 46 58·44 | 59·43 | | | | | | |
| | L | | | | | | | 57 48 | 82 17·99 | 74 30·18 | 0 10 46·05 | 0·09 | 46 43·76 | 55·28 | | | | | | |
| | R | | | | | | | 63 39 | 88 8·79 | 80 21·94 | 1 17 10·35 | 4·77 | 46 50·44 | 57·28 | | | | | | |
| | R | | | | | | | 70 45 | 95 14·56 | 87 28·87 | 3 3 54·30 | 27·06 | 47 14·40 | 58·95 | | | | | | |
| | L | | | | | | | 77 2 | 101 31·35 | 93 46·70 | 4 38 21·75 | 61·90 | 47 48·86 | 58·57 | | | | | | |
| | L | | | | | | | 83 24 | 107 53·14 | 100 9·53 | 6 14 4·20 | 111·61 | 48 38·42 | 58·42 | | | | | | |
| | R | | | | | | | 89 8 | 113 36·95 | 105 54·28 | 7 40 15·45 | 168·71 | 49 34·00 | 56·90 | | | | | | |
| | R | | | | | | | 95 44 | 120 12·73 | 112 31·15 | 9 19 28·50 | 248·82 | 50 55·92 | 58·71 | | | | | | |
| | R | | | | | | | 101 10 | 125 38·55 | 117 57·86 | 10 41 9·15 | 326·24 | 52 12·76 | 58·13 | | | | | | |
| Feb. 25th 0° & 180° | L | 32 Cephei Hev. | ° ′ ″ 4 42 41·99 | ° ′ ″ E. 5 17 14·27 | h. m. s. 22 24 49·28 | h. m. s. 5 50 23·56 | h. m. s. 16 34 25·72 | h. 0+ m. s. 51 3 | h. 17+ m. s. 9 34·58 | h. 15+ m. s. 31 8·99 | ° ′ ″ 15 49 10·95 | ″ 710·17 | 16°+ ′ ″ 9 17·54 | π−11° 3′ ″ 53·44 | π−(11° 3′)−{L 54″·296 R 56·392} | F.R. 6.....F.L. 8 | | | | |
| | L | | | | | | | 53 22 | 11 53·50 | 33 28·29 | 15 14 21·45 | 659·57 | 10 10·00 | 55·30 | | | | | | |
| | R | | | | | | | 61 4 | 19 35·24 | 41 11·29 | 13 18 36·45 | 504·51 | 12 47·70 | 57·94 | | | | | | |
| | R | | | | | | | 63 35 | 22 6·15 | 43 42·62 | 12 40 46·50 | 458·23 | 13 32·36 | 56·32 | | | | | | |
| | L | | | | | | | 73 2 | 31 32·83 | 53 10·85 | 10 18 43·05 | 303·99 | 16 5·00 | 54·72 | | | | | | |
| | L | | | | | | | 75 9 | 33 39·76 | 55 18·13 | 9 46 53·85 | 273·70 | 16 35·60 | 55·03 | | | | | | |
| | R | | | | | | | 86 45 | 45 15·36 | 66 55·63 | 6 52 31·35 | 135·67 | 18 55·60 | 57·00 | | | | | | |
| | R | | | | | | | 89 3 | 47 33·28 | 69 13·93 | 6 17 56·85 | 113·95 | 19 16·06 | 55·74 | | | | | | |
| | L | | | | | | | 97 29 | 55 58·99 | 77 41·03 | 4 11 10·35 | 50·43 | 20 17·62 | 53·78 | | | | | | |
| | L | | | | | | | 99 38 | 58 7·92 | 79 50·31 | 3 38 51·15 | 38·31 | 20 30·82 | 54·86 | | | | | | |
| | R | | | | | | | 108 23 | 66 52·62 | 88 36·45 | 1 27 19·05 | 6·11 | 21 4·04 | 55·88 | | | | | | |
| | R | | | | | | | 114 8 | 72 37·43 | 94 22·20 | 0 0 52·80 | 0·00 | 21 9·74 | 55·47 | | | | | | |
| | L | | | | | | | 120 40 | 79 9·20 | 100 55·05 | 1 37 19·95 | 7·61 | 21 0·00 | 53·34 | | | | | | |
| | L | | | | | | | 122 6 | 80 35·15 | 102 21·23 | 1 58 52·65 | 11·35 | 20 56·82 | 53·90 | | | | | | |
| Feb. 26th 9° & 189° | L | 32 Cephei Hev. | ° ′ ″ 4 42 42·35 | ° ′ ″ E. 5 17 14·68 | h. m. s. 22 24 49·29 | h. m. s. 5 50 23·55 | h. m. s. 16 34 25·74 | h. 0+ m. s. 51 32 | h. 17+ m. s. 9 14·59 | h. 15+ m. s. 34 45·50 | ° ′ ″ 15 55 3·60 | ″ 632·33 | 16°+ ′ ″ 10 41·80 | π−11° 3′ ″ 59·45 | π−(11° 3′)−{L 58·869 R 57·528} | F.R. 6.....F.L. 8 | h. m. s. 0 13 14·52 | h. m. s. (7 54 57′·7−0′·30)=7 54 57·40 | h. m. s. 7 41 42·88 | s. 49·02 |
| | L | | | | | | | 53 49 | 11 31·52 | 37 2·80 | 14 20 44·10 | 585·24 | 11 27·66 | 58·22 | | | | | | |
| | R | | | | | | | 62 44 | 20 26·21 | 45 58·96 | 12 6 41·70 | 418·42 | 14 15·02 | 58·76 | | | | | | |
| | R | | | | | | | 64 37 | 22 19·15 | 47 52·21 | 11 38 22·95 | 386·68 | 14 44·52 | 56·52 | | | | | | |
| | L | | | | | | | 74 47 | 32 28·46 | 58 3·19 | 9 5 38·25 | 236·77 | 17 16·18 | 58·27 | | | | | | |
| | L | | | | | | | 77 6 | 34 47·72 | 60 22·83 | 8 30 43·65 | 207·58 | 17 46·22 | 59·12 | | | | | | |
| | R | | | | | | | 85 45 | 43 26·43 | 69 2·96 | 6 20 41·70 | 115·61 | 19 17·72 | 58·65 | | | | | | |
| | R | | | | | | | 88 3 | 45 44·35 | 71 21·26 | 5 46 7·20 | 95·62 | 19 34·66 | 55·60 | | | | | | |
| | L | | | | | | | 95 16 | 52 57·11 | 78 35·20 | 3 57 38·10 | 45·15 | 20 29·42 | 59·89 | | | | | | |
| | L | | | | | | | 97 11 | 54 52·04 | 80 30·45 | 3 28 49·35 | 34·88 | 20 38·94 | 59·14 | | | | | | |
| | R | | | | | | | 108 2 | 65 42·67 | 91 22·86 | 0 45 43·20 | 1·68 | 21 11·26 | 58·26 | | | | | | |
| | R | | | | | | | 111 12 | 68 52·57 | 94 33·27 | 0 1 52·95 | 0·00 | 21 12·06 | 57·38 | | | | | | |
| | L | | | | | | | 118 25 | 76 5·32 | 101 47·21 | 1 50 22·05 | 9·78 | 21 2·12 | 57·22 | | | | | | |
| | L | | | | | | | 120 34 | 78 14·25 | 103 56·49 | 2 22 41·25 | 16·36 | 20 57·96 | 59·64 | | | | | | |

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G. T. Station Usira Lat. 26° 57′ 6″ Long. 77° 40′ 28″ In time 5ᵐ·178. A.D. 1838.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Hour Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 27th 18° & 198° | L | 32 Cephei Hev. | ° ′ ″ 4 42 42·68 | E. 5 ° 17 ′ 15·05 | H. M. S. 22 24 49·31 | H. M. S. 5 50 23·54 | H. M. S. 16 34 25·77 | H. 0÷ M. S. 48 6 | H. 17+ M. S. 5 0·31 | H. 15+ M. S. 34 27·08 | ° ′ ″ 14 59 40·35 | ″ 638·81 | 16°+ ′ ″ 10 34·14 | π−11° 3′ ″ 57·90 | | | | | | |
| | L | | | | | | | 50 15 | 7 9·24 | 36 36·36 | 14 27 21·15 | 594·19 | 11 17·84 | 56·98 | | | | | | |
| | R | | | | | | | 58 16 | 15 9·97 | 44 38·41 | 12 26 50·40 | 441·75 | 13 53·30 | 60·00 | | | | | | |
| | R | | | | | | | 60 54 | 17 47·89 | 47 16·75 | 11 47 15·30 | 396·50 | 14 36·28 | 57·73 | | | | | | |
| | L | | | | | | | 69 59 | 26 52·58 | 56 22·94 | 9 30 42·45 | 258·91 | 16 52·84 | 56·70 | | | | | | |
| | L | | | | | | | 72 37 | 29 30·49 | 59 1·28 | 8 51 7·35 | 224·55 | 17 27·32 | 56·82 | | | | | | |
| | R | | | | | | | 84 37 | 41 30·09 | 71 2·85 | 5 50 43·80 | 98·18 | 19 36·46 | 59·59 | | | | | | |
| | R | | | | | | | 86 23 | 43 16·03 | 72 49·08 | 5 24 10·35 | 83·91 | 19 49·96 | 58·82 | | | | | | |
| | L | | | | | | | 93 2 | 49 54·81 | 79 28·95 | 3 44 12·30 | 40·20 | 20 32·78 | 57·93 | | | | | | |
| | L | | | | | | | 94 57 | 51 49·75 | 81 24·20 | 3 15 23·55 | 30·55 | 20 41·92 | 57·42 | | | | | | |
| | R | | | | | | | 102 10 | 59 2·51 | 88 38·14 | 1 26 54·45 | 6·05 | 21 7·28 | 58·28 | | | | | | |
| | R | | | | | | | 108 8 | 65 0·31 | 94 36·92 | 0 2 47·25 | 0·01 | 21 11·70 | 56·66 | π−(11° 3′)−{L 57″·246 R 58·001} | F.R. 9 ..... F.L. 8 | H. M. S. 0 13 4·15 | H. M. S. (7 55 36·4−0·44)=7 55 35·96 | H. M. S. 7 42 31·81 | S. 48·93 |
| | L | | | | | | | 114 8 | 71 0·10 | 100 37·71 | 1 32 59·10 | 6·94 | 21 5·88 | 57·77 | | | | | | |
| | L | | | | | | | 115 38 | 72 30·05 | 102 7·90 | 1 55 31·95 | 10·72 | 21 0·78 | 56·45 | | | | | | |
| | R | | | | | | | 121 41 | 78 32·85 | 108 11·70 | 3 26 28·95 | 34·28 | 20 39·10 | 58·33 | | | | | | |
| | R | | | | | | | 125 35 | 82 26·72 | 112 6·21 | 4 25 6·60 | 56·54 | 20 15·00 | 56·49 | | | | | | |
| | R | | | | | | | 127 48 | 84 39·65 | 114 19·50 | 4 58 25·95 | 71·66 | 19 59·50 | 56·11 | | | | | | |
| Feb. 28th 27° & 207° | L | 32 Cephei Hev. | ° ′ ″ 4 42 43·00 | E. 5 ° 17 ′ 15·41 | H. M. S. 22 24 49·35 | H. M. S. 5 50 23·53 | H. M. S. 16 34 25·82 | H. 0+ M. S. 44 57 | H. 17+ M. S. 1 2·81 | H. 15+ M. S. 34 25·47 | ° ′ ″ 15 0 5·25 | ″ 639·40 | 16°+ ′ ″ 10 34·74 | π−11° 3′ ″ 58·73 | | | | | | |
| | L | | | | | | | 47 5 | 3 10·73 | 36 33·75 | 14 28 1·05 | 595·10 | 11 16·80 | 56·49 | | | | | | |
| | R | | | | | | | 56 32 | 12 37·41 | 46 1·98 | 12 5 57·60 | 417·59 | 14 17·32 | 59·50 | | | | | | |
| | R | | | | | | | 59 15 | 15 20·32 | 48 45·33 | 11 25 7·35 | 372·26 | 15 0·64 | 57·49 | | | | | | |
| | L | | | | | | | 66 32 | 22 37·07 | 56 3·28 | 9 35 38·10 | 263·37 | 16 48·62 | 56·58 | | | | | | |
| | L | | | | | | | 68 40 | 24 45·00 | 58 11·56 | 9 3 33·90 | 234·99 | 17 17·14 | 56·72 | | | | | | |
| | R | | | | | | | 78 22 | 34 26·67 | 67 54·82 | 6 37 45·00 | 126·16 | 19 7·10 | 57·85 | | | | | | |
| | R | | | | | | | 81 2 | 37 6·58 | 70 35·17 | 5 57 39·75 | 102·09 | 19 32·10 | 58·78 | | | | | | |
| | L | | | | | | | 91 14 | 47 18·24 | 80 48·50 | 3 24 19·80 | 33·40 | 20 40·90 | 58·89 | | | | | | |
| | L | | | | | | | 93 8 | 49 12·17 | 82 42·75 | 2 55 46·05 | 24·72 | 20 49·76 | 59·07 | | | | | | |
| | R | | | | | | | 101 2 | 57 5·91 | 90 37·78 | 0 57 0·60 | 2·61 | 21 12·88 | 60·08 | π−(11° 3′)−{L 57″·416 R 58·135} | F.R. 8 ..... F.L. 8 | H. M. S. 0 12 53·23 | H. M. S. (7 56 13·55−0·31)=7 56 13·24 | H. M. S. 7 43 20·01 | S. 48·20 |
| | R | | | | | | | 105 8 | 61 11·77 | 94 44·31 | 0 4 37·35 | 0·02 | 21 13·30 | 57·91 | | | | | | |
| | L | | | | | | | 111 18 | 67 21·56 | 100 55·11 | 1 37 19·35 | 7·61 | 21 5·44 | 57·64 | | | | | | |
| | L | | | | | | | 113 30 | 69 33·48 | 103 7·40 | 2 10 23·70 | 13·66 | 20 56·96 | 55·21 | | | | | | |
| | R | | | | | | | 120 1 | 76 4·26 | 109 39·25 | 3 48 21·45 | 41·93 | 20 29·68 | 56·20 | | | | | | |
| | R | | | | | | | 122 49 | 78 52·17 | 112 27·61 | 4 30 26·85 | 58·84 | 20 13·84 | 57·27 | | | | | | |

March 1st ⊙'s Transit M.S. Time H. M. S. 0 12 41·76. Chronom. Time H. M. S. (7 56 50·95−0·36)=S. 7 56 50·59. Error H. M. S. 7 44 8·83. Rate 48″·82.

G. T. Station No Lat. 27° 50′ 44″ Long. 77° 41′ 13″ In time 5ᵐ·179. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Hour Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| April 2nd 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 32·63 | E. 1 ° 45 ′ 47·83 | H. M. S. 1 0 17·32 | H. M. S. 5 56 42·28 | H. M. S. 19 3 35·04 | H. 19+ M. S. 54 32 | | H. 18+ M. S. 14 15·89 | ° ′ ″ 12 19 47·25 | ″ 145·92 | 20°+ ′ ″ 48 9·96 | π+22° 31′ ″ 31·87 | | | | | | |
| | L | | | | | | | 57 18 | | 17 2·25 | 11 38 11·85 | 130·05 | 47 53·68 | 31·46 | | | | | | |
| | R | | | | | | | 65 52 | | 25 37·36 | 9 29 25·20 | 86·65 | 47 16·52 | 37·70 | | | | | | |
| | R | | | | | | | 67 40 | | 27 25·59 | 9 2 21·75 | 78·63 | 47 9·60 | 38·80 | | | | | | |
| | L | | | | | | | 76 20 | | 36 6·72 | 6 52 4·80 | 45·45 | 46 29·08 | 31·46 | | | | | | |
| | L | | | | | | | 78 25 | | 38 1·99 | 6 23 15·75 | 39·33 | 46 21·12 | 29·62 | | | | | | |
| | R | | | | | | | 88 43 | | 48 31·33 | 3 45 55·65 | 13·69 | 46 5·36 | 39·50 | | | | | | |
| | R | | | | | | | 96 36 | | 56 25·36 | 1 47 25·20 | 3·10 | 45 55·20 | 39·93 | π+(22° 31′)+{L 28″·731 R 38·553} | F.L. 14 ..... F.R. 10 | H. M. S. Transit of 15 Argus A.R. 8 0 36·72 | H. M. S. (9 42 12·50−0·02)=9 42 12·48 | H. M. S. 1 41 35·76 | S. 48·93 |
| | L | | | | | | | 104 35 | | 64 25·40 | 0 12 35·40 | 0·04 | 45 41·32 | 29·11 | | | | | | |
| | L | | | | | | | 107 40 | | 67 30·80 | 0 58 56·40 | 0·93 | 45 41·90 | 28·80 | | | | | | |

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G. T. Station No Lat. 27° 50′ 44″ Long. 77° 41′ 13″ In time 5ᵐ·179. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| April 3rd 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 32·77 | ° ′ ″ W. 1 45 48·00 | h. m. s. 1 0 17·32 | h. m. s. 5 56 42·28 | h. m. s. 6 56 59·60 | h. 8+ m. s. 13 14 | | h. 6+ m. s. 34 33·97 | ° ′ ″ 5 36 24·45 | ″ 30·40 | 24°+ ′ ″ 16 45·44 | π+22° 31′ ″ 27·84 | π+(22° 31′)+{ L 28·440 R 37·613 } | F. R. 4 ..... F. L. 4 | | | | |
| | L | | | | | | | 17 6 | | 38 26·47 | 4 38 16·95 | 20·80 | 16 57·04 | 29·84 | | | | | | |
| | R | | | | | | | 27 37 | | 48 58·84 | 2 0 11·40 | 3·88 | 17 20·16 | 36·04 | | | | | | |
| | R | | | | | | | 30 11 | | 51 33·17 | 1 21 36·45 | 1·79 | 17 23·86 | 37·65 | | | | | | |
| | R | | | | | | | 37 34 | | 58 57·13 | 0 29 22·95 | 0·23 | 17 26·12 | 38·35 | | | | | | |
| | L | | | | | | | 45 39 | | 67 3·19 | 2 30 53·85 | 6·11 | 17 20·30 | 38·41 | | | | | | |
| | L | | | | | | | 51 36 | | 73 0·96 | 4 0 20·40 | 15·49 | 16 59·70 | 27·19 | | | | | | |
| | L | | | | | | | 53 32 | | 74 57·21 | 4 29 24·15 | 19·45 | 16 57·44 | 28·89 | | | | | | |
| April 3rd 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 32·92 | ° ′ ″ E. 1 45 48·17 | h. m. s. 1 0 17·33 | h. m. s. 5 56 42·27 | h. m. s. 19 3 35·06 | h. 20+ m. s. 6 3 | | h. 18+ m. s. 28 55·69 | ° ′ ″ 8 39 50·55 | ″ 72·25 | 20°+ ′ ″ 46 51·88 | π+22° 31′ ″ 27·80 | Vide April 2nd A.M. | Vide April 2nd A.M. | | | | |
| | L | | | | | | | 8 18 | | 31 10·98 | 8 6 1·20 | 63·19 | 46 41·66 | 26·64 | | | | | | |
| | R | | | | | | | 17 10 | | 40 4·13 | 5 52 43·95 | 33·33 | 46 22·72 | 37·56 | | | | | | |
| | R | | | | | | | 19 7 | | 42 1·39 | 5 23 25·05 | 28·03 | 46 18·70 | 38·84 | | | | | | |
| | L | | | | | | | 28 10 | | 51 5·56 | 3 7 22·50 | 9·42 | 45 49·56 | 28·31 | | | | | | |
| | L | | | | | | | 33 40 | | 56 36·28 | 1 44 41·70 | 2·94 | 45 41·96 | 27·19 | | | | | | |
| April 4th 9° & 189° | L | α Ursæ Minoris | ° ′ ″ 1 33 33·07 | ° ′ ″ W. 1 45 48·34 | h. m. s. 1 0 17·34 | h. m. s. 5 56 42·27 | h. m. s. 6 56 59·61 | h. 8+ m. s. 21 16 | | h. 6+ m. s. 45 44·32 | ° ′ ″ 2 48 49·35 | ″ 7·66 | 24°+ ′ ″ 17 5·16 | π+22° 31′ ″ 24·48 | π+(22° 31′)+{ L 24·653 R 38·258 } | F. R. 4 ..... F. L. 4 | | | | |
| | L | | | | | | | 23 32 | | 48 0·61 | 2 14 45·00 | 4·88 | 17 8·78 | 25·32 | | | | | | |
| | R | | | | | | | 33 59 | | 58 28·97 | 0 22 20·25 | 0·13 | 17 26·30 | 38·09 | | | | | | |
| | R | | | | | | | 36 4 | | 60 34·24 | 0 53 39·45 | 0·77 | 17 25·02 | 37·45 | | | | | | |
| | L | | | | | | | 43 42 | | 68 13·23 | 2 48 24·30 | 7·61 | 17 5·28 | 24·55 | | | | | | |
| | L | | | | | | | 46 4 | | 70 35·54 | 3 23 58·95 | 11·16 | 17 1·44 | 24·26 | | | | | | |
| | R | | | | | | | 53 31 | | 78 3·51 | 5 15 58·50 | 26·75 | 16 59·96 | 38·37 | | | | | | |
| | R | | | | | | | 55 8 | | 79 40·72 | 5 40 16·65 | 31·02 | 16 56·44 | 39·12 | | | | | | |
| April 4th 9° & 189° | L | α Ursæ Minoris | ° ′ ″ 1 33 33·22 | ° ′ ″ E. 1 45 48·51 | h. m. s. 1 0 17·36 | h. m. s. 5 56 42·26 | h. m. s. 19 3 35·10 | h. 19+ m. s. 57 33 | | h. 18+ m. s. 23 31·88 | ° ′ ″ 10 0 48·30 | ″ 96·42 | 20°+ ′ ″ 47 10·86 | π+22° 31′ ″ 22·95 | π+(22° 31′)+{ L 24·760 R 36·007 } | F. R. 6 ..... F. L. 6 | | | | |
| | L | | | | | | | 59 21 | | 25 20·12 | 9 33 44·70 | 87·96 | 47 5·20 | 25·75 | | | | | | |
| | R | | | | | | | 67 28 | | 33 28·17 | 7 31 43·95 | 54·60 | 46 41·78 | 35·69 | | | | | | |
| | R | | | | | | | 69 19 | | 35 19·41 | 7 3 55·35 | 48·10 | 46 35·54 | 35·95 | | | | | | |
| | L | | | | | | | 78 23 | | 44 24·59 | 4 47 37·65 | 22·17 | 45 58·70 | 25·04 | | | | | | |
| | L | | | | | | | 80 17 | | 46 18·84 | 4 19 3·90 | 17·99 | 45 55·14 | 25·66 | | | | | | |
| | R | | | | | | | 88 43 | | 54 45·94 | 2 12 17·40 | 4·70 | 45 52·22 | 36·03 | | | | | | |
| | R | | | | | | | 91 39 | | 57 42·32 | 1 28 11·70 | 2·09 | 45 48·92 | 35·34 | | | | | | |
| | L | | | | | | | 98 39 | | 64 43·23 | 0 17 1·95 | 0·08 | 45 36·58 | 25·01 | | | | | | |
| | L | | | | | | | 101 6 | | 67 10·55 | 0 53 51·75 | 0·78 | 45 36·42 | 24·15 | | | | | | |
| | R | | | | | | | 109 15 | | 75 20·61 | 2 56 22·65 | 8·36 | 45 56·28 | 36·43 | | | | | | |
| | R | | | | | | | 111 10 | | 77 15·86 | 3 25 11·40 | 11·31 | 45 59·40 | 36·60 | | | | | | |
| April 5th 18° & 198° | L | α Ursæ Minoris | ° ′ ″ 1 33 33·37 | ° ′ ″ W. 1 45 48·68 | h. m. s. 1 0 17·37 | h. m. s. 5 56 42·26 | h. m. s. 6 56 59·63 | h. 8+ m. s. 10 12 | | h. 6+ m. s. 37 46·18 | ° ′ ″ 4 48 21·75 | ″ 22·34 | 24°+ ′ ″ 16 53·62 | π+22° 31′ ″ 27·24 | π+(22° 31′)+{ L 27·200 R 36·153 } | F. R. 4 ..... F. L. 4 | h. m. s. 8 0 36·66 15 Argus | | | |
| | L | | | | | | | 12 27 | | 40 1·47 | 4 14 32·40 | 17·40 | 16 56·96 | 25·68 | | | | | | |
| | R | | | | | | | 19 0 | | 46 35·32 | 2 36 4·65 | 6·54 | 17 17·52 | 35·38 | | | | | | |
| | R | | | | | | | 21 2 | | 48 37·59 | 2 5 30·60 | 4·23 | 17 20·76 | 36·31 | | | | | | |
| | L | | | | | | | 31 29 | | 59 5·95 | 0 31 34·80 | 0·27 | 17 16·18 | 27·77 | | | | | | |
| | L | | | | | | | 34 2 | | 61 39·28 | 1 9 54·75 | 1·31 | 17 15·48 | 28·11 | | | | | | |
| | R | | | | | | | 44 19 | | 71 57·62 | 3 44 29·85 | 13·51 | 17 10·32 | 35·15 | | | | | | |
| | R | | | | | | | 46 23 | | 74 1·88 | 4 15 33·75 | 17·51 | 17 8·94 | 37·77 | | | | | | |

(9 32 51·90—0·17)=9 32 51·73

h. m. s. 1 32 16·07

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G. T. Station No Lat. 27° 50′ 44″ Long. 77° 41′ 13″ In time 5ˢ·179. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | Computed Terms. ✱'s Elongation. | Computed Terms. ✱'s A.R. | Computed Terms. ✱'s Horary Angle. | Computed Terms. ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ′ P | Computed Space. δ′ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ✱'s Transit. A.R. | ✱'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| April 5th 18° & 198° | L | α Ursæ Minoris | ° ′ ″ 1 33 33·52 | ° ′ ″ E. 1 45 48·85 | h. m. s. 1 0 17·39 | h. m. s. 5 56 42·25 | h. m. s. 19 3 35·14 | h. 20+ m. s. 9 3 | | h. 18+ m. s. 38 10·61 | ° ′ ″ 6 21 7·95 | ″ 38·90 | 20°+ ′ ″ 46 19·20 | π+22° 31′ ″ 29·15 | π+(22° 31′)+{L 28·703 R 37·228} | F.R. 4 ..... F.L. 4 | h. m. s. 8 0 36·66 15 Argus | h. m. s. (9 32 51·90−0·17)=9 32 51·73 | h. m. s. 1 32 15·07 | h. m. s. 0 3 6·90 |
| | L | | | | | | | 11 10 | | 40 17·88 | 5 49 18·90 | 32·68 | 46 13·52 | 29·69 | | | | | | |
| | R | | | | | | | 19 53 | | 49 2·01 | 3 38 16·95 | 12·77 | 46 0·88 | 36·96 | | | | | | |
| | R | | | | | | | 22 35 | | 51 44·36 | 2 57 41·70 | 8·87 | 45 56·68 | 36·66 | | | | | | |
| | L | | | | | | | 30 34 | | 59 44·37 | 0 57 41·55 | 0·89 | 45 40·34 | 28·30 | | | | | | |
| | L | | | | | | | 33 37 | | 62 47·80 | 0 11 50·10 | 0·04 | 45 38·86 | 27·67 | | | | | | |
| | R | | | | | | | 44 22 | | 73 34·20 | 2 29 45·90 | 6·02 | 45 55·88 | 38·71 | | | | | | |
| | R | | | | | | | 49 55 | | 79 7·92 | 3 33 11·70 | 14·61 | 46 2·34 | 36·58 | | | | | | |
| April 6th 27° & 207° | L | α Ursæ Minoris | ° ′ ″ 1 33 33·67 | ° ′ ″ W. 1 45 49·02 | h. m. s. 1 0 17·41 | h. m. s. 5 56 42·25 | h. m. s. 6 56 59·66 | h. 8+ m. s. 14 31 | | h. 6+ m. s. 45 12·88 | ° ′ ″ 2 56 41·70 | ″ 8·39 | 24°+ ′ ″ 17 12·40 | π+22° 31′ ″ 31·77 | π+(22° 31′)+{L 30·263 R 38·063} | F.R. 4 ..... F.L. 4 | h. m. s. 8 0 36·64 15 Argus | h. m. s. (9 29 45·20−0·22)=9 29 44·98 | h. m. s. 1 29 8·34 | h. m. s. 0 3 6·73 |
| | L | | | | | | | 16 22 | | 47 4·12 | 2 28 53·10 | 5·96 | 17 15·24 | 32·18 | | | | | | |
| | R | | | | | | | 25 43 | | 56 26·34 | 0 8 19·80 | 0·02 | 17 27·22 | 38·22 | | | | | | |
| | R | | | | | | | 27 53 | | 58 36·62 | 0 24 14·40 | 0·16 | 17 25·72 | 36·86 | | | | | | |
| | L | | | | | | | 35 59 | | 66 43·67 | 2 26 0·15 | 5·72 | 17 10·84 | 27·54 | | | | | | |
| | L | | | | | | | 38 10 | | 68 54·96 | 2 58 49·50 | 8·58 | 17 10·00 | 29·56 | | | | | | |
| | R | | | | | | | 44 53 | | 75 38·83 | 4 39 47·55 | 20·98 | 17 6·96 | 38·92 | | | | | | |
| | R | | | | | | | 47 24 | | 78 10·16 | 5 17 37·50 | 27·03 | 17 0·24 | 38·25 | | | | | | |
| April 6th 27° & 207° | L | α Ursæ Minoris | ° ′ ″ 1 33 33·82 | ° ′ ″ E. 1 45 49·19 | h. m. s. 1 0 17·44 | h. m. s. 5 56 42·24 | h. m. s. 19 3 35·20 | h. 20+ m. s. 9 2 | | h. 18+ m. s. 41 16·93 | ° ′ ″ 5 34 34·05 | ″ 29·99 | 20°+ ′ ″ 46 7·28 | π+22° 31′ ″ 26·48 | π+(22° 31′)+{L 27·230 R 39·513} | F.R. 4 ..... F.L. 4 | h. m. s. 8 0 36·64 15 Argus | h. m. s. (9 29 45·20−0·22)=9 29 44·98 | h. m. s. 1 29 8·34 | h. m. s. 0 3 6·73 |
| | L | | | | | | | 11 8 | | 43 23·21 | 5 2 59·85 | 24·60 | 46 1·82 | 26·41 | | | | | | |
| | R | | | | | | | 19 44 | | 52 0·33 | 2 53 43·05 | 8·10 | 45 56·00 | 37·09 | | | | | | |
| | R | | | | | | | 21 40 | | 53 56·58 | 2 24 39·30 | 5·62 | 45 56·06 | 39·63 | | | | | | |
| | L | | | | | | | 33 23 | | 65 41·11 | 0 31 28·65 | 0·27 | 45 38·22 | 27·14 | | | | | | |
| | L | | | | | | | 36 12 | | 68 30·47 | 1 13 49·05 | 1·46 | 45 41·16 | 28·89 | | | | | | |
| | R | | | | | | | 44 19 | | 76 38·53 | 3 15 49·95 | 10·30 | 46 1·18 | 40·07 | | | | | | |
| | R | | | | | | | 46 22 | | 78 41·80 | 3 46 39·00 | 13·80 | 46 5·88 | 41·27 | | | | | | |
| April 7th 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 34·12 | ° ′ ″ E. 1 45 49·53 | h. m. s. 1 0 17·49 | h. m. s. 5 56 42·23 | h. m. s. 19 3 35·26 | h. 20+ m. s. 2 50 | | h. 18+ m. s. 38 12·36 | ° ′ ″ 6 20 43·50 | ″ 38·82 | 20°+ ′ ″ 46 16·84 | π+22° 31′ ″ 27·55 | Vide April 2nd A.M. | Vide April 2nd A.M. | h. m. s. 8 0 36·63 15 Argus | h. m. s. (9 26 37·90−0·10)=9 26 37·80 | h. m. s. 1 26 1·17 | h. m. s. 0 3 7·17 |
| | L | | | | | | | 5 57 | | 41 19·76 | 5 33 52·50 | 29·86 | 46 8·70 | 28·37 | | | | | | |
| | R | | | | | | | 13 32 | | 48 55·76 | 3 39 52·50 | 12·96 | 46 1·28 | 37·85 | | | | | | |
| | R | | | | | | | 15 27 | | 50 51·06 | 3 11 3·00 | 9·79 | 45 59·78 | 39·52 | | | | | | |
| | L | | | | | | | 23 45 | | 59 10·10 | 1 6 17·40 | 1·18 | 45 38·14 | 26·49 | | | | | | |
| | L | | | | | | | 26 4 | | 61 29·41 | 0 31 27·75 | 0·27 | 45 38·30 | 27·56 | | | | | | |
| | R | | | | | | | 34 15 | | 69 41·48 | 1 31 33·30 | 2·25 | 45 50·46 | 37·74 | | | | | | |
| | R | | | | | | | 36 8 | | 71 34·73 | 1 59 52·05 | 3·86 | 45 52·42 | 38·09 | | | | | | |

Observed Transit of 15 Argus—April 8th for Time and Rate of Chronometer.

✱'s A.R. h. m. s. 8 0 36·61. Chronom. Time h. m. s. (9 23 29·30−s. 0·16)=h. m. s. 9 23 29·14. Error h. m. s. 1 22 52·53. Rate h. m. s. 0 3 8·64



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G. T. Station Dateri Lat. 28° 43′ 59″ Long. 77° 41′ 33″ In time 5ᵐ·179. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 18th 9° & 189° | R | λ Ursæ Minoris | 1° 11′ 5″·40 | W. 1° 21′ 4″·46 | h. m. s. 20 23 54·73 | h. m. s. 5 57 24·14 | h. m. s. 2 21 18·87 | h.7+ m. s. 12 22 | h.5+ m. s. 52 51·02 | h.1+ m. s. 40 42·48 | ° ′ ″ 10 9 5·85 | ″ 76·30 | 8°+ ′ ″ 23 6·10 | π−9° 42′ ″ 54·26 | π−(9° 42′)−{R 58″·357 / L 59·892} | F.R. 6 ..... F.L. 6 | h. m. s. 0 10 29·11 | h. m. s. (1 29 53·5 − 1·77)=1 29 51·73 | | |
| | R | | | | | | | 15 22 | 55 50·95 | 43 42·90 | 9 23 59·55 | 65·44 | 22 58·40 | 57·42 | | | | | | |
| | L | | | | | | | 27 22 | 67 50·66 | 55 44·58 | 6 23 34·35 | 30·28 | 22 23·08 | 57·26 | | | | | | |
| | L | | | | | | | 30 17 | 70 45·59 | 58 39·98 | 5 39 43·35 | 23·76 | 22 18·68 | 59·38 | | | | | | |
| | R | | | | | | | 45 40 | 86 8·21 | 74 5·14 | 1 48 25·95 | 2·42 | 21 59·52 | 61·56 | | | | | | |
| | R | | | | | | | 48 48 | 89 16·14 | 77 13·57 | 1 1 19·50 | 0·77 | 21 54·82 | 58·51 | | | | | | |
| | L | | | | | | | 64 14 | 104 41·76 | 92 41·73 | 2 50 42·90 | 5·99 | 22 0·28 | 58·75 | | | | | | |
| | L | | | | | | | 68 7 | 108 34·66 | 96 35·27 | 3 49 6·00 | 10·79 | 22 6·16 | 59·83 | | | | | | |
| | R | | | | | | | 82 9 | 122 36·32 | 110 39·24 | 7 20 5·55 | 39·75 | 22 33·30 | 58·01 | | | | | | |
| | R | | | | | | | 85 41 | 126 8·24 | 114 11·73 | 8 13 12·90 | 49·89 | 22 43·46 | 58·43 | | | | | | |
| | L | | | | | | | 96 26 | 136 52·97 | 124 58·23 | 10 54 50·40 | 87·78 | 23 29·02 | 65·70 | | | | | | |
| | L | | | | | | | 100 0 | 140 26·89 | 128 32·73 | 11 48 27·90 | 102·68 | 23 38·60 | 60·38 | | | | | | |
| Jan. 18th 9° & 189° | L | λ Ursæ Minoris | 1° 11′ 5″·56 | E. 1° 21′ 4″·64 | h. m. s. 20 23 54·56 | h. m. s. 5 57 24·14 | h. m. s. 14 26 30·42 | h.19+ m. s. 7 35 | h.17+ m. s. 47 46·58 | h.13+ m. s. 37 35·48 | ° ′ ″ 12 13 44·10 | ″ 110·10 | 11°+ ′ ″ 2 17·58 | π−9° 42′ ″ 63·04 | π−(9° 42′)−{L 61″·718 / R 57·595} | F.R. 4 ..... F.L. 4 | h. m. s. 0 10 29·11 | h. m. s. (1 29 53·5 − 1·77)=1 29 51·73 | | |
| | L | | | | | | | 11 43 | 51 54·48 | 41 44·05 | 11 11 35·55 | 92·32 | 2 32·78 | 60·46 | | | | | | |
| | R | | | | | | | 27 10 | 67 21·10 | 57 13·21 | 7 19 18·15 | 39·60 | 3 23·02 | 57·98 | | | | | | |
| | R | | | | | | | 29 48 | 69 59·04 | 59 51·58 | 6 39 42·60 | 32·80 | 3 30·62 | 58·78 | | | | | | |
| | L | | | | | | | 40 38 | 80 48·77 | 70 43·10 | 3 56 49·80 | 11·53 | 3 54·22 | 61·11 | | | | | | |
| | L | | | | | | | 43 48 | 83 58·69 | 73 53·54 | 3 9 13·20 | 7·36 | 3 59·94 | 62·66 | | | | | | |
| | R | | | | | | | 53 22 | 93 32·46 | 83 28·88 | 0 45 23·10 | 0·42 | 4 1·30 | 57·08 | | | | | | |
| | R | | | | | | | 56 5 | 96 15·39 | 86 12·26 | 0 4 32·40 | 0·00 | 4 1·18 | 56·54 | | | | | | |
| Jan. 19th 27° & 207° | R | λ Ursæ Minoris | 1° 11′ 5″·72 | W. 1° 21′ 4″·82 | h. m. s. 20 23 54·41 | h. m. s. 5 57 24·13 | h. m. s. 2 21 18·54 | h.7+ m. s. 12 40 | h.5+ m. s. 52 34·31 | h.1+ m. s. 44 22·28 | ° ′ ″ 9 14 3·90 | ″ 63·15 | 8°+ ′ ″ 22 58·30 | π−9° 42′ ″ 59·97 | π−(9° 42′)−{R 61″·392 / L 65·173} | F.R. 6 ..... F.L. 6 | h. m. s. 0 10 48·47 | h. m. s. (1 30 48·0 − 1·76)=1 30 46·24 | | |
| | R | | | | | | | 17 51 | 57 45·19 | 49 34·01 | 7 56 7·95 | 46·65 | 22 43·02 | 61·19 | | | | | | |
| | L | | | | | | | 28 57 | 68 50·93 | 60 41·57 | 5 9 14·55 | 19·69 | 22 19·56 | 64·69 | | | | | | |
| | L | | | | | | | 30 20 | 70 13·90 | 62 4·77 | 4 48 26·55 | 17·13 | 22 15·18 | 62·87 | | | | | | |
| | R | | | | | | | 40 31 | 80 24·66 | 72 17·20 | 2 15 20·10 | 3·77 | 22 1·68 | 62·73 | | | | | | |
| | R | | | | | | | 43 11 | 83 4·60 | 74 57·58 | 1 35 14·40 | 1·87 | 21 57·16 | 60·11 | | | | | | |
| | L | | | | | | | 53 50 | 93 43·35 | 85 38·08 | 1 4 53·10 | 0·87 | 22 1·74 | 65·69 | | | | | | |
| | L | | | | | | | 56 30 | 96 23·29 | 88 18·46 | 1 44 58·80 | 2·27 | 22 3·40 | 65·95 | | | | | | |
| | R | | | | | | | 65 43 | 105 36·08 | 97 32·76 | 4 3 33·30 | 12·19 | 22 10·34 | 62·97 | | | | | | |
| | R | | | | | | | 69 16 | 109 9·00 | 101 6·26 | 4 56 55·80 | 18·12 | 22 14·68 | 61·38 | | | | | | |
| | L | | | | | | | 80 51 | 120 43·73 | 112 42·89 | 7 51 5·25 | 45·53 | 22 46·04 | 65·33 | | | | | | |
| | L | | | | | | | 83 46 | 123 38·66 | 115 38·30 | 8 34 56·40 | 54·37 | 22 56·06 | 66·51 | | | | | | |
| Jan. 19th 27° & 207° | L | λ Ursæ Minoris | 1° 11′ 5″·88 | E. 1° 21′ 5″·01 | h. m. s. 20 23 54·25 | h. m. s. 5 57 24·12 | h. m. s. 14 26 30·13 | h.19+ m. s. 14 8 | h.17+ m. s. 53 45·59 | h.13+ m. s. 47 32·03 | ° ′ ″ 9 44 31·50 | ″ 70·01 | 11°+ ′ ″ 2 56·92 | π−9° 42′ ″ 61·92 | π−(9° 42′)−{L 62″·798 / R 60·363} | F.R. 4 ..... F.L. 4 | h. m. s. 0 10 48·47 | h. m. s. (1 30 48·0 − 1·76)=1 30 46·24 | | |
| | L | | | | | | | 17 12 | 56 49·52 | 50 36·46 | 8 58 25·05 | 59·43 | 3 7·06 | 61·48 | | | | | | |
| | R | | | | | | | 27 16 | 66 53·28 | 60 41·88 | 6 27 3·75 | 30·76 | 3 36·92 | 62·67 | | | | | | |
| | R | | | | | | | 30 17 | 69 54·21 | 63 43·31 | 5 41 42·30 | 23·98 | 3 40·60 | 59·57 | | | | | | |
| | L | | | | | | | 42 12 | 81 48·94 | 75 39·99 | 2 42 32·10 | 5·43 | 4 1·64 | 62·06 | | | | | | |
| | L | | | | | | | 44 32 | 84 8·88 | 78 0·32 | 2 7 27·15 | 3·34 | 4 7·40 | 65·73 | | | | | | |
| | R | | | | | | | 54 49 | 94 25·65 | 88 18·77 | 0 27 9·60 | 0·15 | 4 3·24 | 58·38 | | | | | | |
| | R | | | | | | | 57 18 | 96 54·59 | 90 48·12 | 1 4 29·85 | 0·86 | 4 4·98 | 60·83 | | | | | | |

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G. T. Station Dateri Lat. 28° 43′ 59″ Long. 77° 41′ 33″ In time 5ᵐ·179. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A. R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | M.S. Time. | Chronom. Time. | Error. | Rate. |
| Jan. 20th 0° & 180° | R | λ Ursæ Minoris | ° ′ ″ 1 11 6·04 | ° ′ ″ W. 1 21 5·19 | h. m. s. 20 23 54·10 | h. m. s. 5 57 24·12 | h. m. s. 2 21 18·22 | H.7+ M. S. 8 29 | H.5+ M. S. 47 49·34 | H.1+ M. S. 43 33·08 | ° ′ ″ 9 26 17·10 | ″ 65·97 | 8°+ ′ ″ 23 3·54 | π−9° 42′ ″ 62·76 | π−(9° 42′)−{R 61″·833 L 61·958} | F.R. 6 ..... F.L. 6 | h. m. s. 0 11 7·09 | h. m. s. (1 31 40·0−1·75)=1 31 38·25 | h. m. s. 1 20 31·16 | s. 36·38 |
| | RRL | | | | | | | 11 11 | 50 31·27 | 46 15·46 | 8 45 41·40 | 56·86 | 22 51·28 | 59·61 | | | | | | |
| | LLRRR | | | | | | | 20 16 | 59 36·04 | 55 21·72 | 6 29 7·50 | 31·17 | 22 27·92 | 61·94 | | | | | | |
| | L | | | | | | | 22 59 | 62 18·97 | 58 5·10 | 5 48 16·80 | 24·97 | 22 23·48 | 63·70 | | | | | | |
| | LRRRL | | | | | | | 32 59 | 72 18·72 | 68 6·49 | 3 17 55·95 | 8·07 | 22 6·60 | 63·72 | | | | | | |
| | L | | | | | | | 35 33 | 74 52·65 | 70 40·85 | 2 39 20·55 | 5·23 | 22 2·34 | 62·30 | | | | | | |
| | | | | | | | | 45 36 | 84 55·40 | 80 45·24 | 0 8 14·70 | 0·01 | 21 55·86 | 61·04 | | | | | | |
| | LRRLL | | | | | | | 48 7 | 87 26·33 | 83 16·59 | 0 29 35·55 | 0·18 | 21 56·18 | 61·19 | | | | | | |
| | | | | | | | | 57 54 | 97 13·09 | 93 4·95 | 2 56 40·95 | 6·42 | 22 4·10 | 62·87 | | | | | | |
| | | | | | | | | 60 29 | 99 48·02 | 95 40·31 | 3 35 31·35 | 9·55 | 22 4·10 | 59·74 | | | | | | |
| | | | | | | | | 71 48 | 111 6·74 | 107 0·88 | 6 25 39·90 | 30·54 | 22 27·46 | 62·11 | | | | | | |
| | | | | | | | | 74 33 | 113 51·67 | 109 46·26 | 7 7 0·60 | 37·42 | 22 34·00 | 61·77 | | | | | | |
| Jan. 20th 0° & 180° | L | λ Ursæ Minoris | ° ′ ″ 1 11 6·21 | ° ′ ″ E. 1 21 5·38 | h. m. s. 20 23 53·95 | h. m. s. 5 57 24·11 | h. m. s. 14 26 29·84 | H.19+ M. S. 12 16 | H.17+ M. S. 51 18·06 | H.13+ M. S. 49 0·66 | ° ′ ″ 9 22 17·70 | ″ 64·80 | 11°+ ′ ″ 2 57·74 | π−9° 42′ ″ 57·16 | π−(9° 42′)−{L 55″·938 R 58·715} | F.R. 4 ..... F.L. 4 | h. m. s. 0 11 7·09 | h. m. s. (1 31 40·0−1·75)=1 31 38·25 | h. m. s. 1 20 31·16 | s. 36·38 |
| | LLRRR | | | | | | | 15 50 | 54 51·97 | 52 35·15 | 8 28 40·35 | 53·06 | 3 9·88 | 57·56 | | | | | | |
| | | | | | | | | 27 50 | 66 51·67 | 64 36·82 | 5 28 15·30 | 22·13 | 3 41·82 | 58·57 | | | | | | |
| | LRRRL | | | | | | | 30 50 | 69 51·59 | 67 37·24 | 4 43 9·00 | 16·47 | 3 49·02 | 60·11 | | | | | | |
| | L | | | | | | | 48 55 | 87 56·14 | 85 44·75 | 0 11 16·35 | 0·03 | 3 59·00 | 53·65 | | | | | | |
| | LRRRR | | | | | | | 52 11 | 91 12·05 | 89 1·21 | 0 37 50·55 | 0·30 | 4 0·46 | 55·38 | | | | | | |
| | | | | | | | | 60 53 | 99 53·83 | 97 44·41 | 2 48 38·55 | 5·85 | 3 56·70 | 57·17 | | | | | | |
| | | | | | | | | 63 34 | 102 34·77 | 100 25·79 | 3 28 59·25 | 8·99 | 3 55·40 | 59·01 | | | | | | |
| Jan. 21st 18° & 198° | R | λ Ursæ Minoris | ° ′ ″ 1 11 6·37 | ° ′ ″ W. 1 21 5·56 | h. m. s. 20 23 53·81 | h. m. s. 5 57 24·11 | h. m. s. 2 21 17·92 | H.7+ M. S. 8 12 | H.5+ M. S. 46 56·09 | H.1+ M. S. 46 36·25 | ° ′ ″ 8 40 25·05 | ″ 55·73 | 8°+ ′ ″ 22 48·28 | π−9° 42′ ″ 58·11 | π−(9° 42′)−{R 60″·168 L 58·317} | F.R. 6 ..... F.L. 6 | h. m. s. 0 11 24·97 | h. m. s. (1 32 34·25−1·74)=1 32 32·51 | h. m. s. 1 21 7·54 | s. 35·90 |
| | RRLLL | | | | | | | 10 36 | 49 20·03 | 49 0·58 | 8 4 20·10 | 48·26 | 22 40·60 | 57·90 | | | | | | |
| | LLRRR | | | | | | | 20 28 | 59 11·79 | 58 53·96 | 5 35 59·40 | 23·24 | 22 14·24 | 56·56 | | | | | | |
| | RRRLL | | | | | | | 23 22 | 62 5·72 | 61 48·36 | 4 52 23·40 | 17·60 | 22 10·12 | 58·08 | | | | | | |
| | LLRRR | | | | | | | 34 14 | 72 57·45 | 72 41·87 | 2 9 0·75 | 3·43 | 21 59·82 | 61·95 | | | | | | |
| | | | | | | | | 37 14 | 75 57·37 | 75 42·29 | 1 23 54·45 | 1·45 | 21 55·62 | 59·73 | | | | | | |
| | LRRRL | | | | | | | 47 38 | 86 21·11 | 86 7·74 | 1 12 27·30 | 1·08 | 21 52·72 | 56·20 | | | | | | |
| | | | | | | | | 50 14 | 88 57·05 | 88 44·10 | 1 51 32·70 | 2·56 | 21 56·20 | 59·20 | | | | | | |
| | L | | | | | | | 62 25 | 101 7·74 | 100 56·80 | 4 54 43·20 | 17·85 | 22 11·80 | 59·51 | | | | | | |
| | | | | | | | | 64 44 | 103 26·69 | 103 16·12 | 5 29 33·00 | 22·31 | 22 20·56 | 63·81 | | | | | | |
| | LRRLL | | | | | | | 78 6 | 116 48·35 | 116 39·98 | 8 50 30·90 | 57·70 | 22 51·64 | 59·50 | | | | | | |
| | | | | | | | | 81 6 | 119 48·28 | 119 40·40 | 9 35 37·20 | 67·90 | 23 2·68 | 60·34 | | | | | | |
| Jan. 21st 18° & 198° | L | λ Ursæ Minoris | ° ′ ″ 1 11 6·54 | ° ′ ″ E. 1 21 5·76 | h. m. s. 20 23 53·67 | h. m. s. 5 57 24·10 | h. m. s. 14 26 29·57 | H.19+ M. S. 18 47 | H.17+ M. S. 57 12·89 | H.13+ M. S. 58 53·01 | ° ′ ″ 6 54 8·40 | ″ 35·20 | 11°+ ′ ″ 3 27·28 | π−9° 42′ ″ 56·72 | π−(9° 42′)−{L 57″·243 R 60·468} | F.R. 4 ..... F.L. 4 | h. m. s. 0 11 24·97 | h. m. s. (1 32 34·25−1·74)=1 32 32·51 | h. m. s. 1 21 7·54 | s. 35·90 |
| | LLRRR | | | | | | | 21 30 | 59 55·82 | 61 36·38 | 6 13 17·85 | 28·61 | 3 33·58 | 56·43 | | | | | | |
| | | | | | | | | 32 0 | 70 25·56 | 72 7·85 | 3 35 25·80 | 9·54 | 3 57·08 | 60·86 | | | | | | |
| | LRRRL | | | | | | | 35 20 | 73 45·47 | 75 28·31 | 2 45 18·90 | 5·62 | 4 0·96 | 60·82 | | | | | | |
| | L | | | | | | | 45 52 | 84 17·21 | 86 1·78 | 0 6 56·85 | 0·01 | 4 2·46 | 56·71 | | | | | | |
| | LRRLL | | | | | | | 48 8 | 86 33·16 | 88 18·09 | 0 27 7·80 | 0·15 | 4 4·72 | 59·11 | | | | | | |
| | | | | | | | | 57 46 | 96 10·92 | 97 57·44 | 2 51 58·05 | 6·09 | 4 0·60 | 60·93 | | | | | | |
| | | | | | | | | 60 47 | 100 11·84 | 101 59·02 | 3 52 21·75 | 11·12 | 3 53·90 | 59·26 | | | | | | |

Jan. 22nd ⊙'s Transit M.S. Time h. m. s. 0 11 42·07. Chronom. Time h. m. s. (1 33 27·25−1·74)=s. 1 33 25·51. Error h. m. s. 1 21 43·44. Rate 34″·45.

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G. T. Station Kaliana Eastern Pillar Lat. 29° 30′ 49″ Long. 77° 41′ 51″·99 In time 5ᵐ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. ✱'s N. P. D. | Computed Terms. ✱'s Elongation. | Computed Terms. ✱'s A.R. | Computed Terms. ✱'s Horary Angle. | Computed Terms. ✱'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 5th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·74 | E. ° ′ ″ 47 42·55 | h. m. s. 1 1 42·72 | h. m. s. 5 56 27·70 | h. m. s. 19 5 15·02 | h. m. s. 58 27 | h. m. s. 42 47·21 | h. m. s. 39 38·03 | ° ′ ″ 6 24 15·75 | ″ 40·24 | ′ ″ 47 3·96 | ″ — 1·65 | ″ π + 0° 0′ | F.R. 6 ..... F.L. 6 | h. m. s. 23 48 26·04 | h. m. s. 0 3 57·95 | m. s. 0 15 31·91 | s. 32·66 |
| | R | | | | | | | 60 25 | 44 45·17 | 41 36·31 | 5 54 41·55 | 34·30 | 47 8·50 | — 0·25 | | | | | | |
| | L | | | | | | | 67 32 | 51 52·01 | 48 44·32 | 4 7 41·40 | 16·74 | 47 26·36 | — 0·55 | | | | | | |
| | L | | | | | | | 69 36 | 53 55·96 | 50 48·61 | 3 36 37·05 | 12·81 | 47 29·36 | + 0·38 | | | | | | |
| | R | | | | | | | 76 23 | 60 42·81 | 57 36·58 | 1 54 37·50 | 3·59 | 47 39·82 | — 0·86 | | | | | | |
| | R | | | | | | | 79 59 | 64 18·73 | 61 13·09 | 1 0 29·85 | 1·00 | 47 41·36 | + 0·19 | | | | | | |
| | L | | | | | | | 86 22 | 70 41·59 | 67 36·99 | 0 35 28·65 | 0·34 | 47 47·26 | — 5·05 | | | | | | |
| | L | | | | | | | 88 58 | 73 17·53 | 70 13·36 | 1 14 34·20 | 1·52 | 47 45·36 | — 4·33 | | | | | | |
| | R | | | | | | | 97 0 | 81 19·35 | 78 16·50 | 3 15 21·30 | 10·44 | 47 36·08 | — 3·97 | | | | | | |
| | R | | | | | | | 99 19 | 83 36·30 | 80 35·83 | 3 50 11·25 | 14·49 | 47 27·18 | + 0·88 | | | | | | |
| | L | | | | | | | 107 18 | 91 37·12 | 88 35·97 | 5 50 13·35 | 33·55 | 47 11·30 | — 2·30 | | | | | | |
| | L | | | | | | | 109 15 | 93 34·08 | 90 33·24 | 6 19 32·40 | 39·39 | 47 2·80 | + 0·36 | | | | | | |
| Oct. 5th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 43·56 | W. ° ′ ″ 47 42·34 | h. m. s. 1 1 42·77 | h. m. s. 5 56 27·71 | h. m. s. 6 58 10·48 | h. m. s. 48 55 | h. m. s. 32 59·41 | h. m. s. 31 46·90 | ° ′ ″ 6 35 54·60 | ″ 42·86 | ′ ″ 46 58·36 | ″ — 1·12 | ″ π + 0° 0′ | F.R. 6 ..... F.L. 6 | h. m. s. 23 48 26·04 | h. m. s. 0 3 57·95 | m. s. 0 15 31·91 | s. 32·66 |
| | R | | | | | | | 51 1 | 35 5·37 | 33 53·20 | 6 4 20·10 | 36·30 | 47 4·10 | — 1·94 | | | | | | |
| | L | | | | | | | 59 34 | 43 38·18 | 42 27·42 | 3 55 46·80 | 15·20 | 47 26·44 | — 0·70 | | | | | | |
| | L | | | | | | | 62 22 | 46 26·12 | 45 15·81 | 3 13 40·95 | 10·26 | 47 31·64 | — 0·44 | | | | | | |
| | R | | | | | | | 70 13 | 54 16·94 | 53 7·93 | 1 15 39·15 | 1·57 | 47 39·58 | — 1·19 | | | | | | |
| | R | | | | | | | 72 29 | 56 32·89 | 55 24·25 | 0 41 34·35 | 0·47 | 47 40·54 | — 1·33 | | | | | | |
| | L | | | | | | | 79 55 | 63 58·72 | 62 51·30 | 1 10 11·40 | 1·35 | 47 38·54 | — 2·45 | | | | | | |
| | L | | | | | | | 81 58 | 66 1·68 | 64 54·60 | 1 41 0·90 | 2·79 | 47 38·22 | — 1·33 | | | | | | |
| | R | | | | | | | 89 51 | 73 54·50 | 72 48·72 | 3 39 32·70 | 13·15 | 47 28·64 | — 0·55 | | | | | | |
| | R | | | | | | | 91 59 | 76 2·46 | 74 57·02 | 4 11 37·20 | 17·28 | 47 23·78 | — 1·28 | | | | | | |
| | L | | | | | | | 99 54 | 83 57·28 | 82 53·14 | 6 10 39·00 | 37·45 | 47 1·38 | — 3·51 | | | | | | |
| | L | | | | | | | 102 22 | 86 25·23 | 85 21·49 | 6 47 44·25 | 45·30 | 46 55·62 | — 1·42 | | | | | | |
| Oct. 6th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 43·35 | E. ° ′ ″ 47 42·10 | h. m. s. 1 1 42·82 | h. m. s. 5 56 27·72 | h. m. s. 19 5 15·10 | h. m. s. 58 28 | h. m. s. 42 16·43 | h. m. s. 43 3·71 | ° ′ ″ 5 32 51·75 | ″ 30·21 | ′ ″ 47 11·22 | ″ + 0·67 | ″ π + 0° 0′ | F.R. 6 ..... F.L. 6 | h. m. s. 23 48 8·57 | h. m. s. 0 4 12·6 | m. s. 0 16 3·93 | s. 32·03 |
| | R | | | | | | | 61 0 | 44 48·37 | 45 36·08 | 4 54 46·20 | 23·70 | 47 17·82 | + 0·58 | | | | | | |
| | L | | | | | | | 68 18 | 52 6·22 | 52 55·12 | 3 5 0·60 | 9·34 | 47 36·12 | — 3·36 | | | | | | |
| | L | | | | | | | 70 34 | 54 22·17 | 55 11·44 | 2 30 55·80 | 6·22 | 47 38·90 | — 3·02 | | | | | | |
| | R | | | | | | | 79 15 | 63 2·98 | 63 53·68 | 0 20 22·20 | 0·11 | 47 39·68 | + 2·31 | | | | | | |
| | R | | | | | | | 81 23 | 65 10·93 | 66 1·98 | 0 11 42·30 | 0·04 | 47 41·30 | + 0·76 | | | | | | |
| | L | | | | | | | 88 2 | 71 49·79 | 72 41·93 | 1 51 41·55 | 3·41 | 47 42·04 | — 3·35 | | | | | | |
| | L | | | | | | | 91 3 | 74 50·73 | 75 43·36 | 2 37 3·00 | 6·75 | 47 36·56 | — 1·21 | | | | | | |
| | R | | | | | | | 98 49 | 82 36·56 | 83 30·47 | 4 33 49·65 | 20·51 | 47 20·76 | + 0·83 | | | | | | |
| | R | | | | | | | 101 1 | 84 48·51 | 85 42·78 | 5 6 54·30 | 25·76 | 47 13·96 | + 2·38 | | | | | | |
| | L | | | | | | | 109 46 | 93 33·32 | 94 29·03 | 7 18 28·05 | 52·57 | 46 52·74 | — 3·21 | | | | | | |
| | L | | | | | | | 112 14 | 96 1·27 | 96 57·38 | 7 55 33·30 | 61·84 | 46 42·30 | — 2·04 | | | | | | |
| Oct. 6th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 43·17 | W. ° ′ ″ 47 41·89 | h. m. s. 1 1 42·87 | h. m. s. 5 56 27·72 | h. m. s. 6 58 10·59 | h. m. s. 42 35 | h. m. s. 26 8·24 | h. m. s. 28 51·15 | ° ′ ″ 7 19 52·50 | ″ 52·91 | ′ ″ 46 51·66 | ″ + 2·68 | ″ π + 0° 0′ | F.R. 6 ..... F.L. 6 | h. m. s. 23 48 8·57 | h. m. s. 0 4 12·5 | m. s. 0 16 3·93 | s. 32·03 |
| | R | | | | | | | 45 52 | 29 25·17 | 32 8·62 | 6 30 30·45 | 41·70 | 47 0·84 | + 0·65 | | | | | | |
| | L | | | | | | | 53 39 | 37 12·00 | 39 56·73 | 4 33 28·80 | 20·45 | 47 19·56 | — 1·88 | | | | | | |
| | L | | | | | | | 56 18 | 39 50·94 | 42 36·11 | 3 53 38·10 | 14·93 | 47 26·48 | — 0·48 | | | | | | |
| | R | | | | | | | 64 46 | 48 18·76 | 51 5·32 | 1 46 19·95 | 3·09 | 47 42·42 | + 3·62 | | | | | | |
| | R | | | | | | | 67 44 | 51 16·70 | 54 3·74 | 1 1 43·65 | 1·04 | 47 44·32 | + 3·47 | | | | | | |
| | L | | | | | | | 75 39 | 59 11·52 | 61 59·87 | 0 57 18·30 | 0·90 | 47 36·98 | — 4·01 | | | | | | |
| | L | | | | | | | 78 27 | 61 59·46 | 64 48·27 | 1 39 24·30 | 2·70 | 47 37·82 | — 1·37 | | | | | | |
| | R | | | | | | | 85 50 | 69 22·31 | 72 12·32 | 3 30 25·05 | 12·09 | 47 35·32 | + 5·52 | | | | | | |
| | R | | | | | | | 87 41 | 71 13·27 | 74 3·58 | 3 58 13·95 | 15·49 | 47 32·46 | + 6·06 | | | | | | |
| | L | | | | | | | 95 18 | 78 50·10 | 81 41·67 | 5 52 45·30 | 33·92 | 47 5·40 | — 2·57 | | | | | | |
| | L | | | | | | | 97 14 | 80 46·06 | 83 37·95 | 6 21 49·50 | 39·73 | 46 59·44 | — 2·72 | | | | | | |

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G. T. Station Kaliana Eastern Pillar Lat. 29° 30′ 49″ Long. 77° 41′ 51″·99 In time 5ᵐ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. M.S. Time. | ⊙'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 7th 27° & 207° | L | α Ursæ Minoris | ° ′ ″ 1 33 42·97 | ° ′ ″ E. 1 47 41·67 | h. m. s. 1 1 42·89 | h. m. s. 5 56 27·73 | h. m. s. 19 5 15·16 | h. m. s. 51 50 | h. m. s. 35 7·01 | h. m. s. 39 49·67 | ° ′ ″ 6 21 23·25 | ″ 39·64 | ° ′ ″ 47 4·84 | π + 0° 0′ — 2·81 | π + (0° 0′) { L — 3·667 R + 1·448 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 47 51·5 | h. m. s. 0 4 26·5 | h. m. s. 0 16 35·0 | s. 31·07 |
| | L | | | | | | | 55 2 | 38 18·93 | 43 2·12 | 5 33 16·50 | 30·28 | 47 15·24 | — 3·85 | | | | | | |
| | R | | | | | | | 64 4 | 47 20·73 | 52 5·40 | 3 17 27·30 | 10·64 | 47 30·64 | + 0·39 | | | | | | |
| | R | | | | | | | 66 24 | 49 40·67 | 54 25·73 | 2 42 22·35 | 7·20 | 47 34·94 | — 0·47 | | | | | | |
| | L | | | | | | | 75 39 | 58 55·46 | 63 42·03 | 0 23 17·85 | 0·15 | 47 44·88 | — 3·36 | | | | | | |
| | L | | | | | | | 78 16 | 61 32·40 | 66 19·40 | 0 16 2·70 | 0·07 | 47 46·36 | — 4·76 | | | | | | |
| | R | | | | | | | 88 36 | 71 52·16 | 76 40·86 | 2 51 24·60 | 8·03 | 47 30·44 | + 3·20 | | | | | | |
| | R | | | | | | | 91 4 | 74 20·10 | 79 9·21 | 3 28 29·85 | 11·89 | 47 28·16 | + 1·62 | | | | | | |
| | L | | | | | | | 99 2 | 82 17·92 | 87 8·33 | 5 28 16·65 | 29·47 | 47 15·20 | — 3·00 | | | | | | |
| | L | | | | | | | 101 16 | 84 31·87 | 89 22·65 | 6 1 52·35 | 35·81 | 47 10·08 | — 4·22 | | | | | | |
| | R | | | | | | | 110 10 | 93 25·66 | 98 17·90 | 8 15 40·20 | 67·17 | 46 31·32 | + 3·18 | | | | | | |
| | R | | | | | | | 113 26 | 96 41·59 | 101 34·37 | 9 4 48·15 | 81·14 | 46 19·76 | + 0·77 | | | | | | |
| Oct. 7th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·79 | ° ′ ″ W. 1 47 41·46 | h. m. s. 1 1 42·94 | h. m. s. 5 56 27·74 | h. m. s. 6 58 10·68 | h. m. s. 43 53 | h. m. s. 26 53·62 | h. m. s. 33 33·21 | ° ′ ″ 6 9 22·95 | ″ 37·31 | ° ′ ″ 47 0·42 | π + 0° 0′ — 3·73 | π + (0° 0′) − { R 2·518 L 1·757 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 47 51·5 | h. m. s. 0 4 26·5 | h. m. s. 0 16 35·0 | s. 31·07 |
| | R | | | | | | | 47 5 | 30 5·55 | 36 45·66 | 5 21 16·20 | 28·23 | 47 9·60 | — 3·64 | | | | | | |
| | L | | | | | | | 55 38 | 38 38·35 | 45 19·87 | 3 12 43·05 | 10·16 | 47 31·60 | + 0·30 | | | | | | |
| | L | | | | | | | 57 44 | 40 44·30 | 47 26·17 | 2 41 8·55 | 7·10 | 47 32·92 | — 1·44 | | | | | | |
| | R | | | | | | | 66 9 | 49 9·11 | 55 52·35 | 0 34 35·85 | 0·33 | 47 39·34 | — 1·79 | | | | | | |
| | R | | | | | | | 68 47 | 51 47·05 | 58 30·73 | 0 4 59·85 | 0·01 | 47 39·02 | — 2·43 | | | | | | |
| | L | | | | | | | 76 19 | 59 18·88 | 66 3·79 | 1 58 15·75 | 3·82 | 47 34·50 | — 3·14 | | | | | | |
| | L | | | | | | | 78 33 | 61 32·83 | 68 18·11 | 2 31 50·55 | 6·29 | 47 34·04 | — 1·13 | | | | | | |
| | R | | | | | | | 88 5 | 71 4·61 | 77 51·45 | 4 55 10·65 | 23·76 | 47 16·56 | — 1·14 | | | | | | |
| | R | | | | | | | 89 49 | 72 48·57 | 79 35·70 | 5 21 14·40 | 28·14 | 47 10·94 | — 2·38 | | | | | | |
| | L | | | | | | | 97 43 | 80 42·38 | 87 30·81 | 7 20 1·05 | 52·74 | 46 44·28 | — 4·44 | | | | | | |
| | L | | | | | | | 99 38 | 82 37·34 | 89 26·08 | 7 48 50·10 | 59·85 | 46 40·92 | — 0·69 | | | | | | |
| Oct. 8th 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 42·57 | ° ′ ″ E. 1 47 41·21 | h. m. s. 1 1 42·95 | h. m. s. 5 56 27·75 | h. m. s. 19 5 15·20 | h. m. s. 48 47 | h. m. s. 31 30·75 | h. m. s. 40 9·37 | ° ′ ″ 6 16 28·35 | ″ 38·62 | ° ′ ″ 47 0·46 | π + 0° 0′ + 2·13 | π + (0° 0′) + { L 0·047 R 0·613 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 47 34·86 | h. m. s. 0 4 43·0 | h. m. s. 0 17 8·14 | s. 33·1 |
| | L | | | | | | | 51 3 | 33 46·70 | 42 25·69 | 5 42 23·55 | 31·96 | 47 11·22 | — 1·97 | | | | | | |
| | R | | | | | | | 57 53 | 40 36·54 | 49 16·65 | 3 59 39·15 | 15·67 | 47 23·42 | + 2·12 | | | | | | |
| | R | | | | | | | 59 48 | 42 31·49 | 51 11·92 | 3 30 50·10 | 12·13 | 47 28·00 | + 1·08 | | | | | | |
| | L | | | | | | | 66 23 | 49 6·34 | 57 47·85 | 1 51 51·15 | 3·42 | 47 37·42 | + 0·37 | | | | | | |
| | L | | | | | | | 68 31 | 51 14·29 | 59 56·15 | 1 19 46·65 | 1·74 | 47 39·66 | — 0·19 | | | | | | |
| | R | | | | | | | 75 2 | 57 45·13 | 66 28·07 | 0 18 12·15 | 0·09 | 47 40·28 | + 0·84 | | | | | | |
| | R | | | | | | | 77 2 | 59 45·09 | 68 28·34 | 0 48 16·20 | 0·64 | 47 42·76 | — 2·19 | | | | | | |
| | L | | | | | | | 84 31 | 67 13·91 | 75 58·40 | 2 40 47·10 | 7·07 | 47 33·70 | + 0·44 | | | | | | |
| | L | | | | | | | 87 58 | 70 40·83 | 79 25·88 | 3 32 39·30 | 12·37 | 47 29·34 | — 0·50 | | | | | | |
| | R | | | | | | | 96 10 | 78 52·64 | 87 39·04 | 5 35 56·70 | 30·86 | 47 9·54 | + 0·81 | | | | | | |
| | R | | | | | | | 98 47 | 81 29·57 | 90 16·40 | 6 15 17·10 | 38·51 | 47 1·68 | + 1·02 | | | | | | |
| Oct. 8th 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 42·39 | ° ′ ″ W. 1 47 41·00 | h. m. s. 1 1 43·00 | h. m. s. 5 56 27·75 | h. m. s. 6 58 10·75 | h. m. s. 35 53 | h. m. s. 18 20·09 | h. m. s. 28 54·82 | ° ′ ″ 7 18 59·85 | ″ 52·69 | ° ′ ″ 46 49·48 | π + 0° 0′ + 1·17 | π + (0° 0′) { L — 0·862 R + 1·220 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 47 34·86 | h. m. s. 0 4 43·0 | h. m. s. 0 17 8·14 | s. 33·14 |
| | L | | | | | | | 39 45 | 22 12·00 | 32 47·37 | 6 20 51·60 | 39·66 | 47 0·66 | — 0·68 | | | | | | |
| | R | | | | | | | 48 30 | 30 56·79 | 41 33·60 | 4 9 18·15 | 16·99 | 47 25·70 | + 1·69 | | | | | | |
| | R | | | | | | | 51 9 | 33 35·73 | 44 12·97 | 3 29 27·60 | 12·00 | 47 31·40 | + 2·40 | | | | | | |
| | L | | | | | | | 59 14 | 41 40·54 | 52 19·11 | 1 27 55·50 | 2·11 | 47 36·64 | — 2·25 | | | | | | |
| | L | | | | | | | 61 20 | 43 46·49 | 54 25·40 | 0 56 21·15 | 0·87 | 47 40·38 | + 0·25 | | | | | | |
| | R | | | | | | | 68 58 | 51 24·31 | 62 4·47 | 0 58 24·90 | 0·93 | 47 39·54 | — 0·53 | | | | | | |
| | R | | | | | | | 71 21 | 53 47·25 | 64 27·81 | 1 34 15·00 | 2·43 | 47 39·60 | + 1·03 | | | | | | |
| | L | | | | | | | 79 41 | 62 7·06 | 72 48·98 | 3 39 32·55 | 13·15 | 47 26·82 | — 1·03 | | | | | | |
| | L | | | | | | | 82 34 | 64 59·99 | 75 42·39 | 4 22 53·70 | 18·85 | 47 19·52 | — 2·63 | | | | | | |
| | R | | | | | | | 92 59 | 75 24·74 | 86 8·85 | 6 59 30·60 | 47·94 | 46 54·72 | + 1·65 | | | | | | |
| | R | | | | | | | 95 12 | 77 37·69 | 88 22·16 | 7 32 50·25 | 55·84 | 46 46·24 | + 1·08 | | | | | | |



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G. T. Station Kaliana Western Pillar Lat. 29° 30′ 47″ Long. 77° 41′ 52″ In time 5ˢ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | ∂ P | ∂ Z | | | | | M.S. Time. | Chronom. Time. | Error. | Rate. |
| Oct. 6th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 33 43·35 | E. 1° 47′ 42″·10 | h. m. s. 1 1 42·82 | h. m. s. 5 56 27·72 | h. m. s. 19 5 15·10 | h. m. s. 51 14 | h. m. s. 48 39·66 | h. m. s. 49 27·10 | ° ′ ″ 3 56 46·52 | ″ 15·30 | ° ′ ″ 47 24·14 | π + 0° 0′ + 2″·66 | π+(° ′)−{ R 0″·263 / L 3·998 } | F.R. 4 ..... F.L. 4 | h. m. s. 23 48 8·57 | h. m. s. 23 50 31·50 | m. s. 2 22·93 | s. 45·57 |
| | R | | | | | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | | | | | |
| | L | | | | | | | 67 22 | 64 47·15 | 65 38·14 | 0 5 45·60 | 0·01 | 47 45·38 | − 3·29 | | | | | | |
| | R | | | | | | | 76 22 | 73 46·86 | 74 39·33 | 2 21 3·45 | 5·44 | 47 38·54 | − 1·88 | | | | | | |
| | R | | | | | | | 79 9 | 76 33·78 | 77 26·70 | 3 2 54·00 | 9·15 | 47 36·32 | − 3·37 | | | | | | |
| | L | | | | | | | 87 33 | 84 57·51 | 85 51·81 | 5 9 10·65 | 26·14 | 47 20·52 | − 4·56 | | | | | | |
| | L | | | | | | | 90 33 | 87 57·42 | 88 52·21 | 5 54 16·65 | 34·32 | 47 9·34 | − 1·56 | | | | | | |
| Oct. 6th 0° & 180° | R | α Ursæ Minoris | ° ′ ″ 1 33 43·17 | W. 1° 47′ 41″·89 | h. m. s. 1 1 42·87 | h. m. s. 5 56 27·72 | h. m. s. 6 58 10·59 | h. m. s. 28 28 | h. m. s. 25 31·60 | h. m. s. 28 14·42 | ° ′ ″ 7 29 2·58 | ″ 55·13 | ° ′ ″ 46 50·40 | π + 0° 0′ + 3″·64 | π+(° ′){ R + 2″·513 / L − 2·103 } | F.R. 6 ..... F.L. 4 | h. m. s. 23 48 8·57 | h. m. s. 23 50 31·50 | m. s. 2 22·93 | s. 45·57 |
| | R | | | | | | | 32 14 | 29 17·48 | 32 0·92 | 6 32 25·05 | 42·11 | 47 0·44 | + 0·66 | | | | | | |
| | L | | | | | | | 40 23 | 37 26·23 | 40 11·00 | 4 29 53·85 | 19·92 | 47 20·78 | − 1·19 | | | | | | |
| | L | | | | | | | 43 23 | 40 26·13 | 43 11·40 | 3 44 47·93 | 13·82 | 47 24·46 | − 3·61 | | | | | | |
| | R | | | | | | | 51 40 | 48 42·87 | 51 29·49 | 1 40 16·50 | 2·75 | 47 38·88 | − 0·26 | | | | | | |
| | R | | | | | | | 54 47 | 51 49·77 | 54 36·91 | 0 53 25·20 | 0·78 | 47 43·20 | + 2·09 | | | | | | |
| | L | | | | | | | 65 16 | 62 18·44 | 65 7·30 | 1 44 10·65 | 2·96 | 47 35·98 | − 2·95 | | | | | | |
| | L | | | | | | | 67 38 | 64 40·36 | 67 29·61 | 2 19 45·30 | 5·33 | 47 35·90 | − 0·66 | | | | | | |
| | R | | | | | | | 76 16 | 73 18·09 | 76 8·75 | 4 29 32·40 | 19·82 | 47 26·64 | + 4·57 | | | | | | |
| | R | | | | | | | 78 26 | 75 28·02 | 78 19·04 | 5 2 6·75 | 24·89 | 47 21·38 | + 4·38 | | | | | | |
| Oct. 7th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·79 | W. 1° 47′ 41″·46 | h. m. s. 1 1 42·94 | h. m. s. 5 56 27·74 | h. m. s. 6 58 10·68 | h. m. s. 28 35 | h. m. s. 24 52·63 | h. m. s. 31 31·89 | ° ′ ″ 6 39 41·93 | ″ 43·68 | ° ′ ″ 46 59·16 | π + 0° 0′ + 1″·38 | π+(° ′){ R + 2″·360 / L − 1·020 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 47 51·50 | h. m. s. 23 51 0·10 | m. s. 3 8·50 | s. 46·14 |
| | R | | | | | | | 31 44 | 28 1·52 | 34 41·30 | 5 52 20·69 | 33·94 | 47 7·98 | + 0·46 | | | | | | |
| | L | | | | | | | 40 48 | 37 5·23 | 43 46·50 | 3 36 2·70 | 12·76 | 47 25·80 | − 2·90 | | | | | | |
| | L | | | | | | | 43 6 | 39 23·16 | 46 4·80 | 3 1 28·16 | 9·00 | 47 27·94 | − 4·52 | | | | | | |
| | R | | | | | | | 51 18 | 47 34·90 | 54 17·89 | 0 58 11·90 | 0·93 | 47 43·06 | + 2·53 | | | | | | |
| | R | | | | | | | 53 31 | 49 47·83 | 56 31·18 | 0 24 52·50 | 0·17 | 47 43·00 | + 1·71 | | | | | | |
| | L | | | | | | | 60 27 | 56 43·60 | 63 28·10 | 1 19 21·24 | 1·72 | 47 40·80 | + 1·06 | | | | | | |
| | L | | | | | | | 62 47 | 59 3·53 | 65 48·41 | 1 54 25·88 | 3·58 | 47 39·12 | + 1·24 | | | | | | |
| | R | | | | | | | 71 7 | 67 23·26 | 74 9·51 | 3 59 42·39 | 15·68 | 47 29·68 | + 3·90 | | | | | | |
| | R | | | | | | | 72 59 | 69 15·20 | 76 1·75 | 4 27 46·10 | 19·56 | 47 26·08 | + 4·18 | | | | | | |
| | L | | | | | | | 79 28 | 75 44·00 | 82 31·61 | 6 5 13·95 | 36·36 | 47 4·88 | − 0·22 | | | | | | |
| | L | | | | | | | 81 18 | 77 33·94 | 84 21·85 | 6 32 47·58 | 42·04 | 46 58·66 | − 0·76 | | | | | | |
| Oct. 8th 9° & 189° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·57 | E. 1° 47′ 41″·21 | h. m. s. 1 1 42·95 | h. m. s. 5 56 27·75 | h. m. s. 19 5 15·20 | h. m. s. 33 33 | h. m. s. 29 27·57 | h. m. s. 38 5·86 | ° ′ ″ 6 47 20·18 | ″ 45·20 | ° ′ ″ 46 55·42 | π + 0° 0′ + 0″·59 | π+(° ′){ R + 2″·590 / L − 1·012 } | F.R. 6 ..... F.L. 6 | h. m. s. 23 47 34·86 | h. m. s. 23 51 29·50 | m. s. 3 54·64 | s. 45·44 |
| | R | | | | | | | 36 7 | 32 1·49 | 40 40·20 | 6 8 45·06 | 37·06 | 47 0·98 | + 3·17 | | | | | | |
| | L | | | | | | | 42 45 | 38 39·28 | 47 19·08 | 4 29 1·88 | 19·74 | 47 24·64 | − 3·17 | | | | | | |
| | L | | | | | | | 44 47 | 40 41·22 | 49 21·35 | 3 58 27·81 | 15·52 | 47 27·82 | − 2·13 | | | | | | |
| | R | | | | | | | 51 57 | 47 50·99 | 56 32·30 | 2 10 43·56 | 4·67 | 47 32·22 | + 4·32 | | | | | | |
| | R | | | | | | | 53 52 | 49 45·93 | 58 27·55 | 1 41 54·75 | 2·84 | 47 33·78 | + 4·59 | | | | | | |
| | L | | | | | | | 60 25 | 56 18·72 | 65 1·42 | 0 3 26·72 | 0·00 | 47 40·88 | + 0·33 | | | | | | |
| | L | | | | | | | 62 20 | 58 13·66 | 66 56·67 | 0 25 22·10 | 0·18 | 47 42·28 | − 1·25 | | | | | | |
| | R | | | | | | | 70 15 | 66 8·41 | 74 52·72 | 2 24 22·85 | 5·70 | 47 33·36 | + 2·15 | | | | | | |
| | R | | | | | | | 72 6 | 67 59·35 | 76 43·97 | 2 52 11·52 | 8·11 | 47 32·38 | + 0·72 | | | | | | |
| | L | | | | | | | 78 35 | 74 28·15 | 83 13·83 | 4 29 39·42 | 19·88 | 47 19·04 | + 2·29 | | | | | | |
| | L | | | | | | | 80 35 | 76 28·09 | 85 14·09 | 4 59 43·41 | 24·57 | 47 18·78 | − 2·14 | | | | | | |

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G. T. Station Kaliana Western Pillar Lat. 29° 30′ 47″ Long. 77° 41′ 52″ In time 5ˢ·180. A.D. 1836.

| Date and Zero. | Face. | Star Observed. | Computed Terms. | | | | | Observed Time by Chronometer. | Corresponding Time. | | Computed Space. | | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | ⊙'s Transit. | | Chronom. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✱'s N. P. D. | ✱'s Elongation. | ✱'s A.R. | ✱'s Horary Angle. | ✱'s Sidereal Time of Maximum. | | M. Solar. | Sidereal. | δ P | δ Z | | | | | M.S. Time. | Chronom. Time. | Error. | Rate. |
| Oct. 8th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·39 | ° ′ ″ W. 1 47 41·00 | h. m. s. 1 1 43·00 | h. m. s. 5 56 27·75 | h. m. s. 6 58 10·75 | h. 17+ m. s. 25 43 | h. 17+ m. s. 21 15·11 | h. 6+ m. s. 31 50·32 | ° ′ ″ 6 35 6·47 | ″ 42·68 | ° ′ ″ 46 58·38 | π + 0° 0′ ″ + 0·06 | | | h. m. s. 23 47 34·86 | h. m. s. 23 51 29·50 | m. s. 3 54·64 | s. 45·44 |
| | R | | | | | | | 27 59 | 23 31·03 | 34 6·62 | 6 1 1·95 | 35·64 | 47 5·88 | + 0·52 | | | | | | |
| | L | | | | | | | 36 28 | 31 59·77 | 42 36·75 | 3 53 30·08 | 14·91 | 47 27·20 | + 1·11 | | | | | | |
| | L | | | | | | | 38 49 | 34 20·69 | 44 58·06 | 3 18 10·40 | 10·74 | 47 30·22 | + 0·04 | | | | | | |
| | R | | | | | | | 46 22 | 41 53·45 | 52 32·06 | 1 24 40·38 | 1·96 | 47 40·30 | + 1·26 | | | | | | |
| | R | | | | | | | 48 26 | 43 57·39 | 54 36·33 | 0 53 36·27 | 0·79 | 47 40·82 | + 0·61 | | | | | | |
| | L | | | | | | | 55 17 | 50 48·17 | 61 28·24 | 0 49 22·37 | 0·67 | 47 35·32 | − 5·01 | | | | | | |
| | L | | | | | | | 57 25 | 52 56·11 | 63 36·52 | 1 21 26·61 | 1·81 | 47 36·04 | − 3·15 | | | | | | |
| | R | | | | | | | 76 39 | 72 9·50 | 82 53·08 | 6 10 34·88 | 37·42 | 47 0·72 | − 2·86 | | | | | | |
| | R | | | | | | | 78 27 | 73 57·44 | 84 41·31 | 6 37 38·46 | 43·08 | 46 55·26 | − 2·66 | | | | | | |
| | L | | | | | | | 86 5 | 81 35·20 | 92 20·33 | 8 32 23·66 | 71·44 | 46 31·02 | + 1·46 | | | | | | |
| | L | | | | | | | 87 52 | 83 22·14 | 94 7·56 | 8 59 12·20 | 79·09 | 46 19·58 | − 2·33 | | | | | | |
| Oct. 9th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·21 | ° ′ ″ E. 1 47 40·75 | h. m. s. 1 1 43·03 | h. m. s. 5 56 27·77 | h. m. s. 19 5 15·26 | h. 5+ m. s. 30 45 | h. 5+ m. s. 25 54·01 | h. 18+ m. s. 38 28·25 | ° ′ ″ 6 41 45·17 | ″ 43·98 | ° ′ ″ 46 58·00 | π + 0° 0′ ″ − 1·23 | | | h. m. s. 23 47 18·67 | h. m. s. 23 51 58·75 | m. s. 4 40·08 | s. 46·40 |
| | R | | | | | | | 32 32 | 27 40·95 | 40 15·48 | 6 14 56·70 | 38·31 | 46 59·62 | + 2·82 | | | | | | |
| | L | | | | | | | 38 39 | 33 47·75 | 46 23·29 | 4 42 59·55 | 21·84 | 47 19·12 | + 0·21 | | | | | | |
| | L | | | | | | | 40 10 | 35 18·70 | 47 54·49 | 4 20 11·55 | 18·47 | 47 24·44 | − 2·16 | | | | | | |
| | R | | | | | | | 44 57 | 40 5·55 | 52 42·12 | 3 8 17·07 | 9·68 | 47 26·94 | + 4·13 | | | | | | |
| | R | | | | | | | 46 26 | 41 34·50 | 54 11·32 | 2 45 59·10 | 7·52 | 47 32·70 | + 0·53 | | | | | | |
| | L | | | | | | | 51 39 | 46 47·34 | 59 25·01 | 1 27 33·75 | 2·09 | 47 41·84 | − 3·18 | | | | | | |
| | L | | | | | | | 54 19 | 49 27·25 | 62 5·36 | 0 47 28·50 | 0·62 | 47 41·48 | − 1·35 | | | | | | |
| | R | | | | | | | 60 45 | 55 53·04 | 68 32·21 | 0 49 14·25 | 0·66 | 47 41·32 | − 1·23 | | | | | | |
| | R | | | | | | | 62 40·5 | 57 48·48 | 70 27·96 | 1 18 10·50 | 1·67 | 47 35·94 | − 3·14 | | | | | | |
| | L | | | | | | | 67 58 | 63 5·81 | 75 46·16 | 2 37 43·50 | 6·80 | 47 31·70 | + 2·25 | | | | | | |
| | L | | | | | | | 69 37 | 64 44·76 | 77 25·38 | 3 2 31·80 | 9·11 | 47 31·74 | + 0·10 | | | | | | |
| | L | | | | | | | 74 50 | 69 57·59 | 82 39·07 | 4 20 57·15 | 18·62 | 47 23·00 | − 0·87 | | | | | | |
| | R | | | | | | | 79 10 | 74 17·45 | 86 59·64 | 5 26 5·70 | 29·08 | 47 12·04 | − 0·37 | | | | | | |
| | R | | | | | | | 82 39 | 77 46·34 | 90 29·10 | 6 18 27·60 | 39·17 | 46 59·86 | + 1·72 | | | | | | |
| | R | | | | | | | 85 39 | 80 46·24 | 93 29·49 | 7 3 33·45 | 49·05 | 46 55·04 | − 3·34 | | | | | | |
| Oct. 9th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 42·01 | ° ′ ″ W. 1 47 40·53 | h. m. s. 1 1 43·05 | h. m. s. 5 56 27·77 | h. m. s. 6 58 10·82 | h. 17+ m. s. 18 39 | h. 17+ m. s. 13 25·21 | h. 6+ m. s. 27 55·67 | ° ′ ″ 7 33 47·25 | ″ 56·30 | ° ′ ″ 46 46·06 | π + 0° 0′ ″ + 1·83 | | | h. m. s. 23 47 18·67 | h. m. s. 23 51 58·75 | m. s. 4 40·08 | s. 46·40 |
| | R | | | | | | | 20 43 | 15 29·14 | 29 59·95 | 7 2 43·11 | 48·86 | 46 53·38 | + 1·71 | | | | | | |
| | L | | | | | | | 27 41 | 22 26·91 | 36 58·87 | 5 17 59·31 | 27·65 | 47 13·80 | + 0·92 | | | | | | |
| | L | | | | | | | 29 9 | 23 54·87 | 38 27·06 | 4 55 56·46 | 23·95 | 47 17·76 | + 1·18 | | | | | | |
| | R | | | | | | | 35 44 | 30 29·66 | 45 2·93 | 3 16 58·41 | 10·61 | 47 31·20 | + 1·28 | | | | | | |
| | R | | | | | | | 37 26 | 32 11·60 | 46 45·15 | 2 51 25·11 | 8·04 | 47 33·38 | + 0·89 | | | | | | |
| | L | | | | | | | 42 59 | 37 44·42 | 52 18·89 | 1 27 59·01 | 2·12 | 47 37·36 | − 1·05 | | | | | | |
| | L | | | | | | | 44 41 | 39 26·37 | 54 1·11 | 1 2 25·71 | 1·07 | 47 37·04 | − 2·42 | | | | | | |
| | R | | | | | | | 50 45 | 45 30·17 | 60 5·91 | 0 28 46·29 | 0·23 | 47 42·56 | + 2·26 | | | | | | |
| | R | | | | | | | 52 27 | 47 12·12 | 61 48·13 | 0 54 19·59 | 0·81 | 47 40·62 | + 0·90 | | | | | | |
| | L | | | | | | | 57 46 | 52 30·95 | 67 7·84 | 2 14 15·24 | 4·92 | 47 35·56 | + 0·05 | | | | | | |
| | L | | | | | | | 59 57 | 54 41·88 | 69 19·12 | 2 47 4·44 | 7·62 | 47 33·82 | + 0·91 | | | | | | |
| | R | | | | | | | 66 5 | 60 49·68 | 75 27·93 | 4 19 16·59 | 18·34 | 47 22·04 | − 0·15 | | | | | | |
| | R | | | | | | | 67 23 | 62 7·64 | 76 46·11 | 4 38 49·29 | 21·21 | 47 17·02 | − 2·30 | | | | | | |
| | L | | | | | | | 73 40 | 68 24·43 | 83 3·93 | 6 13 16·59 | 37·97 | 47 0·56 | − 2·00 | | | | | | |
| | L | | | | | | | 75 1 | 69 45·39 | 84 25·11 | 6 33 34·29 | 42·20 | 46 58·90 | + 0·57 | | | | | | |
| Oct. 10th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 41·81 | ° ′ ″ E. 1 47 40·29 | h. m. s. 1 1 43·08 | h. m. s. 5 56 27·78 | h. m. s. 19 5 15·30 | h. 5+ m. s. 30 47 | h. 5+ m. s. 25 9·62 | h. 18+ m. s. 41 40·29 | ° ′ ″ 5 53 45·08 | ″ 34·11 | ° ′ ″ 47 7·54 | π + 0° 0′ ″ − 1·36 | | | h. m. s. 23 47 2·92 | h. m. s. 23 52 29·40 | m. s. 5 26·48 | s. 46·40 |
| | R | | | | | | | 39 15 | 33 37·35 | 50 9·41 | 3 46 28·28 | 13·99 | 47 25·56 | + 0·74 | | | | | | |
| | L | | | | | | | 43 12 | 37 34·22 | 54 6·93 | 2 47 5·48 | 7·62 | 47 33·26 | + 0·59 | | | | | | |
| | L | | | | | | | 44 45 | 39 7·17 | 55 40·14 | 2 23 47·33 | 5·65 | 47 34·48 | + 0·16 | | | | | | |
| | R | | | | | | | 49 51 | 44 13·01 | 60 46·81 | 1 7 7·28 | 1·23 | 47 35·92 | + 3·14 | | | | | | |
| | R | | | | | | | 51 9 | 45 30·97 | 62 4·98 | 0 47 34·73 | 0·62 | 47 37·74 | + 1·93 | | | | | | |
| | L | | | | | | | 55 59 | 50 20·81 | 66 55·62 | 0 25 4·88 | 0·17 | 47 38·46 | + 1·66 | | | | | | |
| | L | | | | | | | 57 31 | 51 52·76 | 68 27·82 | 0 48 7·88 | 0·63 | 47 39·72 | − 0·06 | | | | | | |
| | R | | | | | | | 63 10 | 57 31·58 | 74 7·57 | 2 13 4·13 | 4·84 | 47 38·42 | + 2·97 | | | | | | |
| | R | | | | | | | 64 27 | 58 48·54 | 75 24·74 | 2 32 21·68 | 6·35 | 47 31·54 | + 2·40 | | | | | | |
| | L | | | | | | | 70 0 | 64 21·36 | 80 58·47 | 3 55 47·63 | 15·20 | 47 25·50 | − 0·41 | | | | | | |
| | L | | | | | | | 71 23 | 65 44·32 | 82 21·65 | 4 16 35·33 | 18·00 | 47 21·42 | + 0·87 | | | | | | |

F.R. 6 ..... F.L. 6 — π + (0° 0′) − { R 0″·512 / L 1·327 }

F.L. 8 ..... F.R. 8 — π + (0° 0′) { R + 0″·818 / L − 0·746 }

F.R. 8 ..... F.L. 8 — π + (0° 0′) { R + 0″·803 / L − 0·243 }

F.R. 6 ..... F.L. 6 — π + (0° 0′) + { R 0″·647 / L 0·272 }

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G. T. Station Banog Lat. 30° 28′ 29″ Long. 78° 3′ 23″ In time 5ᵐ·204. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. δ P | Computed Space. δ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sept. 20th 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 27·84 | W. 1° 48′ 27″·00 | h. m. s. 1 1 53·79 | h. m. s. 5 56 19·94 | h. m. s. 6 58 13·73 | H.18+ M. s. 19 43 | | H.6+ M. s. 3 18·56 | ° ′ ″ 13 43 47·55 | ″ 186·57 | 85°+ ′ ″ 25 22·62 | π−87° 10′ ″ 43·05 | π−(87° 10′)−{L 42″·561 R 27·699} | F.R. 8 ..... F.L. 8 | α² Capricorni | | | |
| | L | | | | | | | 22 38 | | 6 13·97 | 12 59 56·40 | 167·29 | 25 2·80 | 42·51 | | | | | | |
| | R | | | | | | | 32 0 | | 15 37·28 | 10 39 6·75 | 112·41 | 23 53·20 | 27·79 | | | | | | |
| | R | | | | | | | 34 55 | | 18 32·69 | 9 55 15·60 | 97·53 | 23 36·60 | 26·07 | | | | | | |
| | L | | | | | | | 43 25 | | 27 3·88 | 7 47 27·75 | 60·16 | 23 15·30 | 42·14 | | | | | | |
| | L | | | | | | | 45 37 | | 29 16·19 | 7 14 23·10 | 51·96 | 23 6·58 | 41·62 | | | | | | |
| | R | | | | | | | 52 53 | | 36 33·21 | 5 25 7·80 | 29·11 | 22 30·08 | 27·97 | | | | | | |
| | R | | | | | | | 55 0 | | 38 40·50 | 4 53 18·45 | 23·69 | 22 22·12 | 25·43 | | | | | | |
| | L | | | | | | | 62 33 | | 46 14·56 | 2 59 47·55 | 8·90 | 22 23·76 | 41·86 | | | | | | |
| | L | | | | | | | 64 26 | | 48 7·82 | 2 31 28·65 | 6·32 | 22 21·30 | 41·98 | | | | | | |
| | R | | | | | | | 71 46 | | 55 28·85 | 0 41 13·20 | 0·47 | 22 2·78 | 29·31 | | | | | | |
| | R | | | | | | | 73 49 | | 57 32·14 | 0 10 23·85 | 0·03 | 22 0·32 | 27·29 | | | | | | |
| | L | | | | | | | 95 37 | | 79 23·19 | 5 17 21·90 | 27·65 | 22 43·86 | 43·21 | | | | | | |
| | L | | | | | | | 97 31 | | 81 17·46 | 5 45 55·95 | 32·84 | 22 49·96 | 44·12 | | | | | | |
| | R | | | | | | | 105 39 | | 89 26·60 | 7 48 13·05 | 60·10 | 23 2·48 | 29·38 | | | | | | |
| | R | | | | | | | 107 45 | | 91 32·89 | 8 19 47·40 | 68·45 | 23 9·80 | 28·35 | | | | | | |
| Sept. 21st 0° & 180° | L | α Ursæ Minoris | ° ′ ″ 1 33 27·65 | E. 1° 48′ 26″·78 | h. m. s. 1 1 53·92 | h. m. s. 5 56 19·95 | h. m. s. 19 5 33·97 | H.6+ M. s. 49 51 | | H.18+ M. s. 35 11·63 | ° ′ ″ 7 35 35·10 | ″ 56·91 | 88°+ ′ ″ 58 0·38 | π−87° 10′ ″ 30·51 | π−(87° 10′)−{L 29″·877 R 32·565} | F.R. 6 ..... F.L. 6 | | | | | |
| | L | | | | | | | 52 21 | | 37 41·98 | 6 57 59·85 | 47·92 | 58 8·02 | 29·16 | | | | | | |
| | R | | | | | | | 63 17 | | 48 39·51 | 4 13 36·90 | 17·67 | 58 40·00 | 30·89 | | | | | | |
| | R | | | | | | | 65 44 | | 51 6·86 | 3 36 46·65 | 12·91 | 58 44·82 | 30·95 | | | | | | |
| | L | | | | | | | 74 20 | | 59 44·06 | 1 27 28·65 | 2·10 | 58 55·98 | 31·30 | | | | | | |
| | L | | | | | | | 76 41 | | 62 5·39 | 0 52 8·70 | 0·75 | 58 55·86 | 29·83 | | | | | | |
| | R | | | | | | | 86 10 | | 71 35·72 | 1 30 26·25 | 2·25 | 58 57·38 | 32·85 | | | | | | |
| | R | | | | | | | 88 53 | | 74 19·10 | 2 11 16·95 | 4·74 | 58 55·68 | 33·64 | | | | | | |
| | L | | | | | | | 97 50 | | 83 17·35 | 4 25 50·70 | 19·46 | 58 38·60 | 31·28 | | | | | | |
| | L | | | | | | | 101 7 | | 86 34·81 | 5 15 12·60 | 27·36 | 58 26·60 | 27·18 | | | | | | |
| | R | | | | | | | 110 44 | | 96 13·16 | 7 39 47·85 | 58·21 | 58 2·12 | 33·55 | | | | | | |
| | R | | | | | | | 113 31 | | 99 0·55 | 8 21 38·70 | 69·27 | 57 51·02 | 33·51 | | | | | | |
| Sept. 21st 9° & 189° | L | α Ursæ Minoris | ° ′ ″ 1 33 27·46 | W. 1° 48′ 26″·56 | h. m. s. 1 1 54·06 | h. m. s. 5 56 19·96 | h. m. s. 6 58 14·02 | H.18+ M. s. 47 34 | | H.6+ M. s. 34 35·17 | ° ′ ″ 5 54 42·75 | ″ 34·64 | 85°+ ′ ″ 22 40·18 | π−87° 10′ ″ 32·10 | π−(87° 10′)−{L 32″·528 R 33·608} | F.R. 6 ..... F.L. 6 | | | | | |
| | L | | | | | | | 49 18 | | 36 19·41 | 5 28 39·15 | 29·74 | 22 36·12 | 32·94 | | | | | | |
| | R | | | | | | | 56 49 | | 43 51·46 | 3 35 38·40 | 12·80 | 22 21·12 | 34·88 | | | | | | |
| | R | | | | | | | 58 43 | | 45 45·73 | 3 7 4·35 | 9·63 | 22 15·26 | 32·19 | | | | | | |
| | L | | | | | | | 64 53 | | 51 56·59 | 1 34 21·45 | 2·45 | 22 9·00 | 33·11 | | | | | | |
| | L | | | | | | | 66 50 | | 53 53·87 | 1 5 2·25 | 1·16 | 22 7·98 | 33·38 | | | | | | |
| | R | | | | | | | 72 43 | | 59 47·69 | 0 23 25·05 | 0·15 | 22 8·22 | 34·63 | | | | | | |
| | R | | | | | | | 74 34 | | 61 38·95 | 0 51 13·95 | 0·72 | 22 6·80 | 32·64 | | | | | | |
| | L | | | | | | | 80 28 | | 67 33·78 | 2 19 56·40 | 5·38 | 22 11·10 | 32·28 | | | | | | |
| | L | | | | | | | 82 27 | | 69 33·05 | 2 49 45·45 | 7·92 | 22 12·72 | 31·36 | | | | | | |
| | R | | | | | | | 89 52 | | 76 59·09 | 4 41 16·05 | 21·73 | 22 29·94 | 34·77 | | | | | | |
| | R | | | | | | | 91 45 | | 78 52·36 | 5 9 35·10 | 26·32 | 22 32·30 | 32·54 | | | | | | |
| Sept. 22nd 9° & 189° | L | α Ursæ Minoris | ° ′ ″ 1 33 27·27 | E. 1° 48′ 26″·34 | h. m. s. 1 1 54·19 | h. m. s. 5 56 19·96 | h. m. s. 19 5 34·23 | H.6+ M. s. 42 6 | | H.18+ M. s. 30 47·26 | ° ′ ″ 8 41 44·55 | ″ 74·57 | 88°+ ′ ″ 57 47·12 | π−87° 10′ ″ 35·35 | π−(87° 10′)−{L 31″·955 R 33·320} | F.R. 6 ..... F.L. 6 | | | | | |
| | L | | | | | | | 44 45 | | 33 26·63 | 8 1 54·00 | 63·65 | 57 53·90 | 31·21 | | | | | | |
| | R | | | | | | | 52 45 | | 41 27·75 | 6 1 37·20 | 35·89 | 58 23·42 | 32·97 | | | | | | |
| | R | | | | | | | 55 26 | | 44 9·13 | 5 21 16·50 | 28·33 | 58 31·26 | 33·25 | | | | | | |
| | L | | | | | | | 63 49 | | 52 33·30 | 3 15 13·95 | 10·47 | 58 48·84 | 32·97 | | | | | | |
| | L | | | | | | | 66 21 | | 55 5·65 | 2 37 8·70 | 6·79 | 58 49·30 | 29·75 | | | | | | |
| | R | | | | | | | 74 20 | | 63 5·77 | 0 37 6·90 | 0·38 | 58 59·20 | 33·24 | | | | | | |
| | R | | | | | | | 76 58 | | 65 44·14 | 0 2 28·65 | 0·00 | 58 58·94 | 32·60 | | | | | | |
| | L | | | | | | | 85 18 | | 74 5·31 | 2 7 46·20 | 4·49 | 58 54·32 | 32·47 | | | | | | |
| | L | | | | | | | 88 16 | | 77 3·72 | 2 52 22·35 | 8·18 | 58 48·14 | 29·98 | | | | | | |
| | R | | | | | | | 96 5 | | 84 53·82 | 4 49 53·85 | 23·14 | 58 38·80 | 35·60 | | | | | | |
| | R | | | | | | | 98 13 | | 87 2·12 | 5 21 58·35 | 28·54 | 58 30·06 | 32·26 | | | | | | |

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G. T. Station Banog Lat. 30° 28′ 29″ Long. 78° 3′ 23″ In time 5ᵐ·204. A.D. 1837.

| Date and Zero. | Face. | Star Observed. | Computed Terms. *'s N. P. D. | Computed Terms. *'s Elongation. | Computed Terms. *'s A.R. | Computed Terms. *'s Horary Angle. | Computed Terms. *'s Sidereal Time of Maximum. | Observed Time by Chronometer. | Corresponding Time. M. Solar. | Corresponding Time. Sidereal. | Computed Space. ∂ P | Computed Space. ∂ Z | Observed Angle. Star and Lamp. | Corresponding Azimuth of Lamp. One Observation. | Mean at each Zero. | No. of Observs. at each Zero. | *'s Transit. A.R. | *'s Transit. Chronom. Time. | Chronom. Error. | Chronom. Rate. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sept. 25th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 25·93 | ° ′ ″ W. 1 48 24·79 | h. m. s. 1 1 54·04 | h. m. s. 5 56 20·02 | h. m. s. 6 58 15·06 | h. m. s. 40 15 | | h. m. s. 39 11·51 | ° ′ ″ 6 35 51·00 | ″ 42·99 | ° ′ ″ 88°+ 58 12·90 | π−87° 10′ ″ 30·88 | | | | | | |
| | R | | | | | | | 42 22 | | 41 18·81 | 6 4 1·50 | 36·36 | 58 20·18 | 31·53 | | | | | | |
| | L | | | | | | | 51 10 | | 50 8·07 | 3 51 42·60 | 14·75 | 58 46·28 | 36·02 | | | | | | |
| | L | | | | | | | 53 19 | | 52 17·37 | 3 19 23·10 | 10·93 | 58 45·84 | 31·76 | | | | | | |
| | R | | | | | | | 63 9 | | 62 8·78 | 0 51 31·95 | 0·73 | 58 54·92 | 30·64 | | | | | | |
| | R | | | | | | | 64 56 | | 63 56·03 | 0 24 43·20 | 0·17 | 58 58·32 | 33·48 | | | | | | |
| | L | | | | | | | 74 29 | | 73 30·39 | 1 58 52·20 | 3·89 | 58 53·46 | 32·34 | | | | | | |
| | L | | | | | | | 77 12 | | 76 13·78 | 2 39 43·05 | 7·02 | 58 49·62 | 31·63 | | | | | | |
| | R | | | | | | | 87 43 | | 86 46·28 | 5 17 50·55 | 27·81 | 58 28·34 | 31·14 | | | | | | |
| | R | | | | | | | 89 45 | | 88 48·57 | 5 48 24·90 | 33·42 | 58 22·18 | 30·59 | | | | | | |
| | L | | | | | | | 97 27 | | 96 31·67 | 7 44 11·40 | 59·32 | 57 59·86 | 34·17 | | | | | | |
| | L | | | | | | | 99 56 | | 99 1·02 | 8 21 31·65 | 69·24 | 57 46·76 | 30·99 | | | | | | |
| Sept. 25th 27° & 207° | R | α Ursæ Minoris | ° ′ ″ 1 33 25·93 | ° ′ ″ W. 1 48 24·79 | h. m. s. 1 1 55·04 | h. m. s. 5 56 20·02 | h. m. s. 6 58 15·06 | h. m. s. 48 42 | | h. m. s. 49 22·30 | ° ′ ″ 2 13 11·40 | ″ 4·88 | ° ′ ″ 85°+ 22 13·16 | π−87° 10′ ″ 33·07 | | | | | | |
| | R | | | | | | | 51 47 | | 52 27·73 | 1 26 49·95 | 2·08 | 22 12·24 | 34·95 | | | | | | |
| | L | | | | | | | 60 5 | | 60 46·92 | 0 37 57·90 | 0·40 | 22 11·08 | 35·47 | | | | | | |
| | L | | | | | | | 63 8 | | 63 50·35 | 1 23 49·35 | 1·93 | 22 11·90 | 34·76 | | | | | | |
| | R | | | | | | | 70 2 | | 70 45·33 | 3 7 34·05 | 9·67 | 22 20·40 | 35·52 | | | | | | |
| | R | | | | | | | 73 39 | | 74 22·85 | 4 1 56·85 | 16·08 | 22 26·18 | 34·89 | | | | | | |
| | L | | | | | | | 80 32 | | 81 16·83 | 5 45 26·55 | 32·75 | 22 43·78 | 35·82 | | | | | | |
| | L | | | | | | | 82 28 | | 83 13·11 | 6 14 30·75 | 38·48 | 22 48·98 | 35·29 | | | | | | |
| | R | | | | | | | 88 39 | | 89 24·99 | 7 47 28·95 | 59·90 | 23 10·10 | 34·99 | | | | | | |
| | R | | | | | | | 90 23 | | 91 9·23 | 8 13 32·55 | 66·75 | 23 15·06 | 33·10 | | | | | | |
| | L | | | | | | | 96 48 | | 97 35·15 | 9 50 1·35 | 95·28 | 23 45·20 | 34·71 | | | | | | |
| | L | | | | | | | 98 35 | | 99 22·40 | 10 16 50·10 | 104·10 | 23 52·06 | 32·75 | | | | | | |
| Sept. 26th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 25·74 | ° ′ ″ W. 1 48 24·57 | h. m. s. 1 1 55·14 | h. m. s. 5 56 20·02 | h. m. s. 6 58 15·12 | h. m. s. 39 19 | | h. m. s. 41 40·53 | ° ′ ″ 5 58 38·85 | ″ 35·30 | ° ′ ″ 88°+ 58 23·74 | π−87° 10′ ″ 34·47 | | | | | | |
| | R | | | | | | | 41 45 | | 44 6·88 | 5 22 3·60 | 28·47 | 58 29·76 | 33·66 | | | | | | |
| | L | | | | | | | 50 36 | | 52 59·14 | 3 8 59·70 | 9·82 | 58 49·06 | 34·31 | | | | | | |
| | L | | | | | | | 52 36 | | 54 59·42 | 2 38 55·50 | 6·94 | 58 49·80 | 32·17 | | | | | | |
| | R | | | | | | | 62 40 | | 65 4·86 | 0 7 33·90 | 0·02 | 59 1·48 | 36·93 | | | | | | |
| | R | | | | | | | 65 1 | | 67 26·19 | 0 27 46·05 | 0·21 | 58 59·16 | 34·80 | | | | | | |
| | L | | | | | | | 73 17 | | 75 43·37 | 2 32 3·75 | 6·37 | 58 51·52 | 33·32 | | | | | | |
| | L | | | | | | | 75 24 | | 77 50·67 | 3 3 53·25 | 9·31 | 58 45·02 | 29·76 | | | | | | |
| | R | | | | | | | 85 47 | | 88 15·15 | 5 40 0·45 | 31·83 | 58 27·68 | 34·94 | | | | | | |
| | R | | | | | | | 87 49 | | 90 17·44 | 6 10 34·80 | 37·81 | 58 22·38 | 35·62 | | | | | | |
| | L | | | | | | | 112 14 | | 114 45·92 | 12 17 42·00 | 149·67 | 56 28·14 | 33·24 | | | | | | |
| | L | | | | | | | 114 5 | | 116 37·18 | 12 45 30·90 | 161·14 | 56 14·22 | 30·79 | | | | | | |
| Sept. 26th 18° & 198° | R | α Ursæ Minoris | ° ′ ″ 1 33 25·55 | ° ′ ″ W. 1 48 24·34 | h. m. s. 1 1 55·25 | h. m. s. 5 56 20·03 | h. m. s. 6 58 15·28 | h. m. s. 23 1 | | h. m. s. 27 2·78 | ° ′ ″ 7 48 7·50 | ″ 60·32 | ° ′ ″ 85°+ 23 7·96 | π−87° 10′ ″ 31·98 | | | | | | |
| | R | | | | | | | 24 57 | | 28 59·06 | 7 19 3·30 | 53·08 | 23 0·66 | 31·92 | | | | | | |
| | L | | | | | | | 31 54 | | 35 57·05 | 5 34 33·45 | 30·82 | 22 42·44 | 35·96 | | | | | | |
| | L | | | | | | | 33 41 | | 37 44·30 | 5 7 44·70 | 26·07 | 22 36·68 | 34·95 | | | | | | |
| | R | | | | | | | 40 4 | | 44 8·21 | 3 31 46·05 | 12·35 | 22 22·64 | 34·63 | | | | | | |
| | R | | | | | | | 41 47 | | 45 51·46 | 3 5 57·30 | 9·52 | 22 18·38 | 33·20 | | | | | | |
| | L | | | | | | | 48 35 | | 52 40·42 | 1 23 42·90 | 1·93 | 22 26·18 | 48·59 | | | | | | |
| | L | | | | | | | 50 34 | | 54 39·71 | 0 53 53·55 | 0·80 | 22 23·62 | 47·16 | | | | | | |
| | R | | | | | | | 115 57 | | 120 12·02 | 15 29 11·10 | 235·05 | 26 6·26 | 35·55 | | | | | | |
| | R | | | | | | | 117 41 | | 121 56·27 | 15 55 14·85 | 248·31 | 26 17·90 | 33·93 | | | | | | |
| | L | | | | | | | 128 29 | | 132 45·81 | 18 37 37·95 | 338·86 | 28 0·02 | 45·50 | | | | | | |
| | L | | | | | | | 130 27 | | 134 44·09 | 19 7 12·15 | 356·81 | 28 15·60 | 43·13 | | | | | | |



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# SYNOPSIS OF OBSERVED AZIMUTHS

# SECTION KALIANPUR TO KALIANA.

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## SERIES A.

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δ Ursæ Minoris at Kalianpur G. T. Station 1836. $\pi + (0^\circ\ 0')$

**Afternoon Western Elongation.**

| 24th & 29th December. | | 25th December. | | 27th December. | | 28th December. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| — 11″·241 | — 5″·933 | — 10″·566 | — 5″·465 | — 13″·397 | — 5″·317 | — 14″·570 | — 2″·890 |
| — 8·720 | — 8·862 | — 11·311 | — 6·812 | — 10·925 | — 5·159 | — 14·470 | — 2·830 |
| — 12·106 | — 5·096 | — 13·365 | — 5·481 | — 13·038 | — 4·057 | — 15·440 | — 3·340 |
| — 10·016 | — 6·040 | — 11·704 | — 6·187 | — 10·694 | — 4·624 | — 14·310 | — 4·180 |
| — 10·101 | — 5·210 | — 12·026 | — 4·364 | — 9·856 | — 5·511 | — 16·010 | — 4·160 |
| — 8·334 | — 4·371 | — 11·871 | — 4·747 | — 9·482 | — 4·727 | — 14·900 | — 3·700 |
| — 15·320 | — 0·920 | | | | — 5·557 | | — 3·710 |
| — 16·330 | — 2·120 | | | | | | |
| — 14·630 | — 1·350 | | | | | | |
| — 14·300 | — 1·050 | | | | | | |
| — 16·600 | — 1·940 | | | | | | |
| — 14·730 | — 2·050 | | | | | | |
| | — 0·640 | | | | | | |
| | — 1·480 | | | | | | |
| — 12·702 | — 3·362 | — 11·807 | — 5·509 | — 11·232 | — 4·993 | — 14·950 | — 3·544 |

**Aftermidnight Eastern Elongation.**

| 24th & 29th December. | | 25th December. | | 27th December. | | 28th December. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| — 9″·023 | — 1″·393 | — 10″·918 | + 0″·116 | — 11″·110 | — 1″·920 | — 11″·860 | + 2″·100 |
| — 4·718 | — 2·162 | — 8·540 | — 1·276 | — 10·210 | — 3·220 | — 11·260 | + 1·580 |
| — 11·328 | — 3·152 | — 9·368 | — 2·467 | — 9·720 | — 3·500 | — 12·460 | + 1·850 |
| — 8·311 | — 4·051 | — 7·041 | — 1·090 | — 8·620 | — 3·570 | — 10·670 | + 3·430 |
| — 7·977 | — 0·570 | — 10·176 | | — 12·720 | — 2·960 | — 13·150 | + 3·080 |
| — 7·152 | — 2·584 | — 8·485 | | — 9·220 | — 2·560 | — 11·010 | + 2·330 |
| — 9·500 | + 0·810 | | | | — 2·190 | | + 3·830 |
| — 9·750 | + 1·870 | | | | — 1·530 | | + 3·310 |
| — 9·950 | + 1·480 | | | | | | + 1·110 |
| — 10·420 | + 2·930 | | | | | | + 1·790 |
| — 12·160 | + 2·010 | | | | | | |
| — 10·330 | + 3·030 | | | | | | |
| — 9·590 | | | | | | | |
| — 10·110 | | | | | | | |
| — 9·308 | — 0·148 | — 9·088 | — 1·179 | — 10·266 | — 2·681 | — 11·735 | + 2·441 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi - (0^\circ\ 0'\ 5''{\cdot}246)$
- Mean of Western Elongation ..... $\pi - (0\ 0\ 8{\cdot}513)$
- General Mean ..... $\pi - (0\ 0\ 6{\cdot}880)$

4 Ursæ Minoris Bode at Kalianpur G. T. Station 1836-7. $\pi + (0^\circ\ 0')$

**Afternoon Eastern Elongation.**

| 4th January. | | 3rd January. | | 30th Dec. & 2nd Jan. | | 31st Dec. & 1st Jan. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| — 5″·34 | — 9″·15 | — 7″·82 | — 10″·21 | — 14″·54 | — 2″·35 | — 15″·17 | — 4″·81 |
| — 6·22 | — 9·15 | — 6·14 | — 11·74 | — 13·93 | — 3·42 | — 13·46 | — 2·94 |
| — 6·51 | — 11·43 | — 6·92 | — 9·77 | — 14·35 | — 2·65 | — 14·90 | — 2·90 |
| — 6·37 | — 9·91 | — 7·45 | | — 11·07 | — 1·63 | — 14·11 | — 1·76 |
| — 8·27 | — 10·64 | | | — 8·49 | — 10·16 | — 10·14 | — 9·62 |
| — 8·51 | — 9·51 | | | — 7·23 | — 11·71 | — 8·09 | — 11·93 |
| | | | | — 9·57 | — 11·96 | — 7·47 | — 11·31 |
| | | | | — 9·90 | — 10·93 | — 5·75 | — 13·68 |
| | | | | — 9·87 | — 10·73 | — 6·58 | — 12·48 |
| | | | | — 7·31 | — 9·93 | — 6·76 | — 13·06 |
| [illegible] | [illegible] | [illegible] | [illegible] | — 10·626 | — 7·547 | — 10·248 | — 8·449 |

**Aftermidnight Western Elongation.**

| 4th January. | | 3rd January. | | 30th Dec. & 2nd Jan. | | 31st Dec. & 1st Jan. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| — 5″·28 | — 7″·76 | — 3″·39 | — 3″·58 | — 8″·76 | + 3″·44 | — 11″·90 | + 0″·64 |
| — 4·69 | — 4·87 | — 5·26 | — 3·60 | — 9·03 | + 3·22 | — 13·38 | + 0·66 |
| — 3·58 | — 3·63 | — 0·79 | — 3·56 | — 7·95 | + 5·71 | — 12·30 | — 7·98 |
| — 3·25 | — 5·14 | — 2·74 | | — 9·66 | + 5·12 | — 3·92 | — 5·20 |
| — 4·37 | — 8·30 | | | — 2·13 | + 4·77 | — 4·23 | — 6·44 |
| — 0·80 | — 3·33 | | | — 3·23 | — 2·61 | — 3·17 | — 5·47 |
| | | | | + 0·17 | — 3·59 | — 3·67 | — 6·65 |
| | | | | — 3·82 | — 3·24 | — 2·68 | — 7·48 |
| | | | | — 1·93 | — 4·80 | — 3·08 | |
| | | | | — 2·57 | — 5·59 | | |
| [illegible] | [illegible] | [illegible] | [illegible] | — 4·891 | + 0·248 | — 6·481 | — 4·74[illegible] |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi - (0^\circ\ 0'\ 8''{\cdot}920)$
- Mean of Western Elongation ..... $\pi - (0\ 0\ 3{\cdot}958)$
- General Mean ..... $\pi - (0\ 0\ 6{\cdot}439)$

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**51 Cephei Hev. at Kalianpur G. T. Station 1836-7. $\pi - (0^\circ\ 0')$**

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4th January. | | 3rd January. | | 30th Dec. & 2nd Jan. | | 31st Dec. & 1st Jan. | | 4th January. | | 3rd January. | | 30th Dec. & 2nd Jan. | | 31st Dec. & 1st Jan. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| − 1″·83 | − 5″·46 | − 2″·33 | − 7″·02 | − 9″·54 | − 0″·05 | − 8″·70 | + 0″·81 | − 8″·23 | − 9″·54 | − 6″·73 | − 10″·14 | − 12″·02 | − 2″·51 | − 16″·25 | − 3″·42 |
| − 3·11 | − 4·75 | − 3·46 | − 5·88 | − 8·87 | + 0·28 | − 11·66 | + 0·45 | − 8·49 | − 9·75 | − 7·85 | − 10·04 | − 13·57 | − 1·22 | − 16·38 | − 4·90 |
| − 2·08 | − 5·13 | − 3·95 | − 6·87 | − 8·87 | + 1·04 | − 11·81 | + 1·43 | − 6·69 | − 9·43 | − 7·49 | − 8·60 | − 12·72 | − 0·89 | − 15·59 | − 3·78 |
| − 4·28 | − 3·93 | − 1·96 | − 6·86 | − 6·84 | + 0·68 | − 11·50 | + 3·87 | − 8·44 | − 8·87 | − 6·72 | − 9·12 | − 13·29 | − 3·62 | − 14·50 | − 2·77 |
| − 2·84 | − 5·59 | − 4·27 | − 7·12 | − 2·76 | − 5·11 | − 5·34 | − 5·43 | − 8·37 | − 9·56 | − 7·02 | − 10·05 | − 5·94 | − 8·03 | − 7·95 | − 11·73 |
| − 4·33 | − 5·53 | − 6·43 | − 4·03 | − 3·28 | − 7·28 | − 5·84 | − 6·21 | − 8·18 | − 8·32 | − 7·93 | − 9·46 | − 8·10 | − 8·79 | − 7·51 | − 9·30 |
| | | | | − 3·06 | − 7·52 | − 4·08 | − 6·29 | | | | | − 6·38 | − 8·73 | − 8·60 | − 8·55 |
| | | | | − 2·94 | − 7·08 | − 7·53 | − 5·17 | | | | | − 6·39 | − 9·81 | − 8·99 | − 8·80 |
| | | | | − 3·58 | − 8·05 | − 1·81 | − 6·73 | | | | | − 7·02 | − 8·75 | − 7·33 | − 11·34 |
| | | | | − 4·12 | − 8·09 | − 6·65 | − 3·54 | | | | | − 8·57 | − 9·08 | − 7·80 | − 10·76 |
| − 3·078 | − 5·065 | − 3·733 | − 6·297 | − 5·386 | − 4·118 | − 7·492 | − 2·681 | − 8·067 | − 9·245 | − 7·290 | − 9·568 | − 9·400 | − 5·241 | − 11·090 | − 7·535 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi - (0^\circ\ 0'\ 4''\cdot731)$
- Mean of Western Elongation ..... $\pi - (0\ 0\ 8''\cdot429)$
- General Mean ..... $\pi - (0\ 0\ 6''\cdot580)$

**ε Ursæ Minoris at Pahargarh G. T. Station 1836. $\pi - (0^\circ\ 34') -$**

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9th December. | | 6th December. | | 7th December. | | 8th December. | | 9th December. | | 6th December. | | 7th December. | | 8th December. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 11″·79 | 11″·49 | 7″·20 | 14″·59 | 8″·50 | 10″·23 | 8″·21 | 16″·67 | 13″·18 | 16″·13 | 9″·73 | 11″·10 | 10″·94 | 13″·89 | 8″·80 | 14″·97 |
| 10·33 | 13·38 | 5·44 | 11·15 | 8·23 | 17·05 | 8·03 | 16·94 | 11·09 | 17·90 | 7·67 | 16·39 | 9·56 | 15·85 | 9·60 | 14·54 |
| 11·69 | 11·40 | 10·76 | 13·36 | 8·27 | 14·37 | 7·53 | 17·00 | 13·37 | 15·46 | 11·31 | 12·04 | 8·82 | 13·69 | 12·07 | 13·53 |
| 10·81 | 12·14 | 9·61 | 12·35 | 7·07 | 16·30 | 6·79 | 16·35 | 11·65 | 14·44 | 10·52 | 13·40 | 10·68 | 15·58 | 12·36 | 14·45 |
| 10·87 | 14·29 | 7·91 | 13·39 | 9·46 | 13·88 | 9·35 | 13·39 | 15·26 | 14·97 | | 16·50 | 12·73 | 13·76 | 12·63 | 18·15 |
| 9·86 | 13·31 | 7·25 | 12·78 | 9·45 | 16·33 | 7·04 | 17·17 | 13·43 | 16·83 | | 13·75 | 10·16 | 13·12 | 8·60 | 17·81 |
| 12·19 | | | | | | | | 14·29 | 15·54 | | | | | | |
| 9·66 | | | | | | | | 12·77 | 16·27 | | | | | | |
| 10·900 | 12·668 | 8·027 | 12·937 | 8·497 | 14·693 | 7·825 | 16·253 | 13·130 | 15·942 | 9·807 | 13·863 | 10·482 | 14·315 | 10·677 | 15·575 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation ..... $\pi - (0^\circ\ 34'\ 11''\cdot475)$
- Mean of Eastern Elongation ..... $\pi - (0\ 34\ 12''\cdot974)$
- General Mean ..... $\pi - (0\ 34\ 12''\cdot225)$

4 N

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λ Ursæ Minoris at Pahargarh G. T. Station 1837. $\pi - (0^\circ\ 34')$ —

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23rd January. | | 24th & 27th January. | | 25th January. | | 26th January. | | 22nd & 23rd January. | | 24th & 27th January. | | 25th January. | | 26th January. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 15″·36 | 13″·51 | 9″·25 | 14″·04 | 11″·79 | 15″·17 | 11″·17 | 13″·17 | 14″·32 | 9″·84 | 11″·61 | 9″·97 | 15″·77 | 10″·75 | 12″·08 | 11″·70 |
| 11·26 | 12·00 | 9·05 | 15·52 | 11·73 | 13·04 | 11·77 | 14·15 | 12·71 | 7·09 | 14·66 | 7·35 | 12·60 | 11·37 | 9·66 | 11·88 |
| 12·62 | 10·40 | 12·00 | 17·77 | 12·92 | 14·91 | 13·22 | 12·74 | 11·69 | 10·58 | 8·35 | 14·60 | 11·99 | 12·15 | 13·56 | 12·11 |
| 10·38 | 10·18 | 10·33 | 17·27 | 11·35 | 14·62 | 13·69 | 13·07 | 12·50 | | 10·29 | 15·61 | 13·18 | 11·04 | 15·38 | 11·51 |
| | | 11·46 | 14·01 | | | | | 12·78 | | 11·02 | 14·54 | | | | |
| | | 13·03 | 14·34 | | | | | | | | | | | | |
| 12·405 | 11·523 | 10·853 | 15·492 | 11·948 | 14·435 | 12·463 | 13·283 | 12·800 | 9·170 | 11·186 | 12·414 | 13·385 | 11·328 | 12·670 | 11·800 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation..... $\pi - (0^\circ\ 34'\ 11''\cdot844)$
- Mean of Western Elongation..... $\pi - (0\ 34\ 12\cdot800)$
- General Mean ..... $\pi - (0\ 34\ 12\cdot322)$

δ Ursæ Minoris at Kasri G. T. Station 1836. $\pi - (0^\circ\ 0')$ —

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28th December. | | 24th December. | | 25th December. | | 26th & 27th December. | | 28th December. | | 24th December. | | 25th December. | | 26th & 27th December. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 23″·77 | 25″·59 | 26″·76 | 26″·52 | 26″·23 | 26″·48 | 27″·87 | 27″·28 | 25″·98 | 22″·06 | 24″·89 | 24″·12 | 28″·99 | 24″·22 | 27″·24 | 19″·97 |
| 24·55 | 23·96 | 26·98 | 28·14 | 26·13 | 24·96 | 26·08 | 25·97 | 23·69 | 21·14 | 25·79 | 23·95 | 26·10 | 22·95 | 28·47 | 24·72 |
| 31·43 | 22·82 | 28·30 | 27·30 | 26·12 | 32·27 | 26·93 | 25·85 | 27·32 | 17·39 | 25·67 | 24·22 | 29·00 | 23·06 | 26·06 | 19·93 |
| 26·47 | 25·37 | 27·99 | 25·75 | 24·90 | 34·18 | 28·29 | 27·08 | 27·82 | 20·38 | 23·69 | 23·39 | 26·27 | 20·50 | 24·69 | 20·32 |
| | | 28·62 | 23·52 | | | 23·33 | 24·95 | | | | | | | 23·10 | 25·96 |
| | | 27·71 | 27·15 | | | 24·54 | 24·81 | | | | | | | 31·47 | 25·86 |
| | | | | | | 28·16 | 24·03 | | | | | | | 31·37 | |
| | | | | | | 27·41 | 25·40 | | | | | | | | |
| 26·555 | 24·435 | 27·727 | 26·397 | 25·845 | 29·473 | 26·576 | 25·671 | 26·203 | 20·243 | 25·010 | 23·920 | 27·590 | 22·683 | 27·486 | 22·793 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation ..... $\pi - (0^\circ\ 0'\ 26''\cdot585)$
- Mean of Eastern Elongation ..... $\pi - (0\ 0\ 24\cdot491)$
- General Mean ..... $\pi - (0\ 0\ 25\cdot538)$

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29 Camelopardali Hev. at Usira G. T. Station 1838. $\pi - (11^\circ\ 3')$ —

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13th February. | | 17th February. | | 15th February. | | 16th February. | | 15th February. | | 14th February. | | 17th February. | | 16th February. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 59″·29 | 51″·19 | 59″·39 | 57″·64 | 60″·65 | 63″·81 | 56″·94 | 59″·65 | 58″·75 | 57″·08 | 58″·86 | 56″·48 | 59″·27 | 59″·14 | 60″·82 | 59″·31 |
| 56·62 | 50·44 | 59·83 | 55·83 | 60·72 | 61·12 | 56·52 | 57·38 | 58·15 | 57·78 | 57·99 | 55·91 | 60·41 | 64·11 | 60·84 | 57·13 |
| 58·17 | 54·74 | 58·70 | 55·48 | 61·68 | 59·98 | 58·50 | 56·96 | 56·01 | 57·51 | 59·04 | 56·43 | 60·54 | 59·59 | 60·32 | 58·78 |
| 57·14 | 53·42 | 58·79 | 56·33 | 59·86 | 57·76 | 55·98 | 57·69 | 56·84 | 57·37 | 60·00 | 56·49 | 61·60 | 59·65 | 61·35 | 59·13 |
| 58·54 | 55·68 | 59·45 | 58·05 | 60·72 | 57·80 | 57·32 | 58·13 | | 57·33 | 58·01 | 58·77 | 62·06 | 60·80 | 58·84 | 59·68 |
| 57·31 | 54·11 | 57·33 | 57·11 | 62·21 | 59·42 | 59·10 | 58·57 | | 57·13 | 58·72 | 56·98 | 62·99 | 59·31 | 59·66 | 59·55 |
| 58·45 | 55·49 | | | | | | | | 55·52 | | 57·36 | 61·06 | 60·14 | 58·51 | 59·44 |
| 57·93 | 54·58 | | | | | | | | 55·33 | | | 61·92 | 58·08 | 58·59 | 53·71 |
| 57·931 | 53·706 | 58·915 | 56·740 | 60·973 | 59·982 | 57·393 | 58·063 | 57·438 | 56·881 | 58·770 | 56·917 | 61·231 | 60·103 | 59·866 | 58·341 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation..... $\pi - (11^\circ\ 3'\ 58''\cdot693)$
- Mean of Eastern Elongation ..... $\pi - (11\ 3\ 57\cdot963)$
- General Mean ..... $\pi - (11\ 3\ 58\cdot328)$

30 Camelopardali Hev. at Usira G. T. Station 1838. $\pi - (11^\circ\ 3')$ —

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18th February. | | 20th February. | | 19th February. | | 21st February. | | 18th February. | | 20th February. | | 19th February. | | 21st February. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 53″·68 | 56″·32 | 56″·44 | 58″·59 | 56″·73 | 58″·01 | 58″·68 | 55″·24 | 59″·23 | 62″·76 | 63″·11 | 56″·84 | 61″·31 | 57″·44 | 62″·31 | 60″·21 |
| 54·04 | 56·56 | 55·32 | 58·35 | 54·16 | 56·37 | 58·31 | 54·42 | 56·52 | 60·59 | 62·99 | 58·42 | 61·73 | 58·64 | 60·32 | 58·96 |
| 55·29 | 54·99 | 54·42 | 58·43 | 56·09 | 56·74 | 58·58 | 55·93 | 59·21 | 59·95 | 60·61 | 56·90 | 60·31 | 58·19 | 58·98 | 56·84 |
| 56·05 | 57·23 | 57·02 | 60·05 | 55·94 | 56·36 | 59·10 | 55·03 | 60·06 | 60·23 | 60·35 | 58·29 | 61·96 | 58·14 | 59·92 | 59·52 |
| 56·35 | 56·92 | 56·21 | 59·35 | 56·70 | 56·74 | 57·86 | 55·89 | 59·25 | 61·05 | 61·64 | 56·49 | 60·70 | 57·18 | 61·91 | 58·44 |
| 55·61 | 57·07 | 57·45 | 58·22 | 57·17 | 56·82 | 58·04 | 56·24 | 58·31 | 58·64 | 60·45 | 57·76 | 60·85 | 58·20 | 57·91 | 56·12 |
| | | | | | 56·89 | 59·25 | 55·52 | 58·33 | 58·81 | | | | | | |
| | | | | | 55·24 | 57·67 | 55·35 | 59·41 | 58·54 | | | | | | |
| 55·170 | 56·515 | 56·143 | 58·832 | 56·132 | 56·646 | 58·436 | 55·453 | 58·790 | 60·071 | 61·525 | 57·450 | 61·143 | 57·965 | 60·225 | 58·348 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation..... $\pi - (11^\circ\ 3'\ 59''\cdot440)$
- Mean of Eastern Elongation ..... $\pi - (11\ 3\ 56\cdot666)$
- General Mean ..... $\pi - (11\ 3\ 58\cdot053)$

## 32 Cephei Hev. at Usira G. T. Station 1838. $\pi - (11^\circ\ 3')$ —

### Aftermidnight Eastern Elongation.

| 25th February. | | 26th February. | | 27th February. | | 28th February. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 53·44 | 57·94 | 59·45 | 58·76 | 57·90 | 60·00 | 58·73 | 59·50 |
| 55·30 | 56·32 | 58·22 | 56·52 | 56·98 | 57·73 | 56·49 | 57·49 |
| 54·72 | 57·00 | 58·27 | 58·65 | 56·70 | 59·59 | 56·58 | 57·85 |
| 55·03 | 55·74 | 59·12 | 55·60 | 56·82 | 58·82 | 56·72 | 58·78 |
| 53·78 | 55·88 | 59·89 | 58·26 | 57·93 | 58·28 | 58·89 | 60·08 |
| 54·86 | 55·47 | 59·14 | 57·38 | 57·42 | 56·66 | 59·07 | 57·91 |
| 53·34 | | 57·22 | | 57·77 | 58·33 | 57·64 | 56·20 |
| 53·90 | | 59·64 | | 56·45 | 56·49 | 55·21 | 57·27 |
| | | | | | 56·11 | | |
| 54·296 | 56·392 | 58·869 | 57·528 | 57·246 | 58·001 | 57·416 | 58·135 |

### Afternoon Western Elongation.

| 18th February. | | 17th February. | | 15th February. | | 16th February. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 56·42 | 59·80 | 61·30 | 55·90 | 60·18 | 63·31 | 58·46 | 59·95 |
| 56·43 | 59·43 | 59·09 | 55·25 | 60·00 | 62·15 | 57·86 | 58·46 |
| 55·28 | 58·95 | 59·20 | 55·38 | 57·55 | 58·03 | 59·08 | 60·04 |
| 57·28 | 58·57 | 60·86 | 55·15 | 61·23 | 58·06 | 58·06 | 60·66 |
| 58·42 | 58·71 | 59·36 | 58·11 | 60·62 | 59·61 | 60·53 | 60·33 |
| 56·90 | 58·13 | 59·00 | 56·88 | 60·45 | 62·84 | 62·11 | 58·00 |
| 56·788 | 58·932 | 59·802 | 56·112 | 60·005 | 60·667 | 59·350 | 59·573 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi - (11^\circ\ 3'\ 57''\cdot235)$
- Mean of Western Elongation ..... $\pi - (11\ 3\ 58\cdot904)$
- General Mean ..... $\pi - (11\ 3\ 58\cdot070)$

## α Ursæ Minoris at No G. T. Station 1837. $\pi + (22^\circ\ 31') +$

### Aftermidnight Eastern Elongation.

| 2nd, 3rd, & 7th April. | | 4th April. | | 5th April. | | 6th April. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 31·87 | 37·70 | 22·95 | 35·69 | 29·15 | 36·96 | 26·48 | 37·09 |
| 31·46 | 38·80 | 25·75 | 35·95 | 29·69 | 36·66 | 26·41 | 39·53 |
| 31·46 | 39·50 | 25·04 | 36·03 | 28·30 | 38·71 | 27·14 | 40·07 |
| 29·62 | 39·93 | 25·66 | 35·34 | 27·67 | 36·58 | 28·89 | 41·27 |
| 29·11 | 37·56 | 25·01 | 36·43 | | | | |
| 28·80 | 38·84 | 24·15 | 36·60 | | | | |
| 27·80 | 37·85 | | | | | | |
| 26·64 | 39·52 | | | | | | |
| 28·31 | 37·74 | | | | | | |
| 27·19 | 38·09 | | | | | | |
| 27·55 | | | | | | | |
| 28·37 | | | | | | | |
| 26·49 | | | | | | | |
| 27·56 | | | | | | | |
| 28·731 | 38·553 | 24·760 | 36·007 | 28·703 | 37·228 | 27·230 | 39·515 |

### Afternoon Western Elongation.

| 3rd April. | | 4th April. | | 5th April. | | 6th April. | |
|---|---|---|---|---|---|---|---|
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 27·84 | 36·04 | 24·48 | 38·09 | 27·24 | 35·38 | 31·77 | 38·22 |
| 29·84 | 37·65 | 25·32 | 37·45 | 25·68 | 36·31 | 32·18 | 36·86 |
| 27·19 | 38·35 | 24·55 | 38·37 | 27·77 | 35·15 | 27·54 | 38·92 |
| 28·89 | 38·41 | 24·26 | 39·12 | 28·11 | 37·77 | 29·56 | 38·25 |
| 28·440 | 37·613 | 24·653 | 38·258 | 27·200 | 36·153 | 30·263 | 38·063 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi + (22^\circ\ 31'\ 32''\cdot591)$
- Mean of Western Elongation ..... $\pi + (22\ 31\ 32\cdot580)$
- General Mean ..... $\pi + (22\ 31\ 32\cdot585)$

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λ Ursæ Minoris at Dateri G. T. Station 1836. $\pi - (9^\circ\ 42')$ —

| Afternoon Western Elongation. | | | | | | | | Aftermidnight Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20th January. | | 18th January. | | 21st January. | | 19th January. | | 20th January. | | 18th January. | | 21st January. | | 19th January. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 61″·94 | 62″·76 | 57″·26 | 54″·26 | 56″·56 | 58″·11 | 64″·69 | 59″·97 | 57″·16 | 58″·57 | 63″·04 | 57″·98 | 56″·72 | 60″·86 | 61″·92 | 62″·67 |
| 63·70 | 59·61 | 59·38 | 57·42 | 58·08 | 57·90 | 62·87 | 61·19 | 57·56 | 60·11 | 60·46 | 58·78 | 56·43 | 60·82 | 61·48 | 59·57 |
| 61·04 | 63·72 | 58.75 | 61·56 | 56·20 | 61·95 | 65·69 | 62·73 | 53·65 | 57·17 | 61·11 | 57·08 | 56·71 | 60·93 | 62·06 | 58·38 |
| 61·19 | 62·30 | 59·83 | 58·51 | 59·20 | 59·73 | 65·95 | 60·11 | 55·38 | 59·01 | 62·26 | 56·54 | 59·11 | 59·26 | 65·73 | 60·83 |
| 62·11 | 62·87 | 58·43 | 58·01 | 59·50 | 59·51 | 65·33 | 62·97 | | | | | | | | |
| 61·77 | 59·74 | 65·70 | 60·38 | 60·34 | 63·81 | 66·51 | 61·38 | | | | | | | | |
| 61·958 | 61·833 | 59·892 | 58·357 | 58·317 | 60·168 | 65·173 | 61·392 | 55·938 | 58·715 | 61·718 | 57·595 | 57·243 | 60·468 | 62·798 | 60·363 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation..... $\pi - (9^\circ\ 42'\ 60''\cdot887)$
- Mean of Eastern Elongation..... $\pi - (9\ 42\ 59\cdot355)$
- General Mean..... $\pi - (9\ 43\ 0\cdot121)$

α Ursæ Minoris at Kaliana G. T. Station Eastern Pillar 1836. $\pi + (0^\circ\ 0')$

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8th October. | | 5th October. | | 6th October. | | 7th October. | | 8th October. | | 5th October. | | 6th October. | | 7th October. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 0° | 189° | 18° | 198° | 27° | 207° |
| + 2″·13 | + 2″·12 | − 0″·55 | − 1″·65 | − 3″·36 | + 0″·67 | − 2″·81 | + 0″·39 | + 1″·17 | + 1″·69 | − 0″·70 | − 1″·12 | − 1″·88 | + 2″·68 | + 0″·30 | − 3″·73 |
| − 1·97 | + 1·08 | + 0·38 | − 0·25 | − 3·02 | + 0·58 | − 3·85 | − 0·47 | − 0·68 | + 2·40 | − 0·44 | − 1·94 | − 0·48 | + 0·65 | − 1·44 | − 3·64 |
| + 0·37 | + 0·84 | − 5·05 | − 0·86 | − 3·35 | + 2·31 | − 3·36 | + 3·20 | − 2·25 | − 0·53 | − 2·45 | − 1·19 | − 4·01 | + 3·62 | − 3·14 | − 1·79 |
| − 0·19 | − 2·19 | − 4·33 | + 0·19 | − 1·21 | + 0·76 | − 4·76 | + 1·62 | + 0·25 | + 1·03 | − 1·33 | − 1·33 | − 1·37 | + 3·47 | − 1·13 | − 2·43 |
| + 0·44 | + 0·81 | − 2·30 | − 3·97 | − 3·21 | + 0·83 | − 3·00 | + 3·18 | − 1·03 | + 1·65 | − 3·51 | − 0·55 | − 2·57 | + 5·52 | − 4·44 | − 1·14 |
| − 0·50 | + 1·02 | + 0·36 | + 0·88 | − 2·04 | + 2·38 | − 4·22 | + 0·77 | − 2·63 | + 1·08 | − 1·42 | − 1·28 | − 2·72 | + 6·06 | − 0·69 | − 2·38 |
| + 0·047 | + 0·613 | − 1·915 | − 0·943 | − 2·698 | + 1·255 | − 3·667 | + 1·448 | − 0·862 | + 1·220 | − 1·642 | − 1·235 | − 2·172 | + 3·667 | − 1·757 | − 2·518 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation..... $\pi - (0^\circ\ 0'\ 0''\cdot733)$
- Mean of Western Elongation ..... $\pi - (0\ 0\ 0\cdot662)$
- General Mean..... $\pi - (0\ 0\ 0\cdot698)$



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**α Ursæ Minoris at Kaliana Astronomical Station Western Pillar 1836. $\pi + (0^\circ\ 0')$**

| Afternoon Eastern Elongation. | | | | | | | | Aftermidnight Western Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6th October. | | 8th October. | | 9th October. | | 10th October. | | 6th October. | | 7th October. | | 8th October. | | 9th October. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| + 2″·66 | — 2″·98 | + 0″·59 | — 3″·17 | — 1″·23 | — 0″·21 | — 1″·36 | — 0″·59 | + 3″·64 | — 1″·19 | + 1″·38 | — 2″·90 | + 0″·06 | + 1″·11 | + 1″·83 | + 0″·92 |
| + 1·54 | — 3·29 | + 3·17 | — 2·13 | + 2·82 | — 2·14 | + 0·74 | + 0·16 | + 0·66 | — 3·61 | + 0·46 | — 4·52 | + 0·52 | — 0·04 | + 1·71 | + 1·18 |
| — 1·88 | — 4·56 | + 4·32 | + 0·33 | + 4·13 | — 3·18 | + 3·14 | + 1·66 | — 0·26 | — 2·95 | + 2·53 | + 1·06 | + 1·26 | — 5·01 | + 1·28 | — 1·05 |
| — 3·37 | — 1·56 | + 4·59 | — 1·25 | + 0·53 | — 1·35 | + 1·93 | — 0·06 | + 2·09 | — 0·66 | + 1·71 | + 1·24 | + 0·61 | — 3·15 | + 0·89 | — 2·42 |
| | | + 2·15 | + 2·29 | — 1·23 | + 2·25 | — 2·97 | — 0·41 | + 4·57 | | + 3·90 | — 0·22 | — 2·86 | + 1·46 | + 2·26 | — 0·05 |
| | | + 0·72 | — 2·14 | + 3·14 | — 0·10 | + 2·40 | + 0·87 | + 4·38 | | + 4·18 | — 0·76 | — 2·66 | — 2·33 | + 0·90 | + 0·91 |
| | | | | + 1·72 | — 0·87 | | | | | | | | | — 0·15 | — 2·00 |
| | | | | — 3·34 | — 0·37 | | | | | | | | | — 2·30 | + 0·57 |
| — 0·263 | — 3·098 | + 2·590 | — 1·012 | + 0·818 | — 0·746 | + 0·647 | + 0·272 | + 2·513 | — 2·103 | + 2·360 | — 1·020 | — 0·512 | — 1·327 | + 0·803 | — 0·243 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Eastern Elongation ..... $\pi - (0^\circ\ 0'\ 0''\cdot099)$
- Mean of Western Elongation ..... $\pi + (0\ 0\ 0''\cdot059)$
- General Mean ..... $\pi - (0\ 0\ 0''\cdot020)$

**α Ursæ Minoris at Banog G. T. Station 1837. $\pi - (87^\circ\ 10') -$**

| Aftermidnight Western Elongation. | | | | | | | | Afternoon Eastern Elongation. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20th September. | | 21st September. | | 25th September. | | 26th September. | | 21st September. | | 22nd September. | | 25th September. | | 26th September. | |
| 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° | 0° | 180° | 9° | 189° | 18° | 198° | 27° | 207° |
| 43″·05 | 27″·79 | 32″·10 | 34″·88 | 35″·47 | 33″·07 | 35″·96 | 31″·98 | 30″·51 | 30″·89 | 35″·35 | 32″·97 | 36″·02 | 30″·88 | 34″·31 | 34″·47 |
| 42·51 | 26·07 | 32·94 | 32·19 | 34·76 | 34·95 | 34·95 | 31·92 | 29·16 | 30·95 | 31·21 | 33·25 | 31·76 | 31·53 | 32·17 | 33·66 |
| 42·14 | 27·97 | 33·11 | 34·63 | 35·82 | 35·52 | 48·59 | 34·63 | 31·30 | 32·85 | 32·97 | 33·24 | 32·34 | 30·64 | 33·32 | 36·93 |
| 41·62 | 25·43 | 33·38 | 32·64 | 35·29 | 34·89 | 47·16 | 33·20 | 29·83 | 33·64 | 29·75 | 32·60 | 31·63 | 33·48 | 29·76 | 34·80 |
| 41·86 | 29·31 | 32·28 | 34·77 | 34·71 | 34·99 | 45·50 | 35·55 | 31·28 | 33·55 | 32·47 | 35·60 | 34·17 | 31·14 | 33·24 | 34·94 |
| 41·98 | 27·29 | 31·36 | 32·54 | 32·75 | 33·10 | 43·13 | 33·93 | 27·18 | 33·51 | 29·98 | 32·26 | 30·99 | 30·59 | 30·79 | 35·62 |
| 43·21 | 29·38 | | | | | | | | | | | | | | |
| 44·12 | 28·35 | | | | | | | | | | | | | | |
| 42·561 | 27·699 | 32·528 | 33·608 | 34·800 | 34·420 | 42·548 | 33·535 | 29·877 | 32·565 | 31·955 | 33·320 | 32·818 | 31·377 | 32·965 | 35·070 |

Resulting Azimuth of the Referring Lamp ..
- Mean of Western Elongation ..... $\pi - (87^\circ\ 10'\ 35''\cdot212)$
- Mean of Eastern Elongation ..... $\pi - (87\ 10\ 32''\cdot406)$
- General Mean ..... $\pi - (87\ 10\ 33''\cdot809)$

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# SYNOPSIS

OF

## LATITUDES, LONGITUDES, AZIMUTHS, &c. OF THE PRINCIPAL STATIONS

OF THE

# GREAT ARC SERIES OF TRIANGLES

## SECTION KALIANPUR AND KALIANA.

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## SERIES A.

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| No. | Stations of the eye A. | | | | | Stations of the object B. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. | Log. of Geodetic line. | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. |
| 1 | Kalianpur..... | 24 7 11·84 | 77 41 44·75 | 260 41 53·19 | 4·8071952 | N. End Base .. | 24 8 54·11 | 77 53 8·31 | 80 46 32·69 |
| | Kalianpur..... | .. .. .. | .. .. .. | 190 27 6·21 | 4·6439210 | Surantal ..... | 20 14 20·85 | 77 43 11·09 | 10 27 41·57 |
| | N. End Base .. | 24 8 54·11 | 77 53 8·31 | 120 51 25·22 | 4·8087819 | Surantal ..... | .. .. .. | .. .. .. | 300 47 20·47 |
| | Kalianpur..... | 24 7 11·84 | 77 41 44·75 | 267 22 35·12 | 5·0754476 | Bhaorasa ..... | 24 8 4·28 | 78 3 7·90 | 87 31 19·63 |
| 5 | N. End Base .. | 24 8 54·11 | 77 53 8·31 | 275 8 34·35 | 4·7463194 | Bhaorasa ..... | .. .. .. | .. .. .. | 95 12 39·58 |
| | Surantal..... | 24 14 20·85 | 77 43 11·09 | 288 52 14·25 | 5·0687336 | Bhaorasa ..... | .. .. .. | .. .. .. | 109 0 24·60 |
| | N. End Base .. | 24 8 54·11 | 77 53 8·31 | 49 26 11·09 | 4·5844818 | S. End Base.... | 24 4 46·55 | 77 47 53·38 | 229 24 2·43 |
| | Surantal..... | 24 14 20·85 | 77 43 11·09 | 335 42 51·64 | 4·8034551 | S. End Base.... | .. .. .. | .. .. .. | 155 44 47·17 |
| | Kalianpur..... | 24 7 11·84 | 77 41 44·75 | 334 44 3·75 | 4·6973004 | Kamkhera..... | 23 59 45·47 | 77 45 34·03 | 154 45 37·22 |
| 10 | N. End Base .. | 24 8 54·11 | 77 53 8·31 | 37 16 8·61 | 4·8423556 | Kamkhera..... | .. .. .. | .. .. .. | 217 13 3·31 |
| | Surantal..... | 24 14 20·85 | 77 43 11·09 | 351 28 11·69 | 4·9510982 | Kamkhera..... | .. .. .. | .. .. .. | 171 29 10·09 |
| | S. End Base.... | 24 4 46·55 | 77 47 53·38 | 23 2 19·61 | 4·5187381 | Kamkhera..... | .. .. .. | .. .. .. | 203 1 22·84 |
| | Bhaorasa ..... | 24 8 4·28 | 78 3 7·90 | 62 47 24·26 | 5·0409039 | Kamkhera .... | .. .. .. | .. .. .. | 242 40 14·50 |
| | Kalianpur..... | 24 7 11·84 | 77 41 44·75 | 214 52 54·17 | 4·8278352 | Pardho ..... | 24 16 18·26 | 77 48 40·56 | 34 55 44·59 |
| 15 | Bhaorasa ..... | 24 8 4·28 | 78 3 7·90 | 121 53 47·75 | 4·9755315 | Pardho ..... | .. .. .. | .. .. .. | 301 47 52·16 |
| | Kamkhera..... | 23 59 45·47 | 77 45 34·03 | 189 46 14·79 | 5·0073054 | Pardho ..... | .. .. .. | .. .. .. | 9 47 31·05 |
| | Bhaorasa ..... | 24 8 4·28 | 78 3 7·90 | 178 15 55·47 | 5·0354007 | Handiaparo .... | 24 25 58·32 | 78 2 32·36 | 358 15 40·86 |
| | Pardho ..... | 24 16 18·26 | 77 48 40·56 | 232 39 48·82 | 4·9853063 | Handiaparo .... | .. .. .. | .. .. .. | 52 45 31·81 |
| | Pardho ..... | .. .. .. | .. .. .. | 165 6 21·77 | 5·1394071 | Deadheri ..... | 24 38 17·52 | 77 42 16·50 | 345 3 42·78 |
| 20 | Handiaparo .... | 24 25 58·32 | 78 2 32·36 | 123 41 16·73 | 5·1297180 | Deadheri ..... | .. .. .. | .. .. .. | 303 32 51·84 |
| | Handiaparo .... | .. .. .. | .. .. .. | 167 21 34·07 | 5·1508548 | Hatiapahar .... | 24 48 45·94 | 77 56 56·18 | 347 19 14·00 |
| | Deadheri ..... | 24 38 17·52 | 77 42 16·50 | 231 54 30·01 | 5·0127226 | Hatiapahar .... | .. .. .. | .. .. .. | 52 0 37·94 |
| | Deadheri ..... | .. .. .. | .. .. .. | 185 41 52·18 | 5·0353381 | Pahargarh..... | 24 56 6·50 | 77 44 13·52 | 5 42 41·23 |
| | Hatiapahar .... | 24 48 45·94 | 77 56 56·18 | 122 23 49·50 | 4·9197657 | Pahargarh..... | .. .. .. | .. .. .. | 302 18 28·72 |
| 25 | Hatiapahar .... | .. .. .. | .. .. .. | 172 9 6·18 | 4·9258339 | Nimdant ..... | 25 2 32·97 | 77 54 51·00 | 352 8 13·41 |
| | Pahargarh..... | 24 56 6·50 | 77 44 13·52 | 236 19 19·09 | 4·8478372 | Nimdant ..... | .. .. .. | .. .. .. | 56 23 48·38 |
| | Deadheri ..... | 24 38 17·52 | 77 42 16·50 | 147 49 48·55 | 5·1406509 | Bherkheri..... | 24 57 35·85 | 77 28 56·59 | 327 44 13·04 |
| | Pahargarh..... | 24 56 6·50 | 77 44 13·52 | 96 9 22·23 | 4·9287173 | Bherkheri..... | .. .. .. | .. .. .. | 276 2 55·49 |
| | Pahargarh..... | .. .. .. | .. .. .. | 157 41 39·32 | 5·0171257 | Gugubara ..... | 25 11 59·40 | 77 37 3·61 | 337 38 37·18 |
| 30 | Bherkheri..... | 24 57 35·85 | 77 28 56·59 | 207 8 56·69 | 4·9913215 | Gugubara ..... | .. .. .. | .. .. .. | 27 12 23·13 |
| | Nimdant ..... | 25 2 32·97 | 77 54 51·00 | 120 18 34·87 | 5·0551771 | Gugubara ..... | .. .. .. | .. .. .. | 300 11 1·75 |
| | Nimdant ..... | .. .. .. | .. .. .. | 183 4 33·69 | 4·9390953 | Mao ..... | 25 16 52·45 | 77 55 41·82 | 3 4 55·30 |
| | Gugubara ..... | 25 11 59·40 | 77 37 3·61 | 253 51 12·77 | 5·0287321 | Mao ..... | .. .. .. | .. .. .. | 73 59 9·58 |
| | Gugubara ..... | .. .. .. | .. .. .. | 198 8 19·53 | 5·0938149 | Memoni ..... | 25 31 27·21 | 77 44 5·46 | 18 11 20·22 |
| 35 | Mao ..... | 25 16 52·45 | 77 55 41·82 | 144 10 59·71 | 5·0373954 | Memoni ..... | .. .. .. | .. .. .. | 324 6 1·00 |
| | Mao ..... | .. .. .. | .. .. .. | 185 39 35·53 | 5·0518817 | Shergarh ..... | 25 35 22·92 | 77 57 43·22 | 5 40 27·68 |
| | Memoni ..... | 25 31 27·21 | 77 44 5·46 | 252 18 59·08 | 4·8952743 | Shergarh ..... | .. .. .. | .. .. .. | 72 24 51·86 |
| | Memoni ..... | .. .. .. | .. .. .. | 177 11 20·05 | 4·9624711 | Kasri..... | 25 46 34·38 | 77 43 16·25 | 357 10 58·75 |
| | Shergarh ..... | 25 35 22·92 | 77 57 43·22 | 130 35 0·87 | 5·0184540 | Kasri..... | .. .. .. | .. .. .. | 310 28 45·14 |
| 40 | Shergarh ..... | .. .. .. | .. .. .. | 191 28 0·32 | 5·1004541 | Dhobai ..... | 25 55 45·87 | 78 2 17·68 | 11 29 59·60 |
| | Kasri..... | 25 46 34·38 | 77 43 16·25 | 241 49 14·47 | 5·0726319 | Dhobai ..... | .. .. .. | .. .. .. | 61 57 32·20 |
| | Dhobai ..... | 25 55 45·87 | 78 2 17·68 | 118 30 30·66 | 4·8327655 | Den ..... | 26 1 7·02 | 77 51 22·19 | 298 25 43·59 |
| | Kasri..... | 25 46 34·38 | 77 43 16·25 | 206 41 41·76 | 4·9941718 | Den ..... | .. .. .. | .. .. .. | 26 45 14·00 |
| | Kasri..... | .. .. .. | .. .. .. | 143 39 0·04 | 4·9314404 | Chilwani ..... | 25 57 55·14 | 77 34 1·59 | 323 34 58·02 |
| 45 | Den ..... | 26 1 7·02 | 77 51 22·19 | 78 31 38·68 | 4·9863095 | Chilwani ..... | .. .. .. | .. .. .. | 258 24 2·64 |
| | Den ..... | .. .. .. | .. .. .. | 243 38 22·42 | 4·9866714 | Raipur ..... | 26 8 12·51 | 78 7 15·78 | 63 45 21·61 |
| | Dhobai ..... | 25 55 45·87 | 78 2 17·68 | 199 48 32·17 | 4·9039378 | Raipur ..... | .. .. .. | .. .. .. | 19 50 43·00 |
| | Raipur ..... | 26 8 12·51 | 78 7 15·78 | 123 5 15·55 | 4·9480084 | Pagaro ..... | 26 16 11·43 | 77 53 39·13 | 302 59 14·95 |
| | Den ..... | 26 1 7·02 | 77 51 22·19 | 187 46 14·35 | 4·9646723 | Pagaro ..... | .. .. .. | .. .. .. | 7 47 14·68 |
| 50 | Den ..... | .. .. .. | .. .. .. | 120 26 1·47 | 5·1160337 | Juktipura ..... | 26 12 0·73 | 77 30 45·51 | 300 16 57·22 |

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| No. | Stations of the eye A. | | | | | Stations of the object B. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. | Log. of Geodetic line. | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. |
| | Chilwani ..... | 25° 57′ 55″·14 | 77° 34′ 1″·59 | 168° 11′ 22″·80 | 4·9407560 | Juktipura ..... | 26° 12′ 0″·73 | 77° 30′ 45″·51 | 348° 9′ 56″·59 |
| | Pagaro ..... | 26 16 11·43 | 77 53 39·13 | 78 38 21·71 | 5·1058530 | Juktipura ..... | .. .. .. | .. .. .. | 258 28 14·50 |
| | Pagaro ..... | .. .. .. | .. .. .. | 127 16 25·54 | 5·0917381 | Gurjapahar .... | 26 28 31·00 | 77 35 37·33 | 307 8 24·99 |
| | Juktipura ..... | 26 12 0·73 | 77 30 45·51 | 194 50 48·95 | 5·0148350 | Gurjapahar .... | .. .. .. | .. .. .. | 14 52 58·41 |
| 55 | Juktipura ..... | .. .. .. | .. .. .. | 110 39 43·67 | 5·0065527 | Nindhar..... | 26 17 54·37 | 77 13 21·63 | 290 32 1·98 |
| | Gurjapahar .... | 26 28 31·00 | 77 35 37·33 | 62 11 9·87 | 5·1380544 | Nindhar..... | .. .. .. | .. .. .. | 242 1 16·24 |
| | Gurjapahar .... | .. .. .. | .. .. .. | 100 20 33·29 | 5·2206904 | Machi ..... | 26 33 23·32 | 77 5 36·31 | 280 7 9·23 |
| | Nindhar..... | 26 17 54·37 | 77 13 21·63 | 155 45 44·61 | 5·0124701 | Machi ..... | .. .. .. | .. .. .. | 335 42 17·51 |
| | Pagaro ..... | 26 16 11·43 | 77 53 39·13 | 176 17 36·96 | 5·1444194 | Dholpur ..... | 26 39 9·28 | 77 51 59·76 | 356 16 52·68 |
| 60 | Gurjapahar .... | 26 28 31·00 | 77 35 37·33 | 234 4 53·56 | 5·0415967 | Dholpur ..... | .. .. .. | .. .. .. | 54 12 12·89 |
| | Gurjapahar .... | .. .. .. | .. .. .. | 148 1 13·90 | 5·2670024 | Dimdima ..... | 26 54 22·95 | 77 17 35·32 | 327 53 7·91 |
| | Machi ..... | 26 33 23·32 | 77 5 36·31 | 207 5 0·24 | 5·1551839 | Dimdima ..... | .. .. .. | .. .. .. | 27 10 23·66 |
| | Dholpur ..... | 26 39 9·28 | 77 51 59·76 | 149 44 12·86 | 5·0992017 | Usira..... | 26 57 3·40 | 77 40 19·85 | 329 38 57·26 |
| | Gurjapahar .... | 28 28 31·00 | 77 35 37·33 | 188 24 26·64 | 5·2426403 | Usira..... | .. .. .. | .. .. .. | 8 26 33·64 |
| 65 | Dimdima ..... | 26 54 22·95 | 77 17 35·32 | 262 26 17·09 | 5·0953352 | Usira..... | .. .. .. | .. .. .. | 82 36 35·03 |
| | Usira..... | 26 57 3·40 | 77 40 19·85 | 146 55 28·60 | 5·0827065 | Madhoni ..... | 27 13 46·51 | 77 28 8·36 | 326 49 55·48 |
| | Dimdima ..... | 26 54 22·95 | 77 17 35·32 | 205 55 11·30 | 5·1163249 | Madhoni ..... | .. .. .. | .. .. .. | 25 59 59·34 |
| | Dimdima ..... | .. .. .. | .. .. .. | 134 47 1·87 | 5·0869790 | Alipur ..... | 27 8 34·12 | 77 1 35·32 | 314 39 45·67 |
| | Madhoni ..... | 27 13 46·51 | 77 28 8·36 | 77 43 41·91 | 5·1680875 | Alipur ..... | .. .. .. | .. .. .. | 257 31 34·07 |
| 70 | Alipur ..... | 27 8 34·12 | 77 1 35·32 | 209 39 38·89 | 5·0906104 | Rasia..... | 27 26 13·55 | 77 12 52·05 | 29 44 49·18 |
| | Madhoni ..... | 27 13 46·51 | 77 28 8·36 | 132 27 40·99 | 5·0488214 | Rasia..... | .. .. .. | .. .. .. | 312 20 40·26 |
| | Madhoni ..... | .. .. .. | .. .. .. | 199 26 15·41 | 4·9918392 | Aring..... | 27 29 2·58 | 77 34 11·03 | 19 29 2·07 |
| | Rasia..... | 27 26 13·55 | 77 12 52·05 | 261 29 13·97 | 5·0661651 | Aring..... | .. .. .. | .. .. .. | 81 39 3·76 |
| | Rasia ..... | .. .. .. | .. .. .. | 102 16 22·76 | 5·0743508 | Ladpur ..... | 27 30 21·63 | 76 51 24·08 | 282 6 28·61 |
| 75 | Alipur ..... | 27 8 34·12 | 77 1 35·32 | 157 23 5·86 | 5·1556758 | Ladpur ..... | .. .. .. | .. .. .. | 337 18 25·28 |
| | Ladpur ..... | 27 30 21·63 | 76 51 24·08 | 217 18 50·00 | 5·0138135 | Chapra ..... | 27 43 53·94 | 77 3 0·55 | 37 24 12·88 |
| | Rasia ..... | 27 26 13·55 | 77 12 52·05 | 153 37 5·87 | 5·0777493 | Chapra ..... | .. .. .. | .. .. .. | 333 32 31·98 |
| | Rasia ..... | .. .. .. | .. .. .. | 219 49 47·87 | 4·9736003 | Manpur ..... | 27 38 8·52 | 77 24 2·29 | 39 54 57·74 |
| | Aring..... | 27 29 2·58 | 77 34 11·03 | 135 13 47·50 | 4·8905878 | Manpur ..... | .. .. .. | .. .. .. | 315 9 5·84 |
| 80 | Chapra ..... | 27 43 53·94 | 77 3 0·55 | 287 1 8·94 | 5·0743141 | Manpur ..... | .. .. .. | .. .. .. | 107 10 55·13 |
| | Chapra ..... | .. .. .. | .. .. .. | 218 21 4·05 | 5·1638204 | Pahera ..... | 28 2 44·96 | 77 19 50·46 | 38 28 56·45 |
| | Manpur..... | 27 38 8·52 | 77 24 2·29 | 171 23 53·70 | 5·1785422 | Pahera ..... | .. .. .. | .. .. .. | 351 21 56·11 |
| | Manpur..... | .. .. .. | .. .. .. | 230 14 37·00 | 5·0803472 | No..... | 27 50 49·21 | 77 41 12·88 | 50 22 36·73 |
| | Aring..... | 27 29 2·58 | 77 34 11·03 | 196 0 16·96 | 5·1377616 | No..... | .. .. .. | .. .. .. | 16 3 32·83 |
| 85 | Pahera ..... | 28 2 44·96 | 77 19 50·46 | 302 4 32·23 | 5·1330265 | No..... | .. .. .. | .. .. .. | 122 14 33·22 |
| | Pahera ..... | .. .. .. | .. .. .. | 92 13 38·97 | 5·0406818 | Meoli..... | 28 3 25·70 | 76 59 25·46 | 272 4 2·89 |
| | Chapra ..... | 27 43 53·94 | 77 3 0·55 | 170 45 16·98 | 5·0789302 | Meoli..... | .. .. .. | .. .. .. | 350 43 36·35 |
| | Pahera ..... | 28 2 44·96 | 77 19 50·46 | 242 1 34·75 | 4·9795164 | Karol..... | 28 10 7·00 | 77 35 31·90 | 62 8 58·29 |
| | No..... | 27 50 49·21 | 77 41 12·88 | 165 22 44·18 | 5·0823742 | Karol..... | .. .. .. | .. .. .. | 345 20 4·08 |
| 90 | No..... | .. .. .. | .. .. .. | 218 57 17·63 | 5·0424395 | Chandaos ..... | 28 4 57·43 | 77 54 6·94 | 39 3 20·62 |
| | Karol..... | 28 10 7·00 | 77 35 31·90 | 287 19 18·50 | 5·0195631 | Chandaos ..... | .. .. .. | .. .. .. | 107 28 4·14 |
| | Karol..... | .. .. .. | .. .. .. | 229 31 57·06 | 5·1190377 | Bulandsheher .. | 28 24 10·76 | 77 54 12·57 | 49 40 48·11 |
| | Chandaos ..... | 28 4 57·43 | 77 54 6·94 | 180 14 48·77 | 5·0663747 | Bulandsheher .. | .. .. .. | .. .. .. | 0 14 51·43 |
| | Meoli..... | 28 3 25·70 | 76 59 25·46 | 212 40 29·90 | 5·1825554 | Deri ..... | 28 24 33·43 | 77 14 46·02 | 32 47 45·39 |
| 95 | Pahera ..... | 28 2 44·96 | 77 19 50·46 | 168 22 48·98 | 5·1302027 | Deri ..... | .. .. .. | .. .. .. | 348 20 24·98 |
| | Karol..... | 28 10 7·00 | 77 35 31·90 | 128 14 51·38 | 5·1512061 | Deri ..... | .. .. .. | .. .. .. | 308 5 0·96 |
| | Karol..... | .. .. .. | .. .. .. | 174 31 33·17 | 5·1026303 | Bostan ..... | 28 30 55·00 | 77 33 16·44 | 354 30 28·86 |
| | Bulandsheher .. | 28 24 10·76 | 77 54 12·57 | 110 5 58·28 | 5·0766790 | Bostan ..... | .. .. .. | .. .. .. | 289 55 59·67 |
| | Deri ..... | 28 24 33·43 | 77 14 46·02 | 248 40 13·51 | 5·0266586 | Bostan ..... | .. .. .. | .. .. .. | 68 49 2·69 |
| 100 | Deri ..... | .. .. .. | .. .. .. | 181 45 39·29 | 4·9854862 | Pirghyb ..... | 28 40 30·28 | 77 15 19·39 | 1 45 55·23 |



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| No. | Stations of the eye A. | | | | | Stations of the object B. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. | Log. of Geodetic line. | Names of Stations. | Latitude N. | Longitude East of Greenwich. | Azimuths. |
| | Bostan ..... | 28° 30′ 55″·00 | 77° 33′ 16″·44 | 121° 15′ 45″·74 | 5·0500729 | Pirghyb ..... | 28° 40′ 30″·28 | 77° 15′ 19″·39 | 301° 7′ 10″·25 |
| | Bostan ..... | .. .. .. | .. .. .. | 208 40 44·30 | 4·9560585 | Dateri ..... | 28 43 59·59 | 77 41 23·69 | 28 44 37·73 |
| | Bulandsheher .. | 28 24 10·76 | 77 54 12·57 | 150 20 8·93 | 5·1407880 | Dateri ..... | .. .. .. | .. .. .. | 330 14 1·24 |
| | Pirghyb..... | 28 40 30·28 | 77 15 19·39 | 261 15 45·67 | 5·1488478 | Dateri ..... | .. .. .. | .. .. .. | 81 28 16·97 |
| 105 | Pirghyb..... | .. .. .. | .. .. .. | 223 42 1·17 | 5·0894058 | Dholri ..... | 28 55 8·50 | 77 31 14·65 | 43 49 41·35 |
| | Dateri ..... | 28 43 59·59 | 77 41 23·69 | 141 19 45·46 | 4·9375600 | Dholri ..... | .. .. .. | .. .. .. | 321 41 51·83 |
| | Dateri ..... | .. .. .. | .. .. .. | 202 6 5·19 | 5·0772281 | Saini ..... | 29 2 14·86 | 77 49 50·11 | 22 10 9·83 |
| | Dholri ..... | 28 55 8·50 | 77 31 14·65 | 246 25 23·08 | 5·0334998 | Saini ..... | .. .. .. | .. .. .. | 66 34 23·50 |
| | Dholri ..... | .. .. .. | .. .. .. | 188 39 38·92 | 4·9554458 | Saroli..... | 29 9 51·55 | 77 33 47·96 | 8 40 53·34 |
| 110 | Saini ..... | 29 2 14·86 | 77 49 50·11 | 118 27 49·46 | 4·9868527 | Saroli..... | .. .. .. | .. .. .. | 298 20 1·52 |
| | Saini ..... | .. .. .. | .. .. .. | 166 58 42·52 | 5·1000161 | Begarazpur .... | 29 22 28·76 | 77 44 29·45 | 346 56 6·07 |
| | Saroli..... | 29 9 51·55 | 77 33 47·96 | 216 33 3·69 | 4·9790519 | Begarazpur .... | .. .. .. | .. .. .. | 36 38 17·34 |
| | Saini ..... | 29 2 14·86 | 77 49 50·11 | 212 34 38·04 | 5·0784622 | Sheopuri ..... | 29 18 53·48 | 78 1 58·84 | 32 40 33·30 |
| | Begarazpur .... | 29 22 28·76 | 77 44 29·45 | 283 6 42·66 | 4·9794340 | Sheopuri ..... | .. .. .. | .. .. .. | 103 15 16·94 |
| 115 | Begarazpur .... | .. .. .. | .. .. .. | 215 27 17·73 | 5·0401628 | Godhna..... | 29 37 12·51 | 77 56 30·42 | 35 33 12·72 |
| | Sheopuri ..... | 29 18 53·48 | 78 1 58·84 | 165 22 22·71 | 5·0598588 | Godhna..... | .. .. .. | .. .. .. | 345 19 41·14 |
| | Begarazpur .... | 29 22 28·76 | 77 44 29·45 | 162 53 56·18 | 4·7232471 | Kaliana..... | 29 30 48·90 | 77 41 33·46 | 342 52 29·66 |
| | Godhna..... | 29 37 12·51 | 77 56 30·42 | 63 59 1·93 | 4·9453511 | Kaliana..... | .. .. .. | .. .. .. | 243 51 39·32 |
| | Godhna..... | .. .. .. | .. .. .. | 91 25 39·02 | 4·9574639 | Dahera ..... | 29 37 33·76 | 77 39 23·27 | 271 17 11·30 |
| 120 | Kaliana..... | 29 30 48·90 | 77 41 33·46 | 164 18 50·90 | 4·6283150 | Dahera ..... | .. .. .. | .. .. .. | 344 17 46·65 |
| | Begarazpur .... | 29 22 28·76 | 77 44 29·45 | 163 32 24·78 | 4·9793658 | Dahera ..... | .. .. .. | .. .. .. | 343 29 54·00 |
| | Dahera ..... | 29 37 33·76 | 77 39 23·27 | 190 51 40·86 | 4·9890802 | Nojhili ..... | 29 53 21·51 | 77 42 52·04 | 10 53 24·48 |
| | Godhna..... | 29 37 12·51 | 77 56 30·42 | 143 40 45·93 | 5·0849711 | Nojhili ..... | .. .. .. | .. .. .. | 323 33 59·77 |
| | Godhna..... | .. .. .. | .. .. .. | 193 4 54·57 | 5·2695979 | Dhoiwala ..... | 30 7 5·58 | 78 4 29·92 | 13 8 53·38 |
| 125 | Nojhili ..... | 29 53 21·51 | 77 42 52·04 | 233 47 18·38 | 5·1500114 | Dhoiwala ..... | .. .. .. | .. .. .. | 53 58 7·41 |
| | Nojhili ..... | .. .. .. | .. .. .. | 181 25 12·91 | 5·2493262 | Amsot ..... | 30 22 38·03 | 77 43 42·29 | 1 25 38·13 |
| | Dhoiwala ..... | 30 7 5·58 | 78 4 29·92 | 130 49 16·02 | 5·1595587 | Amsot ..... | .. .. .. | .. .. .. | 310 38 47·53 |
| | Dhoiwala ..... | .. .. .. | .. .. .. | 177 26 6·30 | 5·1136707 | Banog ..... | 30 28 29·93 | 78 3 23·47 | 357 25 32·78 |
| | Amsot ..... | 30 22 38·03 | 77 43 42·29 | 250 56 16·71 | 5·0388026 | Banog ..... | .. .. .. | .. .. .. | 71 6 14·91 |
| 130 | Amsot ..... | .. .. .. | .. .. .. | 288 26 18·07 | 4·7625229 | W. End Base .. | 30 19 36·46 | 77 54 8·88 | 108 31 34·72 |
| | Banog ..... | 30 28 29·93 | 78 3 23·47 | 42 3 4·39 | 4·8606799 | W. End Base .. | .. .. .. | .. .. .. | 221 58 23·73 |
| | Banog ..... | .. .. .. | .. .. .. | 10 21 30·79 | 4·8501018 | E. End Base .. | 30 17 0·61 | 78 0 58·24 | 190 20 17·34 |
| | Amsot ..... | 30 22 38·03 | 77 43 42·29 | 290 30 52·76 | 4·9866325 | E. End Base .. | .. .. .. | .. .. .. | 110 39 35·94 |
| | W. End Base .. | 30 19 36·46 | 77 54 8·88 | 293 40 13·21 | 4·5931068 | E. End Base .. | .. .. .. | .. .. .. | 113 43 39·79 |

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# RESULTS OF OBSERVATIONS FOR AMPLITUDE

# SECTION KALIANPUR—KALIANA.

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## SERIES A.

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# RECAPITULATION

OF

## CERTAIN PARTICULARS DETAILED IN THE INTRODUCTORY PAGES.

THE Series which follows consists of simultaneous observations of the zenith distances of stars to determine the amplitude of the section of the Great Arc between Kalianpur in latitude 24° 7′ 11″·84, longitude 77° 41′ 44″·75, and Kaliana in latitude 29° 30′ 48″·90, longitude 77° 41′ 33″·46.

The portion of these observations at the Northern limit of the section was commenced at Kaliana on the 30th November 1839 and terminated on the 3rd February 1840. The stars were observed partly by Lt. Colonel Everest and partly by Captain Renny.

The other portion at the Southern limit was commenced on the 30th of November 1839, and terminated on the 23rd January 1840, and was effected entirely by Captain A. S. Waugh, Astronomical Assistant G. T. Survey. The observations therefore, though not strictly simultaneous, are as nearly so as the state of the heavens permitted.

The stars are 36 in number, of which 18 are to the North, and the remaining 18 to the South of both zeniths.

At both stations altitude and azimuth instruments were employed, the one precisely similar to the other, having an altitude circle of 3 feet diameter and an azimuth circle of 2 feet; the latter was of cast-iron, a description of which will be found in the Transactions of the Royal Astronomical Society for 1840-41. Both instruments were originally constructed by Messrs. Troughton and Simms; that at Kalianpur being designated for distinction by the name of the former celebrated artist, and that at Kaliana by the latter.

The face of the vertical circle in either case was reversed on successive nights and after each star had passed.

It will appear from the Synopsis, page 420, that the amplitude derived from this series is 5° 23′ 37″·058; also that the latitude of Kalianpur is 24° 7′ 11″·093, and of Kaliana 29° 30′ 48″·151.

The elements used in computing the corrections in column 6 are not precisely the same as those by which the latitude is deduced, for this reason, the positions of the stars observed were in the first instance taken from the catalogue of the Royal Astronomical Society, with which as elements, the reductions were made, a procedure which, in the case of rigorous maintenance of simultaneity, can evidently produce no effect on the

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amplitude. Subsequently however, the places of the stars employed were determined by the Astronomer Royal, whence the correct latitude of Kalianpur and consequently that of Kaliana were brought out.

The amplitude may be more or less inaccurate on account of the extreme difficulty of getting the true relative values of the thermometers and barometers used in the operations, but no effort has been spared to accomplish this, and the small correction applied to the end of each series is that arising from a subsequent rigorous comparison of the standards.

Each of these instruments is furnished with four micrometrical microscopes to the vertical circle, of which two are fixed on one side, and two called revolving microscopes, susceptible of change of position, on the other side.

Each face is divided from 0° to 90° and from 90° to 0°, in such wise that the graduation of the semicircle is continuous. All four micrometers have universally been read off, and the readings in column No. 4 are the arithmetical means thence derived.

The revolving microscopes are attached to a moveable arm, so that the pair are shifted in position by one and the same motion; the construction of the arm and pillars does not admit of the microscopes being brought within 30° of the zenith, and as the most likely method to turn this power of changing Zero to the best advantage, the rule followed by both parties was to commence with the revolving microscopes at 20° of altitude, and thence to proceed by successive changes of 20° to 40° and 60° of altitude, 30°, 50°, 70°, of zenith distance; the positions herein adverted to are shewn in column 3, where $a$ implies altitude, and $\underset{(i)}{a}$ zenith distance.

The divided faces are marked $A$ and $B$; half the series of observations were made with the former to the fixed microscopes, and the other half with the latter, and it will be understood that when the position of the face of the instrument is spoken of, the face is implied which was for the time being opposite the fixed microscopes. Thus, to take as an instance the first night's observation at Kaliana of the first star of the series, it appears that on the 30th November 1839 the face $A$ which was then towards the fixed microscopes, was to the East, and the revolving microscopes read 20° altitude, corresponding to the reading 0° of the fixed microscopes.

The 5th column contains the refractions deduced by the rules and formulæ of Mr. Atkinson; the heights of the barometers, attached and detached thermometers, were observed immediately preceding the transits of the 1st star and subsequent to those of the 8th, 14th, 22nd, 27th, 33rd, and 36th, the intermediate states being interpolated; all the thermometers used were compared with a standard, and the refractions deduced accordingly, but there seems to be reason to believe that between the standards of reference at Kaliana and Kalianpur there is still some slight discrepancy, which, should it be eventually determined, will induce the necessity of a future correction to the amplitude.

The corrections in column 6 are those to reduce the star's place at the time of observation to its mean place on the nearest 1st January, the formulæ and rules made



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use of are those given by Mr. Bailey in the Transactions of Astronomical Society of London.

The corrections for collimation are those derived from observations made on a phantom employed as a collimator fixed nearly in the horizon, the instrument being turned half round in azimuth after each observation; three pairs were usually taken in this wise prior to the transit of the first star and as many immediately after that of the last, and the mean of the two results is considered to be the value of the error of horizontal collimation for the night.

The corrections in column 7 are those for the level of the body of the instrument; immediately after each star observation had been taken and the four micrometers of the vertical circle read off and registered, the indications of both ends of the level on the divisions of the scale were read off to the nearest tenth prior to the reversion, and as the instrument was reversed after each star, therefore there is in every instance one indication of the level before and one after the star's transit.

The rule universally followed has been to employ the last indication of the level before and the first after, to render which complete, the indication given by the last observation on the phantom is used in the case of the first star observation, and the preceding series of phantom experiments always begins with the same face as the series of stars, and ends with the opposite face.

The values of the divisions of the level attached to both instruments, as well as the micrometers in the eye-tubes of the telescopes, were determined very carefully by a numerous series of trials made by attaching the level to the vertical circle, and the following are the results :—

| Instrument. | Axis Level 1 Division. | Azimuth Level 1 Division. | Telescope Micrometer 1 Revolution. |
|---|---|---|---|
| Simms ..... | 0″·8872 | 0″·8466 | 37″·1141 |
| Troughton .... | 0·9442 | 0·7351 | 39·1648 |

The rule prescribed was to make four observations on each star at every position of the moveable microscopes, or as it is called of Zero; of these, two would be with the face East and two with the face West, and when that can be accomplished uninterruptedly, without excess or defect, the arithmetical mean of all four is that given in column 11: but in a long series of observations, clouds, adverse weather, and accidents will disturb the harmony of such a system, and to meet such sources of irregularity, the following rule was observed:—Not to change Zero until for every star of the series there had been at least one observation face East and one face West; to take the arithmetical mean of the whole observations face East and the whole face West, and the mean of these two means as the general mean at each Zero.

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The prescribed set of observations face *A* to the fixed microscopes having been completed, the instrument was turned over in its *Y*'s, and those on face *B* gone through in a similar manner. In taking the observations at Kaliana in 1839-40, two astronomical clocks were used, one by Earnshaw and one by Jones, by means of which the transit of each star over the middle wire was noted, the times of the same transits at Kalianpur at the same season were noted by a chronometer. Subsequently the clock by Jones was sent to Damargida, where it was employed in the series of 1840-41, and the clock by Earnshaw was used at Kalianpur, care having been taken to retain the same divisions of the graduated heads for regulating the pendulum at the index.

The pivots were examined in 1837 by fixing the cast-iron frames of a transit instrument on a massive slab of sandstone at such distances from each other as to admit one of the pivots of the astronomical circle into each of the *Y*'s, and the following were the results:—

| | | Div$^{n.}$ | |
|---|---|---|---|
| Simms ..... | Radius of Pivot *B* in excess to Pivot *A* ..... | 0·33 | = 0″·293. |
| Troughton ... | Radius of Pivot *B* in excess to Pivot *A* ..... | 0·807 | = 0″·762. |

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No. 1 (362) 61 ARIETIS $\tau'$. South 8° 56′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | E | | 27″·950 | +8″·747 | +11″·626 | +1″·051 | +2″·434 | +23″·858 | 51″·808 | |
| Dec. 1 | W | | 34·025 | +8·856 | +11·650 | −2·355 | +0·466 | +18·617 | 52·642 | |
| 2 | E | | 32·750 | +8·901 | +11·674 | +1·084 | −0·889 | +20·770 | 53·520 | |
| 3 | W | 20° α | 34·725 | +8·896 | +11·696 | −1·321 | −0·021 | +19·250 | 53·975 | 53″·601 |
| 4 | E | | 31·900 | +8·798 | +11·717 | +3·203 | −0·868 | +22·850 | 54·750 | |
| 5 | W | | 35·925 | +8·809 | +11·737 | −2·361 | +0·741 | +18·926 | 54·851 | |
| 6 | E | | 32·450 | +8·778 | +11·755 | +1·166 | +0·571 | +22·270 | 54·720 | |
| 7 | W | | 32·625 | +8·771 | +11·772 | −0·500 | −0·127 | +19·916 | 52·541 | |
| 8 | E | | 33·200 | +8·773 | +11·789 | −0·250 | +1·016 | +21·328 | 54·528 | |
| 9 | W | 40° α | 31·400 | +8·852 | +11·805 | +0·709 | −0·444 | +20·922 | 52·322 | 52″·206 |
| 10 | E | | 31·600 | +8·803 | +11·819 | −1·032 | −0·021 | +19·569 | 51·169 | |
| 11 | W | | 28·000 | +8·794 | +11·833 | +1·118 | +1·058 | +22·803 | 50·803 | |
| 12 | E | | 29·925 | +8·821 | +11·846 | +3·114 | −0·614 | +23·167 | 53·092 | |
| 13 | W | 60° α | 33·875 | +8·841 | +11·857 | −2·595 | +0·423 | +18·526 | 52·401 | 52″·488 |
| 14 | E | | 28·500 | +8·856 | +11·867 | +2·013 | +1·037 | +23·773 | 52·273 | |
| 15 | W | | 33·575 | +8·874 | +11·876 | −1·534 | +0·444 | +19·660 | 53·235 | |
| 16 | E | | 29·550 | +8·832 | +11·886 | +2·088 | +0·402 | +23·208 | 52·758 | |
| 17 | W | 30° α (i) | 34·450 | +8·881 | +11·894 | −2·115 | +0·656 | +19·316 | 53·766 | 52″·972 |
| 18 | E | | 29·200 | +8·860 | +11·899 | +3·260 | −0·212 | +23·807 | 53·007 | |
| 19 | W | | 37·000 | +8·897 | +11·904 | −3·433 | −2·011 | +15·357 | 52·357 | |
| 20 | E | | 31·850 | +8·870 | +11·909 | +0·613 | −0·190 | +21·202 | 53·052 | |
| 21 | W | 50° α (i) | 32·350 | +8·845 | +11·913 | −0·059 | −0·698 | +20·001 | 52·351 | 52″·988 |
| 22 | E | | 31·000 | +8·839 | +11·914 | +0·162 | +0·529 | +21·444 | 52·444 | |
| 23 | W | | 32·750 | +8·876 | +11·915 | −0·769 | +1·333 | +21·355 | 54·105 | |
| 24 | E | | 27·850 | +8·790 | +11·918 | +1·406 | +1·693 | +23·807 | 51·657 | |
| 26 | W | 70° α (i) | 30·800 | +8·837 | +11·916 | +1·913 | −0·487 | +22·179 | 52·979 | 53″·173 |
| 27 | E | | 34·275 | +8·840 | +11·913 | −2·415 | +1·672 | +20·010 | 54·285 | |
| 28 | W | | 28·750 | +8·871 | +11·908 | +2·528 | +1·714 | +25·021 | 53·771 | |
| 29 | E | 60° α | 29·825 | +8·886 | +11·903 | +0·584 | +1·079 | +22·452 | 52·277 | |
| 30 | W | | 32·275 | +8·872 | +11·897 | −1·159 | −0·233 | +19·377 | 51·652 | |

Mean 8° 56′ 52″·9047

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 26″·875 | +8″·880 | +11″·890 | +3″·191 | +0″·296 | +24″·257 | 51″·132 | |
| Jan. 1 | W | 30° α | 38·600 | +8·907 | +11·927 | −3·840 | +0·571 | +17·565 | 56·165 | 52″·974 |
| 2 | E | | 23·450 | +8·928 | +11·919 | +3·983 | +1·905 | +26·735 | 50·185 | |
| 3 | W | | 37·625 | +8·893 | +11·910 | −4·055 | +0·042 | +16·790 | 54·415 | |
| 4 | E | | 33·175 | +8·912 | +11·899 | −0·634 | −0·423 | +19·754 | 52·929 | |
| 5 | W | 40° α | 34·175 | +8·894 | +11·887 | +0·396 | +0·042 | +21·219 | 55·394 | 53″·909 |
| 6 | W | | 34·825 | +8·889 | +11·875 | −0·696 | −0·444 | +19·624 | 54·449 | |
| 7 | E | | 31·625 | +8·842 | +11·861 | −0·183 | +0·720 | +21·240 | 52·865 | |
| 8 | E | | 31·600 | +8·846 | +11·846 | −1·641 | +1·841 | +20·892 | 52·492 | |
| 9 | W | 60° α | 32·000 | +8·886 | +11·830 | +1·184 | +0·042 | +21·942 | 53·942 | 52″·756 |
| 10 | W | | 32·325 | +8·870 | +11·814 | +0·394 | +0·085 | +21·163 | 53·488 | |
| 11 | E | | 30·250 | +8·778 | +11·797 | −0·549 | +0·825 | +20·851 | 51·101 | |
| 12 | E | | 29·825 | +8·823 | +11·778 | −1·008 | +1·206 | +20·799 | 50·624 | |
| 13 | W | 30° α (i) | 33·025 | +8·834 | +11·758 | +0·429 | −0·423 | +20·598 | 53·623 | 52″·424 |
| 14 | E | | 30·775 | +8·905 | +11·738 | +0·004 | +0·085 | +20·732 | 51·507 | |
| 15 | W | | 34·250 | +8·763 | +11·717 | −0·556 | −0·233 | +19·691 | 53·941 | |
| 16 | E | | 29·825 | +8·742 | +11·694 | −0·824 | +0·635 | +20·247 | 50·072 | |
| 17 | W | | 33·000 | +8·730 | +11·669 | +0·395 | −1·016 | +19·778 | 52·778 | |
| 19 | W | 50° α (i) | 32·550 | +8·827 | +11·619 | −0·524 | +1·693 | +21·615 | 54·165 | 52″·255 |
| 24 | E | | 31·100 | +8·743 | +11·477 | −0·196 | +0·847 | +20·871 | 51·971 | |
| 25 | E | | 31·650 | +8·764 | +11·446 | −0·963 | −0·063 | +19·184 | 50·834 | |
| 26 | W | | 34·800 | +8·774 | +11·414 | −0·493 | −0·783 | +18·912 | 53·712 | |
| 28 | E | | 33·825 | +8·774 | +11·346 | −1·636 | +0·339 | +18·823 | 52·648 | |
| 29 | W | | 32·325 | +8·819 | +11·311 | +1·408 | 0·000 | +21·538 | 53·863 | |
| 30 | E | 70° α (i) | 34·200 | +8·814 | +11·275 | −1·720 | −0·042 | +18·327 | 52·527 | 53″·239 |
| 31 | W | | 31·325 | +8·815 | +11·238 | +2·059 | +0·360 | +22·472 | 53·797 | |
| Feb. 2 | E | | 33·075 | +8·802 | +11·161 | −1·730 | +0·783 | +19·016 | 52·091 | |
| 3 | W | | 33·200 | +8·766 | +11·121 | +1·081 | +0·339 | +21·307 | 54·507 | |

Mean 8° 56′ 52″·9262

Mean Result of both Faces ..... 8° 56′ 52″·9154

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No. 2 (376) 66 ARIETIS. South 7° 15′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 30 | W | | 35″·500 | +7″·086 | +11″·741 | −1″·051 | +3″·471 | +21″·247 | 56″·747 | |
| Dec. 1 | E | | 37·000 | +7·180 | +11·775 | +2·355 | +1·058 | +22·368 | 59·368 | |
| 2 | W | 20° α | 37·425 | +7·210 | +11·808 | −1·084 | −0·085 | +17·847 | 55·272 | |
| 3 | E | | 37·950 | +7·204 | +11·839 | +1·321 | −0·063 | +20·301 | 58·251 | |
| 4 | W | | 40·325 | +7·124 | +11·869 | −3·203 | −0·106 | +15·684 | 56·009 | 57″·042 |
| 5 | E | | 34·675 | +7·135 | +11·898 | +2·361 | +0·444 | +21·838 | 56·513 | |
| 6 | W | | 38·600 | +7·117 | +11·926 | −1·166 | 0·000 | +17·877 | 56·477 | |
| 7 | E | | 38·175 | +7·111 | +11·952 | +0·500 | −0·042 | +19·521 | 57·696 | |
| 8 | W | | 36·000 | +7·109 | +11·979 | +0·250 | +1·143 | +20·481 | 56·481 | |
| 9 | E | 40° α | 39·575 | +7·158 | +12·004 | −0·709 | +0·212 | +18·665 | 58·240 | |
| 10 | W | | 36·750 | +7·129 | +12·027 | +1·032 | +0·593 | +20·781 | 57·531 | 57·592 |
| 11 | E | | 38·625 | +7·121 | +12·050 | −1·118 | +1·439 | +19·492 | 58·117 | |
| 12 | W | | 42·300 | +7·143 | +12·072 | −3·114 | −0·063 | +16·038 | 58·338 | |
| 13 | E | 60° α | 33·100 | +7·160 | +12·093 | +2·595 | +1·249 | +23·097 | 56·197 | 57·975 |
| 14 | W | | 40·925 | +7·172 | +12·112 | −2·013 | +0·677 | +17·948 | 58·873 | |
| 16 | W | | 41·975 | +7·154 | +12·149 | −2·088 | +0·317 | +17·532 | 59·507 | |
| 17 | E | 30° α (c) | 32·675 | +7·191 | +12·166 | +2·115 | +1·799 | +23·271 | 55·946 | |
| 18 | W | | 41·375 | +7·177 | +12·181 | −3·260 | +0·571 | +16·669 | 58·044 | 57·416 |
| 19 | E | | 33·800 | +7·205 | +12·195 | +3·433 | −0·466 | +22·367 | 56·167 | |
| 20 | W | | 38·075 | +7·186 | +12·208 | −0·613 | +0·868 | +19·649 | 57·724 | |
| 21 | E | 50° α (c) | 36·200 | +7·164 | +12·222 | +0·059 | +0·635 | +20·080 | 56·280 | |
| 22 | W | | 36·350 | +7·159 | +12·232 | −0·162 | +1·672 | +20·901 | 57·251 | 57·107 |
| 23 | E | | 35·150 | +7·190 | +12·242 | +0·769 | +1·820 | +22·021 | 57·171 | |
| 24 | W | | 39·200 | +7·120 | +12·253 | −1·406 | +1·714 | +19·681 | 58·881 | |
| 26 | E | 70° α (c) | 42·000 | +7·158 | +12·269 | −1·913 | +0·339 | +17·853 | 59·853 | |
| 27 | W | | 35·900 | +7·163 | +12·275 | +2·415 | +2·476 | +24·329 | 60·229 | 59·406 |
| 28 | E | | 39·250 | +7·184 | +12·279 | −2·528 | +2·476 | +19·411 | 58·661 | |
| 29 | W | 60° α | 38·925 | +7·195 | +12·281 | −0·584 | +0·952 | +19·844 | 58·769 | |
| 30 | E | | 37·475 | +7·188 | +12·284 | +1·159 | +0·275 | +20·906 | 58·381 | |

Mean 7° 15′ 57″·7563

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 31 | W | | 40″·375 | +7″·194 | +12″·286 | −3″·191 | +0″·804 | +17″·093 | 57″·468 | |
| Jan. 1 | E | | 28·225 | +7·212 | +12·331 | +3·840 | +2·201 | +25·584 | 53·809 | |
| 2 | W | 20° α | 42·150 | +7·232 | +12·331 | −3·983 | +2·667 | +18·247 | 60·397 | 56″·716 |
| 3 | E | | 31·600 | +7·203 | +12·331 | +4·055 | 0·000 | +23·589 | 55·189 | |
| 4 | W | | 39·575 | +7·220 | +12·328 | +0·634 | −0·847 | +19·335 | 58·910 | |
| 5 | E | 40° α | 37·650 | +7·203 | +12·323 | −0·396 | +0·233 | +19·363 | 57·013 | |
| 6 | E | | 35·350 | +7·198 | +12·319 | +0·696 | +0·466 | +20·679 | 56·029 | 57·741 |
| 7 | W | | 39·375 | +7·160 | +12·313 | +0·183 | −0·021 | +19·635 | 59·010 | |
| 8 | W | | 36·475 | +7·166 | +12·306 | +1·641 | +1·863 | +22·976 | 59·451 | |
| 9 | E | 60° α | 35·175 | +7·197 | +12·298 | −1·184 | +1·651 | +19·962 | 55·137 | |
| 10 | E | | 35·900 | +7·182 | +12·289 | −0·394 | +1·249 | +20·326 | 56·226 | 57·569 |
| 11 | W | | 38·125 | +7·110 | +12·280 | +0·549 | +1·397 | +21·336 | 59·461 | |
| 12 | W | | 39·175 | +7·149 | +12·268 | +1·008 | +0·910 | +21·335 | 60·510 | |
| 13 | E | 30° α (c) | 37·475 | +7·156 | +12·255 | −0·429 | +0·720 | +19·702 | 57·177 | |
| 14 | W | | 39·625 | +7·212 | +12·242 | −0·004 | −0·085 | +19·365 | 58·990 | 58·159 |
| 15 | E | | 36·075 | +7·099 | +12·228 | +0·556 | 0·000 | +19·883 | 55·958 | |
| 17 | E | | 35·825 | +7·073 | +12·194 | −0·395 | +0·254 | +19·126 | 54·951 | |
| 19 | E | 50° α (c) | 35·225 | +7·148 | +12·157 | +0·524 | +2·625 | +22·454 | 57·679 | |
| 24 | W | | 37·375 | +7·081 | +12·046 | +0·196 | +0·783 | +20·106 | 57·481 | 57·225 |
| 25 | W | | 38·825 | +7·101 | +12·021 | +0·963 | +0·063 | +20·148 | 58·973 | |
| 26 | E | | 36·550 | +7·108 | +11·994 | +0·493 | −0·106 | +19·489 | 56·039 | |
| 28 | W | | 37·300 | +7·107 | +11·937 | +1·636 | −0·275 | +20·405 | 57·705 | |
| 29 | E | | 39·550 | +7·142 | +11·907 | −1·408 | +0·042 | +17·683 | 57·233 | |
| 30 | W | 70° α (c) | 37·850 | +7·137 | +11·875 | +1·720 | −0·127 | +20·605 | 58·455 | |
| 31 | E | | 39·775 | +7·141 | +11·844 | −2·059 | +0·550 | +17·476 | 57·251 | 57·537 |
| Feb. 2 | W | | 38·300 | +7·130 | +11·776 | +1·730 | +0·169 | +20·805 | 59·105 | |
| 3 | E | | 37·100 | +7·100 | +11·740 | −1·081 | +0·614 | +18·373 | 55·473 | |

Mean 7° 15′ 57″·4912

Mean Result of both Faces ..... 7° 15′ 57″·6238



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## No. 3 (383) 7 Tauri. South 5° 35′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | E | | 6″·425 | +5″·443 | +11″·825 | +1″·051 | +3″·196 | +21″·515 | 27″·940 | |
| Dec. 1 | W | | 8·950 | +5·518 | +11·867 | −2·355 | +1·164 | +16·194 | 25·144 | |
| 2 | E | α 20° | 8·150 | +5·537 | +11·910 | +1·084 | +0·063 | +18·594 | 26·744 | |
| 3 | W | | 11·100 | +5·532 | +11·950 | −1·321 | −0·635 | +15·526 | 26·626 | 26″·943 |
| 4 | E | | 9·425 | +5·469 | +11·990 | +3·203 | −1·228 | +19·434 | 28·859 | |
| 5 | W | | 11·400 | +5·479 | +12·029 | −2·361 | +0·085 | +15·232 | 26·632 | |
| 6 | E | | 8·825 | +5·470 | +12·065 | +1·166 | +0·106 | +18·807 | 27·632 | |
| 7 | W | | 9·050 | +5·465 | +12·101 | −0·500 | −0·148 | +16·918 | 25·968 | |
| 8 | E | | 12·800 | +5·461 | +12·137 | −0·250 | +1·079 | +18·427 | 21·227 | |
| 9 | W | α 40° | 6·550 | +5·489 | +12·172 | +0·709 | +0·635 | +19·005 | 25·555 | |
| 10 | E | | 9·175 | +5·473 | +12·205 | −1·032 | +0·931 | +17·577 | 26·752 | 25·221 |
| 11 | W | | 7·025 | +5·467 | +12·237 | +1·118 | +1·503 | +20·325 | 27·350 | |
| 12 | E | | 8·450 | +5·484 | +12·268 | +3·114 | +0·169 | +21·035 | 29·485 | |
| 13 | W | α 60° | 12·875 | +5·498 | +12·298 | −2·595 | +1·206 | +16·407 | 29·282 | |
| 14 | E | | 6·150 | +5·507 | +12·326 | +2·013 | +0·614 | +20·460 | 26·610 | 27·480 |
| 15 | W | | 11·000 | +5·517 | +12·354 | −1·534 | +0·106 | +16·443 | 27·443 | |
| 16 | E | | 9·600 | +5·493 | +12·382 | +2·088 | +1·376 | +21·339 | 30·939 | |
| 17 | W | α (1) 30° | 11·600 | +5·521 | +12·409 | −2·115 | +1·587 | +17·402 | 29·002 | |
| 18 | E | | 6·625 | +5·512 | +12·433 | +3·260 | +0·444 | +21·649 | 28·274 | 29·344 |
| 19 | W | | 14·625 | +5·532 | +12·456 | −3·433 | −0·021 | +14·534 | 29·159 | |
| 20 | E | | 11·825 | +5·519 | +12·478 | +0·613 | +0·698 | +19·308 | 31·133 | |
| 21 | W | α (1) 50° | 10·050 | +5·501 | +12·501 | −0·059 | +1·376 | +19·319 | 29·369 | |
| 22 | E | | 8·550 | +5·497 | +12·520 | +0·162 | +1·609 | +19·788 | 28·338 | 29·298 |
| 23 | W | | 9·450 | +5·522 | +12·539 | −0·769 | +1·609 | +18·901 | 28·351 | |
| 24 | E | | 9·225 | +5·468 | +12·559 | +1·406 | +1·270 | +20·703 | 29·928 | |
| 26 | W | α (1) 70° | 5·125 | +5·498 | +12·592 | +1·913 | +0·804 | +20·807 | 25·932 | |
| 27 | E | | 11·300 | +5·502 | +12·607 | −2·415 | +1·820 | +17·514 | 28·814 | 28·130 |
| 28 | W | | 4·725 | +5·516 | +12·620 | +2·528 | +2·455 | +23·119 | 27·844 | |
| 29 | E | α 60° | 6·675 | +5·524 | +12·631 | +0·584 | +1·037 | +19·776 | 26·451 | |
| 30 | W | | 7·675 | +5·520 | +12·643 | −1·159 | +0·931 | +17·935 | 25·610 | |

Mean 5° 35′ 27″·7360

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 6″·350 | +5″·526 | +12″·653 | +3″·191 | +0″·550 | +21″·920 | 28″·270 | |
| Jan. 1 | W | α 30° | 13·700 | +5·537 | +12·708 | −3·840 | +1·863 | +16·268 | 29·968 | 28″·438 |
| 2 | E | | 3·075 | +5·554 | +12·717 | +3·983 | +2·159 | +24·413 | 27·488 | |
| 3 | W | | 13·825 | +5·531 | +12·725 | −4·055 | 0·000 | +14·201 | 28·026 | |
| 4 | E | | 9·175 | +5·545 | +12·730 | −0·634 | +0·339 | +17·980 | 27·155 | |
| 5 | W | α 40° | 8·750 | +5·531 | +12·734 | +0·396 | +0·275 | +18·936 | 27·686 | |
| 6 | W | | 8·975 | +5·527 | +12·737 | −0·696 | +1·222 | +18·790 | 27·765 | 27·247 |
| 7 | E | | 8·350 | +5·497 | +12·740 | −0·183 | −0·021 | +18·033 | 26·383 | |
| 8 | E | | 10·975 | +5·504 | +12·740 | −1·641 | +1·905 | +18·508 | 29·483 | |
| 9 | W | α 60° | 6·975 | +5·527 | +12·740 | +1·184 | +1·651 | +21·102 | 28·077 | 27·899 |
| 11 | E | | 6·975 | +5·461 | +12·737 | −0·549 | +1·333 | +18·982 | 25·957 | |
| 12 | E | | 7·900 | +5·492 | +12·732 | −1·008 | +0·889 | +18·105 | 26·005 | |
| 13 | W | α (1) 30° | 9·650 | +5·496 | +12·727 | +0·429 | +0·275 | +18·927 | 28·577 | |
| 14 | E | | 8·950 | +5·539 | +12·721 | +0·004 | −0·339 | +17·925 | 26·875 | 27·399 |
| 15 | W | | 10·550 | +5·453 | +12·714 | −0·556 | −0·021 | +17·590 | 28·140 | |
| 16 | E | | 9·000 | +5·438 | +12·706 | −0·824 | +0·762 | +18·082 | 27·082 | |
| 17 | W | | 9·950 | +5·434 | +12·694 | +0·395 | +0·487 | +19·010 | 28·960 | |
| 19 | W | α (1) 50° | 8·400 | +5·488 | +12·671 | −0·524 | +1·799 | +19·434 | 27·834 | |
| 24 | E | | 7·475 | +5·437 | +12·590 | −0·196 | +0·762 | +18·593 | 26·068 | 27·228 |
| 25 | W | | 8·475 | +5·454 | +12·571 | +0·963 | +0·063 | +19·051 | 27·526 | |
| 26 | E | | 7·525 | +5·459 | +12·550 | +0·493 | −0·127 | +18·375 | 25·900 | |
| 28 | E | | 10·025 | +5·458 | +12·504 | −1·636 | −0·021 | +16·305 | 26·330 | |
| 29 | W | | 8·875 | +5·484 | +12·479 | +1·408 | +0·085 | +19·456 | 28·331 | |
| 30 | E | α 70° | 10·425 | +5·480 | +12·453 | −1·720 | 0·000 | +16·213 | 26·638 | |
| 31 | W | | 8·075 | +5·484 | +12·426 | +2·059 | +0·741 | +20·710 | 28·785 | 27·508 |
| Feb. 1 | W | | 10·200 | +5·461 | +12·397 | +1·668 | −0·762 | +18·764 | 28·964 | |
| 2 | E | | 9·950 | +5·475 | +12·367 | −1·730 | −0·063 | +16·049 | 25·999 | |

Mean 5° 35′ 27″·6198

Mean Result of both Faces ..... 5° 35′ 27″·6779

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## No. 4 (400) PERSEI. North 2° 15′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Nov. 30 | W | | 54·275 | +2·203 | −12·185 | +1·051 | −1·714 | −10·645 | 43·630 | |
| Dec. 1 | E | | 54·675 | +2·236 | −12·274 | −2·355 | −0·783 | −13·176 | 41·499 | |
| 2 | W | 20° α | 50·750 | +2·241 | −12·363 | +1·084 | +0·868 | − 8·170 | 42·580 | |
| 3 | E | | 54·825 | +2·238 | −12·450 | −1·321 | +0·571 | −10·962 | 43·863 | 43·259 |
| 4 | W | | 49·725 | +2·212 | −12·535 | +3·203 | +1·566 | − 5·554 | 44·171 | |
| 5 | E | | 55·375 | +2·217 | −12·621 | −2·361 | +0·317 | −12·448 | 42·927 | |
| 6 | W | | 53·700 | +2·216 | −12·703 | +1·166 | −0·275 | − 9·596 | 44·104 | |
| 7 | E | | 54·325 | +2·214 | −12·785 | −0·500 | +0·042 | −11·029 | 43·296 | |
| 8 | W | | 57·125 | +2·211 | −12·867 | −0·250 | −0·825 | −11·731 | 45·394 | |
| 9 | E | 40° α | 53·375 | +2·216 | −12·947 | +0·709 | −0·550 | −10·572 | 42·803 | 43·640 |
| 10 | W | | 55·150 | +2·214 | −13·026 | −1·032 | −0·974 | −12·818 | 42·332 | |
| 11 | E | | 54·100 | +2·211 | −13·103 | +1·118 | −0·296 | −10·070 | 44·030 | |
| 12 | W | | 52·150 | +2·218 | −13·180 | +3·114 | +0·148 | − 7·700 | 44·450 | |
| 13 | E | 60° α | 56·350 | +2·224 | −13·254 | −2·595 | +0·910 | −12·715 | 43·635 | 44·117 |
| 14 | W | | 52·400 | +2·228 | −13·327 | +2·013 | −0·021 | − 9·107 | 43·293 | |
| 15 | E | | 57·450 | +2·232 | −13·399 | −1·534 | −0·106 | −12·807 | 44·643 | |
| 16 | W | | 53·650 | +2·223 | −13·471 | +2·088 | −0·593 | − 9·753 | 43·897 | |
| 17 | E | 30° α (?) | 58·650 | +2·234 | −13·542 | −2·115 | −0·847 | −14·270 | 44·380 | |
| 18 | W | | 52·025 | +2·230 | −13·610 | +3·260 | 0·000 | − 8·120 | 43·905 | 44·181 |
| 19 | E | | 58·650 | +2·238 | −13·676 | −3·433 | +0·762 | −14·109 | 44·541 | |
| 20 | W | | 56·025 | +2·234 | −13·742 | +0·613 | −0·233 | −11·128 | 44·897 | |
| 21 | E | 50° α (?) | 55·525 | +2·226 | −13·807 | −0·059 | −0·783 | −12·423 | 43·102 | |
| 22 | W | | 55·400 | +2·224 | −13·868 | +0·162 | −0·825 | −12·307 | 43·093 | 43·475 |
| 23 | E | | 56·625 | +2·235 | −13·929 | −0·769 | −1·355 | −13·818 | 42·807 | |
| 24 | W | | 54·400 | +2·213 | −13·990 | +1·406 | −0·550 | −10·921 | 43·479 | |
| 26 | E | 70° α (?) | 51·875 | +2·225 | −14·106 | +1·913 | −0·529 | −10·497 | 41·378 | |
| 27 | W | | 58·450 | +2·227 | −14·161 | −2·415 | −1·397 | −15·746 | 42·704 | 42·897 |
| 28 | E | | 55·300 | +2·232 | −14·213 | +2·528 | −1·820 | −11·273 | 44·027 | |
| 29 | W | 60° α | 55·850 | +2·234 | −14·264 | +0·584 | −1·016 | −12·462 | 43·388 | |
| 30 | E | | 59·275 | +2·234 | −14·315 | −1·159 | −0·741 | −13·981 | 45·294 | |

Mean 2° 15′ 43″·5948

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Dec. 31 | W | | 51·700 | +2·237 | −14·364 | +3·191 | +0·042 | − 8·894 | 42·806 | |
| Jan. 1 | E | 20° α | 61·700 | +2·240 | −14·460 | −3·840 | −1·206 | −17·266 | 44·434 | 43·397 |
| 2 | W | | 51·550 | +2·247 | −14·507 | +3·983 | −1·524 | − 9·801 | 41·749 | |
| 3 | E | | 60·925 | +2·238 | −14·551 | −4·055 | +0·042 | −16·326 | 44·599 | |
| 4 | W | | 56·150 | +2·244 | −14·594 | −0·624 | +0·063 | −12·921 | 43·229 | |
| 5 | E | 40° α | 56·650 | +2·238 | −14·633 | +0·396 | −0·042 | −12·041 | 44·609 | 44·017 |
| 6 | E | | 58·375 | +2·236 | −14·672 | −0·696 | −0·741 | −13·873 | 44·502 | |
| 7 | W | | 56·650 | +2·224 | −14·709 | −0·183 | −0·254 | −12·922 | 43·728 | |
| 8 | W | | 59·350 | +2·228 | −14·744 | −1·641 | −1·799 | −15·956 | 43·394 | |
| 9 | E | 60° α | 56·975 | +2·237 | −14·778 | +1·184 | −0·656 | −12·013 | 44·962 | 44·256 |
| 10 | E | | 58·375 | +2·230 | −14·810 | +0·394 | −0·995 | −13·181 | 45·194 | |
| 11 | W | | 57·775 | +2·210 | −14·841 | −0·549 | −1·122 | −14·302 | 43·473 | |
| 12 | W | | 55·900 | +2·223 | −14·869 | −1·008 | −1·312 | −14·966 | 40·934 | |
| 13 | E | 30° α (?) | 56·450 | +2·224 | −14·894 | +0·429 | +0·317 | −11·924 | 44·526 | 43·387 |
| 14 | W | | 53·100 | +2·241 | −14·920 | +0·004 | +1·397 | −11·278 | 41·822 | |
| 15 | E | | 59·750 | +2·207 | −14·943 | −0·556 | −0·191 | −13·483 | 46·267 | |
| 16 | W | | 55·600 | +2·201 | −14·964 | −0·824 | −0·423 | −14·010 | 41·590 | |
| 17 | E | | 56·350 | +2·200 | −14·981 | +0·395 | +0·339 | −12·047 | 44·303 | |
| 18 | W | 50° α (?) | 55·075 | +2·186 | −14·997 | +0·308 | +0·021 | −12·482 | 42·593 | |
| 19 | E | | 59·425 | +2·220 | −15·013 | −0·524 | −0·825 | −14·142 | 45·283 | 43·686 |
| 24 | W | | 56·850 | +2·200 | −15·060 | −0·196 | −0·444 | −13·500 | 43·350 | |
| 25 | E | | 55·375 | +2·208 | −15·064 | +0·963 | +0·444 | −11·449 | 43·926 | |
| 26 | W | | 55·475 | +2·209 | −15·065 | +0·493 | +0·825 | −11·538 | 43·937 | |
| 28 | W | | 56·750 | +2·209 | −15·061 | −1·636 | +0·169 | −14·319 | 42·431 | |
| 29 | E | | 55·950 | +2·219 | −15·057 | +1·408 | +0·169 | −11·261 | 44·689 | |
| 30 | W | 70° α (?) | 57·450 | +2·217 | −15·050 | −1·720 | 0·000 | −14·553 | 42·897 | 43·715 |
| 31 | E | | 56·200 | +2·219 | −15·042 | +2·059 | −0·339 | −11·103 | 45·097 | |
| Feb. 1 | E | | 55·650 | +2·209 | −15·032 | +1·668 | +0·656 | −10·499 | 45·151 | |
| 2 | W | | 56·450 | +2·216 | −15·019 | −1·730 | +0·106 | −14·427 | 42·023 | |

Mean 2° 15′ 43″·743

**Mean Result of both Faces** ..... 2° 15′ 43″·6689

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## G. T. STATION KALIANA.

No. 5 (418) 27 PLEIADUM *f.* South 5° 56′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | E | | 55″·100 | +5″·808 | +11″·615 | +1″·051 | +1″·418 | +19″·892 | 74″·992 | |
| Dec. 1 | W | | 59·300 | +5·896 | +11·654 | −2·355 | +0·762 | +15·957 | 75·257 | |
| 2 | E | | 59·525 | +5·906 | +11·691 | +1·084 | −0·952 | +17·729 | 77·254 | |
| 3 | W | 20° α | 59·575 | +5·898 | +11·728 | −1·321 | −0·847 | +15·458 | 75·033 | 76″·197 |
| 4 | E | | 56·550 | +5·829 | +11·763 | +3·203 | −0·402 | +20·393 | 76·943 | |
| 5 | W | | 59·525 | +5·841 | +11·798 | −2·361 | +0·339 | +15·617 | 75·142 | |
| 6 | E | | 58·600 | +5·845 | +11·831 | +1·166 | +0·360 | +19·202 | 77·802 | |
| 7 | W | | 59·925 | +5·840 | +11·863 | −0·500 | +0·021 | +17·224 | 77·149 | |
| 8 | E | | 61·700 | +5·828 | +11·896 | −0·250 | +0·487 | +17·961 | 79·661 | |
| 9 | W | | 55·475 | +5·833 | +11·927 | +0·709 | +0·910 | +19·379 | 74·854 | |
| 10 | E | 40° α | 60·275 | +5·833 | +11·957 | −1·032 | +1·439 | +18·197 | 78·472 | 77·204 |
| 11 | W | | 56·900 | +5·825 | +11·986 | +1·118 | 0·000 | +18·929 | 75·829 | |
| 12 | E | | 56·200 | +5·845 | +12·015 | +3·114 | +0·169 | +21·143 | 77·343 | |
| 13 | W | | 60·575 | +5·862 | +12·042 | −2·595 | −0·847 | +14·462 | 75·037 | |
| 14 | E | 60° α | 56·475 | +5·872 | +12·068 | +2·013 | +0·021 | +19·974 | 76·449 | 76·659 |
| 15 | W | | 60·250 | +5·880 | +12·094 | −1·534 | +0·423 | +16·863 | 77·113 | |
| 16 | E | | 57·475 | +5·858 | +12·120 | +2·088 | +0·127 | +20·193 | 77·668 | |
| 17 | W | | 61·200 | +5·885 | +12·144 | −2·115 | +0·847 | +16·761 | 77·961 | |
| 18 | E | 30° α (i) | 58·125 | +5·878 | +12·167 | +3·260 | +0·042 | +21·347 | 79·472 | 78·252 |
| 19 | W | | 64·125 | +5·896 | +12·188 | −3·433 | −0·868 | +13·783 | 77·908 | |
| 20 | E | | 61·725 | +5·889 | +12·210 | +0·613 | +0·275 | +18·987 | 80·712 | |
| 21 | W | | 58·775 | +5·867 | +12·231 | −0·059 | +0·720 | +18·759 | 77·534 | |
| 22 | E | 50° α (i) | 58·525 | +5·861 | +12·249 | +0·162 | +0·804 | +19·076 | 77·601 | 77·869 |
| 23 | W | | 56·800 | +5·890 | +12·267 | −0·769 | +1·439 | +18·827 | 75·627 | |
| 24 | E | | 55·925 | +5·831 | +12·287 | +1·406 | +0·910 | +20·434 | 76·359 | |
| 26 | W | | 54·950 | +5·864 | +12·320 | +1·913 | +0·402 | +20·499 | 75·449 | |
| 27 | E | 70° α (i) | 60·025 | +5·871 | +12·334 | −2·415 | +1·524 | +17·314 | 77·339 | 76·918 |
| 28 | W | | 56·075 | +5·881 | +12·347 | +2·528 | +1·693 | +22·449 | 78·524 | |
| 29 | E | 60° α | 56·725 | +5·886 | +12·359 | +0·584 | +1·312 | +20·141 | 76·866 | |
| 30 | W | | 58·900 | +5·889 | +12·371 | −1·159 | +1·143 | +18·244 | 77·144 | |

Mean 5° 57′ 17″·1832

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 56″·475 | +5″·897 | +12″·382 | +3″·191 | +0″·677 | +22″·147 | 78″·622 | |
| Jan. 1 | W | 20° α | 63·675 | +5·901 | +12·440 | −3·840 | +1·587 | +16·088 | 79·763 | |
| 2 | E | | 53·975 | +5·923 | +12·450 | +3·983 | +1·587 | +23·943 | 77·918 | 78″·385 |
| 3 | W | | 62·975 | +5·898 | +12·459 | −4·055 | −0·042 | +14·260 | 77·235 | |
| 4 | E | | 59·800 | +5·916 | +12·466 | −0·634 | +0·042 | +17·790 | 77·590 | |
| 5 | W | 40° α | 59·800 | +5·897 | +12·471 | +0·396 | +0·169 | +18·933 | 78·733 | |
| 6 | W | | 60·300 | +5·892 | +12·476 | −0·696 | +0·783 | +18·455 | 78·755 | 77·855 |
| 7 | E | | 57·825 | +5·860 | +12·480 | −0·183 | +0·360 | +18·517 | 76·342 | |
| 8 | E | | 61·650 | +5·873 | +12·483 | −1·641 | +1·038 | +17·773 | 79·423 | |
| 9 | W | 60° α | 58·175 | +5·894 | +12·485 | +1·184 | +0·995 | +20·558 | 78·733 | |
| 10 | W | | 57·400 | +5·877 | +12·486 | +0·394 | +0·952 | +19·709 | 77·109 | 78·070 |
| 11 | E | | 58·150 | +5·825 | +12·487 | −0·549 | +1·101 | +18·864 | 77·014 | |
| 12 | E | | 55·725 | +5·862 | +12·485 | −1·008 | +2·180 | +19·519 | 75·244 | |
| 13 | W | 30° α (i) | 60·325 | +5·863 | +12·482 | +0·429 | −0·423 | +18·351 | 78·676 | |
| 14 | E | | 58·425 | +5·906 | +12·480 | +0·004 | −0·868 | +17·532 | 75·957 | 76·976 |
| 15 | W | | 60·225 | +5·818 | +12·476 | −0·556 | +0·063 | +17·801 | 78·026 | |
| 16 | E | | 59·275 | +5·800 | +12·471 | −0·824 | 0·000 | +17·447 | 76·722 | |
| 17 | W | | 59·325 | +5·798 | +12·463 | +0·395 | −0·233 | +18·423 | 77·748 | |
| 18 | E | 50° α (i) | 58·150 | +5·761 | +12·455 | +0·308 | 0·000 | +18·524 | 76·674 | |
| 19 | W | | 59·350 | +5·850 | +12·447 | −0·524 | +0·571 | +18·344 | 77·694 | 77·263 |
| 24 | E | | 57·475 | +5·798 | +12·388 | −0·196 | +0·381 | +18·371 | 75·846 | |
| 25 | W | | 59·325 | +5·820 | +12·373 | +0·963 | −0·085 | +19·071 | 78·396 | |
| 26 | E | | 59·250 | +5·823 | +12·357 | +0·493 | −0·847 | +17·826 | 77·076 | |
| 28 | E | | 60·150 | +5·821 | +12·321 | −1·636 | −0·085 | +16·421 | 76·571 | |
| 29 | W | | 58·425 | +5·847 | +12·301 | +1·408 | −0·042 | +19·514 | 77·939 | |
| 30 | E | 70° α (i) | 61·350 | +5·842 | +12·280 | −1·720 | 0·000 | +16·402 | 77·752 | |
| 31 | W | | 58·325 | +5·850 | +12·259 | +2·059 | 0·000 | +20·168 | 78·493 | 77·451 |
| Feb. 1 | W | | 57·275 | +5·821 | +12·236 | +1·668 | −0·233 | +19·492 | 76·767 | |
| 2 | E | | 60·925 | +5·839 | +12·211 | −1·730 | −0·063 | +16·257 | 77·182 | |

Mean 5° 57′ 17″·6667

Mean Result of both Faces..... 5° 57′ 17″·4250

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## No. 6 (430) 44 PERSEI ζ. North 1° 53′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | W | | 30″·725 | +1″·841 | −11″·934 | +1″·051 | −1″·101 | −10″·143 | 20″·582 | |
| Dec. 1 | E | | 30·200 | +1·870 | −12·020 | −2·355 | −0·042 | −12·547 | 17·653 | |
| 2 | W | | 27·175 | +1·872 | −12·105 | +1·084 | +0·952 | − 8·197 | 18·978 | |
| 3 | E | 20° α | 31·150 | +1·870 | −12·189 | −1·321 | +0·931 | −10·709 | 20·441 | |
| 4 | W | | 26·050 | +1·848 | −12·271 | +3·203 | +0·339 | − 6·881 | 19·169 | 19″·487 |
| 5 | E | | 32·325 | +1·852 | −12·353 | −2·361 | 0·000 | −12·862 | 19·463 | |
| 6 | W | | 29·700 | +1·854 | −12·433 | +1·166 | −0·550 | − 9·963 | 19·737 | |
| 7 | E | | 30·950 | +1·852 | −12·512 | −0·500 | +0·085 | −11·075 | 19·875 | |
| 8 | W | | 32·675 | +1·848 | −12·591 | −0·250 | +0·169 | −10·824 | 21·851 | |
| 9 | E | 40° α | 28·375 | +1·847 | −12·669 | +0·709 | −0·021 | −10·134 | 18·241 | |
| 10 | W | | 33·175 | +1·849 | −12·745 | −1·032 | −1·439 | −13·367 | 19·808 | 19·854 |
| 11 | E | | 29·500 | +1·846 | −12·820 | +1·118 | −0·127 | − 9·983 | 19·517 | |
| 12 | W | | 28·725 | +1·853 | −12·895 | +3·114 | −0·021 | − 7·949 | 20·776 | |
| 13 | E | 60° α | 33·900 | +1·858 | −12·967 | −2·595 | −0·444 | −14·148 | 19·752 | |
| 14 | W | | 29·675 | +1·861 | −13·038 | +2·013 | +0·042 | − 9·122 | 20·553 | 20·347 |
| 15 | E | | 33·450 | +1·864 | −13·109 | −1·534 | +0·021 | −12·758 | 20·692 | |
| 16 | W | | 29·000 | +1·857 | −13·179 | +2·088 | −0·127 | − 9·361 | 19·639 | |
| 17 | E | 30° α (1) | 35·500 | +1·866 | −13·249 | −2·115 | −0·635 | −14·133 | 21·367 | |
| 18 | W | | 27·925 | +1·864 | −13·315 | +3·260 | +0·508 | − 7·683 | 20·242 | 20·152 |
| 19 | E | | 33·625 | +1·869 | −13·380 | −3·433 | +0·677 | −14·267 | 19·358 | |
| 20 | W | | 31·075 | +1·867 | −13·445 | +0·613 | +0·042 | −10·923 | 20·152 | |
| 21 | E | 50° α (1) | 33·575 | +1·860 | −13·510 | −0·059 | −0·021 | −11·730 | 21·845 | |
| 22 | W | | 30·925 | +1·858 | −13·570 | +0·162 | −0·698 | −12·248 | 18·677 | 20·003 |
| 23 | E | | 33·775 | +1·867 | −13·631 | −0·769 | −1·905 | −14·438 | 19·337 | |
| 24 | W | | 32·950 | +1·849 | −13·692 | +1·406 | −0·804 | −11·241 | 21·709 | |
| 26 | E | 70° α (1) | 27·475 | +1·859 | −13·807 | +1·913 | +0·529 | − 9·506 | 17·969 | |
| 27 | W | | 34·850 | +1·861 | −13·863 | −2·415 | −0·847 | −15·264 | 19·586 | 19·763 |
| 28 | E | | 31·025 | +1·864 | −13·916 | +2·528 | −1·714 | −11·238 | 19·787 | |
| 29 | W | 60° α | 32·925 | +1·866 | −13·967 | +0·584 | −1·249 | −12·766 | 20·159 | |
| 30 | E | | 34·350 | +1·867 | −14·019 | −1·159 | −0·889 | −14·200 | 20·150 | |

Mean 1° 53′ 19″·9343

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 30″·500 | +1″·870 | −14″·068 | +3″·191 | −0″·783 | − 9″·790 | 20″·710 | |
| Jan. 1 | E | 20° α | 39·525 | +1·870 | −14·165 | −3·840 | −0·402 | −16·537 | 22·988 | 20″·488 |
| 2 | W | | 27·500 | +1·878 | −14·213 | +3·983 | −1·228 | − 9·580 | 17·920 | |
| 3 | E | | 36·650 | +1·870 | −14·258 | −4·055 | +0·127 | −16·316 | 20·334 | |
| 4 | W | | 34·200 | +1·876 | −14·302 | −0·634 | −0·042 | −13·102 | 21·098 | |
| 5 | E | 40° α | 31·375 | +1·869 | −14·343 | +0·396 | −0·085 | −12·163 | 19·212 | |
| 6 | E | | 35·800 | +1·868 | −14·384 | −0·696 | −0·762 | −13·974 | 21·826 | 20·370 |
| 7 | W | | 32·200 | +1·857 | −14·423 | −0·183 | −0·106 | −12·855 | 19·345 | |
| 8 | W | | 35·150 | +1·862 | −14·460 | −1·641 | −0·931 | −15·170 | 19·980 | |
| 9 | E | 60° α | 33·975 | +1·869 | −14·496 | +1·184 | −1·291 | −12·734 | 21·241 | |
| 10 | E | | 33·450 | +1·863 | −14·530 | +0·394 | −0·571 | −12·844 | 20·606 | 20·212 |
| 11 | W | | 33·450 | +1·847 | −14·563 | −0·549 | −1·164 | −14·429 | 19·021 | |
| 12 | W | | 33·975 | +1·859 | −14·593 | −1·008 | −2·117 | −15·859 | 18·116 | |
| 13 | E | 30° α (1) | 32·625 | +1·859 | −14·622 | +0·429 | +0·508 | −11·826 | 20·799 | |
| 14 | W | | 33·125 | +1·872 | −14·650 | +0·004 | −0·190 | −12·964 | 20·161 | 20·350 |
| 15 | E | | 35·775 | +1·845 | −14·676 | −0·556 | −0·063 | −13·450 | 22·325 | |
| 16 | W | | 33·300 | +1·839 | −14·700 | −0·824 | +0·042 | −13·643 | 19·657 | |
| 17 | E | | 33·575 | +1·839 | −14·721 | +0·395 | +0·487 | −12·000 | 21·575 | |
| 18 | W | 50° α (1) | 31·500 | +1·827 | −14·740 | +0·308 | +0·487 | −12·118 | 19·382 | |
| 19 | E | | 35·600 | +1·854 | −14·760 | −0·524 | −0·127 | −13·557 | 22·043 | 20·659 |
| 24 | W | | 34·400 | +1·838 | −14·826 | −0·196 | −0·169 | −13·353 | 21·047 | |
| 25 | E | | 33·000 | +1·845 | −14·834 | +0·963 | +0·233 | −11·793 | 21·207 | |
| 26 | W | | 31·125 | +1·846 | −14·840 | +0·493 | +0·127 | −12·374 | 18·751 | |
| 28 | W | | 33·200 | +1·846 | −14·845 | −1·636 | +0·021 | −14·614 | 18·586 | |
| 29 | E | | 32·125 | +1·853 | −14·845 | +1·408 | +0·021 | −11·563 | 20·562 | |
| 30 | W | 70° α (1) | 34·225 | +1·852 | −14·843 | −1·720 | 0·000 | −14·711 | 19·514 | |
| 31 | E | | 33·025 | +1·855 | −14·840 | +2·059 | 0·000 | −10·926 | 22·099 | 20·273 |
| Feb. 1 | E | | 32·625 | +1·845 | −14·835 | +1·668 | +0·360 | −10·962 | 21·663 | |
| 2 | W | | 33·900 | +1·851 | −14·827 | −1·730 | +0·021 | −14·685 | 19·215 | |

Mean 1° 53′ 20″·3920

Mean Result of both Faces..... 1° 53′ 20″·1632



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## G. T. STATION KALIANA.

No. 7 (448) 37 Tauri *A'*. South 7° 52′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | E | | 4″·650 | +7″·712 | +11″·310 | +1″·051 | +0″·762 | +20″·835 | 25″·485 | |
| Dec. 1 | W | | 8·200 | +7·842 | +11·333 | −2·355 | +0·444 | +17·264 | 25·464 | |
| 2 | E | 20° *a* | 8·275 | +7·839 | +11·356 | +1·084 | −1·016 | +19·263 | 27·538 | |
| 3 | W | | 8·525 | +7·826 | +11·377 | −1·321 | −0·085 | +17·797 | 26·322 | |
| 4 | E | | 6·025 | +7·731 | +11·398 | +3·203 | −0·360 | +21·972 | 27·997 | 26″·450 |
| 5 | W | | 9·975 | +7·752 | +11·419 | −2·361 | −0·571 | +16·239 | 26·214 | |
| 6 | E | | 5·650 | +7·773 | +11·438 | +1·166 | +0·190 | +20·567 | 26·217 | |
| 7 | W | | 7·175 | +7·767 | +11·456 | −0·500 | +0·466 | +19·189 | 26·364 | |
| 8 | E | | 9·100 | +7·742 | +11·474 | −0·250 | +1·503 | +20·469 | 29·569 | |
| 9 | W | 40° *a* | 3·300 | +7·713 | +11·492 | +0·709 | −0·106 | +19·808 | 23·108 | |
| 10 | E | | 7·000 | +7·737 | +11·509 | −1·032 | +0·635 | +18·849 | 25·849 | 26·254 |
| 11 | W | | 6·100 | +7·726 | +11·525 | +1·118 | +0·021 | +20·390 | 26·490 | |
| 12 | E | | 5·000 | +7·753 | +11·541 | +3·114 | +0·317 | +22·725 | 27·725 | |
| 13 | W | 60° *a* | 11·475 | +7·778 | +11·555 | −2·595 | +0·042 | +16·780 | 28·255 | |
| 14 | E | | 5·825 | +7·790 | +11·569 | +2·013 | +0·106 | +21·478 | 27·303 | 27·294 |
| 15 | W | | 8·950 | +7·800 | +11·582 | −1·534 | +0·233 | +18·081 | 27·031 | |
| 16 | E | | 5·100 | +7·775 | +11·596 | +2·088 | 0·000 | +21·459 | 26·559 | |
| 17 | W | 30° *a* (c) | 11·250 | +7·807 | +11·610 | −2·115 | +0·466 | +17·768 | 29·018 | |
| 18 | E | | 4·450 | +7·802 | +11·620 | +3·260 | −0·339 | +22·343 | 26·793 | 27·603 |
| 19 | W | | 12·825 | +7·822 | +11·631 | −3·433 | −0·804 | +15·216 | 28·041 | |
| 20 | E | | 8·925 | +7·820 | +11·641 | +0·613 | +0·847 | +20·921 | 29·846 | |
| 21 | W | 50° *a* (c) | 8·200 | +7·786 | +11·652 | −0·059 | 0·000 | +19·279 | 27·479 | |
| 22 | E | | 6·300 | +7·778 | +11·660 | +0·162 | +0·952 | +20·552 | 26·852 | 27·783 |
| 23 | W | | 5·850 | +7·820 | +11·668 | −0·769 | +2·476 | +21·105 | 26·955 | |
| 24 | E | | 4·675 | +7·740 | +11·678 | +1·406 | +0·720 | +21·544 | 26·219 | |
| 26 | W | 70° *a* (c) | 5·825 | +7·784 | +11·691 | +1·913 | −0·698 | +20·690 | 26·515 | |
| 27 | E | | 9·600 | +7·797 | +11·697 | −2·415 | +0·423 | +17·502 | 27·102 | 27·256 |
| 28 | W | | 4·850 | +7·802 | +11·701 | +2·528 | +2·307 | +24·338 | 29·188 | |
| 29 | E | 60° *a* | 5·925 | +7·805 | +11·705 | +0·584 | +0·825 | +20·919 | 26·844 | |
| 30 | W | | 7·325 | +7·819 | +11·709 | −1·159 | +0·910 | +19·279 | 26·604 | |

Mean 7° 52′ 27″·1067

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 3″·125 | +7″·831 | +11″·712 | +3″·191 | +0″·910 | +23″·644 | 26″·769 | |
| Jan. 1 | W | 20° *a* | 12·150 | +7·826 | +11·762 | −3·840 | +0·847 | +16·595 | 28·745 | |
| 2 | E | | 1·650 | +7·862 | +11·765 | +3·983 | +1·206 | +24·816 | 26·466 | 27″·574 |
| 3 | W | | 12·925 | +7·828 | +11·767 | −4·055 | −0·148 | +15·392 | 28·317 | |
| 4 | E | | 7·925 | +7·855 | +11·767 | −0·634 | +0·106 | +19·094 | 27·019 | |
| 5 | W | 40° *a* | 8·350 | +7·825 | +11·766 | +0·396 | +0·169 | +20·156 | 28·506 | |
| 6 | W | | 8·750 | +7·818 | +11·765 | −0·696 | +0·720 | +19·607 | 28·357 | 27·577 |
| 7 | E | | 7·050 | +7·773 | +11·764 | −0·183 | +0·021 | +19·375 | 26·425 | |
| 8 | E | | 7·950 | +7·799 | +11·761 | −1·641 | +1·566 | +19·485 | 27·435 | |
| 9 | W | 60° *a* | 8·300 | +7·823 | +11·758 | +1·184 | +1·206 | +21·971 | 30·271 | 28·666 |
| 11 | E | | 5·975 | +7·733 | +11·751 | −0·549 | +1·778 | +20·713 | 26·688 | |
| 12 | E | | 4·050 | +7·786 | +11·745 | −1·008 | +2·201 | +20·724 | 24·774 | |
| 13 | W | 30° *a* (c) | 9·650 | +7·784 | +11·738 | +0·429 | −0·402 | +19·549 | 29·199 | |
| 14 | E | | 7·400 | +7·839 | +11·732 | +0·004 | +0·529 | +20·104 | 27·504 | 27·362 |
| 15 | W | | 9·075 | +7·725 | +11·725 | −0·556 | 0·000 | +18·894 | 27·969 | |
| 16 | E | | 8·675 | +7·699 | +11·717 | −0·824 | −0·296 | +18·296 | 26·971 | |
| 18 | E | | 7·300 | +7·651 | +11·696 | +0·308 | −0·106 | +19·549 | 26·849 | |
| 19 | W | 50° *a* (c) | 9·625 | +7·761 | +11·687 | −0·524 | +0·148 | +19·072 | 28·697 | |
| 24 | W | | 7·475 | +7·693 | +11·622 | +0·196 | +1·016 | +20·527 | 28·002 | 27·967 |
| 25 | W | | 9·125 | +7·729 | +11·607 | +0·963 | −0·275 | +20·024 | 29·149 | |
| 26 | E | | 8·275 | +7·731 | +11·591 | +0·493 | +0·042 | +19·857 | 28·132 | |
| 28 | E | | 9·450 | +7·727 | +11·556 | −1·636 | −0·720 | +16·927 | 26·377 | |
| 29 | W | | 7·650 | +7·758 | +11·538 | +1·408 | −0·063 | +20·641 | 28·291 | |
| 31 | E | 70° *a* (c) | 9·850 | +7·766 | +11·499 | −2·059 | +0·339 | +17·545 | 27·395 | |
| Feb. 1 | W | | 8·400 | +7·723 | +11·478 | +1·668 | −0·466 | +20·403 | 28·803 | 27·775 |
| 2 | E | | 9·375 | +7·750 | +11·455 | −1·730 | −0·063 | +17·412 | 26·787 | |
| 3 | W | | 8·425 | +7·716 | +11·433 | +1·081 | +0·339 | +20·569 | 28·994 | |

Mean 7° 52′ 27″·8202

Mean Result of both Faces ..... 7° 52′ 27″·4635

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No. 8 (471) 50 TAURI $\omega^2$. South 9° 19′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | *'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 30 | W | 20° a | 42″·975 | +9″·177 | +11″·094 | −1″·051 | +2″·138 | +21″·358 | 64″·333 | 64″·676 |
| Dec. 1 | E | | 41·850 | +9·344 | +11·104 | +2·355 | +1·799 | +24·602 | 66·452 | |
| 2 | W | | 44·325 | +9·326 | +11·115 | −1·084 | +0·021 | +19·378 | 63·703 | |
| 3 | E | | 44·925 | +9·307 | +11·124 | +1·321 | +0·042 | +21·794 | 66·719 | |
| 4 | W | | 45·775 | +9·190 | +11·133 | −3·203 | −0·085 | +17·035 | 62·810 | |
| 5 | E | | 41·475 | +9·219 | +11·142 | +2·361 | +0·191 | +22·913 | 64·388 | |
| 6 | W | | 42·925 | +9·262 | +11·149 | −1·166 | +0·614 | +19·859 | 62·784 | |
| 7 | E | | 43·550 | +9·254 | +11·156 | +0·500 | +1·757 | +22·667 | 66·217 | |
| 8 | W | 40° a | 42·300 | +9·215 | +11·163 | +0·250 | +3·471 | +24·099 | 66·399 | 65·190 |
| 9 | E | | 43·725 | +9·147 | +11·170 | −0·709 | +1·757 | +21·365 | 65·090 | |
| 10 | W | | 42·150 | +9·198 | +11·175 | +1·032 | +0·825 | +22·230 | 64·380 | |
| 11 | E | | 44·650 | +9·183 | +11·181 | −1·118 | +0·995 | +20·241 | 64·891 | |
| 12 | W | 60° a | 46·825 | +9·217 | +11·186 | −3·114 | +0·571 | +17·860 | 64·685 | 65·146 |
| 13 | E | | 41·675 | +9·249 | +11·190 | +2·595 | +0·444 | +23·478 | 65·153 | |
| 14 | W | | 45·825 | +9·264 | +11·193 | −2·013 | +0·974 | +19·418 | 65·243 | |
| 15 | E | | 42·400 | +9·273 | +11·196 | +1·534 | +0·741 | +22·744 | 65·144 | |
| 16 | W | 30° a (?) | 48·225 | +9·247 | +11·200 | −2·088 | +0·677 | +19·036 | 67·261 | 65·532 |
| 17 | E | | 41·325 | +9·282 | +11·204 | +2·115 | +1·291 | +23·892 | 65·217 | |
| 18 | W | | 47·000 | +9·281 | +11·205 | −3·260 | +0·402 | +17·628 | 64·628 | |
| 19 | E | | 40·975 | +9·300 | +11·206 | +3·433 | +0·106 | +24·045 | 65·020 | |
| 20 | W | 50° a (?) | 42·975 | +9·304 | +11·207 | −0·613 | +1·397 | +21·295 | 64·270 | 65·244 |
| 21 | E | | 43·575 | +9·261 | +11·209 | +0·059 | +0·868 | +21·397 | 64·972 | |
| 22 | W | | 44·400 | +9·249 | +11·208 | −0·162 | +1·672 | +21·967 | 66·367 | |
| 23 | E | | 42·075 | +9·303 | +11·208 | +0·769 | +2·011 | +23·291 | 65·366 | |
| 24 | W | 70° a (?) | 43·875 | +9·207 | +11·209 | −1·406 | +2·074 | +21·084 | 64·959 | 66·462 |
| 26 | E | | 47·300 | +9·260 | +11·207 | −1·913 | +1·079 | +19·633 | 66·933 | |
| 27 | W | | 42·950 | +9·278 | +11·205 | +2·415 | +1·291 | +24·189 | 67·139 | |
| 28 | E | | 45·650 | +9·278 | +11·201 | −2·528 | +3·217 | +21·168 | 66·818 | |
| 29 | W | 60° a | 43·825 | +9·278 | +11·198 | −0·584 | +1·672 | +21·564 | 65·389 | |
| 30 | E | | 42·375 | +9·304 | +11·195 | +1·159 | +1·228 | +22·886 | 65·261 | |

Mean 9° 20′ 5″·3750

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | *'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 31 | W | 20° a | 49″·300 | +9″·319 | +11″·191 | −3″·191 | +1″·270 | +18″·589 | 67″·889 | 65″·948 |
| Jan. 1 | E | | 37·625 | +9·304 | +11·233 | +3·840 | +2·392 | +26·769 | 64·394 | |
| 2 | W | | 48·500 | +9·352 | +11·229 | −3·983 | +1·926 | +18·524 | 67·024 | |
| 3 | E | | 40·000 | +9·311 | +11·224 | +4·055 | −0·106 | +24·484 | 64·484 | |
| 4 | W | 40° a | 44·400 | +9·345 | +11·219 | +0·634 | +0·656 | +21·854 | 66·254 | 65·415 |
| 6 | E | | 42·150 | +9·296 | +11·206 | +0·696 | +1·228 | +22·426 | 64·576 | |
| 8 | W | 60° a | 42·650 | +9·280 | +11·191 | +1·641 | +2·053 | +24·165 | 66·815 | 65·616 |
| 9 | E | | 43·275 | +9·306 | +11·183 | −1·184 | +1·672 | +20·977 | 64·252 | |
| 10 | E | | 43·475 | +9·267 | +11·176 | −0·394 | +0·974 | +21·023 | 64·498 | |
| 11 | W | | 44·100 | +9·199 | +11·167 | +0·549 | +1·884 | +22·799 | 66·899 | |
| 12 | W | 30° a (?) | 42·900 | +9·267 | +11·157 | +1·008 | +2·519 | +23·951 | 66·851 | 65·443 |
| 13 | E | | 43·825 | +9·261 | +11·147 | −0·429 | +0·529 | +20·508 | 64·333 | |
| 14 | W | | 45·900 | +9·324 | +11·137 | −0·004 | +0·360 | +20·817 | 66·717 | |
| 15 | E | | 42·850 | +9·192 | +11·126 | +0·556 | +0·148 | +21·022 | 63·872 | |
| 16 | W | 50° a (?) | 45·450 | +9·159 | +11·115 | +0·824 | +0·275 | +21·373 | 66·823 | 65·085 |
| 18 | W | | 45·950 | +9·104 | +11·089 | −0·308 | +0·381 | +20·266 | 66·216 | |
| 19 | E | | 41·350 | +9·228 | +11·077 | +0·524 | +0·889 | +21·718 | 63·068 | |
| 24 | E | | 42·325 | +9·150 | +11·004 | −0·196 | +0·931 | +20·889 | 63·214 | |
| 25 | E | | 44·250 | +9·198 | +10·988 | −0·963 | +1·185 | +20·408 | 64·658 | |
| 26 | W | | 46·875 | +9·198 | +10·972 | −0·493 | −0·021 | +19·656 | 66·531 | |
| 28 | W | 70° a (?) | 44·700 | +9·192 | +10·936 | +1·636 | −0·466 | +21·298 | 65·998 | 65·062 |
| 29 | E | | 44·700 | +9·226 | +10·917 | −1·408 | +0·021 | +18·756 | 63·456 | |
| 31 | W | | 43·575 | +9·238 | +10·878 | +2·059 | +0·127 | +22·302 | 65·877 | |
| Feb. 1 | E | | 45·875 | +9·184 | +10·858 | −1·668 | +0·254 | +18·628 | 64·503 | |
| 2 | W | | 43·925 | +9·218 | +10·837 | +1·730 | +0·106 | +21·891 | 65·816 | |
| 3 | E | | 45·325 | +9·177 | +10·815 | −1·081 | +0·487 | +19·398 | 64·723 | |

Mean 9° 20′ 5″·4282

Mean Result of both Faces.....9° 20′ 5″·4016

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## G. T. STATION KALIANA.

No. 9 (497) TAURI. North 1° 33′ +

### Face A to the Fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 38″·000 | +1″·527 | −11″·366 | −3″·203 | +1″·143 | −11″·899 | 26″·101 | |
| 5 | W | 20° α | 36·625 | +1·530 | −11·441 | +2·361 | +0·254 | − 7·296 | 29·329 | 27″·300 |
| 6 | E | | 37·675 | +1·536 | −11·514 | −1·166 | −0·233 | −11·377 | 26·298 | |
| 7 | W | | 38·950 | +1·535 | −11·586 | +0·500 | −1·926 | −11·477 | 27·473 | |
| 8 | E | | 37·100 | +1·529 | −11·659 | +0·250 | −1·503 | −11·383 | 25·717 | |
| 9 | W | 40° α | 42·300 | +1·519 | −11·731 | −0·709 | −1·312 | −12·233 | 30·067 | 28·385 |
| 10 | E | | 39·025 | +1·526 | −11·802 | +1·032 | −1·439 | −10·683 | 28·342 | |
| 11 | W | | 42·425 | +1·524 | −11·873 | −1·118 | −1·545 | −13·012 | 29·413 | |
| 12 | E | | 42·275 | +1·530 | −11·943 | −3·114 | +0·042 | −13·485 | 28·790 | |
| 13 | W | 60° α | 36·775 | +1·535 | −12·012 | +2·595 | +0·275 | − 7·607 | 29·168 | 29·696 |
| 14 | E | | 42·650 | +1·538 | −12·079 | −2·013 | −0·233 | −12·787 | 29·863 | |
| 15 | W | | 39·825 | +1·538 | −12·147 | +1·534 | +0·021 | − 9·054 | 30·771 | |
| 16 | E | | 44·850 | +1·534 | −12·215 | −2·088 | −0·042 | −12·811 | 32·039 | |
| 17 | W | 30° α (1) | 37·075 | +1·539 | −12·283 | +2·115 | −0·931 | − 9·560 | 27·515 | 28·752 |
| 18 | E | | 43·350 | +1·541 | −12·348 | −3·260 | −0·974 | −15·041 | 28·309 | |
| 19 | W | | 34·600 | +1·543 | −12·412 | +3·433 | −0·021 | − 7·457 | 27·143 | |
| 20 | E | | 39·125 | +1·544 | −12·476 | −0·613 | +0·360 | −11·185 | 27·940 | |
| 21 | W | 50° α (1) | 38·400 | +1·537 | −12·540 | +0·059 | 0·000 | −10·944 | 27·456 | 28·119 |
| 22 | E | | 41·125 | +1·535 | −12·601 | −0·162 | −1·164 | −12·392 | 28·733 | |
| 23 | W | | 39·800 | +1·543 | −12·663 | +0·769 | −1·101 | −11·452 | 28·348 | |
| 24 | E | | 43·000 | +1·527 | −12·725 | −1·406 | −1·376 | −13·980 | 29·020 | |
| 26 | W | 70° α (1) | 44·075 | +1·536 | −12·844 | −1·913 | −0·656 | −13·877 | 30·198 | 29·205 |
| 27 | E | | 39·275 | +1·539 | −12·902 | +2·415 | −1·503 | −10·451 | 28·824 | |
| 28 | W | | 45·900 | +1·539 | −12·958 | −2·528 | −3·175 | −17·122 | 28·778 | |
| 29 | E | 60° α | 43·625 | +1·540 | −13·013 | −0·584 | −2·582 | −14·639 | 28·986 | |
| 30 | W | | 41·325 | +1·544 | −13·069 | +1·159 | −0·360 | −10·726 | 30·599 | |

Mean 1° 33′ 28″·5762

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 44″·275 | +1″·546 | −13″·123 | −3″·191 | −0″·148 | −14″·916 | 29″·359 | |
| Jan. 1 | W | α 20° | 35·575 | +1·544 | −13·228 | +3·840 | −1·524 | − 9·368 | 26·207 | 28″·736 |
| 2 | E | | 47·850 | +1·552 | −13·281 | −3·983 | −1·820 | −17·532 | 30·318 | |
| 3 | W | | 35·925 | +1·545 | −13·332 | +4·055 | +0·868 | − 6·864 | 29·061 | |
| 4 | E | | 41·300 | +1·550 | −13·382 | +0·634 | −0·042 | −11·240 | 30·060 | |
| 5 | W | α 40° | 40·375 | +1·544 | −13·430 | −0·396 | −0·614 | −12·896 | 27·479 | 28·991 |
| 6 | W | | 40·000 | +1·544 | −13·478 | +0·696 | −0·360 | −11·598 | 28·402 | |
| 7 | E | | 41·850 | +1·534 | −13·525 | +0·183 | −0·021 | −11·829 | 30·021 | |
| 8 | E | | 39·175 | +1·540 | −13·570 | +1·641 | −1·206 | −11·595 | 27·580 | |
| 9 | W | α 60° | 41·275 | +1·544 | −13·614 | −1·184 | −0·042 | −13·296 | 27·979 | 28·565 |
| 10 | W | | 41·675 | +1·538 | −13·657 | −0·394 | −0·402 | −12·915 | 28·760 | |
| 11 | E | | 43·300 | +1·527 | −13·699 | +0·549 | −1·736 | −13·359 | 29·941 | |
| 12 | E | | 43·675 | +1·538 | −13·739 | +1·008 | −1·757 | −12·950 | 30·725 | |
| 13 | W | α 30° (1) | 39·975 | +1·537 | −13·778 | −0·429 | +0·529 | −12·141 | 27·834 | 28·951 |
| 14 | E | | 40·900 | +1·547 | −13·816 | −0·004 | +0·423 | −11·850 | 29·050 | |
| 15 | W | | 40·325 | +1·525 | −13·853 | +0·556 | −0·360 | −12·132 | 28·193 | |
| 16 | E | | 40·300 | +1·520 | −13·888 | +0·824 | +0·635 | −10·909 | 29·391 | |
| 18 | E | | 43·625 | +1·511 | −13·952 | −0·308 | −0·148 | −12·897 | 30·728 | |
| 19 | W | α 50° (1) | 40·525 | +1·532 | −13·984 | +0·524 | −0·868 | −12·796 | 27·729 | 29·153 |
| 24 | W | | 41·550 | +1·519 | −14·117 | −0·196 | −0·254 | −13·048 | 28·502 | |
| 25 | E | | 43·075 | +1·526 | −14·139 | +0·963 | −0·974 | −12·624 | 30·451 | |
| 28 | E | | 40·325 | +1·525 | −14·196 | +1·636 | +0·381 | −10·654 | 29·671 | |
| 29 | W | | 41·000 | +1·531 | −14·211 | −1·408 | −0·063 | −14·151 | 26·849 | |
| 31 | E | α 70° (1) | 40·825 | +1·533 | −14·238 | +2·059 | +0·021 | −10·625 | 30·200 | 28·547 |
| Feb. 1 | W | | 41·500 | +1·524 | −14·249 | −1·668 | 0·000 | −14·393 | 27·107 | |
| 2 | E | | 40·550 | +1·529 | −14·258 | +1·730 | +0·466 | −10·533 | 30·017 | |
| 3 | W | | 41·450 | +1·523 | −14·265 | −1·081 | −0·190 | −14·013 | 27·437 | |

Mean 1° 33′ 28″·8238

Mean Result of both Faces..... 1° 33′ 28″·7000

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No. 10 (543) TAURI τ. South 6° 51′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 53″·700 | +6″·765 | +10″·761 | −3″·203 | −0″·677 | +13″·646 | 67″·346 | |
| 5 | E | α 20° | 51·325 | +6·769 | +10·778 | +2·361 | +0·952 | +20·860 | 72·185 | 70″·515 |
| 6 | W | | 53·325 | +6·781 | +10·795 | −1·166 | +0·085 | +16·495 | 69·820 | |
| 7 | E | | 52·725 | +6·790 | +10·810 | +0·500 | +1·884 | +19·984 | 72·709 | |
| 8 | W | | 51·525 | +6·761 | +10·827 | +0·250 | −0·063 | +17·775 | 69·300 | |
| 9 | E | α 40° | 54·625 | +6·729 | +10·843 | −0·709 | +1·503 | +18·366 | 72·991 | 70·931 |
| 10 | W | | 49·050 | +6·749 | +10·858 | +1·032 | +1·693 | +20·332 | 69·382 | |
| 11 | E | | 54·450 | +6·744 | +10·874 | −1·118 | +1·101 | +17·601 | 72·051 | |
| 12 | W | | 55·175 | +6·766 | +10·889 | −3·114 | −0·212 | +14·329 | 69·504 | |
| 13 | E | α 60° | 50·000 | +6·787 | +10·904 | +2·595 | −0·042 | +20·249 | 70·249 | 70·468 |
| 14 | W | | 54·250 | +6·803 | +10·917 | −2·013 | −0·106 | +15·601 | 69·851 | |
| 15 | E | | 50·600 | +6·802 | +10·931 | +1·534 | +0·254 | +19·521 | 70·121 | |
| 16 | W | | 57·825 | +6·777 | +10·946 | −2·088 | +0·106 | +15·741 | 73·566 | |
| 17 | E | α (1) 30° | 49·575 | +6·800 | +10·961 | +2·115 | +0·952 | +20·828 | 70·403 | 71·375 |
| 18 | W | | 56·275 | +6·822 | +10·974 | −3·260 | +1·482 | +16·018 | 72·293 | |
| 19 | E | | 48·225 | +6·827 | +10·986 | +3·433 | −0·233 | +21·013 | 69·238 | |
| 20 | W | | 51·325 | +6·827 | +10·999 | −0·613 | +0·690 | +17·903 | 69·228 | |
| 21 | E | α (1) 50° | 53·925 | +6·798 | +11·012 | +0·059 | −0·169 | +17·700 | 71·625 | 71·134 |
| 22 | W | | 52·250 | +6·788 | +11·023 | −0·162 | +0·889 | +18·538 | 70·788 | |
| 23 | E | | 53·000 | +6·820 | +11·035 | +0·769 | +1·270 | +19·894 | 72·894 | |
| 24 | W | | 54·125 | +6·750 | +11·048 | −1·406 | +1·143 | +17·535 | 71·660 | |
| 26 | E | α (1) 70° | 57·050 | +6·788 | +11·071 | −1·913 | +0·698 | +16·644 | 73·694 | 72·458 |
| 27 | W | | 50·475 | +6·801 | +11·081 | +2·415 | +1·482 | +21·779 | 72·254 | |
| 28 | E | | 53·575 | +6·803 | +11·091 | −2·528 | +3·281 | +18·647 | 72·222 | |
| 29 | W | α 90° | 51·475 | +6·815 | +11·101 | −0·584 | +2·328 | +19·660 | 71·135 | |
| 30 | E | | 51·850 | +6·832 | +11·111 | +1·159 | +0·995 | +20·097 | 71·947 | |

Mean 6° 52′ 11″·1468

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 56″·125 | +6″·829 | +11″·120 | −3″·191 | +0″·169 | +14″·927 | 71″·052 | |
| Jan. 1 | E | α 20° | 48·275 | +6·824 | +11·177 | +3·840 | +1·503 | +23·344 | 71·619 | 72″·348 |
| 2 | W | | 58·950 | +6·867 | +11·186 | −3·983 | +1·333 | +15·403 | 74·353 | |
| 3 | E | | 49·950 | +6·829 | +11·195 | +4·055 | +0·339 | +22·418 | 72·368 | |
| 4 | W | | 56·200 | +6·847 | +11·203 | +0·634 | −0·021 | +18·663 | 74·863 | |
| 5 | E | α 40° | 52·025 | +6·828 | +11·210 | −0·396 | +0·508 | +18·150 | 70·175 | 72·605 |
| 6 | E | | 51·600 | +6·835 | +11·218 | +0·696 | +0·317 | +19·066 | 70·666 | |
| 7 | W | | 56·375 | +6·784 | +11·225 | +0·183 | +0·148 | +18·340 | 74·715 | |
| 8 | W | | 51·600 | +6·812 | +11·231 | +1·641 | +1·079 | +20·763 | 72·363 | |
| 9 | E | α 60° | 51·825 | +6·826 | +11·237 | −1·184 | +0·339 | +17·218 | 69·043 | 71·243 |
| 10 | E | | 52·550 | +6·800 | +11·243 | −0·394 | +0·423 | +18·072 | 70·622 | |
| 11 | W | | 52·250 | +6·758 | +11·249 | +0·549 | +2·138 | +20·694 | 72·944 | |
| 12 | W | | 51·750 | +6·806 | +11·253 | +1·008 | +2·159 | +21·226 | 72·976 | |
| 13 | E | α (1) 30° | 52·400 | +6·803 | +11·257 | −0·429 | −0·296 | +17·335 | 69·735 | 71·215 |
| 14 | W | | 54·775 | +6·841 | +11·261 | −0·004 | −0·275 | +17·823 | 72·598 | |
| 15 | E | | 50·950 | +6·739 | +11·265 | +0·556 | +0·042 | +18·602 | 69·552 | |
| 18 | W | | 53·825 | +6·681 | +11·270 | −0·308 | +0·042 | +17·685 | 71·510 | |
| 19 | E | α (1) 50° | 51·275 | +6·778 | +11·272 | +0·524 | +0·974 | +19·548 | 70·823 | 70·988 |
| 24 | E | | 50·050 | +6·724 | +11·271 | −0·196 | +1·820 | +19·619 | 69·669 | |
| 25 | W | | 53·075 | +6·750 | +11·269 | +0·963 | −0·106 | +18·876 | 71·951 | |
| 29 | E | | 55·450 | +6·770 | +11·254 | −1·408 | +0·593 | +17·209 | 72·659 | |
| 31 | W | α (1) 70° | 52·125 | +6·776 | +11·244 | +2·059 | +0·127 | +20·206 | 72·331 | 72·446 |
| Feb. 1 | E | | 55·375 | +6·736 | +11·237 | −1·668 | −0·169 | +16·136 | 71·511 | |
| 2 | W | | 53·925 | +6·759 | +11·229 | +1·750 | −0·360 | +19·358 | 73·283 | |

Mean 6° 52′ 11″·8075

Mean Result of both Faces ..... 6° 52′ 11″·4772

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## G. T. STATION KALIANA.

### No. 11 (570) 3 Aurigæ *i*. North 3° 23′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 20° *a* | 41″·100 | +3″·341 | −10″·327 | −3″·203 | +0″·085 | −10″·104 | 30″·996 | 32″·280 |
| 5 | W | | 40·100 | +3·339 | −10·404 | +2·361 | −1·905 | − 6·609 | 33·491 | |
| 6 | E | | 42·200 | +3·339 | −10·480 | −1·166 | −1·270 | − 9·577 | 32·623 | |
| 7 | W | | 40·475 | +3·347 | −10·556 | +0·500 | −1·757 | − 8·466 | 32·009 | |
| 8 | E | 40° *a* | 38·400 | +3·333 | −10·633 | +0·250 | −0·275 | − 7·325 | 31·075 | 32·753 |
| 9 | W | | 43·500 | +3·322 | −10·709 | −0·709 | −1·376 | − 9·472 | 34·028 | |
| 10 | E | | 39·475 | +3·328 | −10·785 | +1·032 | −2·201 | − 8·626 | 30·849 | |
| 11 | W | | 45·025 | +3·326 | −10·861 | −1·118 | −1·312 | − 9·965 | 35·060 | |
| 12 | E | 60° *a* | 42·400 | +3·336 | −10·937 | −3·114 | +0·868 | − 9·847 | 32·553 | 32·331 |
| 13 | W | | 37·175 | +3·346 | −11·011 | +2·595 | +0·339 | − 4·731 | 32·444 | |
| 14 | E | | 42·925 | +3·355 | −11·085 | −2·013 | −0·614 | −10·357 | 32·568 | |
| 15 | W | | 37·350 | +3·353 | −11·160 | +1·534 | −0·487 | − 6·760 | 30·590 | |
| 16 | E | 30° *a* (1) | 45·125 | +3·339 | −11·236 | −2·088 | −0·444 | −10·429 | 34·696 | 32·832 |
| 17 | W | | 38·275 | +3·350 | −11·311 | +2·115 | −0·085 | − 5·931 | 32·344 | |
| 18 | E | | 44·650 | +3·367 | −11·384 | −3·260 | −1·524 | −12·801 | 31·849 | |
| 19 | W | | 36·375 | +3·367 | −11·457 | +3·433 | +0·720 | − 3·937 | 32·438 | |
| 20 | E | 50° *a* (1) | 41·800 | +3·366 | −11·530 | −0·613 | −1·693 | −10·470 | 31·330 | 31·708 |
| 21 | W | | 39·250 | +3·352 | −11·603 | +0·059 | +0·254 | − 7·938 | 31·312 | |
| 22 | E | | 41·700 | +3·347 | −11·674 | −0·162 | −1·778 | −10·267 | 31·433 | |
| 23 | W | | 41·450 | +3·361 | −11·745 | +0·769 | −1·079 | − 8·694 | 32·756 | |
| 24 | E | 70° *a* (1) | 46·050 | +3·326 | −11·818 | −1·406 | −1·376 | −11·274 | 34·776 | 33·557 |
| 26 | W | | 44·650 | +3·344 | −11·959 | −1·913 | −0·593 | −11·121 | 33·529 | |
| 27 | E | | 40·725 | +3·351 | −12·028 | +2·415 | −1·609 | − 7·871 | 32·854 | |
| 28 | W | | 46·775 | +3·352 | −12·097 | −2·528 | −2·434 | −13·707 | 33·068 | |
| 29 | E | 60° *a* | 43·050 | +3·362 | −12·165 | −0·584 | −1·206 | −10·593 | 32·457 | |
| 30 | W | | 43·425 | +3·370 | −12·233 | +1·159 | −2·349 | −10·053 | 33·372 | |

Mean 3° 23′ 32″·5768

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | 20° *a* | 45″·300 | +3″·364 | −12″·300 | −3″·191 | −0″·106 | −12″·233 | 33″·067 | 32″·721 |
| Jan. 1 | W | | 37·975 | +3·363 | −12·418 | +3·840 | −1·672 | − 6·887 | 31·088 | |
| 2 | E | | 49·450 | +3·387 | −12·484 | −3·983 | −1·566 | −14·646 | 34·804 | |
| 3 | W | | 38·175 | +3·366 | −12·550 | +4·055 | −1·122 | − 6·251 | 31·924 | |
| 4 | E | 40° *a* | 41·975 | +3·372 | −12·614 | +0·634 | −0·106 | − 8·714 | 33·261 | 33·445 |
| 5 | W | | 41·900 | +3·366 | −12·677 | −0·396 | −0·423 | −10·130 | 31·770 | |
| 6 | W | | 41·425 | +3·374 | −12·740 | +0·696 | −0·148 | − 8·818 | 32·607 | |
| 7 | E | | 45·925 | +3·345 | −12·802 | +0·183 | −0·508 | − 9·782 | 36·143 | |
| 8 | E | 60° *a* | 43·975 | +3·359 | −12·863 | +1·641 | −1·566 | − 9·429 | 34·546 | 33·739 |
| 9 | W | | 44·525 | +3·365 | −12·923 | −1·184 | −1·122 | −11·864 | 32·661 | |
| 10 | W | | 43·150 | +3·352 | −12·982 | −0·394 | −0·529 | −10·553 | 32·597 | |
| 11 | E | | 46·850 | +3·334 | −13·041 | +0·549 | −2·540 | −11·698 | 35·152 | |
| 12 | E | 30° *a* (1) | 44·850 | +3·357 | −13·097 | +1·008 | −2·371 | −11·103 | 33·747 | 32·326 |
| 13 | W | | 41·625 | +3·356 | −13·153 | −0·429 | −0·212 | −10·438 | 31·187 | |
| 14 | E | | 43·525 | +3·372 | −13·209 | −0·004 | −0·656 | −10·497 | 33·028 | |
| 15 | W | | 40·875 | +3·321 | −13·263 | +0·556 | −0·148 | − 9·534 | 31·341 | |
| 16 | E | 50° *a* (1) | 42·400 | +3·315 | −13·317 | +0·824 | −0·254 | − 9·432 | 32·968 | 32·251 |
| 19 | W | | 40·800 | +3·344 | −13·467 | +0·524 | −0·317 | − 9·916 | 30·884 | |
| 24 | W | | 43·600 | +3·318 | −13·696 | −0·196 | −2·349 | −12·923 | 30·677 | |
| 25 | E | | 42·925 | +3·328 | −13·739 | +0·963 | +0·487 | − 8·961 | 33·964 | |
| 27 | E | | 44·575 | +3·332 | −13·818 | −0·365 | +0·508 | −10·343 | 34·232 | |
| 29 | W | 70° *a* (1) | 44·125 | +3·337 | −13·891 | −1·408 | −0·910 | −12·872 | 31·253 | 33·054 |
| 31 | E | | 43·775 | +3·340 | −13·959 | +2·059 | −0·127 | − 8·687 | 35·088 | |
| Feb. 1 | W | | 43·850 | +3·320 | −13·991 | −1·668 | +0·063 | −12·276 | 31·574 | |
| 2 | E | | 42·900 | +3·331 | −14·021 | +1·730 | +0·360 | − 8·600 | 34·300 | |

Mean 3° 23′ 32″·9227

Mean Result of both Faces ..... 3° 23′ 32″·7498

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## No. 12 (585) 102 TAURI. South 8° 9′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | W | | 13″·400 | +8″·080 | +10″·288 | −3″·203 | −0″·106 | +15″·059 | 28″·459 | |
| 5 | E | | 10·675 | +8·069 | +10·291 | +2·361 | +0·085 | +20·806 | 31·481 | |
| 6 | W | α 0°.32 | 11·950 | +8·064 | +10·292 | −1·166 | +1·630 | +18·820 | 30·770 | 30″·544 |
| 7 | E | | 10·825 | +8·088 | +10·294 | +0·500 | +1·757 | +20·639 | 31·464 | |
| 8 | W | | 8·825 | +8·053 | +10·296 | +0·250 | +1·418 | +20·017 | 28·842 | |
| 9 | E | | 10·225 | +8·034 | +10·298 | −0·709 | +2·201 | +19·824 | 30·049 | |
| 10 | W | α 0°.40 | 9·250 | +8·041 | +10·300 | +1·032 | +2·371 | +21·744 | 30·994 | 30·400 |
| 11 | E | | 12·275 | +8·039 | +10·302 | −1·118 | +2·117 | +19·440 | 31·715 | |
| 13 | E | | 8·050 | +8·085 | +10·305 | +2·595 | +0·656 | +21·641 | 29·691 | |
| 14 | W | α 0°.60 | 12·825 | +8·110 | +10·305 | −2·013 | +0·889 | +17·291 | 30·116 | 30·580 |
| 15 | E | | 9·800 | +8·101 | +10·307 | +1·534 | +0·466 | +20·408 | 30·208 | |
| 16 | W | | 15·600 | +8·066 | +10·309 | −2·088 | +0·825 | +17·112 | 32·712 | |
| 17 | E | α (1) 0°.80 | 7·900 | +8·091 | +10·312 | +2·115 | 0·000 | +20·518 | 28·418 | |
| 18 | W | | 13·500 | +8·139 | +10·313 | −3·260 | +1·397 | +16·589 | 30·089 | 30·351 |
| 19 | E | | 8·725 | +8·137 | +10·313 | +3·433 | −0·423 | +21·460 | 30·185 | |
| 20 | W | | 12·100 | +8·134 | +10·315 | −0·613 | +0·952 | +18·788 | 30·888 | |
| 21 | E | α (1) 0°.50 | 10·250 | +8·101 | +10·317 | +0·059 | +0·275 | +18·752 | 29·002 | |
| 22 | W | | 10·000 | +8·088 | +10·317 | −0·162 | +2·053 | +20·296 | 30·296 | 30·062 |
| 23 | E | | 9·225 | +8·119 | +10·318 | +0·769 | +1·630 | +20·836 | 30·061 | |
| 24 | W | | 11·400 | +8·035 | +10·320 | −1·406 | +1·333 | +18·282 | 29·682 | |
| 26 | E | α (1) 0°.70 | 14·450 | +8·078 | +10·324 | −1·913 | +0·720 | +17·209 | 31·659 | |
| 27 | W | | 7·975 | +8·096 | +10·324 | +2·415 | +1·990 | +22·825 | 30·800 | 30·558 |
| 28 | E | | 11·675 | +8·099 | +10·325 | −2·528 | +2·519 | +18·415 | 30·090 | |
| 29 | W | α 0°.90 | 11·425 | +8·126 | +10·326 | −0·584 | +1·122 | +18·990 | 30·415 | |
| 30 | E | | 10·975 | +8·145 | +10·328 | +1·159 | +2·180 | +21·812 | 32·787 | |

Mean 8° 9′ 30″·4158

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 31 | W | | 15″·775 | +8″·126 | +10″·329 | −3″·191 | +0″·550 | +15″·814 | 31″·589 | |
| Jan. 1 | E | | 4·950 | +8·127 | +10·378 | +3·840 | +2·011 | +24·356 | 29·306 | |
| 2 | W | α 0°.32 | 15·175 | +8·186 | +10·380 | −3·983 | +2·752 | +17·335 | 32·510 | 30″·978 |
| 3 | E | | 7·600 | +8·133 | +10·381 | +4·055 | +0·339 | +22·908 | 30·508 | |
| 4 | W | | 12·700 | +8·145 | +10·382 | +0·634 | +0·275 | +19·436 | 32·136 | |
| 5 | E | | 11·350 | +8·134 | +10·382 | −0·396 | +0·550 | +18·670 | 30·020 | |
| 6 | E | α 0°.40 | 10·025 | +8·157 | +10·383 | +0·696 | −0·106 | +19·130 | 29·155 | 30·758 |
| 7 | W | | 12·475 | +8·084 | +10·384 | +0·183 | +0·593 | +19·244 | 31·719 | |
| 9 | E | | 11·200 | +8·130 | +10·385 | −1·184 | +1·312 | +18·643 | 29·843 | |
| 10 | E | α 0°.60 | 10·525 | +8·101 | +10·385 | −0·394 | +0·635 | +18·727 | 29·252 | 31·062 |
| 11 | W | | 11·550 | +8·059 | +10·386 | +0·549 | +2·032 | +21·026 | 32·576 | |
| 12 | W | | 11·500 | +8·114 | +10·385 | +1·008 | +1·863 | +21·370 | 32·870 | |
| 13 | E | α (1) 0°.80 | 10·175 | +8·111 | +10·385 | −0·429 | +0·550 | +18·617 | 28·792 | |
| 14 | W | | 13·175 | +8·149 | +10·385 | −0·004 | +0·910 | +19·440 | 32·615 | 30·989 |
| 15 | E | | 9·975 | +8·023 | +10·385 | +0·556 | +0·741 | +19·705 | 29·680 | |
| 19 | E | | 9·900 | +8·082 | +10·381 | +0·524 | +0·466 | +19·453 | 29·353 | |
| 24 | W | α (1) 0°.50 | 9·950 | +8·020 | +10·371 | +0·196 | +3·006 | +21·593 | 31·543 | |
| 25 | E | | 11·725 | +8·042 | +10·369 | −0·963 | +0·190 | +17·638 | 29·363 | 30·442 |
| 27 | W | | 13·950 | +8·050 | +10·362 | −0·365 | −0·487 | +17·560 | 31·510 | |
| 28 | W | | 11·725 | +8·020 | +10·359 | +1·636 | −0·360 | +19·655 | 31·380 | |
| 29 | E | | 12·750 | +8·065 | +10·354 | −1·408 | +0·381 | +17·392 | 30·142 | |
| 31 | W | α (1) 0°.70 | 11·000 | +8·070 | +10·345 | +2·059 | +0·339 | +20·813 | 31·813 | |
| Feb. 1 | E | | 12·075 | +8·021 | +10·340 | −1·668 | −0·085 | +16·608 | 28·683 | 30·548 |
| 2 | W | | 11·750 | +8·048 | +10·334 | +1·730 | −0·254 | +19·858 | 31·608 | |
| 3 | E | | 12·100 | +8·016 | +10·328 | −1·081 | +0·296 | +17·559 | 29·659 | |

Mean 8° 9′ 30″·7962

Mean Result of both Faces..... 8 9′ 30″·6060

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## G. T. STATION KALIAN A.

### No. 13 (594) Tauri. South 5° 27′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 42″·775 | +5″·397 | +10″·110 | +3″·203 | +0″·148 | +18″·858 | 61″·633 | |
| 5 | W | α 20° | 43·875 | +5·387 | +10·128 | −2·361 | 0·000 | +13·154 | 57·029 | 59″·648 |
| 6 | E | | 43·550 | +5·381 | +10·145 | +1·166 | +1·185 | +17·877 | 61·427 | |
| 7 | W | | 41·750 | +5·399 | +10·162 | −0·500 | +1·693 | +16·754 | 58·504 | |
| 8 | E | | 44·525 | +5·376 | +10·179 | −0·250 | +1·566 | +16·871 | 61·396 | |
| 9 | W | α 40° | 40·400 | +5·366 | +10·197 | +0·709 | +2·053 | +18·325 | 58·725 | |
| 10 | E | | 43·850 | +5·368 | +10·213 | −1·032 | +1·799 | +16·348 | 60·198 | 60·552 |
| 11 | W | | 43·100 | +5·367 | +10·231 | +1·118 | +2·074 | +18·790 | 61·890 | |
| 13 | W | | 44·575 | +5·397 | +10·265 | −2·595 | +1·693 | +14·760 | 59·335 | |
| 14 | E | α 60° | 41·275 | +5·415 | +10·281 | +2·013 | +1·016 | +18·725 | 60·000 | 59·251 |
| 15 | W | | 44·075 | +5·407 | +10·298 | −1·534 | +0·085 | +14·256 | 58·331 | |
| 16 | E | | 42·150 | +5·383 | +10·316 | +2·088 | +0·466 | +18·253 | 60·403 | |
| 17 | W | α (1) 30° | 46·650 | +5·399 | +10·334 | −2·115 | +1·609 | +15·227 | 61·877 | |
| 18 | E | | 40·925 | +5·435 | +10·351 | +3·260 | +1·482 | +20·528 | 61·453 | 60·982 |
| 19 | W | | 48·250 | +5·433 | +10·367 | −3·433 | −0·423 | +11·944 | 60·194 | |
| 20 | E | | 44·150 | +5·430 | +10·384 | +0·613 | +1·206 | +17·633 | 61·783 | |
| 21 | W | α (1) 50° | 43·725 | +5·409 | +10·402 | −0·059 | +0·804 | +16·556 | 60·281 | |
| 22 | E | | 41·550 | +5·399 | +10·417 | +0·162 | +2·032 | +18·010 | 59·560 | 59·758 |
| 23 | W | | 40·200 | +5·419 | +10·434 | −0·769 | +2·222 | +17·206 | 57·406 | |
| 24 | E | | 40·925 | +5·363 | +10·453 | +1·406 | +1·566 | +18·788 | 59·713 | |
| 26 | W | α (1) 70° | 39·700 | +5·392 | +10·486 | +1·913 | +0·825 | +18·616 | 58·316 | |
| 27 | E | | 44·650 | +5·403 | +10·502 | −2·415 | +1·863 | +15·353 | 60·003 | 59·261 |
| 28 | W | | 38·000 | +5·406 | +10·518 | +2·528 | +2·561 | +21·013 | 59·013 | |
| 29 | E | α 60° | 40·650 | +5·426 | +10·534 | +0·584 | +1·820 | +18·364 | 59·014 | |
| 30 | W | | 43·325 | +5·438 | +10·551 | −1·159 | +1·164 | +15·994 | 59·319 | |

Mean 5° 27′ 59″·9087

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 37″·850 | +5″·423 | +10″·567 | +3″·191 | +1″·524 | +20″·705 | 58″·555 | |
| Jan. 1 | W | α 20° | 48·975 | +5·425 | +10·631 | −3·840 | +1·101 | +13·317 | 62·292 | 59″·993 |
| 2 | E | | 36·525 | +5·466 | +10·648 | +3·983 | +2·836 | +22·933 | 59·458 | |
| 3 | W | | 47·650 | +5·429 | +10·664 | −4·055 | −0·021 | +12·017 | 59·667 | |
| 4 | E | | 43·375 | +5·436 | +10·680 | −0·634 | +0·529 | +16·011 | 59·386 | |
| 5 | W | α 40° | 42·450 | +5·430 | +10·695 | +0·396 | +0·868 | +17·389 | 59·839 | |
| 6 | W | | 45·025 | +5·447 | +10·711 | −0·696 | +0·063 | +15·525 | 60·550 | 59·277 |
| 7 | E | | 41·350 | +5·397 | +10·726 | −0·183 | +0·042 | +15·982 | 57·332 | |
| 8 | E | | 45·175 | +5·420 | +10·740 | −1·641 | +1·566 | +16·085 | 61·260 | |
| 9 | W | α 60° | 40·925 | +5·427 | +10·755 | +1·184 | +1·312 | +18·678 | 59·603 | |
| 10 | W | | 42·950 | +5·408 | +10·770 | +0·394 | +0·508 | +17·080 | 60·030 | 59·442 |
| 11 | E | | 39·500 | +5·381 | +10·785 | −0·549 | +1·757 | +17·374 | 56·874 | |
| 12 | E | | 40·825 | +5·418 | +10·798 | −1·008 | +2·328 | +17·536 | 58·361 | |
| 13 | W | α (1) 30° | 43·300 | +5·416 | +10·812 | +0·429 | +0·656 | +17·313 | 60·613 | |
| 14 | E | | 40·750 | +5·440 | +10·826 | +0·004 | +0·741 | +17·011 | 57·761 | 59·268 |
| 15 | W | | 44·700 | +5·355 | +10·839 | −0·556 | 0·000 | +15·638 | 60·338 | |
| 19 | W | | 43·950 | +5·396 | +10·888 | −0·524 | +0·783 | +16·543 | 60·493 | |
| 24 | E | α (1) 50° | 41·200 | +5·356 | +10·941 | −0·196 | +2·011 | +18·112 | 59·312 | |
| 25 | W | | 43·475 | +5·369 | +10·951 | +0·963 | +0·889 | +18·172 | 61·647 | 60·066 |
| 27 | E | | 41·850 | +5·373 | +10·968 | +0·365 | +0·254 | +16·960 | 58·810 | |
| 28 | E | | 43·800 | +5·353 | +10·976 | −1·636 | −0·085 | +14·608 | 58·408 | |
| 29 | W | α (1) 70° | 42·100 | +5·384 | +10·982 | +1·408 | −0·317 | +17·457 | 59·557 | |
| 31 | E | | 43·100 | +5·387 | +10·996 | −2·059 | +0·021 | +14·345 | 57·445 | 59·058 |
| Feb. 2 | W | | 42·925 | +5·372 | +11·006 | +1·730 | −0·212 | +17·896 | 60·821 | |

Mean 5° 27′ 59″·5173

Mean Result of both Faces ..... 5° 27′ 59″·7130

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No. 14 (612) 14 AURIGÆ *a*. North 2° 58′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | W | 20° *a* | 56″·275 | +2″·945 | — 9″·614 | +3″·203 | +0″·889 | — 2″·577 | 53″·698 | 53″·657 |
| 5 | E | | 63·325 | +2·938 | — 9·682 | —2·361 | —0·995 | —10·100 | 53·225 | |
| 6 | W | | 61·575 | +2·932 | — 9·749 | +1·166 | +0·339 | — 5·312 | 56·263 | |
| 7 | E | | 59·850 | +2·944 | — 9·816 | —0·500 | —1·037 | — 8·409 | 51·441 | |
| 8 | W | 40° *a* | 64·600 | +2·931 | — 9·885 | —0·250 | +0·085 | — 7·119 | 57·481 | 54·697 |
| 9 | E | | 60·550 | +2·928 | — 9·953 | +0·709 | —0·508 | — 6·824 | 53·726 | |
| 10 | W | | 63·500 | +2·927 | —10·020 | —1·032 | —0·952 | — 9·077 | 54·423 | |
| 11 | E | | 60·850 | +2·927 | —10·088 | +1·118 | —1·651 | — 7·694 | 53·156 | |
| 12 | W | 60° *a* | 57·325 | +2·935 | —10·157 | +3·114 | +1·101 | — 3·007 | 54·318 | 54·060 |
| 13 | E | | 64·375 | +2·943 | —10·224 | —2·595 | —0·021 | — 9·897 | 54·478 | |
| 14 | W | | 59·025 | +2·953 | —10·291 | +2·013 | —0·614 | — 5·939 | 53·086 | |
| 15 | E | | 63·350 | +2·948 | —10·359 | —1·534 | —0·085 | — 9·030 | 54·320 | |
| 16 | W | 30° *a* (1) | 60·325 | +2·934 | —10·428 | +2·088 | +0·254 | — 5·152 | 55·173 | 54·577 |
| 17 | E | | 65·625 | +2·943 | —10·497 | —2·115 | —1·482 | —11·151 | 54·474 | |
| 18 | W | | 59·725 | +2·965 | —10·565 | +3·260 | —0·995 | — 5·335 | 54·390 | |
| 19 | E | | 64·525 | +2·963 | —10·632 | —3·433 | +0·847 | —10·255 | 54·270 | |
| 20 | W | 50° *a* (1) | 64·225 | +2·961 | —10·700 | +0·613 | —0·169 | — 7·295 | 56·930 | 54·240 |
| 21 | E | | 61·300 | +2·949 | —10·768 | —0·059 | +0·635 | — 7·243 | 54·057 | |
| 22 | W | | 62·075 | +2·944 | —10·834 | +0·162 | —1·587 | — 9·315 | 52·760 | |
| 23 | E | | 64·150 | +2·954 | —10·901 | —0·769 | —2·222 | —10·938 | 53·212 | |
| 24 | W | 70° *a* (1) | 62·275 | +2·924 | —10·970 | +1·406 | —1·439 | — 8·079 | 54·196 | 54·070 |
| 26 | E | | 61·775 | +2·939 | —11·103 | +1·913 | —0·106 | — 6·357 | 55·418 | |
| 27 | W | | 65·500 | +2.945 | —11·169 | —2·415 | —1·228 | —11·867 | 53·633 | |
| 28 | E | | 60·825 | +2·947 | —11·235 | +2·528 | —2·032 | — 7·792 | 53·033 | |
| 29 | W | 60° *a* | 62·500 | +2·959 | —11·301 | +0·584 | —1·503 | — 9·261 | 53·239 | |
| 30 | E | | 66·025 | +2·966 | —11·367 | —1·159 | —1·545 | —11·105 | 54·920 | |

Mean 2° 58′ 54″·2168

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 31 | W | 20° *a* | 59″·150 | +2″·956 | —11″·432 | +3″·191 | —1″·016 | — 6″·301 | 52″·849 | 54″·111 |
| Jan. 1 | E | | 68·625 | +2·957 | —11·548 | —3·840 | +0·127 | —12·304 | 56·321 | |
| 2 | W | | 58·800 | +2·981 | —11·613 | +3·983 | —1·714 | — 6·363 | 52·437 | |
| 3 | E | | 67·650 | +2·960 | —11·677 | —4·055 | —0·042 | —12·814 | 54·836 | |
| 4 | W | 40° *a* | 64·025 | +2·963 | —11·741 | —0·634 | +0·508 | — 8·904 | 55·121 | 54·659 |
| 5 | E | | 61·900 | +2·961 | —11·803 | +0·396 | —0·021 | — 8·467 | 53·433 | |
| 6 | E | | 64·275 | +2·972 | —11·866 | —0·696 | +0·275 | — 9·315 | 54·960 | |
| 8 | W | 60° *a* | 65·125 | +2·956 | —11·989 | —1·641 | —0·635 | —11·309 | 53·816 | 54·006 |
| 9 | E | | 63·800 | +2·959 | —12·050 | +1·184 | —0·825 | — 8·732 | 55·068 | |
| 10 | E | | 63·250 | +2·949 | —12·111 | +0·394 | —0·169 | — 8·937 | 54·313 | |
| 11 | W | | 64·475 | +2·935 | —12·170 | —0·549 | —1·863 | —11·647 | 52·828 | |
| 12 | W | 30° *a* (1) | 63·125 | +2·955 | —12·228 | —1·008 | —1·799 | —12·080 | 51·045 | 53·498 |
| 13 | E | | 63·725 | +2·954 | —12·286 | +0·429 | +0·317 | — 8·586 | 55·139 | |
| 14 | W | | 61·825 | +2·966 | —12·344 | +0·004 | —0·360 | — 9·734 | 52·091 | |
| 15 | E | | 65·775 | +2·919 | —12·400 | —0·556 | —0·021 | —10·058 | 55·717 | |
| 19 | E | 50° *a* (1) | 66·650 | +2·943 | —12·617 | —0·524 | —0·063 | —10·261 | 56·389 | 54·454 |
| 24 | W | | 64·400 | +2·921 | —12·868 | —0·196 | —0·847 | —10·990 | 53·410 | |
| 25 | E | | 64·525 | +2·928 | —12·916 | +0·963 | +0·042 | — 8·983 | 55·542 | |
| 27 | W | | 62·400 | +2·929 | —13·006 | +0·365 | —0·212 | — 9·924 | 52·476 | |
| 29 | E | 70° *a* (1) | 63·325 | +2·935 | —13·092 | +1·408 | +0·635 | — 8·114 | 55·211 | 54·175 |
| 31 | W | | 65·700 | +2·937 | —13·173 | —2·059 | +0·085 | —12·210 | 53·490 | |
| Feb. 2 | E | | 64·350 | +2·928 | —13·249 | +1·730 | +0·042 | — 8·549 | 55·801 | |
| 3 | W | | 63·625 | +2·917 | —13·285 | —1·081 | +0·021 | —11·428 | 52·197 | |

Mean 2° 58′ 54″·1505

Mean Result of both Faces ..... 2° 58′ 54″·1837



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## G. T. STATION KALIANA.

### No. 15 (637) Aurigæ. North 1° 28′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 32″·575 | +1″·456 | — 9″·309 | —3″·203 | +1″·270 | — 9″·786 | 22″·789 | |
| 5 | W | α | 31·350 | +1·453 | — 9·363 | +2·361 | —1·164 | — 6·713 | 24·637 | 24″·210 |
| 6 | E | 20° | 34·300 | +1·450 | — 9·418 | —1·166 | —0·423 | — 9·557 | 24·743 | |
| 7 | W | | 31·850 | +1·455 | — 9·472 | +0·500 | +0·339 | — 7·178 | 24·672 | |
| 8 | E | | 31·650 | +1·449 | — 9·527 | +0·250 | —0·487 | — 8·315 | 23·335 | |
| 9 | W | α | 36·000 | +1·447 | — 9·582 | —0·709 | —0·847 | — 9·691 | 26·309 | |
| 10 | E | 40° | 33·675 | +1·448 | — 9·637 | +1·032 | —2·371 | — 9·528 | 24·147 | 24·587 |
| 11 | W | | 35·825 | +1·449 | — 9·693 | —1·118 | —1·905 | —11·267 | 24·558 | |
| 13 | W | | 29·825 | +1·456 | — 9·804 | +2·595 | +0·381 | — 5·372 | 24·453 | |
| 14 | E | α | 36·350 | +1·460 | — 9·859 | —2·013 | —0·508 | —10·920 | 25·430 | 25·226 |
| 15 | W | 60° | 30·950 | +1·458 | — 9·915 | +1·534 | —0·614 | — 7·537 | 23·413 | |
| 16 | E | | 35·425 | +1·452 | — 9·972 | —2·088 | +0·212 | —10·396 | 25·029 | |
| 17 | W | α (i) | 30·075 | +1·456 | —10·029 | +2·115 | —0·910 | — 7·368 | 22·707 | |
| 18 | E | 30° | 37·875 | +1·466 | —10·085 | —3·260 | +0·190 | —11·689 | 26·186 | 23·894 |
| 19 | W | | 26·750 | +1·465 | —10·141 | +3·433 | +0·148 | — 5·095 | 21·655 | |
| 20 | E | | 35·375 | +1·463 | —10·198 | —0·613 | +1·122 | — 8·226 | 27·149 | |
| 21 | W | α (i) | 32·550 | +1·460 | —10·255 | +0·059 | +0·762 | — 7·974 | 24·576 | |
| 22 | E | 50° | 35·675 | +1·457 | —10·310 | —0·162 | —1·101 | —10·116 | 25·559 | 25·454 |
| 23 | W | | 33·175 | +1·461 | —10·367 | +0·769 | —0·508 | — 8·645 | 24·530 | |
| 24 | E | | 37·225 | +1·446 | —10·425 | —1·406 | —0·423 | —10·808 | 26·417 | |
| 26 | W | α (i) | 36·325 | +1·453 | —10·538 | —1·913 | —0·106 | —11·104 | 25·221 | |
| 27 | E | 70° | 33·175 | +1·456 | —10·594 | +2·415 | —1·376 | — 8·099 | 25·076 | 25·484 |
| 28 | W | | 37·875 | +1·457 | —10·650 | —2·528 | —0·931 | —12·652 | 25·223 | |
| 29 | E | α | 36·350 | +1·463 | —10·706 | —0·584 | —0·804 | —10·631 | 25·719 | |
| 30 | W | 60° | 37·700 | +1·466 | —10·763 | +1·159 | —2·794 | —10·932 | 26·768 | |

Mean 1° 28′ 24″·8092

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 33″·675 | +1″·463 | —10″·818 | —3″·191 | 0″·000 | —12″·546 | 21″·129 | |
| Jan. 1 | W | α | 32·800 | +1·463 | —10·923 | +3·840 | +0·444 | — 5·176 | 27·624 | 24″·585 |
| 2 | E | 20° | 42·075 | +1·474 | —10·979 | —3·983 | —2·011 | —15·499 | 26·576 | |
| 3 | W | | 28·000 | +1·463 | —11·035 | +4·055 | +0·529 | — 4·988 | 23·012 | |
| 4 | E | | 35·075 | +1·466 | —11·090 | +0·634 | +0·423 | — 8·567 | 26·508 | |
| 5 | W | α | 34·475 | +1·464 | —11·145 | —0·396 | +0·106 | — 9·971 | 24·504 | |
| 6 | W | 40° | 33·500 | +1·469 | —11·200 | +0·696 | +0·910 | — 8·125 | 25·375 | 25·911 |
| 7 | E | | 36·850 | +1·455 | —11·254 | +0·183 | +0·021 | — 9·595 | 27·255 | |
| 8 | E | | 35·150 | +1·462 | —11·307 | +1·641 | —0·720 | — 8·924 | 26·226 | |
| 9 | W | α | 35·150 | +1·463 | —11·361 | —1·184 | —0·444 | —11·526 | 23·624 | |
| 10 | W | 60° | 34·275 | +1·458 | —11·414 | —0·394 | —0·148 | —10·498 | 23·777 | 25·197 |
| 11 | E | | 38·425 | +1·451 | —11·467 | +0·549 | —1·799 | —11·266 | 27·159 | |
| 12 | E | | 37·825 | +1·461 | —11·518 | +1·008 | —1·460 | —10·509 | 27·316 | |
| 13 | W | α (i) | 34·100 | +1·463 | —11·570 | —0·429 | +0·550 | — 9·986 | 24·114 | |
| 14 | E | 30° | 35·525 | +1·467 | —11·621 | —0·004 | +0·339 | — 9·819 | 25·706 | 25·133 |
| 15 | W | | 32·900 | +1·444 | —11·672 | +0·556 | +0·169 | — 9·503 | 23·397 | |
| 19 | W | | 33·575 | +1·455 | —11·867 | +0·524 | —0·042 | — 9·930 | 23·645 | |
| 24 | E | α (i) | 37·850 | +1·445 | —12·096 | +0·196 | —1·143 | —11·598 | 26·252 | |
| 25 | W | 50° | 35·900 | +1·448 | —12·140 | —0·963 | +1·037 | —10·618 | 25·282 | 25·305 |
| 27 | E | | 36·950 | +1·448 | —12·224 | —0·365 | +0·233 | —10·908 | 26·042 | |
| 28 | E | | 34·075 | +1·443 | —12·265 | +1·636 | +0·317 | — 8·869 | 25·206 | |
| 29 | W | | 38·350 | +1·452 | —12·304 | —1·408 | +0·402 | —11·858 | 26·492 | |
| 30 | E | α (i) | 34·850 | +1·449 | —12·343 | +1·720 | +0·402 | — 8·772 | 26·078 | |
| 31 | W | 70° | 37·275 | +1·453 | —12·381 | —2·059 | —0·021 | —13·008 | 24·267 | 25·262 |
| Feb. 2 | W | | 36·400 | +1·449 | —12·453 | —1·730 | +0·085 | —12·649 | 23·751 | |
| 3 | E | | 35·675 | +1·443 | —12·487 | +1·081 | +0·063 | — 9·900 | 25·775 | |

Mean 1° 28′ 25″·2322

Mean Result of both Faces ..... 1° 28′ 25″·0207

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## No. 16 (661) 25 AURIGÆ χ. North 2° 33′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | Corrections. ✱'s Place. | Corrections. Collimatn. | Corrections. Level. | Corrections. Sum. | Corrected Zenith distance. Each Observ. | Corrected Zenith distance. Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 14″·100 | +2″·521 | — 8″·938 | +3″·203 | +1″·630 | — 1″·584 | 12″·516 | |
| 5 | E | α 20° | 19·650 | +2·517 | — 8·996 | —2·361 | —1·397 | —10·237 | 9·413 | 10″·821 |
| 6 | W | | 18·000 | +2·512 | — 9·053 | +1·166 | —0·593 | — 5·968 | 12·032 | |
| 7 | E | | 16·625 | +2·519 | — 9·111 | —0·500 | —0·212 | — 7·304 | 9·321 | |
| 8 | W | | 19·325 | +2·509 | — 9·170 | —0·250 | —0·614 | — 7·525 | 11·800 | |
| 9 | E | α 40° | 15·500 | +2·506 | — 9·229 | +0·709 | —0·931 | — 6·945 | 8·555 | 10·473 |
| 10 | W | | 20·650 | +2·509 | — 9·287 | —1·032 | —3·027 | —10·837 | 9·813 | |
| 11 | E | | 19·600 | +2·510 | — 9·347 | +1·118 | —2·159 | — 7·878 | 11·722 | |
| 12 | W | | 17·875 | +2·514 | — 9·407 | +3·114 | +0·212 | — 3·567 | 14·308 | |
| 13 | E | α 60° | 21·850 | +2·522 | — 9·466 | —2·595 | —0·381 | — 9·920 | 11·930 | 11·511 |
| 14 | W | | 17·025 | +2·528 | — 9·525 | +2·013 | —0·974 | — 5·958 | 11·067 | |
| 15 | E | | 20·100 | +2·524 | — 9·586 | —1·534 | —0·529 | — 9·125 | 10·975 | |
| 16 | W | | 16·075 | +2·516 | — 9·647 | +2·088 | +0·910 | — 4·133 | 11·942 | |
| 17 | E | α (1) 30° | 20·975 | +2·522 | — 9·709 | —2·115 | —1·058 | —10·360 | 10·615 | 10·707 |
| 18 | W | | 14·900 | +2·538 | — 9·770 | +3·260 | +0·021 | — 3·951 | 10·949 | |
| 19 | E | | 20·300 | +2·538 | — 9·830 | —3·433 | —0·254 | —10·979 | 9·321 | |
| 20 | W | | 18·750 | +2·533 | — 9·892 | +0·613 | +1·143 | — 5·603 | 13·147 | |
| 21 | E | α (1) 50° | 17·350 | +2·530 | — 9·954 | —0·059 | 0·000 | — 7·483 | 9·867 | 11·086 |
| 22 | W | | 18·375 | +2·525 | —10·014 | +0·162 | —0·847 | — 8·174 | 10·201 | |
| 23 | E | | 19·550 | +2·530 | —10·076 | —0·769 | —0·106 | — 8·421 | 11·129 | |
| 24 | W | | 17·625 | +2·504 | —10·139 | +1·406 | +0·402 | — 5·827 | 11·798 | |
| 26 | E | α (1) 70° | 16·175 | +2·517 | —10·263 | +1·913 | —0·042 | — 5·875 | 10·300 | 11·219 |
| 27 | W | | 21·900 | +2·522 | —10·324 | —2·415 | —0·402 | —10·619 | 11·281 | |
| 28 | E | | 16·850 | +2·524 | —10·386 | +2·528 | —0·021 | — 5·355 | 11·495 | |
| 29 | W | α 60° | 19·375 | +2·534 | —10·448 | +0·584 | —1·016 | — 8·346 | 11·029 | |
| 30 | E | | 21·050 | +2·538 | —10·511 | —1·159 | —2·159 | —11·291 | 9·759 | |

Mean 2° 33′ 10″·9695

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | Corrections. ✱'s Place. | Corrections. Collimatn. | Corrections. Level. | Corrections. Sum. | Corrected Zenith distance. Each Observ. | Corrected Zenith distance. Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 15″·275 | +2″·535 | —10″·572 | +3″·191 | +0″·021 | — 4″·825 | 10″·450 | |
| Jan. 1 | E | α 20° | 26·325 | +2·534 | —10·674 | —3·840 | +0·190 | —11·790 | 14·535 | 10″·936 |
| 2 | W | | 13·175 | +2·553 | —10·736 | +3·983 | —1·609 | — 5·809 | 7·366 | |
| 3 | E | | 22·125 | +2·534 | —10·798 | —4·055 | +1·587 | —10·732 | 11·393 | |
| 4 | W | | 19·550 | +2·539 | —10·860 | —0·634 | +0·381 | — 8·574 | 10·976 | |
| 5 | E | α 40° | 17·975 | +2·536 | —10·920 | +0·396 | +0·148 | — 7·840 | 10·135 | 10·416 |
| 6 | E | | 18·800 | +2·545 | —10·981 | —0·696 | +1·206 | — 7·926 | 10·874 | |
| 7 | W | | 19·125 | +2·520 | —11·042 | —0·183 | —0·741 | — 9·446 | 9·679 | |
| 8 | W | | 22·375 | +2·532 | —11·102 | —1·641 | —0·593 | —10·804 | 11·571 | |
| 9 | E | α 60° | 20·550 | +2·533 | —11·162 | +1·184 | —0·085 | — 7·530 | 13·020 | 11·198 |
| 10 | E | | 19·350 | +2·526 | —11·222 | +0·394 | —0·444 | — 8·746 | 10·604 | |
| 11 | W | | 20·225 | +2·513 | —11·281 | —0·549 | —1·312 | —10·629 | 9·596 | |
| 12 | W | | 18·650 | +2·531 | —11·339 | —1·008 | —1·228 | —11·044 | 7·606 | |
| 13 | E | α (1) 30° | 20·850 | +2·538 | —11·398 | +0·429 | +0·296 | — 8·135 | 12·715 | 10·224 |
| 14 | W | | 15·550 | +2·540 | —11·456 | +0·004 | +1·185 | — 7·727 | 7·823 | |
| 15 | E | | 22·300 | +2·500 | —11·513 | —0·556 | +0·021 | — 9·548 | 12·752 | |
| 19 | E | | 22·475 | +2·520 | —11·736 | —0·524 | —0·021 | — 9·761 | 12·714 | |
| 24 | W | α (1) 50° | 21·200 | +2·503 | —12·001 | —0·196 | —0·931 | —10·625 | 10·575 | 11·498 |
| 25 | E | | 20·350 | +2·508 | —12·052 | +0·963 | +0·910 | — 7·671 | 12·679 | |
| 27 | W | | 18·350 | +2·507 | —12·150 | +0·365 | +0·952 | — 8·326 | 10·024 | |
| 28 | W | | 18·050 | +2·499 | —12·198 | —1·636 | +0·317 | —11·018 | 7·032 | |
| 29 | E | | 19·625 | +2·514 | —12·245 | +1·408 | +0·508 | — 7·815 | 11·810 | |
| 31 | E | α (1) 70° | 21·050 | +2·516 | —12·336 | +2·059 | —1·206 | — 8·967 | 12·083 | 9·988 |
| Feb. 1 | W | | 20·350 | +2·500 | —12·380 | —1·668 | +0·677 | —10·871 | 9·479 | |
| 2 | E | | 19·750 | +2·510 | —12·423 | +1·730 | +0·106 | — 8·077 | 11·673 | |
| 3 | W | | 18·875 | +2·499 | —12·464 | —1·081 | +0·021 | —11·025 | 7·850 | |

Mean 2° 33′ 10″·7100

**Mean Result of both Faces.....2° 33′ 10″·8398**

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## G. T. STATION KALIANA.

### No. 17 (687) 26 Aurigæ *l*. North 0° 52′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 45″·450 | +0″·867 | − 8″·779 | −3″·203 | +1″·228 | − 9″·887 | 35″·563 | |
| 5 | W | 20° *a* | 41·475 | +0·866 | − 8·824 | +2·361 | −0·550 | − 6·147 | 35·328 | 35″·590 |
| 6 | E | | 46·300 | +0·864 | − 8·868 | −1·166 | −0·910 | −10·080 | 36·220 | |
| 7 | W | | 42·900 | +0·866 | − 8·912 | +0·500 | −0·106 | − 7·652 | 35·248 | |
| 8 | E | | 42·175 | +0·863 | − 8·958 | +0·250 | −0·741 | − 8·586 | 33·589 | |
| 9 | W | 40° *a* | 46·525 | +0·862 | − 9·004 | −0·709 | −0·423 | − 9·274 | 37·251 | 35·819 |
| 10 | E | | 44·800 | +0·863 | − 9·050 | +1·032 | −2·836 | − 9·991 | 34·809 | |
| 11 | W | | 49·200 | +0·864 | − 9·097 | −1·118 | −2·222 | −11·573 | 37·627 | |
| 12 | E | | 47·675 | +0·865 | − 9·144 | −3·114 | +0·254 | −11·139 | 36·536 | |
| 13 | W | *a* | 41·775 | +0·867 | − 9·191 | +2·595 | +1·249 | − 4·480 | 37·295 | |
| 14 | E | 60° | 45·825 | +0·869 | − 9·237 | −2·013 | −0·021 | −10·402 | 35·423 | 37·054 |
| 15 | W | | 42·700 | +0·868 | − 9·285 | +1·534 | +0·127 | − 6·756 | 35·944 | |
| 16 | E | | 48·025 | +0·866 | − 9·334 | −2·088 | +1·884 | − 8·672 | 39·353 | |
| 17 | W | 30° *a* (1) | 42·900 | +0·868 | − 9·384 | +2·115 | −0·466 | − 6·867 | 36·033 | 37·172 |
| 18 | E | | 50·025 | +0·873 | − 9·432 | −3·260 | −0·381 | −12·200 | 37·825 | |
| 19 | W | | 39·975 | +0·873 | − 9·481 | +3·433 | +0·677 | − 4·498 | 35·477 | |
| 20 | E | | 45·375 | +0·871 | − 9·530 | −0·613 | +1·079 | − 8·193 | 37·182 | |
| 21 | W | 50° *a* (1) | 46·325 | +0·871 | − 9·580 | +0·059 | +0·423 | − 8·227 | 38·098 | 37·514 |
| 22 | E | | 45·850 | +0·869 | − 9·629 | −0·162 | −0·339 | − 9·261 | 36·589 | |
| 23 | W | | 47·200 | +0·870 | − 9·679 | +0·769 | −0·974 | − 9·014 | 38·186 | |
| 24 | E | | 48·300 | +0·861 | − 9·731 | −1·406 | +0·677 | − 9·599 | 38·701 | |
| 26 | W | 70° *a* (1) | 48·100 | +0·866 | − 9·832 | −1·913 | +1·206 | − 9·673 | 38·427 | 38·106 |
| 27 | E | | 43·700 | +0·867 | − 9·882 | +2·415 | −0·212 | − 6·812 | 36·888 | |
| 28 | W | | 51·100 | +0·868 | − 9·933 | −2·528 | −1·101 | −12·694 | 38·406 | |
| 29 | E | 60° *a* | 48·900 | +0·872 | − 9·984 | −0·584 | −1·143 | −10·839 | 38·061 | |
| 30 | W | | 47·575 | +0·873 | −10·036 | +1·159 | −0·508 | − 8·512 | 39·063 | |

Mean 0° 52′ 36″·8758

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✻'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 50″·625 | +0″·872 | −10″·087 | −3″·191 | −0″·804 | −13″·210 | 37″·415 | |
| Jan. 1 | W | 20° *a* | 41·825 | +0·872 | −10·187 | +3·840 | +0·063 | − 5·412 | 36·413 | 37″·484 |
| 2 | E | | 52·025 | +0·878 | −10·239 | −3·983 | −1·016 | −14·360 | 37·665 | |
| 3 | W | | 42·325 | +0·871 | −10·291 | +4·055 | +1·482 | − 3·883 | 38·442 | |
| 4 | E | | 46·150 | +0·873 | −10·342 | +0·634 | +0·741 | − 8·094 | 38·056 | |
| 5 | W | 40° *a* | 47·650 | +0·873 | −10·393 | −0·396 | +0·529 | − 9·387 | 38·263 | 38·195 |
| 6 | W | | 45·450 | +0·875 | −10·444 | +0·696 | +1·482 | − 7·391 | 38·059 | |
| 7 | E | | 47·825 | +0·867 | −10·495 | +0·183 | +0·021 | − 9·424 | 38·401 | |
| 8 | E | | 46·500 | +0·871 | −10·546 | +1·641 | −0·593 | − 8·627 | 37·873 | |
| 9 | W | *a* | 48·525 | +0·871 | −10·597 | −1·184 | −0·339 | −11·249 | 37·276 | 37·413 |
| 10 | W | 60° | 46·475 | +0·869 | −10·648 | −0·394 | −0·508 | −10·681 | 35·794 | |
| 11 | E | | 49·050 | +0·864 | −10·698 | +0·549 | −1·058 | −10·343 | 38·707 | |
| 12 | E | | 48·975 | +0·870 | −10·748 | +1·008 | −1·016 | − 9·886 | 39·089 | |
| 13 | W | 30° *a* (1) | 44·925 | +0·874 | −10·798 | −0·429 | +0·783 | − 9·570 | 35·355 | 36·870 |
| 14 | E | | 47·025 | +0·874 | −10·848 | −0·004 | +1·143 | − 8·835 | 38·190 | |
| 15 | W | | 45·300 | +0·860 | −10·897 | +0·556 | −0·974 | −10·455 | 34·845 | |
| 19 | W | | 46·325 | +0·867 | −11·090 | +0·524 | −0·021 | − 9·720 | 36·605 | |
| 24 | E | 50° *a* (1) | 49·175 | +0·861 | −11·321 | +0·196 | −0·169 | −10·433 | 38·742 | 37·663 |
| 25 | W | | 47·775 | +0·863 | −11·365 | −0·963 | +0·423 | −11·042 | 36·733 | |
| 27 | E | | 48·575 | +0·862 | −11·452 | −0·365 | +0·952 | −10·003 | 38·572 | |
| 28 | E | | 47·400 | +0·860 | −11·495 | +1·636 | +0·698 | − 8·301 | 39·099 | |
| 29 | W | | 49·350 | +0·865 | −11·536 | −1·408 | +0·656 | −11·423 | 37·927 | |
| 30 | W | 70° *a* (1) | 50·400 | +0·863 | −11·577 | −1·720 | +0·571 | −11·863 | 38·537 | 37·439 |
| 31 | E | | 48·125 | +0·866 | −11·617 | +2·059 | −1·164 | − 9·856 | 38·269 | |
| Feb. 1 | W | | 46·875 | +0·860 | −11·657 | −1·668 | +0·614 | −11·851 | 35·024 | |
| 2 | E | | 44·775 | +0·864 | −11·695 | +1·730 | +0·106 | − 8·995 | 35·780 | |

Mean 0° 52′ 37″·5107

Mean Result of both Faces ..... 0° 52′ 37″·1933

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## No. 18 (727) AURIGÆ. North 2° 9′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 27″·450 | +2″·128 | — 7″·989 | +3″·203 | —0″·233 | — 2″·891 | 24″·559 | |
| 5 | E | 20° α | 31·925 | +2·127 | — 8·033 | —2·361 | —0·360 | — 8·627 | 23·298 | 23″·806 |
| 6 | W | | 28·175 | +2·122 | — 8·078 | +1·166 | —0·106 | — 4·896 | 23·279 | |
| 7 | E | | 31·175 | +2·127 | — 8·122 | —0·500 | —0·593 | — 7·088 | 24·087 | |
| 8 | W | | 32·100 | +2·118 | — 8·168 | —0·250 | —0·677 | — 6·977 | 25·123 | |
| 9 | E | 40° α | 28·025 | +2·115 | — 8·215 | +0·709 | —0·106 | — 5·497 | 22·528 | 23·627 |
| 10 | W | | 33·450 | +2·123 | — 8·261 | —1·032 | —2·815 | — 9·985 | 23·465 | |
| 11 | E | | 31·800 | +2·125 | — 8·309 | +1·118 | —3·344 | — 8·410 | 23·390 | |
| 12 | W | | 27·275 | +2·124 | — 8·358 | +3·114 | +0·868 | — 2·252 | 25·023 | |
| 13 | E | 60° α | 32·950 | +2·132 | — 8·406 | —2·595 | +1·714 | — 7·155 | 25·795 | 24·412 |
| 14 | W | | 28·350 | +2·135 | — 8·454 | +2·013 | +0·466 | — 3·840 | 24·510 | |
| 15 | E | | 31·700 | +2·132 | — 8·504 | —1·534 | +0·042 | — 7·864 | 23·836 | |
| 16 | W | | 27·325 | +2·128 | — 8·556 | +2·088 | +1·355 | — 2·985 | 24·340 | |
| 17 | E | 30° α (1) | 34·250 | +2·133 | — 8·608 | —2·115 | —0·677 | — 9·267 | 24·983 | 24·362 |
| 18 | W | | 26·725 | +2·142 | — 8·659 | +3·260 | —0·529 | — 3·786 | 22·939 | |
| 19 | E | | 34·250 | +2·146 | — 8·710 | —3·433 | +0·931 | — 9·066 | 25·184 | |
| 20 | W | | 31·850 | +2·137 | — 8·763 | +0·613 | +0·169 | — 5·844 | 26·006 | |
| 21 | E | 50° α (1) | 33·525 | +2·143 | — 8·816 | —0·059 | —0·889 | — 7·621 | 25·904 | 25·155 |
| 22 | W | | 31·200 | +2·138 | — 8·869 | +0·162 | —0·254 | — 6·823 | 24·377 | |
| 23 | E | | 32·925 | +2·137 | — 8·923 | —0·769 | —1·037 | — 8·592 | 24·333 | |
| 24 | W | | 27·950 | +2·117 | — 8·978 | +1·406 | +0·190 | — 5·265 | 22·685 | |
| 26 | E | 70° α (1) | 26·700 | +2·127 | — 9·088 | +1·913 | +1·206 | — 3·842 | 22·858 | 22·905 |
| 27 | W | | 34·025 | +2·131 | — 9·143 | —2·415 | —1·376 | —10·803 | 23·222 | |
| 28 | E | | 29·000 | +2·133 | — 9·199 | +2·528 | —1·609 | — 6·147 | 22·853 | |
| 29 | W | 60° α | 30·250 | +2·142 | — 9·255 | +0·584 | —0·910 | — 7·439 | 22·811 | |
| 30 | E | | 32·975 | +2·143 | — 9·313 | —1·159 | —0·148 | — 8·477 | 24·498 | |

Mean 2° 9′ 24″·0445

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 27″·350 | +2″·146 | — 9″·359 | +3″·191 | —0″·889 | — 4″·921 | 22″·429 | |
| Jan. 1 | E | 20° α | 37·075 | +2·143 | — 9·474 | —3·840 | +0·106 | —11·065 | 26·010 | 23″·556 |
| 2 | W | | 27·150 | +2·158 | — 9·532 | +3·983 | —1·439 | — 4·830 | 22·320 | |
| 3 | E | | 34·950 | +2·140 | — 9·590 | —4·055 | +0·021 | —11·484 | 23·466 | |
| 4 | W | | 32·000 | +2·147 | — 9·648 | —0·634 | +0·233 | — 7·902 | 24·098 | |
| 5 | E | 40° α | 33·025 | +2·144 | — 9·705 | +0·396 | —0·466 | — 7·631 | 25·394 | 23·917 |
| 6 | E | | 31·225 | +2·150 | — 9·763 | —0·696 | +0·783 | — 7·526 | 23·699 | |
| 7 | W | | 29·950 | +2·129 | — 9·822 | —0·183 | +0·402 | — 7·474 | 22·476 | |
| 8 | W | | 32·300 | +2·139 | — 9·879 | —1·641 | —0·825 | —10·206 | 22·094 | |
| 9 | E | 60° α | 32·675 | +2·140 | — 9·938 | +1·184 | —1·016 | — 7·630 | 25·045 | 23·684 |
| 10 | E | | 33·025 | +2·134 | — 9·996 | +0·394 | —0·593 | — 8·061 | 24·964 | |
| 11 | W | | 32·700 | +2·123 | —10·054 | —0·549 | —1·587 | —10·067 | 22·633 | |
| 12 | W | | 31·650 | +2·138 | —10·112 | —1·008 | —0·614 | — 9·596 | 22·054 | |
| 13 | E | 30° α (1) | 34·450 | +2·154 | —10·170 | +0·429 | +0·423 | — 7·164 | 27·286 | 24·456 |
| 14 | W | | 31·500 | +2·147 | —10·228 | +0·004 | 0·000 | — 8·077 | 23·423 | |
| 15 | E | | 34·825 | +2·113 | —10·286 | —0·556 | —1·037 | — 9·766 | 25·059 | |
| 19 | E | | 34·125 | +2·129 | —10·514 | —0·524 | —0·825 | — 9·734 | 24·391 | |
| 24 | W | 50° α (1) | 34·000 | +2·116 | —10·793 | —0·196 | —1·270 | —10·143 | 23·857 | 24·533 |
| 25 | E | | 33·600 | +2·120 | —10·847 | +0·963 | +0·190 | — 7·574 | 26·026 | |
| 28 | W | | 32·900 | +2·112 | —11·007 | —1·636 | +0·466 | —10·065 | 22·835 | |
| 30 | E | | 32·350 | +2·121 | —11·110 | +1·720 | +0·212 | — 7·057 | 25·293 | |
| 31 | W | 70° α (1) | 32·575 | +2·127 | —11·162 | —2·059 | —1·143 | —12·237 | 20·338 | 23·675 |
| Feb. 1 | E | | 32·550 | +2·113 | —11·212 | +1·668 | +0·296 | — 7·135 | 25·415 | |
| 2 | W | | 32·225 | +2·123 | —11·261 | —1·730 | +0·614 | —10·254 | 21·971 | |
| 3 | E | | 33·225 | +2·113 | —11·309 | +1·081 | +0·085 | — 7·030 | 26·195 | |

Mean 2° 9′ 23″·9702

Mean Result of both Faces..... 2° 9′ 24″·0074

4 X

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## G. T. STATION KALIANA.

No. 19 (749) 1 Geminor *H.* South 6° 14′ +

### Face A to the Fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 20° *a* | 35″·150 | +6″·178 | + 8″·409 | +3″·203 | +0″·614 | +18″·404 | 53″·554 | |
| 5 | W | | 41·475 | +6·178 | + 8·398 | −2·361 | +1·439 | +13·654 | 55·129 | 55″·119 |
| 6 | E | | 40·125 | +6·164 | + 8·386 | +1·166 | −0·212 | +15·504 | 55·629 | |
| 7 | W | | 41·225 | +6·174 | + 8·375 | −0·500 | +0·889 | +14·938 | 56·163 | |
| 8 | E | 40° *a* | 39·125 | +6·150 | + 8·364 | −0·250 | +0·995 | +15·259 | 54·384 | |
| 9 | W | | 35·350 | +6·139 | + 8·355 | +0·709 | +1·376 | +16·579 | 51·929 | 53·837 |
| 10 | E | | 37·500 | +6·168 | + 8·345 | −1·032 | +3·090 | +16·571 | 54·071 | |
| 11 | W | | 36·625 | +6·176 | + 8·336 | +1·118 | +2·709 | +18·339 | 54·964 | |
| 12 | E | 60° *a* | 36·375 | +6·169 | + 8·328 | +3·114 | +0·529 | +18·140 | 54·515 | |
| 13 | W | | 40·100 | +6·193 | + 8·320 | −2·595 | +0·529 | +12·447 | 52·547 | 53·676 |
| 14 | E | | 36·600 | +6·197 | + 8·312 | +2·013 | +1·037 | +17·559 | 54·159 | |
| 15 | W | | 40·250 | +6·189 | + 8·305 | −1·534 | +0·804 | +13·764 | 54·014 | |
| 16 | E | 30° *a* (1) | 37·700 | +6·184 | + 8·300 | +2·088 | −0·762 | +15·810 | 53·510 | |
| 17 | W | | 40·825 | +6·196 | + 8·296 | −2·115 | +2·180 | +14·557 | 55·382 | 54·906 |
| 18 | E | | 35·950 | +6·219 | + 8·291 | +3·260 | +1·524 | +19·294 | 55·244 | |
| 19 | W | | 44·550 | +6·234 | + 8·286 | −3·433 | −0·148 | +10·939 | 55·489 | |
| 20 | E | 50° *a* (1) | 39·500 | +6·202 | + 8·283 | +0·613 | +1·079 | +16·177 | 55·677 | |
| 21 | W | | 37·750 | +6·229 | + 8·280 | −0·059 | +3·069 | +17·519 | 55·269 | 54·486 |
| 22 | E | | 36·625 | +6·213 | + 8·277 | +0·162 | +1·312 | +15·964 | 52·589 | |
| 23 | W | | 39·700 | +6·207 | + 8·275 | −0·769 | +0·995 | +14·708 | 54·408 | |
| 24 | E | 70° *a* (1) | 37·275 | +6·148 | + 8·276 | +1·406 | +1·587 | +17·417 | 54·692 | |
| 26 | W | | 36·650 | +6·175 | + 8·275 | +1·913 | +1·079 | +17·442 | 54·092 | 54·815 |
| 27 | E | | 40·725 | +6·187 | + 8·275 | −2·415 | +2·244 | +14·291 | 55·016 | |
| 28 | W | | 37·150 | +6·194 | + 8·277 | +2·528 | +1·312 | +18·311 | 55·461 | |
| 29 | E | 60° *a* | 36·175 | +6·220 | + 8·279 | +0·584 | +1·884 | +16·967 | 53·142 | |
| 30 | W | | 39·300 | +6·220 | + 8·282 | −1·159 | +1·037 | +14·380 | 53·680 | |

Mean 6° 14′ 54″·4732

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | 20° *a* | 34″·850 | +6″·235 | + 8″·284 | +3″·191 | +1″·820 | +19″·530 | 54″·380 | |
| Jan. 1 | W | | 45·475 | +6·226 | + 8·333 | −3·840 | +0·698 | +11·417 | 56·892 | 55″·425 |
| 2 | E | | 33·075 | +6·269 | + 8·338 | +3·983 | +2·667 | +21·257 | 54·332 | |
| 3 | W | | 45·000 | +6·213 | + 8·343 | −4·055 | +0·593 | +11·094 | 56·094 | |
| 4 | E | 40° *a* | 39·800 | +6·237 | + 8·349 | −0·634 | +0·931 | +14·883 | 54·683 | |
| 5 | W | | 39·925 | +6·227 | + 8·354 | +0·396 | +1·185 | +16·162 | 56·087 | 55·141 |
| 6 | W | | 41·725 | +6·243 | + 8·361 | −0·696 | −0·127 | +13·781 | 55·506 | |
| 7 | E | | 39·200 | +6·181 | + 8·368 | −0·183 | +0·720 | +15·086 | 54·286 | |
| 8 | E | 60° *a* | 39·000 | +6·213 | + 8·375 | −1·641 | +1·947 | +14·894 | 53·894 | |
| 9 | W | | 38·000 | +6·213 | + 8·383 | +1·184 | −1·990 | +13·790 | 51·790 | 53·738 |
| 10 | W | | 39·100 | +6·198 | + 8·392 | +0·394 | +1·355 | +16·339 | 55·439 | |
| 11 | E | | 37·950 | +6·163 | + 8·401 | −0·549 | +1·863 | +15·878 | 53·828 | |
| 12 | E | 30° *a* (1) | 36·150 | +6·210 | + 8·410 | −1·008 | +1·587 | +15·199 | 51·349 | |
| 13 | W | | 39·950 | +6·266 | + 8·420 | +0·429 | +0·571 | +15·686 | 55·636 | 54·531 |
| 14 | E | | 39·600 | +6·234 | + 8·430 | +0·004 | +1·228 | +15·896 | 55·496 | |
| 15 | W | | 40·375 | +6·135 | + 8·441 | −0·556 | +1·249 | +15·269 | 55·644 | |
| 19 | W | 50° *a* (1) | 39·450 | +6·180 | + 8·487 | −0·524 | +0·762 | +14·905 | 54·355 | |
| 24 | E | | 38·050 | +6·146 | + 8·551 | −0·196 | +2·413 | +16·914 | 54·964 | 55·038 |
| 25 | W | | 39·675 | +6·156 | + 8·565 | +0·963 | +0·508 | +16·192 | 55·867 | |
| 30 | W | 70° *a* (1) | 38·250 | +6·161 | + 8·634 | +1·720 | +0·042 | +16·557 | 54·807 | |
| 31 | E | | 40·075 | +6·179 | + 8·649 | −2·059 | +1·058 | +13·827 | 53·902 | 54·574 |
| Feb. 1 | W | | 40·300 | +6·138 | + 8·664 | +1·668 | −0·063 | +16·407 | 56·707 | |
| 2 | E | | 39·425 | +6·168 | + 8·678 | −1·730 | +0·339 | +13·455 | 52·880 | |

Mean 6° 14′ 54″·7412

Mean Result of both Faces..... 6° 14′ 54″·6072

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## No. 20 (760) 3 GEMINOR. South 6° 22′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | W | | 37″·075 | +6″·310 | + 8″·228 | —3″·203 | +0″·698 | +12″·033 | 49″·108 | |
| 5 | E | 20° α | 35·125 | +6·311 | + 8·213 | +2·361 | +1·079 | +17·964 | 53·089 | 51″·098 |
| 6 | W | | 36·100 | +6·297 | + 8·198 | —1·166 | +0·825 | +14·154 | 50·254 | |
| 7 | E | | 36·700 | +6·305 | + 8·183 | +0·500 | +0·254 | +15·242 | 51·942 | |
| 8 | W | | 33·350 | +6·281 | + 8·169 | +0·250 | +2·984 | +17·684 | 51·034 | |
| 9 | E | 40° α | 35·875 | +6·270 | + 8·156 | —0·709 | +1·757 | +15·474 | 51·349 | 52·043 |
| 10 | W | | 36·950 | +6·302 | + 8·142 | +1·032 | +2·921 | +18·397 | 55·347 | |
| 11 | E | | 34·600 | +6·311 | + 8·131 | —1·118 | +2·519 | +15·843 | 50·443 | |
| 12 | W | | 39·625 | +6·302 | + 8·119 | —3·114 | +0·995 | +12·302 | 51·927 | |
| 13 | E | 60° α | 34·450 | +6·328 | + 8·108 | +2·595 | +1·545 | +18·576 | 53·026 | 52·656 |
| 14 | W | | 39·600 | +6·330 | + 8·097 | —2·013 | +1·185 | +13·599 | 53·199 | |
| 15 | E | | 35·100 | +6·322 | + 8·087 | +1·534 | +0·825 | +16·768 | 51·868 | |
| 16 | W | | 39·300 | +6·319 | + 8·079 | —2·088 | —0·698 | +11·612 | 50·912 | |
| 17 | E | 30° α (i) | 32·675 | +6·331 | + 8·071 | +2·115 | +2·413 | +18·930 | 51·605 | 51·899 |
| 18 | W | | 41·450 | +6·351 | + 8·063 | —3·260 | +1·185 | +12·339 | 53·789 | |
| 19 | E | | 33·750 | +6·369 | + 8·056 | +3·433 | —0·317 | +17·541 | 51·291 | |
| 20 | W | | 38·825 | +6·333 | + 8·050 | —0·613 | +0·169 | +13·939 | 52·764 | |
| 21 | E | 50° α (i) | 34·400 | +6·366 | + 8·044 | +0·059 | +2·730 | +17·199 | 51·599 | 52·124 |
| 22 | W | | 34·725 | +6·350 | + 8·038 | —0·162 | +2·455 | +16·681 | 51·406 | |
| 23 | E | | 35·975 | +6·340 | + 8·034 | +0·769 | +1·609 | +16·752 | 52·727 | |
| 24 | W | | 39·925 | +6·281 | + 8·031 | —1·406 | +2·328 | +15·234 | 55·159 | |
| 26 | E | 70° α (i) | 38·550 | +6·308 | + 8·025 | —1·913 | +2·328 | +14·748 | 53·298 | 53·103 |
| 27 | W | | 33·325 | +6·320 | + 8·023 | +2·415 | +2·201 | +18·959 | 52·284 | |
| 28 | E | | 38·450 | +6·328 | + 8·023 | —2·528 | +1·397 | +13·220 | 51·670 | |
| 29 | W | 60° α | 37·450 | +6·353 | + 8·023 | —0·584 | +2·519 | +16·311 | 53·761 | |
| 30 | E | | 35·225 | +6·352 | + 8·024 | +1·159 | +1·397 | +16·932 | 52·157 | |

Mean 6° 22′ 52″·1538

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 31 | W | | 39″·575 | +6″·372 | + 8″·024 | —3″·191 | +2″·180 | +13″·385 | 52″·960 | |
| Jan. 1 | E | 20° α | 33·500 | +6·361 | + 8·071 | +3·840 | +0·995 | +19·267 | 52·767 | 52″·952 |
| 2 | W | | 40·150 | +6·404 | + 8·074 | —3·983 | +2·836 | +13·331 | 53·481 | |
| 3 | E | | 33·400 | +6·346 | + 8·078 | +4·055 | +0·720 | +19·199 | 52·599 | |
| 4 | W | | 41·450 | +6·373 | + 8·081 | +0·634 | +1·016 | +16·104 | 57·554 | |
| 5 | E | 40° α | 35·725 | +6·361 | + 8·085 | —0·396 | +1·333 | +15·383 | 51·108 | 53·719 |
| 6 | E | | 36·175 | +6·377 | + 8·090 | +0·696 | —0·063 | +15·100 | 51·275 | |
| 7 | W | | 39·925 | +6·314 | + 8·095 | +0·183 | +0·423 | +15·015 | 54·940 | |
| 8 | W | | 32·825 | +6·347 | + 8·101 | +1·641 | +2·476 | +18·565 | 51·390 | |
| 9 | E | 60° α | 36·400 | +6·346 | + 8·108 | —1·184 | +2·709 | +15·979 | 52·379 | 52·133 |
| 10 | E | | 36·300 | +6·332 | + 8·115 | —0·394 | +1·333 | +15·386 | 51·686 | |
| 11 | W | | 36·225 | +6·295 | + 8·123 | +0·549 | +1·884 | +16·851 | 53·076 | |
| 12 | W | | 36·925 | +6·343 | + 8·130 | +1·008 | +2·244 | +17·725 | 54·650 | |
| 13 | E | 30° α (i) | 35·975 | +6·408 | + 8·139 | —0·429 | +1·101 | +15·219 | 51·194 | 52·023 |
| 14 | W | | 37·300 | +6·369 | + 8·148 | —0·004 | +0·720 | +15·233 | 52·533 | |
| 15 | E | | 33·825 | +6·267 | + 8·158 | +0·556 | +0·910 | +15·891 | 49·716 | |
| 18 | W | | 37·625 | +6·216 | + 8·187 | —0·308 | +0·402 | +14·497 | 52·122 | |
| 19 | E | 50° α (i) | 33·750 | +6·312 | + 8·200 | +0·524 | +1·037 | +16·073 | 49·823 | 51·526 |
| 24 | W | | 37·525 | +6·279 | + 8·262 | +0·196 | +1·016 | +15·753 | 53·278 | |
| 25 | E | | 35·775 | +6·289 | + 8·275 | —0·963 | +1·503 | +15·104 | 50·879 | |
| 30 | E | | 37·725 | +6·293 | + 8·344 | —1·720 | —0·063 | +12·854 | 50·579 | |
| 31 | W | 70° α (i) | 37·400 | +6·313 | + 8·359 | +2·059 | +1·778 | +18·509 | 55·909 | 52·953 |
| Feb. 1 | E | | 38·000 | +6·270 | + 8·374 | —1·668 | —0·127 | +12·849 | 50·849 | |
| 2 | W | | 37·525 | +6·302 | + 8·388 | +1·730 | +0·529 | +16·949 | 54·474 | |

Mean 6° 22′ 52″·5510

Mean Result of both Faces ..... 6° 22′ 52″·3524

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## G. T. STATION KALIANA.

No. 21 (774) 44 AURIGÆ α. North 0° 2′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 20″·375 | +0″·038 | — 7″·300 | —3″·203 | —0″·190 | —10″·655 | 9″·720 | |
| 5 | W | α | 15·975 | +0·038 | — 7·320 | +2·361 | +0·169 | — 4·752 | 11·223 | 10″·025 |
| 6 | E | 20° | 19·225 | +0·038 | — 7·341 | —1·166 | —0·550 | — 9·019 | 10·206 | |
| 7 | W | | 15·225 | +0·038 | — 7·362 | +0·500 | +0·550 | — 6·274 | 8·951 | |
| 8 | E | | 16·275 | +0·038 | — 7·384 | +0·250 | —1·630 | — 8·726 | 7·549 | |
| 9 | W | α | 21·425 | +0·038 | — 7·408 | —0·709 | —0·085 | — 8·164 | 13·261 | |
| 10 | E | 40° | 18·800 | +0·038 | — 7·431 | +1·032 | —1·714 | — 8·075 | 10·725 | 11·073 |
| 11 | W | | 24·000 | +0·038 | — 7·456 | —1·118 | —2·709 | —11·245 | 12·755 | |
| 12 | E | | 20·800 | +0·038 | — 7·482 | —3·114 | +0·021 | —10·537 | 10·263 | |
| 13 | W | α | 17·400 | +0·038 | — 7·508 | +2·595 | —1·079 | — 5·954 | 11·446 | |
| 14 | E | 60° | 22·550 | +0·038 | — 7·534 | —2·013 | —0·995 | —10·504 | 12·046 | 11·309 |
| 15 | W | | 17·075 | +0·038 | — 7·562 | +1·534 | —0·339 | — 6·329 | 10·746 | |
| 16 | E | | 22·325 | +0·038 | — 7·592 | —2·088 | +0·063 | — 9·579 | 12·746 | |
| 17 | W | α (?) | 16·150 | +0·038 | — 7·623 | +2·115 | —1·736 | — 7·206 | 8·944 | |
| 18 | E | 30° | 22·575 | +0·038 | — 7·653 | —3·260 | —0·190 | —11·065 | 11·510 | 10·790 |
| 19 | W | | 12·925 | +0·038 | — 7·684 | +3·433 | +1·249 | — 2·964 | 9·961 | |
| 20 | E | | 18·450 | +0·038 | — 7·716 | —0·613 | +1·079 | — 7·212 | 11·238 | |
| 21 | W | α (?) | 19·250 | +0·038 | — 7·748 | +0·059 | —1·249 | — 8·900 | 10·350 | |
| 22 | E | 50° | 18·975 | +0·038 | — 7·781 | —0·162 | —2·434 | —10·339 | 8·636 | 10·262 |
| 23 | W | | 18·975 | +0·038 | — 7·816 | +0·769 | —1·143 | — 8·152 | 10·823 | |
| 24 | E | | 21·875 | +0·038 | — 7·852 | —1·406 | —1·439 | —10·659 | 11·216 | |
| 26 | W | α (?) | 22·100 | +0·038 | — 7·923 | —1·913 | —0·423 | —10·221 | 11·879 | |
| 27 | E | 70° | 18·400 | +0·038 | — 7·960 | +2·415 | —1·714 | — 7·221 | 11·179 | 11·401 |
| 28 | W | | 23·150 | +0·038 | — 7·998 | —2·528 | —1·333 | —11·821 | 11·329 | |
| 29 | E | α | 21·975 | +0·038 | — 8·037 | —0·584 | —1·884 | —10·467 | 11·508 | |
| 30 | W | 60° | 19·550 | +0·038 | — 8·077 | +1·159 | —0·825 | — 7·705 | 11·845 | |

Mean 0° 2′ 10″·8100

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 21″·300 | +0″·038 | — 8″·116 | —3″·191 | —1″·482 | —12″·751 | 8″·549 | |
| Jan. 1 | W | α | 16·800 | +0·038 | — 8·202 | +3·840 | —0·487 | — 4·811 | 11·989 | 10″·658 |
| 2 | E | 20° | 25·250 | +0·038 | — 8·244 | —3·983 | —2·032 | —14·221 | 11·029 | |
| 3 | W | | 15·300 | +0·038 | — 8·286 | +4·055 | —0·042 | — 4·235 | 11·065 | |
| 4 | E | | 18·300 | +0·038 | — 8·328 | +0·634 | +0·593 | — 7·063 | 11·237 | |
| 5 | W | α | 19·675 | +0·038 | — 8·370 | —0·396 | —0·720 | — 9·448 | 10·227 | |
| 6 | W | 40° | 18·175 | +0·038 | — 8·414 | +0·696 | 0·000 | — 76·80 | 10·495 | 11·154 |
| 7 | E | | 20·850 | +0·038 | — 8·457 | +0·183 | +0·042 | — 8·194 | 12·656 | |
| 8 | E | | 18·025 | +0·038 | — 8·501 | +1·641 | —1·524 | — 8·346 | 9·679 | |
| 9 | W | α | 22·250 | +0·038 | — 8·546 | —1·184 | —1·863 | —11·555 | 10·695 | |
| 10 | W | 60° | 21·900 | +0·038 | — 8·591 | —0·394 | —0·508 | — 9·455 | 12·445 | 10·778 |
| 11 | E | | 19·675 | +0·038 | — 8·636 | +0·549 | —1·333 | — 9·382 | 10·293 | |
| 12 | E | | 21·350 | +0·038 | — 8·680 | +1·008 | —0·635 | — 8·269 | 13·081 | |
| 13 | W | α (?) | 19·175 | +0·038 | — 8·727 | —0·429 | —0·529 | — 9·647 | 9·528 | |
| 14 | E | 30° | 20·300 | +0·038 | — 8·773 | —0·004 | —0·106 | — 8·845 | 11·455 | 11·082 |
| 15 | W | | 19·400 | +0·038 | — 8·819 | +0·556 | —0·910 | — 9·135 | 10·265 | |
| 18 | E | | 19·350 | +0·037 | — 8·958 | —0·308 | +0·402 | — 8·827 | 10·523 | |
| 19 | W | α (?) | 20·150 | +0·038 | — 9·006 | +0·524 | —1·757 | —10·201 | 9·949 | |
| 24 | E | 50° | 21·175 | +0·038 | — 9·242 | +0·196 | +0·233 | — 8·775 | 12·400 | 10·508 |
| 25 | W | | 20·325 | +0·038 | — 9·290 | —0·963 | —0·952 | —11·167 | 9·158 | |
| 30 | W | | 20·625 | +0·038 | — 9·523 | —1·720 | +0·212 | —10·993 | 9·632 | |
| 31 | E | α (?) | 19·600 | +0·038 | — 9·570 | +2·059 | —1·355 | — 8·828 | 10·772 | |
| Feb. 1 | W | 70° | 20·850 | +0·038 | — 9·616 | —1·668 | +0·212 | —11·034 | 9·816 | 10·297 |
| 2 | E | | 18·225 | +0·038 | — 9·661 | +1·730 | +0·635 | — 7·258 | 10·967 | |

Mean 0° 2′ 10″·7462

Mean Result of both Faces ..... 0° 2′ 10″·7781

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No. 22 (790) 13 GEMINOR $\mu$. South 6° 55′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 14″·950 | +6″·851 | + 7″·826 | —3″·203 | +0″·339 | +11″·813 | 26″·763 | |
| 5 | E | 20° $\alpha$ | 10·850 | +6·857 | + 7·801 | +2·361 | +0·275 | +17·294 | 28·144 | 27″·006 |
| 6 | W | | 12·650 | +6·840 | + 7·776 | —1·166 | +0·190 | +13·640 | 26·290 | |
| 7 | E | | 11·750 | +6·846 | + 7·751 | +0·500 | —0·021 | +15·076 | 26·826 | |
| 8 | W | | 11·225 | +6·820 | + 7·727 | +0·250 | +0·466 | +15·263 | 26·488 | |
| 9 | E | 40° $\alpha$ | 13·025 | +6·806 | + 7·704 | —0·709 | +0·042 | +13·843 | 26·868 | 27·290 |
| 10 | W | | 11·325 | +6·851 | + 7·681 | +1·032 | +1·863 | +17·427 | 28·752 | |
| 11 | E | | 10·325 | +6·863 | + 7·660 | —1·118 | +3·323 | +16·728 | 27·053 | |
| 12 | W | | 15·675 | +6·846 | + 7·639 | —3·114 | —0·381 | +10·990 | 26·665 | |
| 13 | E | 60° $\alpha$ | 11·475 | +6·876 | + 7·618 | +2·595 | +1·079 | +18·168 | 29·643 | 28·029 |
| 14 | W | | 14·525 | +6·873 | + 7·598 | —2·013 | +1·206 | +13·664 | 28·189 | |
| 15 | E | | 11·175 | +6·865 | + 7·579 | +1·534 | +0·339 | +16·317 | 27·492 | |
| 16 | W | | 17·725 | +6·870 | + 7·562 | —2·088 | —0·212 | +12·132 | 29·857 | |
| 17 | E | 30° $\alpha$ (?) | 9·025 | +6·881 | + 7·545 | +2·115 | +1·524 | +18·065 | 27·090 | 27·946 |
| 18 | W | | 17·575 | +6·896 | + 7·529 | —3·260 | +0·402 | +11·567 | 29·142 | |
| 19 | E | | 8·675 | +6·921 | + 7·513 | +3·433 | —0·847 | +17·020 | 25·695 | |
| 20 | W | | 13·525 | +6·874 | + 7·498 | —0·613 | —0·381 | +13·378 | 26·903 | |
| 21 | E | 50° $\alpha$ (?) | 10·775 | +6·925 | + 7·484 | +0·059 | +1·884 | +16·352 | 27·127 | 27·355 |
| 22 | W | | 11·800 | +6·906 | + 7·470 | —0·162 | +2·244 | +16·458 | 28·258 | |
| 23 | E | | 10·600 | +6·887 | + 7·458 | +0·769 | +1·418 | +16·532 | 27·132 | |
| 24 | W | | 16·775 | +6·824 | + 7·448 | —1·406 | +1·333 | +14·199 | 30·974 | |
| 26 | E | 70° $\alpha$ (?) | 15·900 | +6·852 | + 7·426 | —1·913 | —0·212 | +12·153 | 28·053 | 28·693 |
| 27 | W | | 9·300 | +6·865 | + 7·417 | +2·415 | +2·159 | +18·856 | 28·156 | |
| 28 | E | | 14·375 | +6·874 | + 7·409 | —2·528 | +1·460 | +13·215 | 27·590 | |
| 29 | W | 60° $\alpha$ | 13·275 | +6·902 | + 7·402 | —0·584 | +1·693 | +15·413 | 28·688 | |
| 30 | E | | 11·600 | +6·897 | + 7·396 | +1·159 | +0·444 | +15·896 | 27·496 | |

Mean 6° 55′ 27″·7198

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 16″·425 | +6″·929 | + 7″·389 | —3″·191 | +1″·820 | +12″·947 | 29″·372 | |
| Jan. 1 | E | 20° $\alpha$ | 7·875 | +6·913 | + 7·428 | +3·840 | +1·249 | +19·420 | 27·295 | 28″·928 |
| 2 | W | | 16·950 | +6·959 | + 7·425 | —3·983 | +2·307 | +12·708 | 29·658 | |
| 3 | E | | 11·125 | +6·891 | + 7·422 | +4·055 | —0·106 | +18·262 | 29·387 | |
| 4 | W | | 16·575 | +6·926 | + 7·419 | +0·634 | —0·423 | +14·556 | 31·131 | |
| 5 | E | 40° $\alpha$ | 11·600 | +6·911 | + 7·417 | —0·396 | +1·206 | +15·138 | 26·738 | 29·295 |
| 6 | E | | 12·600 | +6·926 | + 7·416 | +0·696 | +0·339 | +15·377 | 27·977 | |
| 7 | W | | 16·050 | +6·858 | + 7·416 | +0·183 | +0·825 | +15·282 | 31·332 | |
| 8 | W | | 11·500 | +6·895 | + 7·416 | +1·641 | +1·439 | +17·391 | 28·891 | |
| 9 | E | 60° $\alpha$ | 11·900 | +6·892 | + 7·418 | —1·184 | +2·540 | +15·666 | 27·566 | 28·469 |
| 10 | E | | 12·950 | +6·879 | + 7·420 | —0·394 | +1·143 | +15·048 | 27·998 | |
| 11 | W | | 13·175 | +6·836 | + 7·422 | +0·549 | +1·439 | +16·246 | 29·421 | |
| 12 | W | | 14·425 | +6·891 | + 7·425 | +1·008 | +0·783 | +16·107 | 30·532 | |
| 13 | E | 30° $\alpha$ (?) | 12·500 | +6·978 | + 7·429 | —0·429 | +0·677 | +14·655 | 27·155 | 28·834 |
| 14 | W | | 14·750 | +6·918 | + 7·434 | —0·004 | +0·889 | +15·237 | 29·987 | |
| 15 | E | | 11·525 | +6·808 | + 7·439 | +0·556 | +1·333 | +16·136 | 27·661 | |
| 18 | W | | 13·925 | +6·751 | + 7·458 | —0·308 | —0·508 | +13·393 | 27·318 | |
| 19 | E | 50° $\alpha$ (?) | 11·225 | +6·856 | + 7·467 | +0·524 | +1·714 | +16·561 | 27·786 | |
| 24 | W | | 13·525 | +6·822 | + 7·514 | +0·196 | +0·677 | +15·209 | 28·734 | 28·064 |
| 25 | E | | 13·075 | +6·832 | + 7·525 | —0·963 | +1·079 | +14·473 | 27·548 | |
| 27 | W | | 15·500 | +6·817 | + 7·548 | —0·365 | —0·169 | +13·831 | 29·331 | |
| 30 | E | | 14·775 | +6·837 | + 7·585 | —1·720 | +0·529 | +13·231 | 28·006 | |
| 31 | W | 70° $\alpha$ (?) | 12·125 | +6·860 | + 7·599 | +2·059 | +0·487 | +17·005 | 29·130 | 28·249 |
| Feb. 1 | E | | 13·625 | +6·813 | + 7·612 | —1·668 | +0·402 | +13·159 | 26·784 | |
| 2 | W | | 12·700 | +6·850 | + 7·625 | +1·730 | +0·169 | +16·374 | 29·074 | |

Mean 6° 55′ 28″·6398

Mean Result of both Faces ..... 6° 55′ 28″·1798



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No. 23 (800) 48 AURIGÆ *z*. North 1° 4′ +

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | * 's Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 22″·150 | +1″·057 | — 6″·581 | —3″·203 | +0″·508 | — 8″·219 | 13″·931 | |
| 5 | W | 20° *a* | 20·525 | +1·058 | — 6·600 | +2·361 | —0·508 | — 3·689 | 16·836 | 15″·249 |
| 6 | E | | 21·875 | +1·055 | — 6·619 | —1·166 | —0·085 | — 6·815 | 15·060 | |
| 7 | W | | 20·675 | +1·056 | — 6·639 | +0·500 | —0·423 | — 5·506 | 15·169 | |
| 8 | E | | 19·800 | +1·052 | — 6·660 | +0·250 | —0·847 | — 6·205 | 13·595 | |
| 9 | W | 40° *a* | 25·350 | +1·050 | — 6·682 | —0·709 | 0·000 | — 6·341 | 19·009 | 16·264 |
| 10 | E | | 22·600 | +1·057 | — 6·705 | +1·032 | —2·074 | — 6·690 | 15·910 | |
| 11 | W | | 26·950 | +1·058 | — 6·730 | —1·118 | —3·619 | —10·409 | 16·541 | |
| 13 | W | | 21·425 | +1·061 | — 6·781 | +2·595 | —0·804 | — 3·929 | 17·496 | |
| 14 | E | 60° *a* | 25·400 | +1·060 | — 6·807 | —2·013 | —0·889 | — 8·649 | 16·751 | 17·332 |
| 15 | W | | 20·950 | +1·059 | — 6·835 | +1·534 | 0·000 | — 4·242 | 16·708 | |
| 16 | E | | 25·050 | +1·060 | — 6·865 | —2·088 | +0·910 | — 6·983 | 18·067 | |
| 17 | W | 80° *a* (1) | 19·625 | +1·061 | — 6·896 | +2·115 | —0·762 | — 4·482 | 15·143 | 16·010 |
| 18 | E | | 26·125 | +1·064 | — 6·928 | —3·260 | —0·021 | — 9·145 | 16·980 | |
| 19 | W | | 15·375 | +1·068 | — 6·959 | +3·433 | +0·931 | — 1·527 | 13·848 | |
| 20 | E | | 22·750 | +1·060 | — 6·993 | —0·613 | +0·614 | — 5·932 | 16·818 | |
| 21 | W | 50° *a* (1) | 21·625 | +1·068 | — 7·026 | +0·059 | —1·566 | — 7·465 | 14·160 | 15·699 |
| 22 | E | | 24·400 | +1·065 | — 7·061 | —0·162 | —1·714 | — 7·872 | 16·528 | |
| 23 | W | | 22·375 | +1·063 | — 7·097 | +0·769 | —1·820 | — 7·085 | 15·290 | |
| 25 | E | | 26·850 | +1·057 | — 7·172 | —2·193 | —0·677 | — 8·985 | 17·865 | |
| 26 | W | 70° *a* (1) | 24·500 | +1·057 | — 7·210 | —1·913 | +0·275 | — 7·791 | 16·709 | 17·137 |
| 27 | E | | 23·000 | +1·059 | — 7·250 | +2·415 | —1·905 | — 5·681 | 17·319 | |
| 28 | W | | 26·850 | +1·061 | — 7·290 | —2·528 | —1·439 | —10·196 | 16·654 | |
| 29 | E | 60° *a* | 25·550 | +1·065 | — 7·332 | —0·584 | —1·820 | — 8·671 | 16·879 | |
| 30 | W | | 25·150 | +1·064 | — 7·375 | +1·159 | —0·656 | — 5·808 | 19·342 | |

Mean 1° 4′ 16″·2818

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | * 's Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 24″·675 | +1″·068 | — 7″·417 | —3″·191 | —1″·206 | —10″·746 | 13″·929 | |
| Jan. 1 | W | 20° *a* | 18·925 | +1·066 | — 7·506 | +3·840 | —1·228 | — 3·828 | 15·097 | 15″·630 |
| 2 | E | | 30·000 | +1·073 | — 7·551 | —3·983 | —2·180 | —12·641 | 17·359 | |
| 3 | W | | 18·675 | +1·064 | — 7·597 | +4·055 | —0·063 | — 2·541 | 16·134 | |
| 4 | E | | 23·250 | +1·068 | — 7·643 | +0·634 | +0·190 | — 5·751 | 17·499 | |
| 5 | W | 40° *a* | 23·925 | +1·066 | — 7·689 | —0·396 | —1·503 | — 8·522 | 15·403 | 16·325 |
| 6 | W | | 21·675 | +1·068 | — 7·737 | +0·696 | —0·296 | — 6·269 | 15·406 | |
| 7 | E | | 24·150 | +1·058 | — 7·785 | +0·183 | —0·614 | — 7·158 | 16·992 | |
| 8 | E | | 22·575 | +1·064 | — 7·833 | +1·641 | —0·825 | — 5·953 | 16·622 | |
| 9 | W | 60° *a* | 24·100 | +1·063 | — 7·882 | —1·184 | —2·201 | —10·204 | 13·896 | 15·434 |
| 10 | W | | 23·250 | +1·061 | — 7·932 | —0·394 | —1·355 | — 8·620 | 14·630 | |
| 11 | E | | 24·700 | +1·055 | — 7·982 | +0·549 | —1·736 | — 8·114 | 16·586 | |
| 12 | E | | 25·150 | +1·063 | — 8·032 | +1·008 | —1·037 | — 6·998 | 18·152 | |
| 13 | W | 30° *a* (1) | 22·075 | +1·076 | — 8·083 | —0·429 | —0·762 | — 8·198 | 13·877 | 16·004 |
| 14 | E | | 25·175 | +1·067 | — 8·135 | —0·004 | —0·931 | — 8·003 | 17·172 | |
| 15 | W | | 22·600 | +1·050 | — 8·187 | +0·556 | —1·206 | — 7·787 | 14·813 | |
| 18 | E | | 25·275 | +1·042 | — 8·343 | —0·308 | +0·042 | — 7·567 | 17·708 | |
| 19 | W | 50° *a* (1) | 24·175 | +1·057 | — 8·398 | +0·524 | —1·609 | — 8·426 | 15·749 | 16·245 |
| 24 | E | | 25·450 | +1·052 | — 8·668 | +0·196 | —0·360 | — 7·780 | 17·670 | |
| 25 | W | | 23·475 | +1·054 | — 8·722 | —0·963 | —0·995 | — 9·626 | 13·849 | |
| 27 | W | | 22·400 | +1·052 | — 8·831 | —0·365 | +0·550 | — 7·594 | 14·806 | |
| 29 | W | | 26·875 | +1·056 | — 8·939 | —1·408 | —0·233 | — 9·524 | 17·351 | |
| 30 | E | 70° *a* (1) | 22·850 | +1·055 | — 8·992 | +1·720 | +0·275 | — 5·942 | 16·908 | 16·658 |
| 31 | W | | 26·450 | +1·058 | — 9·047 | —2·059 | —0·995 | —11·043 | 15·407 | |
| Feb. 1 | E | | 23·500 | +1·051 | — 9·101 | +1·668 | —0·360 | — 6·742 | 16·758 | |
| 2 | W | | 26·625 | +1·057 | — 9·154 | —1·730 | —0·106 | — 9·933 | 16·692 | |

Mean 1° 4′ 16″·0493

Mean Result of both Faces ..... 1° 4′ 16″·1656

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No. 24 (846) 34 Geminor $\theta$. North 4° 37′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 58″·700 | +4″·574 | — 4″·884 | +3″·203 | +1″·524 | + 4″·417 | 63″·117 | |
| 5 | E | α 20° | 62·325 | +4·579 | — 4·907 | —2·361 | +0·212 | — 2·477 | 59·848 | 61″·539 |
| 6 | W | | 61·550 | +4·570 | — 4·931 | +1·166 | +0·021 | + 0·826 | 62·376 | |
| 7 | E | | 61·675 | +4·573 | — 4·956 | —0·500 | +0·021 | — 0·862 | 60·813 | |
| 8 | W | | 64·050 | +4·560 | — 4·983 | —0·250 | +0·190 | — 0·483 | 63·567 | |
| 9 | E | α 40° | 58·850 | +4·546 | — 5·011 | +0·709 | +0·106 | + 0·350 | 59·200 | 60·367 |
| 10 | W | | 62·700 | +4·576 | — 5·040 | —1·032 | —2·074 | — 3·570 | 59·130 | |
| 11 | E | | 62·650 | +4·577 | — 5·072 | +1·118 | —3·704 | — 3·081 | 59·569 | |
| 12 | W | | 59·025 | +4·568 | — 5·105 | +3·114 | +0·402 | + 2·979 | 62·004 | |
| 13 | E | α 60° | 61·375 | +4·594 | — 5·138 | —2·595 | —0·212 | — 3·351 | 58·024 | 60·911 |
| 14 | W | | 59·825 | +4·597 | — 5·173 | +2·013 | +1·757 | + 3·194 | 63·019 | |
| 15 | E | | 65·200 | +4·587 | — 5·209 | —1·534 | —1·333 | — 3·489 | 61·711 | |
| 16 | W | | 58·925 | +4·591 | — 5·249 | +2·088 | +1·524 | + 2·954 | 61·879 | |
| 17 | E | α (1) 30° | 67·850 | +4·598 | — 5·289 | —2·115 | —0·423 | — 3·229 | 64·621 | 62·117 |
| 18 | W | | 57·775 | +4·609 | — 5·330 | +3·260 | +0·148 | + 2·687 | 60·462 | |
| 19 | E | | 64·925 | +4·623 | — 5·372 | —3·433 | +0·762 | — 3·420 | 61·505 | |
| 20 | W | | 59·775 | +4·597 | — 5·416 | +0·613 | +2·011 | + 1·805 | 61·580 | |
| 21 | E | α (1) 50° | 65·775 | +4·619 | — 5·461 | —0·059 | —1·566 | — 2·467 | 63·308 | 61·254 |
| 22 | W | | 62·050 | +4·608 | — 5·507 | +0·162 | —1·439 | — 2·176 | 59·874 | |
| 23 | E | | 63·450 | +4·608 | — 5·555 | —0·769 | —1·482 | — 3·198 | 60·252 | |
| 25 | W | | 59·175 | +4·577 | — 5·655 | +2·193 | —0·127 | + 0·988 | 60·163 | |
| 26 | E | α (1) 70° | 59·725 | +4·579 | — 5·706 | +1·913 | +0·233 | + 1·019 | 60·744 | 60·823 |
| 27 | W | | 66·875 | +4·590 | — 5·758 | —2·415 | —2·095 | — 5·678 | 61·197 | |
| 28 | E | | 60·525 | +4·604 | — 5·813 | +2·528 | —0·656 | + 0·663 | 61·188 | |
| 29 | W | α 60° | 62·650 | +4·611 | — 5·869 | +0·584 | —1·672 | — 2·346 | 60·304 | |
| 30 | E | | 63·725 | +4·611 | — 5·927 | —1·159 | —0·847 | — 3·322 | 60·403 | |

Mean 4° 38′ 1″·1685

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 58″·400 | +4″·620 | — 5″·984 | +3″·191 | +0″·889 | + 2″·716 | 61″·116 | |
| Jan. 1 | E | α 20° | 69·375 | +4·619 | — 6·087 | —3·840 | —1·164 | — 6·472 | 62·903 | 61″·369 |
| 2 | W | | 60·125 | +4·647 | — 6·147 | +3·983 | —2·307 | + 0·176 | 60·301 | |
| 3 | E | | 67·750 | +4·620 | — 6·209 | —4·055 | —0·952 | — 6·596 | 61·154 | |
| 4 | W | | 60·725 | +4·628 | — 6·271 | —0·634 | +0·847 | — 1·430 | 59·295 | |
| 5 | E | α 40° | 61·900 | +4·624 | — 6·334 | +0·396 | —0·360 | — 1·674 | 60·226 | 59·785 |
| 6 | E | | 62·900 | +4·622 | — 6·398 | —0·696 | +0·254 | — 2·218 | 60·682 | |
| 7 | W | | 60·450 | +4·585 | — 6·464 | —0·183 | +0·550 | — 1·512 | 58·938 | |
| 8 | W | | 64·200 | +4·607 | — 6·529 | —1·641 | —0·487 | — 4·050 | 60·150 | |
| 9 | E | α 60° | 64·350 | +4·613 | — 6·596 | +1·184 | —1·841 | — 2·640 | 61·710 | 60·709 |
| 10 | E | | 62·575 | +4·600 | — 6·664 | +0·394 | —0·466 | — 2·136 | 60·439 | |
| 11 | W | | 65·025 | +4·571 | — 6·732 | —0·549 | —1·778 | — 4·488 | 60·537 | |
| 12 | W | | 63·600 | +4·596 | — 6·801 | —1·008 | —0·466 | — 3·679 | 59·921 | |
| 13 | E | α (1) 30° | 63·450 | +4·644 | — 6·871 | +0·429 | —0·296 | — 2·094 | 61·356 | 59·953 |
| 14 | W | | 61·000 | +4·626 | — 6·942 | +0·004 | —0·021 | — 2·333 | 58·667 | |
| 15 | E | | 63·625 | +4·554 | — 7·013 | —0·556 | —0·741 | — 3·756 | 59·869 | |
| 18 | W | | 61·250 | +4·515 | — 7·230 | +0·308 | +0·550 | — 1·857 | 59·393 | |
| 19 | E | α (1) 50° | 64·650 | +4·576 | — 7·305 | —0·524 | —0·952 | — 4·205 | 60·445 | |
| 24 | W | | 63·900 | +4·558 | — 7·680 | —0·196 | —0·042 | — 3·360 | 60·540 | 60·875 |
| 25 | E | | 65·325 | +4·562 | — 7·756 | +0·963 | —0·381 | — 2·612 | 62·713 | |
| 26 | W | | 62·725 | +4·556 | — 7·832 | +0·493 | +0·635 | — 2·148 | 60·577 | |
| 30 | W | | 66·100 | +4·566 | — 8·136 | —1·720 | —0·169 | — 5·459 | 60·641 | |
| 31 | E | α (1) 70° | 63·275 | +4·585 | — 8·214 | +2·059 | —1·185 | — 2·755 | 60·520 | 60·056 |
| Feb. 1 | W | | 63·900 | +4·553 | — 8·290 | —1·668 | —0·021 | — 5·426 | 58·474 | |
| 2 | E | | 62·625 | +4·577 | — 8·366 | +1·730 | +0·021 | — 2·038 | 60·587 | |

Mean 4° 38′ 0″·4578

Mean Result of both Faces ..... 4° 38′ 0″·8132



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## G. T. STATION KALIANA.

### No. 25 (871) Geminor. North 0° 5′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | #'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 20° α | 12″·375 | +0″·085 | — 5″·086 | —3″·203 | +1″·058 | — 7″·146 | 5″·229 | 6″·395 |
| 5 | W | | 9·825 | +0·085 | — 5·077 | +2·361 | +0·169 | — 2·462 | 7·363 | |
| 6 | E | | 12·675 | +0·085 | — 5·068 | —1·166 | —0·063 | — 6·212 | 6·463 | |
| 7 | W | | 10·575 | +0·085 | — 5·060 | +0·500 | +0·423 | — 4·052 | 6·523 | |
| 8 | E | 40° α | 10·500 | +0·085 | — 5·054 | +0·250 | +0·127 | — 4·592 | 5·908 | 6·895 |
| 9 | W | | 13·325 | +0·085 | — 5·049 | —0·709 | +0·254 | — 5·419 | 7·906 | |
| 10 | E | | 12·725 | +0·085 | — 5·045 | +1·032 | —1·630 | — 5·558 | 7·167 | |
| 11 | W | | 15·150 | +0·085 | — 5·043 | —1·118 | —2·476 | — 8·552 | 6·598 | |
| 13 | W | 60° α | 11·725 | +0·085 | — 5·043 | +2·595 | +0·042 | — 2·321 | 9·404 | 7·270 |
| 14 | E | | 14·375 | +0·086 | — 5·044 | —2·013 | —0·423 | — 7·394 | 6·981 | |
| 15 | W | | 10·225 | +0·085 | — 5·047 | +1·534 | —1·841 | — 5·269 | 4·956 | |
| 16 | E | 30° α (1) | 15·525 | +0·085 | — 5·053 | —2·088 | +0·847 | — 6·209 | 9·316 | 7·082 |
| 17 | W | | 10·675 | +0·086 | — 5·060 | +2·115 | —0·106 | — 2·965 | 7·710 | |
| 18 | E | | 15·725 | +0·086 | — 5·068 | —3·260 | —0·783 | — 9·025 | 6·700 | |
| 19 | W | | 6·075 | +0·086 | — 5·077 | +3·433 | +0·085 | — 1·473 | 4·602 | |
| 20 | E | 50° α (1) | 14·000 | +0·086 | — 5·087 | —0·613 | +0·698 | — 4·916 | 9·084 | 8·800 |
| 21 | W | | 13·275 | +0·086 | — 5·099 | +0·059 | —1·164 | — 6·118 | 7·157 | |
| 23 | W | | 17·150 | +0·086 | — 5·126 | +0·769 | —3·006 | — 7·277 | 9·873 | |
| 25 | E | 70° α (1) | 12·575 | +0·085 | — 5·160 | —2·193 | +0·085 | — 7·183 | 5·392 | 7·153 |
| 26 | W | | 17·225 | +0·085 | — 5·178 | —1·913 | —0·931 | — 7·937 | 9·288 | |
| 27 | E | | 9·925 | +0·085 | — 5·198 | +2·415 | —2·434 | — 5·132 | 4·793 | |
| 28 | W | | 17·500 | +0·086 | — 5·220 | —2·528 | —0·698 | — 8·360 | 9·140 | |
| 29 | E | 60° α | 13·950 | +0·086 | — 5·244 | —0·584 | —1·482 | — 7·224 | 6·726 | |
| 30 | W | | 12·700 | +0·086 | — 5·269 | +1·159 | +0·021 | — 4·003 | 8·697 | |

Mean 0 ′ 5 ″·2658

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | #'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | 20° α | 15″·225 | +0″·086 | — 5″·293 | —3″·191 | +0″·487 | — 7″·911 | 7″·314 | 6″·203 |
| Jan. 1 | W | | 7·025 | +0·086 | — 5·359 | +3·840 | —0·593 | — 2·026 | 4·999 | |
| 2 | E | | 17·475 | +0·086 | — 5·388 | —3·983 | —2·265 | —11·550 | 5·925 | |
| 3 | W | | 9·500 | +0·086 | — 5·418 | +4·055 | —1·651 | — 2·928 | 6·572 | |
| 4 | E | 40° α | 10·575 | +0·086 | — 5·448 | +0·634 | +0·571 | — 4·157 | 6·418 | 7·162 |
| 5 | W | | 12·550 | +0·086 | — 5·479 | —0·396 | —0·466 | — 6·255 | 6·295 | |
| 6 | W | | 11·200 | +0·086 | — 5·513 | +0·696 | +0·698 | — 4·033 | 7·167 | |
| 7 | E | | 13·625 | +0·085 | — 5·547 | +0·183 | +0·423 | — 4·856 | 8·769 | |
| 8 | E | 60° α | 11·950 | +0·086 | — 5·582 | +1·641 | —1·101 | — 4·956 | 6·994 | 6·401 |
| 9 | W | | 13·525 | +0·086 | — 5·619 | —1·184 | —2·476 | — 9·193 | 4·332 | |
| 10 | W | | 13·275 | +0·086 | — 5·656 | —0·394 | +0·190 | — 5·774 | 7·501 | |
| 11 | E | | 13·700 | +0·085 | — 5·694 | +0·549 | —1·863 | — 6·923 | 6·777 | |
| 12 | E | 30° α (1) | 13·100 | +0·085 | — 5·733 | +1·008 | —0·317 | — 4·957 | 8·143 | 6·307 |
| 13 | W | | 10·750 | +0·086 | — 5·774 | —0·429 | +0·042 | — 6·075 | 4·675 | |
| 14 | E | | 13·075 | +0·086 | — 5·812 | —0·004 | +0·190 | — 5·540 | 7·535 | |
| 15 | W | | 10·600 | +0·085 | — 5·857 | +0·556 | —0·508 | — 5·724 | 4·876 | |
| 18 | E | 50° α (1) | 12·675 | +0·084 | — 5·990 | —0·308 | +0·825 | — 5·389 | 7·286 | 6·648 |
| 19 | W | | 12·850 | +0·085 | — 6·038 | +0·524 | —0·487 | — 5·916 | 6·934 | |
| 24 | E | | 13·400 | +0·085 | — 6·280 | +0·196 | —0·381 | — 6·380 | 7·020 | |
| 25 | W | | 13·150 | +0·085 | — 6·330 | —0·963 | —0·614 | — 7·822 | 5·328 | |
| 27 | W | | 11·475 | +0·085 | — 6·433 | +0·365 | +0·677 | — 5·306 | 6·169 | |
| 28 | E | 70° α (1) | 12·100 | +0·085 | — 6·485 | +1·636 | 0·000 | — 4·764 | 7·336 | 5·791 |
| 30 | W | | 14·125 | +0·085 | — 6·590 | —1·720 | —0·169 | — 8·394 | 5·731 | |
| 31 | W | | 13·050 | +0·085 | — 6·645 | —2·059 | —0·254 | — 8·873 | 4·177 | |
| Feb. 2 | E | | 10·900 | +0·085 | — 6·753 | +1·730 | —0·042 | — 4·980 | 5·920 | |

Mean 0° 5′ 6″·4187

Mean Result of both Faces..... 0° 5′ 6″·8423

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No. 26 (881) 46 GEMINOR r. North 0° 59′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 14″·250 | +0″·973 | — 4″·558 | +3″·203 | +1″·482 | + 1″·100 | 15″·350 | |
| 5 | E | α | 19·750 | +0·975 | — 4·548 | —2·361 | —0·148 | — 6·082 | 13·668 | 14″·792 |
| 6 | W | 20° | 17·775 | +0·973 | — 4·539 | +1·166 | —0·339 | — 2·739 | 15·036 | |
| 7 | E | | 18·725 | +0·973 | — 4·530 | —0·500 | +0·444 | — 3·613 | 15·112 | |
| 8 | W | | 19·150 | +0·971 | — 4·524 | —0·250 | +0·275 | — 3·528 | 15·622 | |
| 9 | E | α | 14·600 | +0·968 | — 4·519 | +0·709 | +0·381 | — 2·461 | 12·139 | 13·861 |
| 10 | W | 40° | 19·550 | +0·974 | — 4·515 | —1·032 | —0·931 | — 5·504 | 14·046 | |
| 11 | E | | 17·900 | +0·973 | — 4·514 | +1·118 | —1·841 | — 4·264 | 13·636 | |
| 12 | W | | 14·575 | +0·972 | — 4·514 | +3·114 | +0·995 | + 0·567 | 15·142 | |
| 13 | E | α | 20·975 | +0·978 | — 4·515 | —2·595 | —0·127 | — 6·259 | 14·716 | 14·140 |
| 14 | W | 60° | 16·775 | +0·979 | — 4·516 | +2·013 | —1·164 | — 2·688 | 14·087 | |
| 15 | E | | 19·350 | +0·977 | — 4·520 | —1·534 | 0·000 | — 5·077 | 14·273 | |
| 16 | W | | 16·050 | +0·978 | — 4·527 | +2·088 | +0·656 | — 0·805 | 15·245 | |
| 17 | E | α (1) | 21·525 | +0·979 | — 4·535 | —2·115 | +0·021 | — 5·650 | 15·875 | 14·798 |
| 18 | W | 30° | 14·850 | +0·982 | — 4·544 | +3·260 | —1·079 | — 1·381 | 13·469 | |
| 19 | E | | 21·075 | +0·984 | — 4·554 | —3·433 | +0·529 | — 6·474 | 14·601 | |
| 20 | W | | 19·200 | +0·979 | — 4·566 | +0·613 | +0·042 | — 2·932 | 16·268 | |
| 21 | E | α (1) | 20·725 | +0·982 | — 4·579 | —0·059 | +0·254 | — 3·402 | 17·323 | 14·875 |
| 22 | W | 50° | 17·950 | +0·980 | — 4·593 | +0·162 | —1·693 | — 5·144 | 12·806 | |
| 23 | E | | 20·250 | +0·982 | — 4·610 | —0·769 | —2·752 | — 7·149 | 13·101 | |
| 25 | W | | 16·900 | +0·974 | — 4·648 | +2·193 | 0·000 | — 1·481 | 15·419 | |
| 26 | E | α (1) | 14·575 | +0·975 | — 4·667 | +1·913 | +0·042 | — 1·737 | 12·838 | 13·983 |
| 27 | W | 70° | 22·200 | +0.978 | — 4·690 | —2·415 | —1·609 | — 7·736 | 14·464 | |
| 28 | E | | 15·325 | +0·982 | — 4·714 | +2·528 | —0·910 | — 2·114 | 13·211 | |
| 29 | W | α | 16·825 | +0·981 | — 4·740 | +0·584 | —0·952 | — 4·127 | 12·698 | |
| 30 | E | 60° | 18·825 | +0·982 | — 4·768 | —1·159 | +0·042 | — 4·903 | 13·922 | |

Mean 0° 59′ 14″·4082

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 13″·850 | +0″·982 | — 4″·795 | +3″·191 | +0″·466 | — 0″·156 | 13″·694 | |
| Jan. 1 | E | α | 23·800 | +0·983 | — 4·865 | —3·840 | +0·021 | — 7·701 | 16·099 | 14″·315 |
| 2 | W | 20° | 15·175 | +0·989 | — 4·896 | +3·983 | —1·841 | — 1·765 | 13·410 | |
| 3 | E | | 23·450 | +0·986 | — 4·929 | —4·055 | —1·397 | — 9·395 | 14·055 | |
| 4 | W | | 16·400 | +0·985 | — 4·963 | —0·634 | +1·312 | — 3·300 | 13·100 | |
| 5 | E | α | 18·975 | +0·986 | — 4·997 | +0·396 | —1·376 | — 4·991 | 13·984 | 13·611 |
| 6 | E | 40° | 19·875 | +0·983 | — 5·034 | —0·696 | —0·042 | — 4·789 | 15·086 | |
| 7 | W | | 16·425 | +0·977 | — 5·071 | —0·183 | +0·127 | — 4·150 | 12·275 | |
| 8 | W | | 20·050 | +0·981 | — 5·110 | —1·641 | —0·741 | — 6·511 | 13·539 | |
| 9 | E | α | 20·725 | +0·983 | — 5·150 | +1·184 | —2·032 | — 5·015 | 15·710 | 13·949 |
| 10 | E | 60° | 18·275 | +0·980 | — 5·192 | +0·394 | —0·127 | — 3·945 | 14·330 | |
| 11 | W | | 18·125 | +0·974 | — 5·233 | —0·549 | —1·101 | — 5·909 | 12·216 | |
| 12 | W | | 18·150 | +0·978 | — 5·276 | —1·008 | —0·360 | — 5·666 | 12·484 | |
| 13 | E | α (1) | 18·625 | +0·986 | — 5·321 | +0·429 | +0·656 | — 3·250 | 15·375 | 13·523 |
| 14 | W | 30° | 16·200 | +0·985 | — 5·367 | +0·004 | +0·317 | — 4·061 | 12·139 | |
| 15 | E | | 20·425 | +0·970 | — 5·414 | —0·556 | —1·333 | — 6·333 | 14·092 | |
| 18 | W | | 16·550 | +0·962 | — 5·559 | +0·308 | +0·635 | — 3·654 | 12·896 | |
| 19 | E | α (1) | 19·775 | +0·974 | — 5·611 | —0·524 | —0·487 | — 5·648 | 14·127 | 14·224 |
| 24 | W | 50° | 19·775 | +0·970 | — 5·877 | —0·196 | —0·254 | — 5·357 | 14·418 | |
| 25 | E | | 19·325 | +0·971 | — 5·933 | +0·963 | +0·127 | — 3·872 | 15·453 | |
| 28 | W | | 20·150 | +0·970 | — 6·103 | —1·636 | —0·042 | — 6·811 | 13·339 | |
| 31 | E | α (1) | 17·700 | +0·976 | — 6·279 | +2·059 | —0·212 | — 3·456 | 14·244 | 13·823 |
| Feb. 1 | W | 70° | 20·100 | +0·970 | — 6·338 | —1·668 | +1·249 | — 5·787 | 14·313 | |
| 2 | E | | 18·000 | +0·975 | — 6·398 | +1·730 | —0·910 | — 4·603 | 13·397 | |

Mean 0° 59′ 13″·9075

Mean Result of both Faces ..... 0° 59′ 14″·1579

4 Z



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## G. T. STATION KALIANA.

No. 27 (900) 55 Geminor δ. South 7° 14′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 16″·325 | +7″·167 | + 5″·704 | +3″·203 | −0″·698 | +15″·376 | 31″·701 | |
| 5 | W | | 21·725 | +7·177 | + 5·644 | −2·361 | +1·249 | +11·709 | 33·434 | 33″·328 |
| 6 | E | 20° α | 19·475 | +7·164 | + 5·584 | +1·166 | +0·444 | +14·358 | 33·833 | |
| 7 | W | | 21·475 | +7·168 | + 5·525 | −0·500 | +0·677 | +12·870 | 34·345 | |
| 8 | E | | 20·400 | +7·155 | + 5·467 | −0·250 | +1·609 | +13·981 | 34·381 | |
| 9 | W | 40° α | 18·550 | +7·126 | + 5·411 | +0·709 | +0·677 | +13·923 | 32·473 | 33·762 |
| 10 | E | | 19·625 | +7·171 | + 5·355 | −1·032 | +1·736 | +13·230 | 32·855 | |
| 11 | W | | 19·300 | +7·164 | + 5·301 | +1·118 | +2·455 | +16·038 | 35·338 | |
| 13 | W | | 27·050 | +7·203 | + 5·197 | −2·595 | +0·212 | +10·017 | 37·067 | |
| 14 | E | 60° α | 18·750 | +7·214 | + 5·145 | +2·013 | +1·376 | +15·748 | 34·498 | 34·320 |
| 15 | W | | 23·000 | +7·192 | + 5·095 | −1·534 | 0·000 | +10·753 | 33·753 | |
| 16 | E | | 18·475 | +7·201 | + 5·048 | +2·088 | +0·212 | +14·549 | 33·024 | |
| 17 | W | 30° α (1) | 25·400 | +7·210 | + 5·002 | −2·115 | +0·868 | +10·965 | 36·365 | 34·363 |
| 18 | E | | 15·450 | +7·229 | + 4·958 | +3·260 | +1·376 | +16·823 | 32·273 | |
| 19 | W | | 27·125 | +7·248 | + 4·913 | −3·433 | −0·063 | + 8·665 | 35·790 | |
| 20 | E | | 20·125 | +7·213 | + 4·870 | +0·613 | +0·190 | +12·886 | 33·011 | |
| 21 | W | 50° α (1) | 22·575 | +7·232 | + 4·828 | −0·059 | +0·910 | +12·911 | 35·486 | 33·313 |
| 22 | E | | 19·750 | +7·216 | + 4·788 | +0·162 | −1·143 | +11·023 | 30·773 | |
| 23 | W | | 20·800 | +7·234 | + 4·750 | −0·769 | +1·968 | +13·183 | 33·983 | |
| 25 | E | | 17·475 | +7·171 | + 4·677 | +2·193 | +1·397 | +15·438 | 32·913 | |
| 26 | W | 70° α (1) | 20·125 | +7·183 | + 4·642 | +1·913 | +0·339 | +14·077 | 34·202 | 33·715 |
| 27 | E | | 22·425 | +7·203 | + 4·609 | −2·415 | +1·630 | +11·027 | 33·452 | |
| 28 | W | | 19·400 | +7·235 | + 4·578 | +2·528 | +0·550 | +14·891 | 34·291 | |
| 29 | E | 60° α | 18·975 | +7·228 | + 4·549 | +0·584 | +1·418 | +13·779 | 32·754 | |
| 30 | W | | 22·400 | +7·234 | + 4·521 | −1·159 | +1·228 | +11·824 | 34·224 | |

Mean 7° 14′ 33″·8002

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 16″·850 | +7″·230 | + 4″·493 | +3″·191 | +0″·042 | +14″·956 | 31″·806 | |
| Jan. 1 | W | 20° α | 27·025 | +7·242 | + 4·504 | −3·840 | +1·270 | + 9·176 | 36·201 | 33″·542 |
| 2 | E | | 13·925 | +7·283 | + 4·480 | +3·983 | +2·688 | +18·434 | 32·359 | |
| 3 | W | | 23·825 | +7·266 | + 4·458 | −4·055 | +2·307 | + 9·976 | 33·801 | |
| 4 | E | | 22·100 | +7·256 | + 4·437 | −0·634 | +0·042 | +11·101 | 33·201 | |
| 5 | W | 40° α | 21·800 | +7·261 | + 4·416 | +0·396 | +2·307 | +14·380 | 36·180 | 34·117 |
| 6 | W | | 23·900 | +7·239 | + 4·398 | −0·696 | +0·741 | +11·682 | 35·582 | |
| 7 | E | | 20·050 | +7·194 | + 4·381 | −0·183 | +0·063 | +11·455 | 31·505 | |
| 8 | E | | 21·625 | +7·225 | + 4·364 | −1·641 | +1·185 | +11·133 | 32·758 | |
| 9 | W | 60° α | 18·575 | +7·246 | + 4·350 | +1·184 | +3·048 | +15·828 | 34·403 | 33·826 |
| 10 | W | | 22·650 | +7·220 | + 4·338 | +0·394 | +0·931 | +12·883 | 35·533 | |
| 11 | E | | 19·375 | +7·172 | + 4·325 | −0·549 | +2·286 | +13·234 | 32·609 | |
| 12 | E | | 20·225 | +7·195 | + 4·315 | −1·008 | +1·418 | +11·920 | 32·145 | |
| 13 | W | 30° α (1) | 25·150 | +7·253 | + 4·306 | +0·429 | −0·381 | +11·607 | 36·757 | 34·534 |
| 14 | E | | 20·025 | +7·258 | + 4·299 | +0·004 | +0·444 | +12·005 | 32·030 | |
| 15 | W | | 24·775 | +7·147 | + 4·292 | −0·556 | +1·545 | +12·428 | 37·203 | |
| 18 | E | | 20·900 | +7·086 | + 4·281 | +0·308 | 0·000 | +11·675 | 32·575 | |
| 19 | W | 50° α (1) | 22·825 | +7·167 | + 4·281 | −0·524 | +1·037 | +11·961 | 34·786 | 33·938 |
| 24 | E | | 21·075 | +7·146 | + 4·295 | −0·196 | +0·825 | +12·070 | 33·145 | |
| 25 | W | | 22·525 | +7·149 | + 4·301 | +0·963 | +0·508 | +12·921 | 35·446 | |
| 26 | E | | 21·175 | +7·152 | + 4·309 | +0·493 | −0·571 | +11·383 | 32·558 | |
| 28 | E | | 21·375 | +7·144 | + 4·327 | −1·636 | +1·058 | +10·893 | 32·268 | |
| 29 | W | | 21·775 | +7·173 | + 4·337 | +1·408 | +0·360 | +13·278 | 35·053 | |
| 30 | W | 70° α (1) | 21·525 | +7·156 | + 4·349 | +1·720 | +0·148 | +13·373 | 34·898 | 34·109 |
| 31 | E | | 23·200 | +7·190 | + 4·362 | −2·059 | +0·148 | + 9·641 | 32·841 | |
| Feb. 1 | W | | 21·875 | +7·142 | + 4·376 | +1·668 | −0·698 | +12·488 | 34·363 | |
| 2 | E | | 24·800 | +7·177 | + 4·390 | −1·730 | +0·593 | +10·430 | 35·230 | |

Mean 7° 14′ 34″·0110

Mean Result of both Faces ..... 7° 14′ 33″·9056

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No. 28 (918) 62 GEMINOR ρ. North 2° 34′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 52″·825 | +2″·547 | — 3″·355 | +3″·203 | +1″·143 | + 3″·538 | 56″·363 | |
| 5 | E | 20° α | 58·450 | +2·549 | — 3·340 | —2·361 | —0·847 | — 3·999 | 54·451 | 56″·367 |
| 6 | W | | 58·325 | +2·544 | — 3·326 | +1·166 | +0·085 | + 0·469 | 58·704 | |
| 7 | E | | 58·250 | +2·547 | — 3·314 | —0·500 | —1·122 | — 2·389 | 55·861 | |
| 8 | W | | 59·475 | +2·540 | — 3·303 | —0·250 | —1·355 | — 2·368 | 57·107 | |
| 9 | E | 40° α | 57·600 | +2·531 | — 3·295 | +0·709 | —0·677 | — 0·732 | 56·868 | 57·025 |
| 10 | W | | 60·675 | +2·546 | — 3·287 | —1·032 | —1·947 | — 3·720 | 56·955 | |
| 11 | E | | 58·525 | +2·545 | — 3·283 | +1·118 | —1·736 | — 1·356 | 57·169 | |
| 13 | E | | 59·950 | +2·558 | — 3·278 | —2·595 | +0·212 | — 3·103 | 56·847 | |
| 14 | W | 60° α | 56·425 | +2·562 | — 3·277 | +2·013 | —0·910 | + 0·388 | 56·813 | 56·476 |
| 15 | E | | 60·225 | +2·553 | — 3·279 | —1·534 | —0·910 | — 3·170 | 57·055 | |
| 16 | W | | 57·450 | +2·557 | — 3·284 | +2·088 | —1·122 | + 0·239 | 57·689 | |
| 17 | E | 30° α (i) | 61·800 | +2·561 | — 3·290 | —2·115 | —1·376 | — 4·220 | 57·580 | |
| 18 | W | | 55·425 | +2·568 | — 3·298 | +3·260 | —1·418 | + 1·112 | 56·537 | 56·764 |
| 19 | E | | 59·625 | +2·575 | — 3·307 | —3·433 | —0·212 | — 4·377 | 55·248 | |
| 20 | W | | 57·650 | +2·561 | — 3·318 | +0·613 | —0·042 | — 0·186 | 57·464 | |
| 21 | E | 50° α (i) | 58·450 | +2·568 | — 3·330 | —0·059 | —0·995 | — 1·816 | 56·634 | |
| 22 | W | | 58·850 | +2·564 | — 3·345 | +0·162 | +0·550 | — 0·069 | 58·781 | 57·886 |
| 23 | E | | 60·850 | +2·570 | — 3·361 | —0·769 | —0·625 | — 2·185 | 58·665 | |
| 25 | W | | 56·550 | +2·546 | — 3·400 | +2·193 | —1·418 | — 0·079 | 56·471 | |
| 26 | E | 70° α (i) | 54·200 | +2·551 | — 3·420 | +1·913 | —0·593 | + 0·451 | 54·651 | |
| 27 | W | | 62·100 | +2·560 | — 3·444 | —2·415 | —2·519 | — 5·818 | 56·282 | 56·353 |
| 28 | E | | 57·225 | +2·571 | — 3·470 | +2·528 | —0·847 | + 0·782 | 58·007 | |
| 29 | W | 60° α | 58·300 | +2·567 | — 3·498 | +0·584 | —1·905 | — 2·252 | 56·048 | |
| 30 | E | | 59·475 | +2·569 | — 3·528 | —1·159 | —1·693 | — 3·811 | 55·664 | |

Mean 2° 34′ 56″·8118

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 53″·800 | +2″·569 | — 3″·557 | +3″·191 | —0″·487 | + 1″·716 | 55″·516 | |
| Jan. 1 | E | 20° α | 62·800 | +2·573 | — 3·628 | —3·840 | —0·296 | — 5·191 | 57·609 | 55″·934 |
| 2 | W | | 55·275 | +2·588 | — 3·663 | +3·983 | —3·365 | — 0·457 | 54·818 | |
| 3 | E | | 63·950 | +2·579 | — 3·699 | —4·055 | —2·984 | — 8·159 | 55·791 | |
| 4 | W | | 56·750 | +2·579 | — 3·735 | —0·634 | —0·762 | — 2·552 | 54·198 | |
| 5 | E | 40° α | 57·725 | +2·581 | — 3·774 | +0·396 | —2·349 | — 3·146 | 54·579 | 55·189 |
| 6 | E | | 58·550 | +2·573 | — 3·814 | —0·696 | —0·656 | — 2·593 | 55·957 | |
| 7 | W | | 57·675 | +2·556 | — 3·856 | —0·183 | —0·169 | — 1·652 | 56·023 | |
| 8 | W | | 59·450 | +2·566 | — 3·899 | —1·641 | —0·868 | — 3·842 | 55·608 | |
| 9 | E | 60° α | 60·275 | +2·574 | — 3·944 | +1·184 | —2·963 | — 3·149 | 57·126 | 56·050 |
| 10 | E | | 58·325 | +2·563 | — 3·990 | +0·394 | —1·270 | — 2·303 | 56·022 | |
| 11 | W | | 60·000 | +2·547 | — 4·037 | —0·549 | —2·519 | — 4·558 | 55·442 | |
| 12 | W | | 57·875 | +2·556 | — 4·085 | —1·008 | —1·079 | — 3·616 | 54·259 | |
| 13 | E | 30° α (i) | 58·100 | +2·576 | — 4·136 | +0·429 | +0·508 | — 0·623 | 57·477 | |
| 14 | W | | 56·975 | +2·578 | — 4·188 | +0·004 | —0·720 | — 2·326 | 54·649 | 55·837 |
| 15 | E | | 59·750 | +2·539 | — 4·241 | —0·556 | —0·529 | — 2·787 | 56·963 | |
| 18 | W | | 57·875 | +2·518 | — 4·406 | +0·308 | —0·106 | — 1·686 | 56·189 | |
| 19 | E | 50° α (i) | 60·900 | +2·547 | — 4·465 | —0·524 | —1·884 | — 4·326 | 56·574 | |
| 24 | W | | 59·175 | +2·538 | — 4·771 | —0·196 | —0·529 | — 2·958 | 56·217 | 56·429 |
| 25 | E | | 59·250 | +2·540 | — 4·835 | +0·963 | —0·444 | — 1·776 | 57·474 | |
| 26 | W | | 56·350 | +2·540 | — 4·900 | +0·493 | +0·614 | — 1·253 | 55·097 | |
| 28 | W | | 60·900 | +2·538 | — 5·033 | —1·636 | —1·397 | — 5·528 | 55·372 | |
| 29 | E | 70° α (i) | 58·850 | +2·547 | — 5·100 | +1·408 | —0·254 | — 1·399 | 57·451 | |
| 30 | E | | 59·825 | +2·541 | — 5·167 | +1·720 | —0·825 | — 1·731 | 58·094 | 56·660 |
| 31 | W | | 60·050 | +2·554 | — 5·237 | —2·059 | —0·169 | — 4·911 | 55·139 | |
| Feb. 1 | E | | 59·450 | +2·537 | — 5·306 | +1·668 | +0·614 | — 0·487 | 58·963 | |
| 2 | W | | 59·200 | +2·549 | — 5·376 | —1·730 | +0·296 | — 4·261 | 54·939 | |

Mean 2° 34′ 56″·0165

Mean Result of both Faces..... 2° 34′ 56″·4142



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## G. T. STATION KALIANA.

No. 29 (927) 66 Geminor *a*. North 2° 43′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 20° *a* | 11″·875 | +2″·683 | — 3″·042 | —3″·203 | +1″·376 | — 2″·186 | 9″·689 | 8″·211 |
| 5 | W | | 8·075 | +2·685 | — 3·023 | +2·361 | +0·402 | + 2·425 | 10·500 | |
| 6 | E | | 7·600 | +2·679 | — 3·006 | —1·166 | +0·106 | — 1·387 | 6·213 | |
| 7 | W | | 5·550 | +2·683 | — 2·990 | +0·500 | +0·698 | + 0·891 | 6·441 | |
| 8 | E | 40° *a* | 6·700 | +2·674 | — 2·976 | +0·250 | +0·296 | + 0·244 | 6·944 | 8·658 |
| 9 | W | | 11·500 | +2·665 | — 2·964 | —0·709 | +0·085 | — 0·923 | 10·577 | |
| 10 | E | | 7·950 | +2·680 | — 2·954 | +1·032 | —1·164 | — 0·406 | 7·544 | |
| 11 | W | | 12·200 | +2·681 | — 2·946 | —1·118 | —1·249 | — 2·632 | 9·568 | |
| 12 | E | 60° *a* | 12·100 | +2·675 | — 2·940 | —3·114 | 0·000 | — 3·379 | 8·721 | 8·378 |
| 13 | W | | 7·400 | +2·695 | — 2·935 | +2·595 | +0·317 | + 2·672 | 10·072 | |
| 14 | E | | 11·775 | +2·699 | — 2·931 | —2·013 | —0·910 | — 3·155 | 8·620 | |
| 15 | W | | 6·625 | +2·688 | — 2·930 | +1·534 | —1·016 | + 0·276 | 6·901 | |
| 16 | E | 30° *a* (1) | 12·175 | +2·693 | — 2·932 | —2·088 | —0·974 | — 3·301 | 8·874 | 7·470 |
| 17 | W | | 6·575 | +2·697 | — 2·935 | +2·115 | —0·402 | + 1·475 | 8·050 | |
| 18 | E | | 12·950 | +2·704 | — 2·940 | —3·260 | —0·952 | — 4·448 | 8·502 | |
| 19 | W | | 0·875 | +2·712 | — 2·946 | +3·433 | +0·381 | + 3·580 | 4·455 | |
| 20 | E | 50° *a* (1) | 11·100 | +2·697 | — 2·955 | —0·613 | +0·127 | — 0·744 | 10·356 | 8·716 |
| 21 | W | | 8·450 | +2·703 | — 2·965 | +0·059 | +0·085 | — 0·118 | 8·332 | |
| 22 | E | | 8·750 | +2·701 | — 2·977 | —0·162 | —1·058 | — 1·496 | 7·254 | |
| 23 | W | | 10·425 | +2·708 | — 2·991 | +0·769 | —1·990 | — 1·504 | 8·921 | |
| 25 | E | 70° *a* (1) | 10·400 | +2·681 | — 3·025 | —2·193 | +0·042 | — 2·495 | 7·905 | 8·748 |
| 26 | W | | 12·825 | +2·686 | — 3·044 | —1·913 | +0·402 | — 1·869 | 10·956 | |
| 27 | E | | 7·325 | +2·697 | — 3·065 | +2·415 | —1·778 | + 0·269 | 7·594 | |
| 28 | W | | 12·525 | +2·708 | — 3·089 | —2·528 | —1·079 | — 3·988 | 8·537 | |
| 29 | E | 60° *a* | 10·750 | +2·704 | — 3·115 | —0·584 | —1·143 | — 2·138 | 8·612 | |
| 30 | W | | 7·725 | +2·705 | — 3·143 | +1·159 | —1·101 | — 0·380 | 7·345 | |

Mean 2° 43′ 8″·3635

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | 20° *a* | 13″·150 | +2″·706 | — 3″·170 | —3″·191 | 0″·000 | — 3″·655 | 9″·495 | 8″·798 |
| Jan. 1 | W | | 6·750 | +2·711 | — 3·238 | +3·840 | +0·571 | + 3·884 | 10·634 | |
| 2 | E | | 15·950 | +2·727 | — 3·270 | —3·983 | —2·561 | — 7·087 | 8·863 | |
| 3 | W | | 5·125 | +2·716 | — 3·305 | +4·055 | —2·392 | + 1·074 | 6·199 | |
| 4 | E | 40° *a* | 7·575 | +2·717 | — 3·341 | +0·634 | +0·529 | + 0·539 | 8·114 | 8·023 |
| 5 | W | | 8·225 | +2·719 | — 3·377 | —0·396 | —0·593 | — 1·647 | 6·578 | |
| 6 | W | | 8·375 | +2·711 | — 3·416 | +0·696 | —0·127 | — 0·136 | 8·239 | |
| 7 | E | | 9·850 | +2·692 | — 3·457 | +0·183 | —0·106 | — 0·688 | 9·162 | |
| 8 | E | 60° *a* | 10·400 | +2·702 | — 3·499 | +1·641 | —0·508 | + 0·336 | 10·736 | 9·065 |
| 9 | W | | 11·625 | +2·711 | — 3·543 | —1·184 | —1·312 | — 3·328 | 8·297 | |
| 10 | W | | 9·475 | +2·698 | — 3·589 | —0·394 | —0·550 | — 1·835 | 7·640 | |
| 11 | E | | 11·325 | +2·682 | — 3·635 | +0·549 | —1·333 | — 1·737 | 9·588 | |
| 12 | E | 30° *a* (1) | 12·725 | +2·692 | — 3·682 | +1·008 | —0·106 | — 0·088 | 12·637 | 9·699 |
| 13 | W | | 8·475 | +2·713 | — 3·733 | —0·429 | +1·164 | — 0·285 | 8·190 | |
| 14 | E | | 12·225 | +2·714 | — 3·784 | —0·004 | —0·317 | — 1·391 | 10·834 | |
| 15 | W | | 7·975 | +2·674 | — 3·836 | +0·556 | —0·233 | — 0·839 | 7·136 | |
| 18 | E | 50° *a* (1) | 10·775 | +2·653 | — 4·000 | —0·308 | +0·466 | — 1·189 | 9·586 | 8·834 |
| 19 | W | | 9·550 | +2·683 | — 4·060 | +0·524 | —1·439 | — 2·292 | 7·258 | |
| 24 | E | | 11·625 | +2·673 | — 4·366 | +0·196 | —0·148 | — 1·645 | 9·980 | |
| 25 | W | | 10·825 | +2·676 | — 4·430 | —0·963 | +0·402 | — 2·315 | 8·510 | |
| 28 | E | 70° *a* (1) | 11·325 | +2·673 | — 4·630 | +1·636 | —0·127 | — 0·448 | 10·877 | 7·713 |
| 29 | W | | 10·075 | +2·682 | — 4·697 | —1·408 | +0·593 | — 2·830 | 7·245 | |
| 30 | W | | 9·650 | +2·676 | — 4·760 | —1·720 | —0·698 | — 4·508 | 5·142 | |
| 31 | E | | 10·425 | +2·690 | — 4·837 | +2·059 | —0·021 | — 0·109 | 10·316 | |
| Feb. 1 | W | | 8·300 | +2·672 | — 4·907 | —1·668 | +1·418 | — 2·485 | 5·815 | |
| 2 | E | | 10·675 | +2·684 | — 4·978 | —1·730 | +0·233 | — 3·791 | 6·884 | |

Mean 2° 43′ 8″·6887

Mean Result of both Faces ..... 2° 43′ 8″·5261

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## No. 30 (945) GEMINOR. South 6° 44′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 26″·925 | +6″·683 | + 4″·644 | —3″·203 | 0″·000 | + 8″·124 | 35″·049 | |
| 5 | E | α | 20·950 | +6·683 | + 4·572 | +2·361 | +0·339 | +13·955 | 34·905 | |
| 6 | W | 20° | 23·150 | +6·668 | + 4·500 | —1·166 | +0·529 | +10·531 | 33·681 | 34″·530 |
| 7 | E | | 22·750 | +6·680 | + 4·429 | +0·500 | +0·127 | +11·736 | 34·486 | |
| 8 | W | | 21·250 | +6·651 | + 4·360 | +0·250 | +0·995 | +12·256 | 33·506 | |
| 9 | E | α | 23·500 | +6·635 | + 4·292 | —0·709 | +0·847 | +11·065 | 34·565 | |
| 10 | W | 40° | 21·325 | +6·667 | + 4·224 | +1·032 | +1·249 | +13·172 | 34·497 | 34·545 |
| 11 | E | | 24·225 | +6·674 | + 4·160 | —1·118 | +1·672 | +11·388 | 35·613 | |
| 13 | E | α | 20·525 | +6·707 | + 4·033 | +2·595 | +0.783 | +14·118 | 34·643 | |
| 14 | W | 60° | 26·375 | +6·718 | + 3·971 | —2·013 | +1·164 | + 9·840 | 36·215 | 34·929 |
| 16 | W | | 26·150 | +6·702 | + 3·853 | —2·088 | +1·545 | +10·012 | 36·162 | |
| 17 | E | α (1) | 20·525 | +6·715 | + 3·797 | +2·115 | +0·952 | +13·579 | 34·104 | |
| 18 | W | 30° | 27·025 | +6·732 | + 3·743 | —3·260 | +0·783 | + 7·998 | 35·023 | 34·570 |
| 19 | E | | 19·625 | +6·752 | + 3·689 | +3·433 | —0·508 | +13·366 | 32·991 | |
| 20 | W | | 26·400 | +6·710 | + 3·637 | —0·613 | +0·931 | +10·665 | 37·065 | |
| 21 | E | α (1) | 22·025 | +6·726 | + 3·586 | +0·059 | +1·037 | +11·408 | 33·433 | |
| 22 | W | 50° | 23·225 | +6·726 | + 3·537 | —0·162 | +0·762 | +10·863 | 34·088 | 35·148 |
| 23 | E | | 22·400 | +6·742 | + 3·490 | +0·769 | +2·603 | +13·604 | 36·004 | |
| 26 | E | | 25·900 | +6·684 | + 3·357 | —1·913 | +1·249 | + 9·377 | 35·277 | |
| 27 | W | α (1) | 21·075 | +6·717 | + 3·316 | +2·415 | +0.995 | +13·443 | 34·518 | 34·516 |
| 28 | E | 70° | 24·900 | +6·744 | + 3·278 | —2·528 | +1·355 | + 8·849 | 33·749 | |
| 29 | W | α | 23·475 | +6·732 | + 3·242 | —0·584 | +1·714 | +11·104 | 34·579 | |
| 30 | E | 60° | 22·400 | +6·732 | + 3·207 | +1·159 | +0·783 | +11·881 | 34·281 | |

Mean 6° 44′ 34″·7063

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 28″·350 | +6″·740 | + 3″·172 | —3″·191 | +0″·804 | + 7″·525 | 35″·875 | |
| Jan. 1 | E | α | 19·925 | +6·752 | + 3·172 | +3·840 | +0·741 | +14·505 | 34·430 | |
| 2 | W | 20° | 27·075 | +6·792 | + 3·142 | —3·983 | +2·371 | + 8·322 | 35·397 | 35″·342 |
| 3 | E | | 19·775 | +6·755 | + 3·113 | +4·055 | +1·968 | +15·891 | 35·666 | |
| 4 | W | | 24·575 | +6·767 | + 3·086 | +0·634 | +0·720 | +11·207 | 35·782 | |
| 5 | E | α | 22·800 | +6·774 | + 3·060 | —0·396 | +0·783 | +10·221 | 33·021 | |
| 6 | E | 40° | 23·100 | +6·754 | + 3·036 | +0·696 | +0·021 | +10·507 | 33·607 | 35·009 |
| 7 | W | | 27·175 | +6·703 | + 3·014 | +0·183 | +0·550 | +10·450 | 37·625 | |
| 8 | W | α | 22·850 | +6·727 | + 2·993 | +1·641 | +1·714 | +13·075 | 35·925 | |
| 11 | E | 60° | 22·575 | +6·673 | + 2·942 | —0·549 | +1·841 | +10·907 | 33·482 | 34·704 |
| 12 | W | | 25·100 | +6·703 | + 2·927 | +1·008 | +1·122 | +11·760 | 36·860 | |
| 13 | E | α (1) | 24·850 | +6·755 | + 2·916 | —0·429 | +0·169 | + 9·411 | 34·261 | |
| 14 | W | 30° | 26·725 | +6·756 | + 2·905 | —0·004 | +0·402 | +10·059 | 36·784 | 35·225 |
| 15 | E | | 21·700 | +6·658 | + 2·896 | +0·556 | +1·185 | +11·295 | 32·995 | |
| 18 | W | | 25·450 | +6·607 | + 2·877 | —0·308 | —0·233 | + 8·943 | 34·393 | |
| 19 | E | α (1) | 21·375 | +6·684 | + 2·876 | +0·524 | +2·434 | +12·518 | 33·893 | |
| 24 | W | 50° | 24·750 | +6·653 | + 2·885 | +0·196 | —0·847 | + 8·887 | 33·637 | 34·040 |
| 25 | E | | 24·175 | +6·664 | + 2·891 | —0·963 | +1·206 | + 9·798 | 33·973 | |
| 27 | W | | 26·050 | +6·642 | + 2·908 | —0·365 | —0·931 | + 8·254 | 34·304 | |
| 28 | W | | 24·125 | +6·653 | + 2·918 | +1·636 | +0·275 | +11·482 | 35·607 | |
| 29 | E | α (1) | 26·175 | +6·673 | + 2·929 | —1·408 | —0·254 | + 7·940 | 34·115 | |
| 30 | E | 70° | 25·650 | +6·661 | + 2·941 | —1·720 | +0·741 | + 8·623 | 34·273 | 35·477 |
| 31 | W | | 24·575 | +6·697 | + 2·957 | +2·059 | +0·212 | +11·925 | 36·500 | |
| Feb. 2 | W | | 25·175 | +6·681 | + 2·988 | +1·730 | +0·317 | +11·716 | 36·891 | |

Mean 6° 44′ 34″·9662

Mean Result of both Faces..... 6° 44′ 34″·8363

5 A

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No. 31 (956) 82 GEMINOR *B.* South 5° 58′ +

Face A to the Fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 46″·050 | +5″·927 | + 4″·250 | +3″·203 | —0″·698 | +12″·682 | 58″·732 | |
| 5 | W | 20° *a* | 49·875 | +5·925 | + 4·178 | —2·361 | +0·931 | + 8·673 | 58·548 | 59″·136 |
| 6 | E | | 47·075 | +5·911 | + 4·106 | +1·166 | +1·228 | +12·411 | 59·486 | |
| 7 | W | | 49·175 | +5·923 | + 4·036 | —0·500 | +1·143 | +10·602 | 59·777 | |
| 8 | E | | 48·325 | +5·894 | + 3·967 | —0·250 | +0·974 | +10·585 | 58·910 | |
| 9 | W | 40° *a* | 45·675 | +5·882 | + 3·900 | +0·709 | +1·016 | +11·507 | 57·182 | 58·023 |
| 10 | E | | 47·350 | +5·908 | + 3·833 | —1·032 | +1·545 | +10·254 | 57·604 | |
| 11 | W | | 45·750 | +5·918 | + 3·769 | +1·118 | +1·841 | +12·646 | 58·396 | |
| 13 | W | 60° *a* | 52·275 | +5·947 | + 3·644 | —2·595 | +1·355 | + 8·351 | 60·626 | 58·273 |
| 14 | E | | 45·600 | +5·956 | + 3·583 | +2·013 | +0·825 | +12·377 | 57·977 | |
| 16 | E | | 46·500 | +5·941 | + 3·468 | +2·088 | +1·672 | +13·169 | 59·669 | |
| 17 | W | 30° *a* (1) | 51·475 | +5·953 | + 3·413 | —2·115 | +1·799 | + 9·050 | 60·525 | 59·026 |
| 18 | E | | 43·275 | +5·969 | + 3·360 | +3·260 | +0·825 | +13·414 | 56·689 | |
| 19 | W | | 53·700 | +5·987 | + 3·307 | —3·433 | —0·339 | + 5·522 | 59·222 | |
| 20 | E | | 50·300 | +5·948 | + 3·257 | +0·613 | +0·487 | +10·305 | 60·605 | |
| 21 | W | 50° *a* (1) | 50·850 | +5·962 | + 3·207 | —0·059 | +1·778 | +10·888 | 61·738 | 59·995 |
| 22 | E | | 47·050 | +5·964 | + 3·160 | +0·162 | +2·032 | +11·318 | 58·368 | |
| 23 | W | | 47·875 | +5·978 | + 3·115 | —0·769 | +3·069 | +11·393 | 59·268 | |
| 25 | E | | 45·100 | +5·913 | + 3·029 | +2·193 | +2·371 | +13·506 | 58·606 | |
| 26 | W | 70° *a* (1) | 45·900 | +5·924 | + 2·988 | +1·913 | +2·709 | +13·534 | 59·434 | 59·010 |
| 27 | E | | 50·150 | +5·957 | + 2·949 | —2·415 | +1·503 | + 7·994 | 58·144 | |
| 28 | W | | 46·275 | +5·980 | + 2·913 | +2·528 | +2·159 | +13·580 | 59·855 | |
| 29 | E | 60° *a* | 44·200 | +5·969 | + 2·879 | +0·584 | +3·958 | +13·390 | 57·590 | |
| 30 | W | | 48·250 | +5·967 | + 2·847 | —1·159 | +0·995 | + 8·650 | 56·900 | |

Mean 5° 58′ 58″·9105

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | | 47″·450 | +5″·977 | + 2″·814 | +3″·191 | +0″·868 | +12″·850 | 60″·300 | |
| Jan. 1 | W | 20° *a* | 54·800 | +5·988 | + 2·819 | —3·840 | +1·143 | + 6·110 | 60·910 | 59″·771 |
| 2 | E | | 43·000 | +6·023 | + 2·791 | +3·983 | +3·048 | +15·845 | 58·845 | |
| 3 | W | | 53·400 | +5·987 | + 2·765 | —4·055 | +0·931 | + 5·628 | 59·028 | |
| 4 | E | | 49·375 | +6·002 | + 2·741 | —0·634 | +1·545 | + 9·654 | 59·029 | |
| 5 | W | 40° *a* | 48·875 | +6·008 | + 2·717 | +0·396 | +1·609 | +10·730 | 59·605 | 59·198 |
| 6 | W | | 50·200 | +5·991 | + 2·696 | —0·696 | +0·614 | + 8·605 | 58·805 | |
| 7 | E | | 50·300 | +5·944 | + 2·677 | —0·183 | +0·614 | + 9·052 | 59·352 | |
| 8 | E | 60° *a* | 50·525 | +5·963 | + 2·659 | —1·641 | +2·138 | + 9·119 | 59·644 | |
| 10 | W | | 48·000 | +5·950 | + 2·630 | +0·394 | +1·016 | + 9·990 | 57·990 | 58·550 |
| 11 | E | | 47·250 | +5·915 | + 2·617 | +0·549 | +2·244 | +11·325 | 58·575 | |
| 12 | E | | 47·450 | +5·943 | + 2·606 | —1·008 | +2·328 | + 9·869 | 57·319 | |
| 13 | W | 30° *a* (1) | 51·100 | +5·989 | + 2·597 | +0·429 | +0·593 | + 9·608 | 60·708 | 58·207 |
| 14 | E | | 47·300 | +5·989 | + 2·590 | +0·004 | +0·423 | + 9·006 | 56·306 | |
| 15 | W | | 49·275 | +5·903 | + 2·583 | —0·556 | +1·291 | + 9·221 | 58·496 | |
| 18 | E | | 46·250 | +5·859 | + 2·575 | +0·308 | +0·487 | + 9·229 | 55·479 | |
| 19 | W | 50° *a* (1) | 49·550 | +5·928 | + 2·578 | —0·524 | +2·857 | +10·839 | 60·389 | |
| 24 | E | | 48·475 | +5·898 | + 2·605 | —0·196 | +1·291 | + 9·598 | 58·073 | 58·548 |
| 25 | W | | 49·650 | +5·910 | + 2·615 | +0·963 | +1·503 | +10·991 | 60·641 | |
| 27 | E | | 48·000 | +5·887 | + 2·639 | +0·365 | —0·698 | + 8·193 | 56·193 | |
| 28 | E | | 49·975 | +5·898 | + 2·653 | —1·636 | +1·355 | + 8·270 | 58·245 | |
| 29 | W | 70° *a* (1) | 48·425 | +5·914 | + 2·669 | +1·408 | +0·275 | +10·266 | 58·691 | |
| 30 | W | | 47·925 | +5·905 | + 2·685 | +1·720 | +0·741 | +11·051 | 58·976 | 58·340 |
| 31 | E | | 50·550 | +5·938 | + 2·704 | —2·059 | +0·593 | + 7·176 | 57·726 | |
| Feb. 1 | W | | 48·400 | +5·899 | + 2·724 | +1·668 | 0·000 | +10·291 | 58·691 | |
| 2 | E | | 49·925 | +5·923 | + 2·744 | —1·730 | +0·847 | + 7·784 | 57·709 | |

Mean 5° 58′ 58″·7690

Mean Result of both Faces..... 5° 58′ 58″·8398

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## No. 32 (989) 9 CANCRI $\mu^1$. South 6° 25′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 30″·075 | +6″·382 | + 3″·591 | —3″·203 | —0″·148 | + 6″·622 | 36″·697 | |
| 5 | E | 20° *a* | 23·675 | +6·372 | + 3·505 | +2·361 | +1·820 | +14·058 | 37·733 | 36″·390 |
| 6 | W | | 26·350 | +6·355 | + 3·420 | —1·166 | +1·101 | + 9·710 | 36·060 | |
| 7 | E | | 23·275 | +6·373 | + 3·335 | +0·500 | +1·587 | +11·795 | 35·070 | |
| 8 | W | | 24·425 | +6·330 | + 3·252 | +0·250 | +1·418 | +11·250 | 35·675 | |
| 9 | E | 40° *a* | 24·650 | +6·326 | + 3·171 | —0·709 | +1·312 | +10·100 | 34·750 | 35·995 |
| 10 | W | | 24·675 | +6·346 | + 3·091 | +1·032 | +1·630 | +12·099 | 36·774 | |
| 11 | E | | 26·550 | +6·368 | + 3·013 | —1·118 | +1·968 | +10·231 | 36·781 | |
| 13 | E | | 21·925 | +6·396 | + 2·861 | +2·595 | +1·079 | +12·931 | 34·856 | |
| 14 | W | 60° *a* | 28·150 | +6·406 | + 2·787 | —2·013 | +0·614 | + 7·794 | 35·944 | 36·307 |
| 15 | E | | 24·250 | +6·370 | + 2·714 | +1·534 | +1·651 | +12·269 | 36·519 | |
| 16 | W | | 28·825 | +6·388 | + 2·645 | —2·088 | +2·222 | + 9·167 | 37·992 | |
| 17 | E | 30° *a* (1) | 23·600 | +6·403 | + 2·577 | +2·115 | +1·566 | +12·661 | 36·261 | 36·274 |
| 18 | W | | 29·275 | +6·420 | + 2·511 | —3·260 | +0·550 | + 6·221 | 35·496 | |
| 19 | E | | 22·775 | +6·441 | + 2·445 | +3·433 | +0·254 | +12·573 | 35·348 | |
| 20 | W | | 28·925 | +6·392 | + 2·383 | —0·613 | +0·825 | + 8·987 | 37·912 | |
| 21 | E | 50° *a* (1) | 26·250 | +6·406 | + 2·320 | +0·059 | +1·863 | +10·648 | 36·898 | 37·171 |
| 22 | W | | 26·225 | +6·420 | + 2·261 | —0·162 | +2·773 | +11·292 | 37·517 | |
| 23 | E | | 23·650 | +6·434 | + 2·203 | +0·769 | +3·302 | +12·708 | 36·358 | |
| 25 | W | | 29·750 | +6·354 | + 2·093 | —2·193 | +2·328 | + 8·582 | 38·332 | |
| 26 | E | 70° *a* (1) | 30·150 | +6·368 | + 2·039 | —1·913 | +2·561 | + 9·055 | 39·205 | 37·537 |
| 27 | W | | 25·000 | +6·414 | + 1·988 | +2·415 | +1·016 | +11·833 | 36·833 | |
| 28 | E | | 27·325 | +6·437 | + 1·942 | —2·528 | +2·603 | + 8·454 | 35·779 | |
| 29 | W | 60° *a* | 25·550 | +6·422 | + 1·896 | —0·584 | +4·530 | +12·264 | 37·814 | |
| 30 | E | | 25·175 | +6·414 | + 1·852 | +1·159 | +1·228 | +10·653 | 35·828 | |

Mean 6° 25′ 36″·6123

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 30″·025 | +6″·434 | + 1″·808 | —3″·191 | +2″·117 | + 7″·168 | 37″·193 | |
| Jan. 1 | E | 20° *a* | 23·875 | +6·447 | + 1·797 | +3·840 | +0·847 | +12·931 | 36·806 | 36″·767 |
| 2 | W | | 28·575 | +6·485 | + 1·759 | —3·983 | +3·831 | + 8·092 | 36·667 | |
| 3 | E | | 23·325 | +6·431 | + 1·723 | +4·055 | +0·868 | +13·077 | 36·402 | |
| 4 | W | | 27·625 | +6·463 | + 1·687 | +0·634 | +1·693 | +10·477 | 38·102 | |
| 5 | E | 40° *a* | 27·200 | +6·471 | + 1·654 | —0·396 | +1·376 | + 9·105 | 36·305 | 37·613 |
| 6 | E | | 25·925 | +6·453 | + 1·623 | +0·696 | +1·609 | +10·381 | 36·306 | |
| 7 | W | | 31·375 | +6·396 | + 1·594 | +0·183 | +0·190 | + 8·363 | 39·738 | |
| 8 | W | | 26·275 | +6·413 | + 1·566 | +1·641 | +2·265 | +11·885 | 38·160 | |
| 9 | E | 60° *a* | 23·225 | +6·434 | + 1·541 | —1·184 | +4·000 | +10·791 | 34·016 | 36·672 |
| 10 | E | | 27·925 | +6·392 | + 1·518 | —0·394 | +0·995 | + 8·511 | 36·436 | |
| 11 | W | | 27·025 | +6·359 | + 1·495 | +0·549 | +2·646 | +11·049 | 38·074 | |
| 12 | W | | 27·400 | +6·395 | + 1·475 | +1·008 | +2·667 | +11·545 | 38·945 | |
| 13 | E | 30° *a* (1) | 27·450 | +6·441 | + 1·458 | —0·429 | +0·698 | + 8·168 | 35·618 | 36·673 |
| 14 | W | | 28·500 | +6·440 | + 1·442 | —0·004 | +1·143 | + 9·021 | 37·521 | |
| 15 | E | | 24·750 | +6·350 | + 1·427 | +0·556 | +1·524 | + 9·857 | 34·607 | |
| 18 | W | | 28·500 | +6·308 | + 1·396 | —0·308 | +0·529 | + 7·925 | 36·425 | |
| 19 | E | 50° *a* (1) | 23·750 | +6·383 | + 1·391 | +0·524 | +2·625 | +10·923 | 34·673 | 35·697 |
| 24 | W | | 27·650 | +6·343 | + 1·384 | +0·196 | +1·376 | + 9·299 | 36·949 | |
| 25 | E | | 27·575 | +6·361 | + 1·388 | —0·963 | +0·381 | + 7·167 | 34·742 | |
| 28 | W | | 27·125 | +6·344 | + 1·409 | +1·636 | +1·566 | +10·955 | 38·080 | |
| 31 | W | 70° *a* (1) | 27·575 | +6·388 | + 1·445 | +2·059 | +0·762 | +10·654 | 38·229 | 37·451 |
| Feb. 1 | E | | 30·050 | +6·346 | + 1·460 | —1·668 | +0·085 | + 6·223 | 36·273 | |
| 2 | E | | 29·625 | +6·368 | + 1·476 | —1·730 | +1·482 | + 7·596 | 37·221 | |

Mean 6° 25′ 36″·8122

Mean Result of both Faces ..... 6° 25′ 36″·7123

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## G. T. STATION KALIANA.

No. 33 (999) 15 Cancri $\psi^3$. North 0° 36′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 20° α | 62″·075 | +0″·610 | — 1″·546 | —3″·203 | +0″·169 | — 3″·970 | 58″·105 | 58″·925 |
| 5 | W | | 60·100 | +0·609 | — 1·487 | +2·361 | —1·270 | + 0·213 | 60·313 | |
| 6 | E | | 61·400 | +0·608 | — 1·429 | —1·166 | —0·783 | — 2·770 | 58·630 | |
| 7 | W | | 60·800 | +0·609 | — 1·372 | +0·500 | —1·884 | — 2·147 | 58·653 | |
| 8 | E | 40° α | 59·900 | +0·605 | — 1·318 | +0·250 | —0·317 | — 0·780 | 59·120 | 60·768 |
| 9 | W | | 64·300 | +0·605 | — 1·266 | —0·709 | —1·143 | — 2·513 | 61·787 | |
| 10 | E | | 62·275 | +0·607 | — 1·215 | +1·032 | —1·312 | — 0·888 | 61·387 | |
| 11 | W | | 64·275 | +0·609 | — 1·168 | —1·118 | —1·820 | — 3·497 | 60·778 | |
| 13 | W | 60° α | 59·175 | +0·612 | — 1·078 | +2·595 | —0·677 | + 1·452 | 60·627 | 60·868 |
| 14 | E | | 64·075 | +0·612 | — 1·035 | —2·013 | —0·847 | — 3·283 | 60·792 | |
| 15 | W | | 61·575 | +0·609 | — 0·995 | +1·534 | —0·677 | + 0·471 | 62·046 | |
| 16 | E | 30° α (1) | 64·950 | +0·611 | — 0·959 | —2·088 | —1·397 | — 3·833 | 61·117 | 61·357 |
| 17 | W | | 59·725 | +0·612 | — 0·924 | +2·115 | —0·550 | + 1·253 | 60·978 | |
| 18 | E | | 66·200 | +0·614 | — 0·892 | —3·260 | —0·254 | — 3·792 | 62·408 | |
| 19 | W | | 58·075 | +0·616 | — 0·860 | +3·433 | —0·339 | + 2·850 | 60·925 | |
| 20 | E | 50° α (1) | 63·525 | +0·611 | — 0·832 | —0·613 | —0·275 | — 1·109 | 62·416 | 60·689 |
| 21 | W | | 62·100 | +0·612 | — 0·804 | +0·059 | —1·058 | — 1·191 | 60·909 | |
| 22 | E | | 61·400 | +0·614 | — 0·781 | —0·162 | —2·307 | — 2·636 | 58·764 | |
| 23 | W | | 63·175 | +0·615 | — 0·758 | +0·769 | —3·133 | — 2·507 | 60·668 | |
| 25 | E | 70° α (1) | 62·450 | +0·607 | — 0·722 | —2·193 | —0·889 | — 3·197 | 59·253 | 60·306 |
| 26 | W | | 63·400 | +0·609 | — 0·705 | —1·913 | —0·169 | — 2·178 | 61·222 | |
| 27 | E | | 58·425 | +0·613 | — 0·692 | +2·415 | —0·275 | + 2·061 | 60·486 | |
| 28 | W | | 64·825 | +0·616 | — 0·683 | —2·528 | —1·968 | — 4·563 | 60·262 | |
| 29 | E | 60° α | 61·975 | +0·614 | — 0·675 | —0·584 | —2·349 | — 2·994 | 58·981 | |
| 30 | W | | 62·050 | +0·613 | — 0·670 | +1·159 | —0·275 | + 0·827 | 62·877 | |

Mean 0° 37′ 0″·4855

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | 20° α | 66″·200 | +0″·615 | — 0″·664 | —3″·191 | —2″·794 | — 6″·034 | 60″·166 | 60″·348 |
| Jan. 1 | W | | 56·875 | +0·617 | — 0·693 | +3·840 | —0·169 | + 3·595 | 60·470 | |
| 2 | E | | 66·600 | +0·620 | — 0·694 | —3·983 | —3·937 | — 7·994 | 58·606 | |
| 3 | W | | 59·975 | +0·615 | — 0·698 | +4·055 | —1·799 | + 2·173 | 62·148 | |
| 4 | E | 40° α | 61·450 | +0·618 | — 0·702 | +0·634 | —0·868 | — 0·318 | 61·132 | 61·378 |
| 5 | W | | 60·525 | +0·619 | — 0·709 | —0·396 | 0·000 | — 0·486 | 60·039 | |
| 6 | W | | 63·250 | +0·617 | — 0·718 | +0·696 | —2·709 | — 2·114 | 61·136 | |
| 7 | E | | 63·350 | +0·612 | — 0·730 | +0·183 | —0·212 | — 0·147 | 63·203 | |
| 8 | E | 60° α | 59·350 | +0·613 | — 0·743 | +1·641 | —1·270 | + 0·241 | 59·591 | 60·603 |
| 9 | W | | 64·250 | +0·615 | — 0·759 | —1·184 | —3·344 | — 4·672 | 59·578 | |
| 10 | W | | 62·625 | +0·611 | — 0·777 | —0·394 | —0·571 | — 1·131 | 61·494 | |
| 11 | E | | 63·250 | +0·608 | — 0·796 | +0·549 | —1·863 | — 1·502 | 61·748 | |
| 12 | E | 30° α (1) | 62·750 | +0·611 | — 0·816 | +1·008 | —1·884 | — 1·081 | 61·669 | 60·254 |
| 13 | W | | 60·175 | +0·616 | — 0·842 | —0·429 | —0·212 | — 0·867 | 59·308 | |
| 14 | E | | 62·000 | +0·616 | — 0·867 | —0·004 | —1·249 | — 1·504 | 60·496 | |
| 15 | W | | 60·925 | +0·607 | — 0·895 | +0·556 | —1·651 | — 1·383 | 59·542 | |
| 18 | E | 50° α (1) | 61·200 | +0·603 | — 0·989 | —0·308 | +0·042 | — 0·652 | 60·548 | 60·482 |
| 19 | W | | 61·900 | +0·611 | — 1·026 | +0·524 | —2·392 | — 2·283 | 59·617 | |
| 24 | E | | 61·925 | +0·606 | — 1·231 | +0·196 | —0·656 | — 1·085 | 60·840 | |
| 25 | W | | 62·025 | +0·608 | — 1·277 | —0·963 | +0·529 | — 1·103 | 60·922 | |
| 28 | E | 70° α (1) | 61·925 | +0·607 | — 1·425 | +1·636 | —1·058 | — 0·240 | 61·685 | 60·784 |
| 30 | W | | 63·275 | +0·607 | — 1·531 | —1·720 | —0·635 | — 3·279 | 59·996 | |
| 31 | E | | 60·950 | +0·611 | — 1·587 | +2·059 | —0·042 | + 1·041 | 61·991 | |
| Feb. 2 | W | | 63·050 | +0·609 | — 1·702 | —1·730 | —0·762 | — 3·585 | 59·465 | |

Mean 0° 37′ 0″·6415

Mean Result of both Faces ..... 0° 37′ 0″·5635

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No. 34 (1037) 33 CANCRI $\eta$. South 8° 31′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | α 20° | 52″·350 | +8″·493 | + 3″·018 | −3″·203 | −0″·360 | + 7″·948 | 60″·298 | 60″·689 |
| 5 | E | | 47·400 | +8·496 | + 2·904 | +2·361 | +0·868 | +14·629 | 62·029 | |
| 6 | W | | 49·275 | +8·471 | + 2·792 | −1·166 | +0·847 | +10·944 | 60·219 | |
| 7 | E | | 47·575 | +8·501 | + 2·680 | +0·500 | +0·952 | +12·633 | 60·208 | |
| 8 | W | α 40° | 49·075 | +8·448 | + 2·571 | +0·250 | +0·296 | +11·565 | 60·640 | 60·952 |
| 9 | E | | 49·300 | +8·458 | + 2·463 | −0·709 | +1·968 | +12·180 | 61·480 | |
| 10 | W | | 47·275 | +8·460 | + 2·355 | +1·032 | +1·249 | +13·096 | 60·371 | |
| 11 | E | | 50·450 | +8·483 | + 2·251 | −1·118 | +1·249 | +10·865 | 61·315 | |
| 12 | W | α 60° | 51·750 | +8·451 | + 2·147 | −3·114 | +1·164 | + 8·648 | 60·398 | 60·569 |
| 13 | E | | 46·400 | +8·524 | + 2·045 | +2·595 | +0·656 | +13·820 | 60·220 | |
| 14 | W | | 51·100 | +8·541 | + 1·943 | −2·013 | +1·503 | + 9·974 | 61·074 | |
| 15 | E | | 46·225 | +8·490 | + 1·844 | +1·534 | +0·656 | +12·524 | 58·749 | |
| 16 | W | α (1) 30° | 52·000 | +8·514 | + 1·747 | −2·088 | +1·312 | + 9·485 | 61·485 | 61·378 |
| 17 | E | | 47·350 | +8·527 | + 1·652 | +2·115 | +0·148 | +12·442 | 59·792 | |
| 18 | W | | 54·100 | +8·564 | + 1·560 | −3·260 | +1·079 | + 7·943 | 62·043 | |
| 19 | E | | 49·150 | +8·584 | + 1·467 | +3·433 | −0·444 | +13·040 | 62·190 | |
| 20 | W | α (1) 50° | 53·625 | +8·533 | + 1·378 | −0·613 | −1·249 | + 8·049 | 61·674 | 61·920 |
| 21 | E | | 51·875 | +8·525 | + 1·288 | +0·059 | +0·614 | +10·486 | 62·361 | |
| 22 | W | | 50·150 | +8·549 | + 1·202 | −0·162 | +2·201 | +11·790 | 61·940 | |
| 23 | E | | 48·525 | +8·583 | + 1·118 | +0·769 | +2·709 | +13·179 | 61·704 | |
| 25 | W | α (1) 70° | 52·800 | +8·471 | + 0·955 | −2·193 | +0·952 | + 8·185 | 60·985 | 60·769 |
| 26 | E | | 54·050 | +8·489 | + 0·874 | −1·913 | −0·317 | + 7·133 | 61·183 | |
| 27 | W | | 48·675 | +8·544 | + 0·798 | +2·415 | +0·847 | +12·604 | 61·279 | |
| 28 | E | | 51·125 | +8·572 | + 0·725 | −2·528 | +1·736 | + 8·505 | 59·630 | |
| 29 | W | α 60° | 51·025 | +8·555 | + 0·653 | −0·584 | +1·609 | +10·233 | 61·258 | |
| 30 | E | | 50·575 | +8·552 | + 0·584 | +1·159 | +0·842 | +11·137 | 61·712 | |

Mean 8° 32′ 1″·0462

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | α 20° | 55″·900 | +8″·580 | + 0″·514 | −3″·191 | +1″·714 | + 7″·617 | 63″·517 | 62″·184 |
| Jan. 1 | E | | 47·525 | +8·587 | + 0·473 | +3·840 | +0·212 | +13·112 | 60·637 | |
| 2 | W | | 53·875 | +8·646 | + 0·409 | −3·983 | +3·514 | + 8·586 | 62·461 | |
| 3 | E | | 47·300 | +8·576 | + 0·348 | +4·055 | +1·841 | +14·820 | 62·120 | |
| 4 | W | α 40° | 51·025 | +8·618 | + 0·287 | +0·634 | +0·783 | +10·322 | 61·347 | 61·623 |
| 5 | E | | 53·825 | +8·620 | + 0·229 | −0·396 | −1·270 | + 7·183 | 61·008 | |
| 6 | E | | 48·025 | +8·620 | + 0·173 | +0·696 | +3·746 | +13·235 | 61·260 | |
| 7 | W | | 51·950 | +8·549 | + 0·120 | +0·183 | +2·074 | +10·926 | 62·876 | |
| 8 | W | α 60° | 51·175 | +8·544 | + 0·068 | +1·641 | +0·825 | +11·078 | 62·253 | 61·000 |
| 9 | E | | 48·925 | +8·587 | + 0·019 | −1·184 | +3·069 | +10·491 | 59·416 | |
| 10 | E | | 51·725 | +8·523 | − 0·029 | −0·394 | +0·995 | + 9·095 | 60·820 | |
| 11 | W | | 50·800 | +8·479 | − 0·074 | +0·549 | +1·757 | +10·711 | 61·511 | |
| 12 | W | α (1) 30° | 52·575 | +8·528 | − 0·118 | +1·008 | +1·714 | +11·132 | 63·707 | 61·409 |
| 13 | E | | 51·800 | +8·588 | − 0·158 | −0·429 | +0·169 | + 8·170 | 59·970 | |
| 14 | W | | 52·225 | +8·586 | − 0·197 | −0·004 | +1·482 | + 9·867 | 62·092 | |
| 15 | E | | 49·000 | +8·472 | − 0·234 | +0·556 | +2·074 | +10·868 | 59·868 | |
| 18 | W | α (1) 50° | 55·150 | +8·406 | − 0·332 | −0·308 | −0·529 | + 7·237 | 62·387 | 61·698 |
| 24 | E | | 51·325 | +8·452 | − 0·468 | −0·196 | +1·672 | + 9·460 | 60·785 | |
| 25 | E | | 54·750 | +8·486 | − 0·483 | −0·963 | −0·614 | + 6·426 | 61·176 | |
| 27 | W | | 55·650 | +8·430 | − 0·508 | −0·365 | −0·762 | + 6·795 | 62·445 | |
| 28 | W | α (1) 70° | 53·275 | +8·458 | − 0·518 | +1·636 | +0·487 | +10·063 | 63·338 | 61·494 |
| 29 | E | | 52·100 | +8·473 | − 0·526 | −1·408 | +0·254 | + 6·793 | 58·893 | |
| 30 | E | | 52·000 | +8·468 | − 0·533 | −1·720 | +1·291 | + 7·506 | 59·506 | |
| 31 | W | | 52·075 | +8·512 | − 0·536 | +2·059 | −0·063 | + 9·972 | 62·047 | |
| Feb. 1 | E | | 53·475 | +8·455 | − 0·538 | −1·668 | +0·487 | + 6·736 | 60·211 | |
| 2 | W | | 53·850 | +8·486 | − 0·538 | +1·730 | +1·439 | +11·117 | 64·967 | |

Mean 8° 32′ 1″·5680

Mean Result of both Faces ..... 8° 32′ 1″·3071

5 B

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## G. T. STATION KALIANA.

### No. 35 (1060) 43 Cancri γ. South 7° 28′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 20° α | 13″·600 | +7″·419 | + 2″·277 | +3″·203 | +1″·016 | +13″·915 | 27″·515 | 27″·466 |
| 5 | W | | 18·750 | +7·431 | + 2·160 | −2·361 | +1·651 | + 8·881 | 27·631 | |
| 6 | E | | 15·650 | +7·409 | + 2·045 | +1·166 | +1·524 | +12·144 | 27·794 | |
| 7 | W | | 16·150 | +7·437 | + 1·931 | −0·500 | +1·905 | +10·773 | 26·923 | |
| 8 | E | 40° α | 17·400 | +7·395 | + 1·819 | −0·250 | +3·217 | +12·181 | 29·581 | 28·300 |
| 9 | W | | 15·275 | +7·408 | + 1·708 | +0·709 | +3·069 | +12·894 | 28·169 | |
| 10 | E | | 17·075 | +7·400 | + 1·599 | −1·032 | +2·455 | +10·422 | 27·497 | |
| 11 | W | | 16·275 | +7·415 | + 1·492 | +1·118 | +1·651 | +11·676 | 27·951 | |
| 13 | W | 60° α | 22·775 | +7·454 | + 1·282 | −2·595 | +0·847 | + 6·988 | 29·763 | 27·561 |
| 14 | E | | 14·725 | +7·471 | + 1·179 | +2·013 | +1·757 | +12·420 | 27·145 | |
| 15 | W | | 19·700 | +7·426 | + 1·078 | −1·534 | +1·312 | + 8·282 | 27·982 | |
| 16 | E | 30° α (1) | 13·950 | +7·445 | + 0·980 | +2·008 | +2·688 | +13·121 | 27·071 | 28·399 |
| 17 | W | | 25·200 | +7·454 | + 0·884 | −2·115 | +0·698 | + 6·921 | 32·121 | |
| 18 | E | | 13·300 | +7·493 | + 0·791 | +3·260 | +1·841 | +13·385 | 26·685 | |
| 19 | W | | 23·625 | +7·506 | + 0·697 | −3·433 | −0·677 | + 4·093 | 27·718 | |
| 20 | E | 50° α (1) | 18·600 | +7·470 | + 0·606 | +0·613 | −0·275 | + 8·414 | 27·014 | 28·131 |
| 21 | W | | 19·225 | +7·451 | + 0·515 | −0·059 | +2·180 | +10·087 | 29·312 | |
| 22 | E | | 16·050 | +7·472 | + 0·429 | +0·162 | +2·307 | +10·370 | 26·420 | |
| 23 | W | | 19·775 | +7·508 | + 0·344 | −0·769 | +2·921 | +10·004 | 29·779 | |
| 25 | E | 70° α (1) | 13·000 | +7·410 | + 0·181 | +2·193 | +2·984 | +12·768 | 25·768 | 27·489 |
| 26 | W | | 17·700 | +7·426 | + 0·100 | +1·913 | +2·328 | +11·767 | 29·467 | |
| 27 | E | | 18·025 | +7·469 | + 0·023 | −2·415 | +2·434 | + 7·511 | 25·536 | |
| 28 | W | | 16·050 | +7·492 | − 0·049 | +2·528 | +3·163 | +13·134 | 29·184 | |
| 29 | E | 60° α | 16·175 | +7·479 | − 0·120 | +0·584 | +2·265 | +10·208 | 26·383 | |
| 30 | W | | 19·800 | +7·481 | − 0·190 | −1·159 | +1·397 | + 7·529 | 27·329 | |

Mean 7° 28′ 27″·8910

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | E | 20° α | 14″·275 | +7″·504 | − 0″·259 | +3″·191 | +2″·667 | +13″·103 | 27″·378 | 28″·228 |
| Jan. 1 | W | | 25·025 | +7·505 | − 0·302 | −3·840 | +0·825 | + 4·188 | 29·213 | |
| 2 | E | | 12·250 | +7·561 | − 0·365 | +3·983 | +3·852 | +15·031 | 27·281 | |
| 3 | W | | 24·175 | +7·503 | − 0·426 | −4·055 | +1·841 | + 4·863 | 29·038 | |
| 4 | E | 40° α | 18·725 | +7·536 | − 0·485 | −0·634 | +2·328 | + 8·745 | 27·470 | 28·225 |
| 5 | W | | 22·325 | +7·534 | − 0·542 | +0·396 | −0·614 | + 6·774 | 29·099 | |
| 7 | E | | 16·725 | +7·487 | − 0·649 | −0·183 | +3·852 | +10·507 | 27·232 | |
| 8 | E | 60° α | 19·700 | +7·471 | − 0·699 | −1·641 | +2·434 | + 7·565 | 27·265 | 28·036 |
| 9 | W | | 18·575 | +7·514 | − 0·746 | +1·184 | +4·043 | +11·995 | 30·570 | |
| 10 | W | | 19·800 | +7·456 | − 0·792 | +0·394 | +1·587 | + 8·645 | 28·445 | |
| 11 | E | | 17·525 | +7·417 | − 0·836 | −0·549 | +2·307 | + 8·339 | 25·864 | |
| 13 | W | 30° α (1) | 21·925 | +7·512 | − 0·915 | +0·429 | +1·757 | + 8·783 | 30·708 | 28·775 |
| 14 | E | | 18·400 | +7·510 | − 0·951 | +0·004 | +1·990 | + 8·553 | 26·953 | |
| 15 | W | | 22·475 | +7·413 | − 0·986 | −0·556 | +2·138 | + 8·009 | 30·484 | |
| 18 | E | 50° α (1) | 19·250 | +7·349 | − 1·075 | +0·308 | −0·042 | + 6·540 | 25·790 | 27·461 |
| 24 | W | | 21·900 | +7·391 | − 1·191 | +0·196 | +1·460 | + 7·856 | 29·756 | |
| 25 | W | | 21·600 | +7·423 | − 1·203 | +0·963 | −0·275 | + 6·908 | 28·508 | |
| 28 | E | 70° α (1) | 19·800 | +7·398 | − 1·226 | −1·636 | +1·185 | + 5·721 | 25·521 | 27·802 |
| 29 | W | | 20·625 | +7·411 | − 1·229 | +1·408 | +0·762 | + 8·352 | 28·977 | |
| 30 | W | | 19·500 | +7·408 | − 1·232 | +1·720 | +1·630 | + 9·526 | 29·026 | |
| 31 | E | | 21·725 | +7·443 | − 1·230 | −2·059 | +0·952 | + 5·106 | 26·831 | |
| Feb. 1 | W | | 21·750 | +7·392 | − 1·228 | +1·668 | +0·444 | + 8·276 | 30·026 | |
| 2 | E | | 20·675 | +7·420 | − 1·224 | −1·730 | +1·291 | + 5·757 | 26·432 | |

Mean 7° 28′ 28″·0878

Mean Result of both Faces..... 7° 28′ 27″·9894

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## No. 36 (216) 61 CANCRI. North 1° 19′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | * 's Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 42″·525 | +1″·311 | + 0″·973 | +3″·203 | +0″·212 | + 5″·699 | 48″·224 | |
| 5 | E | | 48·275 | +1·315 | + 1·068 | —2·361 | —0·614 | — 0·592 | 47·683 | |
| 6 | W | 20° α | 48·275 | +1·311 | + 1·160 | +1·166 | —1·482 | + 2·155 | 50·430 | 48″·566 |
| 7 | E | | 47·575 | +1·316 | + 1·250 | —0·500 | —1·714 | + 0·352 | 47·927 | |
| 8 | W | | 48·225 | +1·310 | + 1·338 | —0·250 | —2·307 | + 0·091 | 48·316 | |
| 9 | E | | 44·900 | +1·314 | + 1·423 | +0·709 | —2·413 | + 1·033 | 45·933 | |
| 10 | W | 40° α | 49·275 | +1·310 | + 1·507 | —1·032 | —2·730 | — 0·945 | 48·330 | 47·407 |
| 11 | E | | 44·875 | +1·311 | + 1·587 | +1·118 | —1·841 | + 2·175 | 47·050 | |
| 13 | E | | 48·950 | +1·319 | + 1·740 | —2·595 | 0·000 | + 0·464 | 49·414 | |
| 14 | W | 60° α | 44·825 | +1·322 | + 1·814 | +2·013 | —1·058 | + 4·091 | 48·916 | 48·808 |
| 15 | E | | 49·425 | +1·314 | + 1·885 | —1·534 | —1·968 | — 0·303 | 49·122 | |
| 16 | W | | 45·975 | +1·317 | + 1·952 | +2·088 | —2·117 | + 3·240 | 49·215 | |
| 17 | E | 30° α (1) | 50·675 | +1·318 | + 2·018 | —2·115 | —0·402 | + 0·819 | 51·494 | |
| 18 | W | | 42·100 | +1·327 | + 2·078 | +3·260 | —1·482 | + 5·183 | 47·283 | 49·148 |
| 19 | E | | 48·250 | +1·328 | + 2·139 | —3·433 | +0·317 | + 0·351 | 48·601 | |
| 20 | W | | 45·050 | +1·324 | + 2·196 | +0·613 | —0·190 | + 3·943 | 48·993 | |
| 21 | E | 50° α (1) | 48·450 | +1·317 | + 2·253 | —0·059 | —1·079 | + 2·432 | 50·882 | |
| 22 | W | | 46·700 | +1·321 | + 2·304 | +0·162 | —1·863 | + 1·924 | 48·624 | 49·755 |
| 23 | E | | 50·825 | +1·329 | + 2·353 | —0·769 | —3·217 | — 0·304 | 50·521 | |
| 25 | W | | 43·575 | +1·312 | + 2·443 | +2·193 | —1·397 | + 4·551 | 48·126 | |
| 26 | E | 70° α (1) | 44·900 | +1·314 | + 2·487 | +1·913 | —2·392 | + 3·322 | 48·222 | |
| 27 | W | | 49·675 | +1·321 | + 2·525 | —2·415 | —2·392 | — 0·961 | 48·714 | 48·543 |
| 28 | E | | 45·175 | +1·325 | + 2·558 | +2·528 | —2·476 | + 3·935 | 49·110 | |
| 29 | W | 60° α | 46·625 | +1·323 | + 2·590 | +0·584 | —2·286 | + 2·211 | 48·836 | |
| 30 | E | | 46·550 | +1·324 | + 2·619 | —1·159 | —1·651 | + 1·133 | 47·683 | |

Mean 1° 19′ 48″·7045

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | * 's Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 31 | W | | 43″·925 | +1″·328 | + 2″·647 | +3″·191 | —2″·561 | + 4″·605 | 48″·530 | |
| Jan. 1 | E | | 48·425 | +1·327 | + 2·546 | —3·840 | —0·021 | + 0·012 | 48·437 | |
| 2 | W | 20° α | 44·325 | +1·338 | + 2·567 | +3·983 | —2·730 | + 5·158 | 49·483 | 48″·746 |
| 3 | E | | 50·750 | +1·328 | + 2·585 | —4·055 | —2·074 | — 2·216 | 48·534 | |
| 4 | W | | 46·600 | +1·333 | + 2·602 | —0·634 | —1·566 | + 1·735 | 48·335 | |
| 5 | E | | 45·700 | +1·332 | + 2·615 | +0·396 | +0·698 | + 5·041 | 50·741 | |
| 6 | E | 40° α | 50·200 | +1·337 | + 2·626 | —0·696 | —3·090 | + 0·177 | 50·377 | 49·306 |
| 7 | W | | 47·950 | +1·327 | + 2·633 | —0·183 | —3·958 | — 0·181 | 47·769 | |
| 8 | W | | 46·375 | +1·322 | + 2·639 | —1·641 | —1·905 | + 0·415 | 46·790 | |
| 9 | E | | 45·875 | +1·331 | + 2·641 | +1·184 | —3·471 | + 1·685 | 47·560 | |
| 10 | E | 60° α | 46·525 | +1·320 | + 2·641 | +0·394 | —1·905 | + 2·450 | 48·975 | 47·850 |
| 11 | W | | 47·425 | +1·313 | + 2·639 | —0·549 | —2·752 | + 0·651 | 48·076 | |
| 13 | E | | 46·850 | +1·329 | + 2·624 | +0·429 | —1·228 | + 3·154 | 50·004 | |
| 14 | W | 30° α (1) | 43·275 | +1·329 | + 2·614 | +0·004 | —0·995 | + 2·952 | 46·227 | 48·167 |
| 15 | E | | 48·375 | +1·312 | + 2·601 | —0·556 | —1·524 | + 1·833 | 50·208 | |
| 18 | W | | 43·750 | +1·300 | + 2·545 | +0·308 | +0·677 | + 4·830 | 48·580 | |
| 24 | E | 50° α (1) | 46·275 | +1·308 | + 2·363 | +0·196 | —0·783 | + 3·084 | 49·359 | |
| 25 | E | | 43·350 | +1·314 | + 2·325 | +0·963 | +1·249 | + 5·851 | 49·201 | 48·919 |
| 27 | W | | 44·225 | +1·303 | + 2·241 | +0·365 | +0·402 | + 4·311 | 48·536 | |
| 28 | W | | 48·900 | +1·309 | + 2·195 | —1·636 | —1·651 | + 0·217 | 49·117 | |
| 29 | E | | 46·800 | +1·312 | + 2·148 | +1·408 | —0·889 | + 3·979 | 50·779 | |
| 30 | E | 70° α (1) | 45·500 | +1·312 | + 2·099 | +1·720 | —0·741 | + 4·390 | 49·890 | 49·289 |
| 31 | W | | 47·450 | +1·317 | + 2·046 | —2·059 | —0·825 | + 0·479 | 47·929 | |
| Feb. 2 | W | | 46·950 | +1·313 | + 1·937 | —1·730 | —0·783 | + 0·737 | 47·687 | |

Mean 1° 19′ 48″·7128

Mean Result of both Faces ..... 1° 19′ 48″·7087

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## G. T. STATION KALIANPUR.

### No. 1 (362) 61 Arietis $\tau'$. South 3° 32′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | W | | 63″·875 | +3″·287 | +11″·626 | −3″·206 | +0″·680 | +12″·387 | 76″·262 | |
| Dec. 1 | E | | 53·025 | +3·295 | +11·650 | +3·550 | +1·985 | +20·480 | 73·505 | |
| 2 | W | | 60·075 | +3·308 | +11·674 | −1·654 | +1·342 | +14·670 | 74·745 | |
| 3 | E | 60° α | 55·450 | +3·297 | +11·696 | +1·960 | +1·011 | +17·964 | 73·414 | 74·885 |
| 4 | W | | 61·250 | +3·308 | +11·717 | −1·663 | +1·139 | +14·501 | 75·751 | |
| 5 | E | | 58·000 | +3·295 | +11·737 | +0·092 | +1·599 | +16·723 | 74·723 | |
| 6 | W | | 58·100 | +3·268 | +11·755 | +3·340 | +0·551 | +18·914 | 77·014 | |
| 7 | E | | 61·025 | +3·269 | +11·772 | −2·288 | −0·110 | +12·643 | 73·668 | |
| 8 | W | | 59·950 | +3·282 | +11·789 | +2·348 | −0·165 | +17·254 | 77·204 | |
| 9 | E | | 62·850 | +3·292 | +11·805 | −3·571 | −1·507 | +10·019 | 72·869 | |
| 10 | W | 40° α | 57·375 | +3·289 | +11·819 | +4·252 | −1·139 | +18·221 | 75·596 | 74·366 |
| 11 | E | | 61·425 | +3·293 | +11·833 | −4·371 | −0·386 | +10·369 | 71·794 | |
| 12 | W | | 59·375 | +3·285 | +11·846 | +1·756 | +0·312 | +17·199 | 76·574 | |
| 13 | E | | 56·850 | +3·272 | +11·857 | −0·408 | +2·775 | +17·496 | 74·346 | |
| 14 | W | 20° α | 59·950 | +3·264 | +11·867 | +1·217 | +1·066 | +17·414 | 77·364 | 75·490 |
| 15 | E | | 57·400 | +3·281 | +11·876 | −1·454 | +2·573 | +16·276 | 73·676 | |
| 16 | W | | 61·925 | +3·279 | +11·886 | −0·970 | +1·250 | +15·445 | 77·370 | |
| 17 | E | 30° α (1) | 57·950 | +3·288 | +11·894 | +0·788 | +0·698 | +16·668 | 74·618 | 75·823 |
| 18 | W | | 61·375 | +3·297 | +11·899 | +0·076 | +0·992 | +16·264 | 77·639 | |
| 19 | E | | 57·050 | +3·320 | +11·904 | +0·306 | +1·084 | +16·614 | 73·664 | |
| 20 | W | | 61·925 | +3·319 | +11·909 | −1·174 | +1·434 | +15·488 | 77·413 | |
| 21 | E | 50° α (1) | 57·100 | +3·309 | +11·913 | +1·218 | +0·864 | +17·304 | 74·404 | |
| 22 | W | | 61·350 | +3·324 | +11·914 | −0·991 | +1·911 | +16·158 | 77·508 | 75·533 |
| 23 | E | | 57·625 | +3·319 | +11·915 | +0·426 | −0·478 | +15·182 | 72·807 | |
| 25 | E | | 55·575 | +3·320 | +11·916 | −0·231 | +1·158 | +16·163 | 71·738 | |
| 26 | W | 70° α (1) | 63·350 | +3·335 | +11·916 | −1·171 | +1·525 | +15·605 | 78·955 | |
| 27 | E | | 57·225 | +3·349 | +11·913 | +0·853 | +0·074 | +16·189 | 73·414 | 75·815 |
| 28 | W | | 63·100 | +3·341 | +11·908 | +0·068 | +0·735 | +16·052 | 79·152 | |

Mean 3° 33′ 15″·3187

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 62″·900 | +3″·337 | +11″·903 | −1″·516 | +0″·055 | +13″·779 | 76″·679 | |
| 30 | E | 20° α | 56·875 | +3·335 | +11·897 | +1·006 | +0·459 | +16·697 | 73·572 | 75″·355 |
| 31 | W | | 61·550 | +3·342 | +11·890 | −1·854 | +1·029 | +14·407 | 75·957 | |
| Jan. 1 | E | | 51·800 | +3·341 | +11·927 | +6·471 | +1·672 | +23·411 | 75·211 | |
| 2 | W | | 60·825 | +3·354 | +11·919 | +0·601 | −1·305 | +14·569 | 75·394 | |
| 3 | E | 40° α | 59·650 | +3·345 | +11·910 | +0·019 | +0·753 | +16·027 | 75·677 | 75·519 |
| 4 | W | | 60·500 | +3·335 | +11·899 | −0·853 | +0·864 | +15·245 | 75·745 | |
| 5 | E | | 58·425 | +3·329 | +11·887 | −0·145 | +1·764 | +16·835 | 75·260 | |
| 6 | W | | 63·750 | +3·328 | +11·875 | −0·436 | −1·103 | +13·664 | 77·414 | |
| 7 | E | 60° α | 57·650 | +3·323 | +11·861 | −0·195 | +0·423 | +15·412 | 73·062 | 75·913 |
| 8 | W | | 64·725 | +3·316 | +11·846 | −0·436 | −0·680 | +14·046 | 78·771 | |
| 9 | E | | 59·850 | +3·296 | +11·830 | −0·554 | −0·018 | +14·554 | 74·404 | |
| 10 | W | | 60·100 | +3·280 | +11·814 | +1·135 | 0·000 | +16·229 | 76·329 | |
| 11 | E | 30° α (1) | 57·350 | +3·280 | +11·797 | −1·705 | +1·783 | +15·155 | 72·505 | 75·183 |
| 12 | W | | 59·700 | +3·300 | +11·778 | +1·336 | −0·184 | +16·230 | 75·930 | |
| 13 | E | | 67·700 | +3·312 | +11·758 | −9·246 | +2·444 | + 8·268 | 75·968 | |
| 14 | W | | 62·925 | +3·309 | +11·738 | −0·224 | −0·037 | +14·786 | 77·711 | |
| 15 | E | 50° α (1) | 61·500 | +3·283 | +11·717 | −0·333 | +0·551 | +15·218 | 76·718 | 76·055 |
| 16 | W | | 60·575 | +3·253 | +11·694 | −0·183 | −1·268 | +13·496 | 74·071 | |
| 17 | E | | 61·325 | +3·242 | +11·669 | +0·108 | −0·625 | +14·394 | 75·719 | |
| 18 | W | | 60·225 | +3·226 | +11·644 | +0·254 | −0·937 | +14·187 | 74·412 | |
| 19 | E | 70° α (1) | 61·825 | +3·233 | +11·619 | −0·849 | −0·018 | +13·985 | 75·810 | 76·048 |
| 21 | E | | 62·350 | +3·221 | +11·565 | −1·203 | +0·864 | +14·447 | 76·797 | |
| 22 | E | | 62·725 | +3·218 | +11·537 | −1·291 | +2·003 | +15·467 | 78·192 | |
| 23 | W | | 59·350 | +3·224 | +11·507 | +1·151 | +0·680 | +16·562 | 75·912 | |

Mean 3° 33′ 15″·6788

Mean Result of both Faces ..... 3° 33′ 15″·4988

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No. 2 (376) 66 ARIETIS. South 1° 51′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 30 | E | | 65″·025 | +1″·729 | +11″·741 | +3″·206 | +0″·368 | +17″·044 | 82″·069 | |
| Dec. 1 | W | | 69·775 | +1·733 | +11·775 | −3·550 | +1·764 | +11·722 | 81·497 | |
| 2 | E | | 58·425 | +1·740 | +11·808 | +1·654 | +2·279 | +17·481 | 75·906 | |
| 3 | W | 60° α | 67·950 | +1·734 | +11·839 | −1·960 | +0·992 | +12·605 | 80·555 | |
| 4 | E | | 62·825 | +1·739 | +11·869 | +1·663 | +0·992 | +16·263 | 79·088 | 79″·687 |
| 5 | W | | 66·550 | +1·733 | +11·898 | −0·092 | +0·790 | +14·329 | 80·879 | |
| 6 | E | | 66·525 | +1·719 | +11·926 | −3·340 | +1·011 | +11·316 | 77·841 | |
| 7 | W | | 63·000 | +1·719 | +11·952 | +2·288 | +0·698 | +16·657 | 79·657 | |
| 8 | E | | 65·100 | +1·726 | +11·979 | −2·348 | −0·202 | +11·155 | 76·255 | |
| 9 | W | 40° α | 63·400 | +1·731 | +12·004 | +3·571 | −1·048 | +16·258 | 79·658 | 78·422 |
| 10 | E | | 67·000 | +1·730 | +12·027 | −4·252 | −0·551 | + 8·954 | 75·954 | |
| 11 | W | | 62·675 | +1·732 | +12·050 | +4·371 | +0·992 | +19·145 | 81·820 | |
| 12 | E | | 66·200 | +1·727 | +12·072 | −1·756 | +0·110 | +12·153 | 78·353 | |
| 13 | W | 20° α | 64·750 | +1·721 | +12·093 | +0·408 | +2·169 | +16·391 | 81·141 | 79·299 |
| 14 | E | | 62·350 | +1·716 | +12·112 | −1·217 | +2·904 | +15·515 | 77·865 | |
| 15 | W | | 63·350 | +1·726 | +12·130 | +1·454 | +1·176 | +16·486 | 79·836 | |
| 16 | E | | 64·500 | +1·724 | +12·149 | +0·970 | +1·856 | +16·699 | 81·199 | |
| 17 | W | 30° α (i) | 66·500 | +1·728 | +12·166 | −0·788 | +0·901 | +14·007 | 80·507 | 80·194 |
| 18 | E | | 63·225 | +1·734 | +12·181 | −0·076 | +0·551 | +14·390 | 77·615 | |
| 19 | W | | 66·550 | +1·746 | +12·195 | −0·306 | +1·268 | +14·903 | 81·453 | |
| 20 | E | | 61·250 | +1·746 | +12·208 | +1·174 | +1·378 | +16·506 | 77·756 | |
| 21 | W | 50° α (i) | 68·050 | +1·740 | +12·222 | −1·218 | +0·037 | +12·781 | 80·831 | |
| 22 | E | | 61·800 | +1·749 | +12·232 | +0·991 | +0·864 | +15·836 | 77·636 | 79·576 |
| 23 | W | | 68·500 | +1·746 | +12·242 | −0·426 | +0·018 | +13·580 | 82·080 | |
| 24 | E | | 61·625 | +1·734 | +12·253 | +0·391 | +0·606 | +14·984 | 76·609 | |
| 25 | W | | 65·675 | +1·746 | +12·261 | +0·231 | +1·507 | +15·745 | 81·420 | |
| 26 | E | 70° α (i) | 60·175 | +1·754 | +12·269 | +1·171 | +0·386 | +15·580 | 75·755 | 78·949 |
| 27 | W | | 68·125 | +1·761 | +12·275 | −0·853 | +0·037 | +13·220 | 81·345 | |
| 28 | E | | 63·175 | +1·757 | +12·279 | −0·068 | +0·037 | +14·005 | 77·180 | |

Mean 1° 52′ 19″·3545

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | | 61″·625 | +1″·755 | +12″·281 | +1″·516 | −0″·845 | +14″·707 | 76″·332 | |
| 30 | W | 20° α | 67·400 | +1·753 | +12·284 | −1·006 | +1·121 | +14·152 | 81·552 | 79″·519 |
| 31 | E | | 62·550 | +1·758 | +12·286 | +1·854 | +1·139 | +17·037 | 79·587 | |
| Jan. 1 | W | | 71·075 | +1·757 | +12·331 | −6·471 | +1·911 | + 9·528 | 80·603 | |
| 2 | E | | 62·625 | +1·764 | +12·331 | −0·601 | +0·276 | +13·770 | 76·395 | |
| 3 | W | 40° α | 64·100 | +1·759 | +12·331 | −0·019 | +1·139 | +15·210 | 79·310 | 79·173 |
| 4 | E | | 64·700 | +1·754 | +12·328 | +0·853 | −0·129 | +14·806 | 79·506 | |
| 5 | W | | 66·675 | +1·751 | +12·323 | +0·145 | +0·588 | +14·807 | 81·482 | |
| 6 | E | | 62·375 | +1·750 | +12·319 | +0·436 | −1·250 | +13·255 | 75·630 | |
| 7 | W | 60° α | 67·625 | +1·747 | +12·313 | +0·195 | +0·625 | +14·880 | 82·505 | 78·272 |
| 8 | E | | 59·050 | +1·744 | +12·306 | +0·436 | −0·202 | +14·284 | 73·334 | |
| 9 | W | | 67·050 | +1·734 | +12·298 | +0·554 | −0·018 | +14·568 | 81·618 | |
| 10 | E | | 63·275 | +1·725 | +12·289 | −1·135 | −0·147 | +12·732 | 76·007 | |
| 11 | W | 30° α (i) | 62·475 | +1·725 | +12·280 | +1·705 | +1·397 | +17·107 | 79·582 | 79·121 |
| 12 | E | | 64·825 | +1·736 | +12·268 | −1·336 | +0·533 | +13·201 | 78·026 | |
| 13 | W | | 57·200 | +1·743 | +12·255 | +9·246 | +2·426 | +25·670 | 82·870 | |
| 14 | E | | 66·450 | +1·740 | +12·242 | +0·224 | −0·055 | +14·151 | 80·601 | |
| 15 | W | 50° α (i) | 65·250 | +1·727 | +12·228 | +0·333 | −0·092 | +14·196 | 79·446 | 79·439 |
| 16 | E | | 66·800 | +1·711 | +12·212 | +0·183 | −1·378 | +12·728 | 79·528 | |
| 17 | W | | 65·325 | +1·705 | +12·194 | −0·108 | −0·937 | +12·854 | 78·179 | |
| 18 | E | | 67·350 | +1·696 | +12·175 | −0·254 | −1·139 | +12·478 | 79·828 | |
| 19 | W | 70° α (i) | 61·575 | +1·701 | +12·157 | +0·849 | +0·055 | +14·762 | 76·337 | |
| 21 | W | | 62·150 | +1·694 | +12·116 | +1·203 | +1·139 | +16·152 | 78·302 | 78·838 |
| 22 | W | | 61·500 | +1·693 | +12·093 | +1·291 | +1·268 | +16·345 | 77·845 | |
| 23 | E | | 67·900 | +1·695 | +12·070 | −1·151 | +0·018 | +12·632 | 80·532 | |

Mean 1° 52′ 19″·0603

Mean Result of both Faces ..... 1° 52′ 19″·2074

5 C

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## G. T. STATION KALIANPUR.

No. 3 (383) 7 Tauri. South 0° 11′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | W | | 39″·425 | +0″·179 | +11″·825 | −3″·206 | +0″·368 | + 9″·166 | 48″·591 | |
| Dec. 1 | E | | 33·750 | +0·179 | +11·867 | +3·550 | +1·048 | +16·644 | 50·394 | |
| 2 | W | | 36·775 | +0·180 | +11·910 | −1·654 | +1·746 | +12·182 | 48·957 | |
| 3 | E | 60° α | 31·575 | +0·180 | +11·950 | +1·960 | +1·011 | +15·101 | 46·676 | 49″·355 |
| 4 | W | | 38·450 | +0·180 | +11·990 | −1·663 | +0·588 | +11·095 | 49·545 | |
| 5 | E | | 37·425 | +0·180 | +12·029 | +0·092 | +0·515 | +12·816 | 50·241 | |
| 6 | W | | 34·325 | +0·178 | +12·065 | +3·340 | +1·195 | +16·778 | 51·103 | |
| 7 | E | | 38·775 | +0·178 | +12·101 | −2·288 | +0·570 | +10·561 | 49·336 | |
| 8 | W | | 37·750 | +0·179 | +12·137 | +2·348 | −0·368 | +14·296 | 52·046 | |
| 9 | E | 40° α | 40·150 | +0·179 | +12·172 | −3·571 | −0·625 | + 8·155 | 48·305 | 50·007 |
| 10 | W | | 36·050 | +0·179 | +12·205 | +4·252 | −0·625 | +16·011 | 52·061 | |
| 11 | E | | 39·275 | +0·179 | +12·237 | −4·371 | +0·294 | + 8·339 | 47·614 | |
| 12 | W | | 36·350 | +0·179 | +12·268 | +1·756 | −0·312 | +13·891 | 50·241 | |
| 13 | E | 20° α | 35·075 | +0·178 | +12·298 | −0·408 | +2·058 | +14·126 | 49·201 | 50·040 |
| 14 | W | | 34·900 | +0·178 | +12·326 | +1·217 | +2·904 | +16·625 | 51·525 | |
| 15 | E | | 36·900 | +0·179 | +12·354 | −1·454 | +1·213 | +12·292 | 49·192 | |
| 16 | W | | 38·375 | +0·179 | +12·382 | −0·970 | +1·985 | +13·576 | 51·951 | |
| 17 | E | 30° α (1) | 37·500 | +0·179 | +12·409 | +0·788 | +1·029 | +14·405 | 51·905 | 50·867 |
| 18 | W | | 36·800 | +0·180 | +12·433 | +0·076 | +0·753 | +13·442 | 50·242 | |
| 19 | E | | 35·175 | +0·181 | +12·456 | +0·306 | +1·250 | +14·193 | 49·368 | |
| 20 | W | | 39·025 | +0·181 | +12·478 | −1·174 | +1·470 | +12·955 | 51·980 | |
| 21 | E | 50° α (1) | 34·775 | +0·180 | +12·501 | +1·218 | +0·349 | +14·248 | 49·023 | 50·384 |
| 22 | W | | 39·100 | +0·181 | +12·520 | −0·991 | +0·441 | +12·151 | 51·251 | |
| 23 | E | | 36·025 | +0·181 | +12·539 | +0·426 | +0·110 | +13·256 | 49·281 | |
| 24 | W | | 39·075 | +0·180 | +12·559 | −0·391 | +0·643 | +12·991 | 52·066 | |
| 25 | E | 70° α (1) | 35·025 | +0·181 | +12·575 | −0·231 | +1·470 | +13·995 | 49·020 | |
| 26 | W | | 38·475 | +0·182 | +12·592 | −1·171 | +0·423 | +12·026 | 50·501 | 49·802 |
| 27 | E | | 34·725 | +0·182 | +12·607 | +0·853 | −0·037 | +13·605 | 48·330 | |
| 28 | W | | 37·475 | +0·182 | +12·620 | +0·068 | −0·129 | +12·741 | 50·216 | |

Mean 0° 11′ 50″·0758

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 38″·700 | +0″·182 | +12″·631 | −1″·516 | 0″·000 | +11″·297 | 49″·997 | |
| 30 | E | 20° α | 36·400 | +0·182 | +12·643 | +1·006 | +0·662 | +14·493 | 50·893 | 50″·054 |
| 31 | W | | 37·550 | +0·182 | +12·653 | −1·854 | +0·974 | +11·955 | 49·505 | |
| Jan. 1 | E | | 29·650 | +0·182 | +12·708 | +6·471 | +0·809 | +20·170 | 49·820 | |
| 2 | W | | 36·275 | +0·183 | +12·717 | +0·601 | +1·415 | +14·916 | 51·191 | |
| 3 | E | 40° α | 35·775 | +0·182 | +12·725 | +0·019 | +0·625 | +13·551 | 49·326 | 49·859 |
| 4 | W | | 38·650 | +0·182 | +12·730 | −0·853 | −0·478 | +11·581 | 50·231 | |
| 5 | E | | 36·525 | +0·181 | +12·734 | −0·145 | −0·606 | +12·164 | 48·689 | |
| 6 | W | | 37·625 | +0·181 | +12·737 | −0·436 | −0·055 | +12·427 | 50·052 | |
| 7 | E | 60° α | 35·125 | +0·181 | +12·740 | −0·195 | −0·478 | +12·248 | 47·373 | 49·560 |
| 8 | W | | 39·075 | +0·181 | +12·740 | −0·436 | +0·882 | +13·367 | 52·442 | |
| 9 | E | | 36·025 | +0·180 | +12·740 | −0·554 | −0·018 | +12·348 | 48·373 | |
| 10 | W | | 36·775 | +0·179 | +12·739 | +1·135 | −0·165 | +13·888 | 50·663 | |
| 11 | E | 30° α (1) | 36·125 | +0·179 | +12·737 | −1·705 | +1·011 | +12·222 | 48·347 | 49·994 |
| 12 | W | | 35·375 | +0·180 | +12·732 | +1·336 | +0·496 | +14·744 | 50·119 | |
| 13 | E | | 45·475 | +0·181 | +12·727 | −9·246 | +1·709 | + 5·371 | 50·846 | |
| 14 | W | | 39·475 | +0·180 | +12·721 | −0·224 | −0·018 | +12·659 | 52·134 | |
| 15 | E | 50° α (1) | 38·275 | +0·179 | +12·714 | −0·333 | +0·055 | +12·615 | 50·890 | 50·695 |
| 16 | W | | 36·950 | +0·177 | +12·706 | −0·183 | −0·827 | +11·873 | 48·823 | |
| 17 | E | | 38·725 | +0·177 | +12·694 | +0·108 | −0·772 | +12·207 | 50·932 | |
| 18 | W | | 36·400 | +0·176 | +12·682 | +0·254 | −0·680 | +12·432 | 48·832 | |
| 19 | E | 70° α (1) | 38·575 | +0·176 | +12·671 | −0·849 | +0·018 | +12·016 | 50·591 | 50·445 |
| 22 | E | | 40·800 | +0·175 | +12·626 | −1·291 | −1·066 | +11·444 | 52·244 | |
| 23 | W | | 35·550 | +0·176 | +12·609 | +1·151 | +0·625 | +14·561 | 50·111 | |

Mean 0° 11′ 50″·1012

Mean Result of both Faces..... 0° 11′ 50″·0885

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No. 4 (400) Persei. North 7° 39′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | *'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Nov. 30 | E | | 29·025 | +7·130 | −12·185 | −3·206 | −1·434 | − 9·695 | 19·330 | |
| Dec. 1 | W | | 20·050 | +7·143 | −12·274 | +3·550 | −0·662 | − 2·243 | 17·807 | |
| 2 | E | | 28·575 | +7·174 | −12·363 | −1·654 | −1·562 | − 8·405 | 20·170 | |
| 3 | W | 60° a | 24·225 | +7·151 | −12·450 | +1·960 | −1·783 | − 5·122 | 19·103 | |
| 4 | E | | 29·075 | +7·169 | −12·535 | −1·663 | 0·000 | − 7·029 | 22·046 | 19·847 |
| 5 | W | | 24·675 | +7·145 | −12·621 | +0·092 | −0·386 | − 5·770 | 18·905 | |
| 6 | E | | 24·525 | +7·089 | −12·703 | +3·340 | −0·496 | − 2·770 | 21·755 | |
| 7 | W | | 27·875 | +7·085 | −12·785 | −2·288 | −0·221 | − 8·209 | 19·666 | |
| 8 | E | | 25·700 | +7·119 | −12·867 | +2·348 | +0·662 | − 2·738 | 22·962 | |
| 9 | W | 40° a | 28·200 | +7·132 | −12·947 | −3·571 | +0·717 | − 8·669 | 19·531 | |
| 10 | E | | 23·300 | +7·137 | −13·026 | +4·252 | −0·515 | − 2·152 | 21·148 | 21·111 |
| 11 | W | | 31·300 | +7·142 | −13·103 | −4·371 | −0·165 | −10·497 | 20·803 | |
| 12 | E | | 26·175 | +7·111 | −13·180 | +1·756 | −0·202 | − 4·515 | 21·660 | |
| 13 | W | 20° a | 27·175 | +7·099 | −13·254 | −0·408 | −1·489 | − 8·052 | 19·123 | |
| 14 | E | | 30·975 | +7·073 | −13·327 | +1·217 | −2·940 | − 7·977 | 22·998 | 20·319 |
| 15 | W | | 27·175 | +7·119 | −13·399 | −1·454 | −1·948 | − 9·682 | 17·493 | |
| 16 | E | | 29·800 | +7·105 | −13·471 | −0·970 | −1·838 | − 9·174 | 20·626 | |
| 17 | W | 30° a (1) | 23·675 | +7·118 | −13·542 | +0·788 | +0·294 | − 5·342 | 18·333 | |
| 18 | E | | 29·025 | +7·150 | −13·610 | +0·076 | −1·250 | − 7·634 | 21·391 | 19·650 |
| 19 | W | | 25·850 | +7·203 | −13·676 | +0·306 | −1·434 | − 7·601 | 18·249 | |
| 20 | E | | 31·300 | +7·206 | −13·742 | −1·174 | −1·360 | − 9·070 | 22·230 | |
| 21 | W | 50° a (1) | 23·750 | +7·175 | −13·807 | +1·218 | −0·478 | − 5·892 | 17·858 | |
| 22 | E | | 30·750 | +7·214 | −13·868 | −0·991 | +0·294 | − 7·351 | 23·399 | 20·545 |
| 23 | W | | 25·250 | +7·202 | −13·929 | +0·426 | −0·257 | − 6·558 | 18·692 | |
| 25 | W | | 26·450 | +7·202 | −14·048 | −0·231 | −1·195 | − 8·272 | 18·178 | |
| 26 | E | 70° a (1) | 31·425 | +7·231 | −14·106 | −1·171 | −0·717 | − 8·763 | 22·662 | |
| 27 | W | | 22·175 | +7·254 | −14·161 | +0·853 | +0·753 | − 5·301 | 16·874 | 19·835 |
| 28 | E | | 28·300 | +7·249 | −14·213 | +0·068 | +0·221 | − 6·675 | 21·625 | |

Mean 7° 39′ 20″·2178

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | *'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| | | | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Dec. 29 | E | | 29·600 | +7·233 | −14·264 | −1·516 | 0·000 | − 8·547 | 21·053 | |
| 30 | W | 30° a | 25·125 | +7·220 | −14·315 | +1·006 | −0·074 | − 6·163 | 18·962 | |
| 31 | E | | 30·575 | +7·252 | −14·364 | −1·854 | −0·882 | − 9·848 | 20·727 | 19·875 |
| Jan. 1 | W | | 19·775 | +7·248 | −14·460 | +6·471 | −0·276 | − 1·017 | 18·758 | |
| 2 | E | | 27·675 | +7·281 | −14·507 | +0·601 | −0·772 | − 7·397 | 20·278 | |
| 3 | W | 40° a | 25·300 | +7·259 | −14·551 | +0·019 | +0·643 | − 6·630 | 18·670 | |
| 4 | E | | 28·575 | +7·241 | −14·594 | −0·853 | +0·202 | − 8·004 | 20·571 | 19·618 |
| 5 | W | | 25·450 | +7·219 | −14·633 | −0·145 | +1·066 | − 6·497 | 18·953 | |
| 6 | E | | 29·125 | +7·215 | −14·672 | −0·436 | +0·717 | − 7·176 | 21·949 | |
| 7 | W | 60° a | 24·300 | +7·200 | −14·709 | −0·195 | +1·195 | − 6·509 | 17·791 | |
| 8 | E | | 30·500 | +7·191 | −14·744 | −0·436 | −0·588 | − 8·577 | 21·923 | 19·790 |
| 9 | W | | 24·950 | +7·162 | −14·778 | −0·554 | +0·717 | − 7·453 | 17·497 | |
| 10 | E | | 31·225 | +7·118 | −14·810 | +1·135 | −0·864 | − 7·421 | 23·804 | |
| 11 | W | 30° a (1) | 28·800 | +7·114 | −14·841 | −1·705 | +0·221 | − 9·211 | 19·589 | |
| 12 | E | | 28·525 | +7·165 | −14·869 | +1·336 | −1·268 | − 7·636 | 20·889 | 20·653 |
| 13 | W | | 36·250 | +7·193 | −14·894 | −9·246 | −0·974 | −17·921 | 18·329 | |
| 14 | E | | 33·900 | +7·175 | −14·920 | −0·224 | +0·055 | − 7·914 | 25·986 | |
| 15 | W | 50° a (1) | 27·750 | +7·124 | −14·943 | −0·333 | +0·459 | − 7·693 | 20·057 | |
| 16 | E | | 27·300 | +7·056 | −14·964 | −0·183 | +0·478 | − 7·613 | 19·687 | 21·491 |
| 17 | W | | 27·075 | +7·039 | −14·981 | +0·108 | +0·992 | − 6·842 | 20·233 | |
| 18 | E | | 27·925 | +6·994 | −14·997 | +0·254 | +0·680 | − 7·069 | 20·856 | |
| 19 | W | 70° a (1) | 28·750 | +7·024 | −15·013 | −0·849 | +0·037 | − 8·801 | 19·949 | |
| 21 | W | | 31·075 | +6·991 | −15·038 | −1·203 | −0·588 | − 9·838 | 21·237 | 20·783 |
| 22 | W | | 29·850 | +6·989 | −15·047 | −1·291 | +1·158 | − 8·191 | 21·659 | |
| 23 | E | | 27·275 | +6·989 | −15·054 | +1·151 | +0·018 | − 6·896 | 20·379 | |

Mean 7° 39′ 20″·3683

Mean Result of both Faces ..... 7° 39′ 20″·2931



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## G. T. STATION KALIANPUR.

No. 5 (418) 27 PLEIADUM *f*. South 0° 33′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | W | 60° *a* | 28″·225 | +0″·516 | +11″·615 | −3″·206 | +2″·003 | +10″·928 | 39″·153 | 40″·135 |
| Dec. 1 | E | | 24·925 | +0·517 | +11·654 | +3·550 | +0·257 | +15·978 | 40·903 | |
| 2 | W | | 27·850 | +0·519 | +11·691 | −1·654 | +2·224 | +12·780 | 40·630 | |
| 3 | E | | 24·800 | +0·518 | +11·728 | +1·960 | +1·728 | +15·934 | 40·734 | |
| 4 | W | | 28·025 | +0·519 | +11·763 | −1·663 | −0·423 | +10·196 | 38·221 | |
| 5 | E | | 26·050 | +0·517 | +11·798 | +0·092 | +0·974 | +13·381 | 39·431 | |
| 6 | W | | 24·450 | +0·513 | +11·831 | +3·340 | +1·048 | +16·732 | 41·182 | |
| 7 | E | | 30·150 | +0·513 | +11·863 | −2·288 | +0·588 | +10·676 | 40·826 | |
| 8 | W | 40° *a* | 25·825 | +0·515 | +11·896 | +2·348 | +0·110 | +14·869 | 40·694 | 39·741 |
| 9 | E | | 29·850 | +0·516 | +11·927 | −3·571 | −0·845 | + 8·027 | 37·877 | |
| 10 | W | | 22·800 | +0·517 | +11·957 | +4·252 | +1·378 | +18·104 | 40·904 | |
| 11 | E | | 31·025 | +0·517 | +11·986 | −4·371 | +0·331 | + 8·463 | 39·488 | |
| 12 | W | 20° *a* | 27·175 | +0·515 | +12·015 | +1·756 | +0·478 | +14·764 | 41·939 | 40·387 |
| 13 | E | | 24·425 | +0·514 | +12·042 | −0·408 | +1·562 | +13·710 | 38·135 | |
| 14 | W | | 24·900 | +0·512 | +12·068 | +1·217 | +3·400 | +17·197 | 42·097 | |
| 15 | E | | 25·925 | +0·515 | +12·094 | −1·454 | +2·297 | +13·452 | 39·377 | |
| 16 | W | 30° (i) | 27·825 | +0·514 | +12·120 | −0·970 | +2·187 | +13·851 | 41·676 | 40·379 |
| 17 | E | | 24·825 | +0·515 | +12·144 | +0·788 | +0·221 | +13·668 | 38·493 | |
| 18 | W | | 28·100 | +0·518 | +12·167 | +0·076 | +0·992 | +13·753 | 41·853 | |
| 19 | E | | 25·025 | +0·521 | +12·188 | +0·306 | +1·452 | +14·467 | 39·492 | |
| 20 | W | 50° *a* (i) | 27·975 | +0·522 | +12·210 | −1·174 | +1·434 | +12·992 | 40·967 | 40·044 |
| 21 | E | | 23·525 | +0·519 | +12·231 | +1·218 | +0·845 | +14·813 | 38·338 | |
| 22 | W | | 29·375 | +0·522 | +12·249 | −0·991 | +0·753 | +12·533 | 41·908 | |
| 23 | E | | 26·225 | +0·521 | +12·267 | +0·426 | −0·478 | +12·736 | 38·961 | |
| 24 | W | 70° *a* (i) | 29·225 | +0·517 | +12·287 | −0·391 | +0·368 | +12·781 | 42·006 | 39·634 |
| 25 | E | | 24·025 | +0·521 | +12·303 | −0·231 | +1·139 | +13·732 | 37·757 | |
| 26 | W | | 29·000 | +0·523 | +12·320 | −1·171 | +1·342 | +13·014 | 42·014 | |
| 27 | E | | 25·275 | +0·525 | +12·334 | +0·853 | −0·809 | +12·903 | 38·178 | |
| 28 | W | | 27·050 | +0·525 | +12·347 | +0·068 | −0·110 | +12·830 | 39·880 | |

Mean 0° 33′ 40″·0533

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° *a* | 27″·125 | +0″·524 | +12″·359 | −1″·516 | 0″·000 | +11″·367 | 38″·492 | 38″·570 |
| 30 | E | | 24·175 | +0·522 | +12·371 | +1·006 | +0·625 | +14·524 | 38·699 | |
| 31 | W | | 26·475 | +0·525 | +12·382 | −1·854 | +1·048 | +12·101 | 38·576 | |
| Jan. 1 | E | | 18·800 | +0·525 | +12·440 | +6·471 | +0·276 | +19·712 | 38·512 | |
| 2 | W | 40° *a* | 26·525 | +0·527 | +12·450 | +0·601 | +1·323 | +14·901 | 41·426 | 39·442 |
| 3 | E | | 25·150 | +0·526 | +12·459 | +0·019 | +0·202 | +13·206 | 38·356 | |
| 4 | W | | 26·475 | +0·524 | +12·466 | −0·853 | +1·103 | +13·240 | 39·715 | |
| 5 | E | | 25·625 | +0·523 | +12·471 | −0·145 | −0·202 | +12·647 | 38·272 | |
| 6 | W | 60° *a* | 28·050 | +0·522 | +12·476 | −0·436 | −0·827 | +11·735 | 39·785 | 39·244 |
| 7 | E | | 24·800 | +0·521 | +12·480 | −0·195 | −0·165 | +12·641 | 37·441 | |
| 8 | W | | 29·575 | +0·521 | +12·483 | −0·436 | −0·312 | +12·256 | 41·831 | |
| 9 | E | | 25·100 | +0·519 | +12·485 | −0·554 | +0·368 | +12·818 | 37·918 | |
| 10 | W | 30° *a* (i) | 25·150 | +0·515 | +12·486 | +1·135 | +1·470 | +15·606 | 40·756 | 39·622 |
| 11 | E | | 25·200 | +0·515 | +12·487 | −1·705 | −0·184 | +11·113 | 36·313 | |
| 12 | W | | 25·850 | +0·519 | +12·485 | +1·336 | +1·048 | +15·388 | 41·238 | |
| 13 | E | | 34·900 | +0·521 | +12·482 | −9·246 | +1·525 | + 5·282 | 40·182 | |
| 14 | W | 50° *a* (i) | 28·550 | +0·519 | +12·480 | −0·224 | −0·845 | +11·930 | 40·480 | 39·881 |
| 15 | E | | 27·450 | +0·516 | +12·476 | −0·333 | −0·533 | +12·126 | 39·576 | |
| 16 | W | | 26·900 | +0·511 | +12·471 | −0·183 | −0·386 | +12·413 | 39·313 | |
| 17 | E | | 27·825 | +0·510 | +12·463 | +0·108 | −0·753 | +12·328 | 40·153 | |
| 18 | W | 70° *a* (i) | 26·650 | +0·506 | +12·455 | +0·254 | +0·459 | +13·674 | 40·324 | 29·446 |
| 19 | E | | 27·325 | +0·509 | +12·447 | −0·849 | 0·000 | +12·107 | 39·432 | |
| 20 | W | | 24·600 | +0·511 | +12·437 | +1·645 | −0·386 | +14·207 | 38·807 | |
| 22 | E | | 28·125 | +0·506 | +12·415 | −1·291 | +0·331 | +11·961 | 40·086 | |
| 23 | W | | 24·575 | +0·506 | +12·402 | +1·151 | −0·368 | +13·691 | 38·266 | |

Mean 0° 33′ 39″·3675

Mean Result of both Faces ..... 0° 33′ 39″·7104

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No. 6 (430) 44 Persei ζ. North 7° 16′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Nov. 30 | E | 60° α | 67″·025 | +6″·781 | −11″·934 | −3″·206 | −1″·617 | − 9″·976 | 57″·049 | 56″·790 |
| Dec. 1 | W | | 57·900 | +6·792 | −12·020 | +3·550 | −0·147 | − 1·825 | 56·075 | |
| 2 | E | | 67·975 | +6·823 | −12·105 | −1·654 | −1·470 | − 8·406 | 59·569 | |
| 3 | W | | 59·650 | +6·801 | −12·189 | +1·960 | −1·599 | − 5·027 | 54·623 | |
| 4 | E | | 66·300 | +6·816 | −12·271 | −1·663 | +0·165 | − 6·953 | 59·347 | |
| 5 | W | | 60·975 | +6·795 | −12·353 | +0·092 | −1·305 | − 6·771 | 54·204 | |
| 6 | E | | 60·950 | +6·743 | −12·433 | +3·340 | −1·029 | − 3·379 | 57·571 | |
| 7 | W | | 64·825 | +6·737 | −12·512 | −2·288 | −0·882 | − 8·945 | 55·880 | |
| 8 | E | 40° α | 62·150 | +6·770 | −12·591 | +2·348 | −0·588 | − 4·061 | 58·089 | 56·485 |
| 9 | W | | 63·875 | +6·778 | −12·669 | −3·571 | +1·158 | − 8·304 | 55·571 | |
| 10 | E | | 59·975 | +6·789 | −12·745 | +4·252 | −1·599 | − 3·303 | 56·672 | |
| 11 | W | | 65·050 | +6·792 | −12·820 | −4·371 | +0·956 | − 9·443 | 55·607 | |
| 12 | E | 20° α | 62·700 | +6·758 | −12·895 | +1·756 | +0·092 | − 4·289 | 58·411 | 57·213 |
| 13 | W | | 64·925 | +6·751 | −12·967 | −0·408 | −1·746 | − 8·370 | 56·555 | |
| 14 | E | | 67·825 | +6·724 | −13·038 | +1·217 | −3·143 | − 8·240 | 59·585 | |
| 15 | W | | 63·875 | +6·772 | −13·109 | −1·454 | −1·783 | − 9·574 | 54·301 | |
| 16 | E | 30° α (○) | 66·675 | +6·754 | −13·179 | −0·970 | −2·352 | − 9·747 | 56·928 | 56·115 |
| 17 | W | | 60·425 | +6·764 | −13·249 | +0·788 | +0·386 | − 5·311 | 55·114 | |
| 18 | E | | 65·075 | +6·800 | −13·315 | +0·076 | −0·404 | − 6·843 | 58·232 | |
| 19 | W | | 62·025 | +6·851 | −13·380 | +0·306 | −1·617 | − 7·840 | 54·185 | |
| 20 | E | 50° α (○) | 68·025 | +6·856 | −13·445 | −1·174 | −1·305 | − 9·068 | 58·957 | 57·543 |
| 21 | W | | 60·325 | +6·823 | −13·510 | +1·218 | +0·184 | − 5·285 | 55·040 | |
| 22 | E | | 68·575 | +6·863 | −13·570 | −0·991 | −1·452 | − 9·150 | 59·425 | |
| 23 | W | | 61·800 | +6·850 | −13·631 | +0·426 | +1·305 | − 5·050 | 56·750 | |
| 25 | W | 70° α (○) | 63·175 | +6·850 | −13·750 | −0·231 | −0·790 | − 7·921 | 55·254 | 56·854 |
| 26 | E | | 67·475 | +6·875 | −13·807 | −1·171 | −0·680 | − 8·783 | 58·692 | |
| 27 | W | | 59·325 | +6·894 | −13·863 | +0·853 | +1·121 | − 4·995 | 54·330 | |
| 28 | E | | 66·700 | +6·895 | −13·916 | +0·068 | −0·606 | − 7·559 | 59·141 | |

Mean 7° 16′ 56″·8333

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | 20° α | 66″·450 | +6″·877 | −13″·967 | −1″·516 | +0″·018 | − 8″·588 | 57″·862 | 56″·146 |
| 30 | W | | 61·100 | +6·860 | −14·019 | +1·006 | −0·478 | − 6·631 | 54·469 | |
| 31 | E | | 65·800 | +6·898 | −14·068 | −1·854 | −1·011 | −10·035 | 54·765 | |
| Jan. 1 | W | | 57·775 | +6·893 | −14·165 | +6·471 | +0·515 | − 0·286 | 57·489 | |
| 2 | E | 40° α | 64·475 | +6·927 | −14·213 | +0·601 | −0·368 | − 7·053 | 57·422 | 56·479 |
| 3 | W | | 63·925 | +6·906 | −14·258 | +0·019 | −0·221 | − 7·554 | 56·371 | |
| 4 | E | | 65·825 | +6·890 | −14·302 | −0·853 | −0·753 | − 9·018 | 56·807 | |
| 5 | W | | 63·250 | +6·865 | −14·343 | −0·145 | −0·312 | − 7·935 | 55·315 | |
| 6 | E | 60° α | 67·800 | +6·861 | −14·384 | −0·436 | +0·496 | − 7·463 | 60·337 | 56·891 |
| 7 | W | | 60·525 | +6·845 | −14·423 | −0·195 | +0·809 | − 6·964 | 53·561 | |
| 8 | E | | 67·575 | +6·839 | −14·460 | −0·436 | +0·478 | − 7·579 | 59·996 | |
| 9 | W | | 61·150 | +6·817 | −14·496 | −0·554 | +0·753 | − 7·480 | 53·670 | |
| 10 | E | 30° α (○) | 65·125 | +6·771 | −14·530 | +1·135 | −1·029 | − 7·653 | 57·472 | 56·631 |
| 11 | W | | 67·450 | +6·766 | −14·563 | −1·705 | −1·250 | −10·752 | 56·698 | |
| 12 | E | | 64·250 | +6·817 | −14·593 | +1·336 | −0·606 | − 7·046 | 57·204 | |
| 13 | W | | 73·075 | +6·845 | −14·622 | −9·246 | −0·901 | −17·924 | 55·151 | |
| 14 | E | 50° α (○) | 67·050 | +6·822 | −14·650 | −0·224 | +0·845 | − 7·207 | 59·843 | 58·164 |
| 15 | W | | 65·175 | +6·776 | −14·676 | −0·333 | +0·165 | − 8·068 | 57·107 | |
| 16 | E | | 65·475 | +6·711 | −14·700 | −0·183 | +0·698 | − 7·474 | 58·001 | |
| 17 | W | | 65·600 | +6·698 | −14·721 | +0·108 | +0·018 | − 7·897 | 57·703 | |
| 18 | E | 70° α (○) | 63·675 | +6·650 | −14·740 | +0·254 | +0·404 | − 7·432 | 56·243 | 57·242 |
| 19 | W | | 67·275 | +6·685 | −14·760 | −0·849 | 0·000 | − 8·924 | 58·351 | |
| 20 | E | | 62·525 | +6·712 | −14·777 | +1·645 | +1·066 | − 5·354 | 57·171 | |
| 21 | W | | 67·725 | +6·651 | −14·792 | −1·203 | −1·323 | −10·667 | 57·058 | |
| 22 | W | | 66·900 | +6·650 | −14·805 | −1·291 | +0·018 | − 9·428 | 57·472 | |
| 23 | E | | 63·825 | +6·645 | −14·816 | +1·151 | +0·349 | − 6·671 | 57·154 | |

Mean 7° 16′ 56″·9255

Mean Result of both Faces ..... 7° 16′ 56″·8794





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G. T. STATION KALIANPUR.

No. 7 (448) 37 Tauri *A'*. South 2° 28′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | W | | 36″·050 | +2″·296 | +11″·310 | −3″·206 | +1″·489 | +11″·889 | 47″·939 | |
| Dec. 1 | E | | 30·675 | +2·299 | +11·333 | +3·550 | +0·992 | +18·174 | 48·849 | |
| 2 | W | | 35·800 | +2·309 | +11·356 | −1·654 | +1·581 | +13·592 | 49·392 | |
| 3 | E | 60° α | 33·325 | +2·302 | +11·377 | +1·960 | +1·470 | +17·109 | 50·434 | |
| 4 | W | | 37·000 | +2·306 | +11·398 | −1·663 | −0·110 | +11·931 | 48·931 | 49″·227 |
| 5 | E | | 32·000 | +3·300 | +11·419 | +0·092 | +1·103 | +14·914 | 46·914 | |
| 6 | W | | 34·175 | +2·283 | +11·438 | +3·340 | +0·478 | +17·539 | 51·714 | |
| 7 | E | | 37·900 | +2·280 | +11·456 | −2·288 | +0·294 | +11·742 | 49·642 | |
| 8 | W | | 35·700 | +2·292 | +11·474 | +2·348 | −0·221 | +15·893 | 51·593 | |
| 9 | E | 40° α | 38·475 | +2·293 | +11·492 | −3·571 | −0·533 | + 9·681 | 48·156 | 50·187 |
| 10 | W | | 33·300 | +2·299 | +11·509 | +4·252 | +1·231 | +19·291 | 52·591 | |
| 11 | E | | 38·825 | +2·299 | +11·525 | −4·371 | +0·129 | + 9·582 | 48·407 | |
| 12 | W | | 38·075 | +2·286 | +11·541 | +1·756 | −0·221 | +15·362 | 53·437 | |
| 13 | E | 20° α | 34·775 | +2·286 | +11·555 | −0·408 | +1·360 | +14·793 | 49·568 | 51·532 |
| 14 | W | | 36·800 | +2·275 | +11·569 | +1·217 | +2·297 | +17·358 | 54·158 | |
| 15 | E | | 34·300 | +2·293 | +11·582 | −1·454 | +2·242 | +14·663 | 48·963 | |
| 16 | W | | 36·750 | +2·285 | +11·596 | −0·970 | +1·875 | +14·786 | 51·536 | |
| 17 | E | 30° α (i) | 33·250 | +2·287 | +11·610 | +0·788 | −0·570 | +14·115 | 47·365 | 49·841 |
| 18 | W | | 36·500 | +2·302 | +11·620 | +0·076 | +0·753 | +14·751 | 51·251 | |
| 19 | E | | 33·025 | +2·319 | +11·631 | +0·306 | +1·930 | +16·186 | 49·211 | |
| 20 | W | | 37·250 | +2·322 | +11·641 | −1·174 | +1·470 | +14·259 | 51·509 | |
| 21 | E | 50° α (i) | 33·675 | +2·309 | +11·652 | +1·218 | −0·221 | +14·958 | 48·633 | 49·709 |
| 22 | W | | 35·975 | +2·324 | +11·660 | −0·991 | +1·121 | +14·114 | 50·089 | |
| 23 | E | | 34·100 | +2·320 | +11·668 | +0·426 | +0·092 | +14·506 | 48·606 | |
| 25 | E | | 32·950 | +2·319 | +11·684 | −0·231 | +0·772 | +14·544 | 47·494 | |
| 26 | W | 70° α (i) | 38·400 | +2·327 | +11·691 | −1·171 | +0·294 | +13·141 | 51·541 | 50·057 |
| 27 | E | | 34·350 | +2·332 | +11·697 | +0·853 | −1·029 | +13·853 | 48·203 | |
| 28 | W | | 39·125 | +2·335 | +11·701 | +0·068 | −0·239 | +13·865 | 52·990 | |

Mean 2° 28′ 50″·0922

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 38″·850 | +2″·326 | +11″·705 | −1″·516 | −0″·809 | +11″·706 | 50″·556 | |
| 30 | E | 20° α | 34·300 | +2·320 | +11·709 | +1·006 | −0·257 | +14·778 | 49·078 | |
| 31 | W | | 37·675 | +2·336 | +11·712 | −1·854 | +0·606 | +12·800 | 50·475 | 49″·919 |
| Jan. 1 | E | | 28·650 | +2·334 | +11·762 | +6·471 | +0·349 | +20·916 | 49·566 | |
| 2 | W | | 35·625 | +2·346 | +11·765 | +0·601 | +0·570 | +15·282 | 50·907 | |
| 3 | E | 40° α | 35·000 | +2·339 | +11·767 | +0·019 | +0·110 | +14·235 | 49·235 | 49·865 |
| 4 | W | | 35·700 | +2·334 | +11·767 | −0·853 | +0·496 | +13·744 | 49·444 | |
| 5 | E | | 36·625 | +2·324 | +11·766 | −0·145 | −0·698 | +13·247 | 49·872 | |
| 6 | W | | 39·100 | +2·322 | +11·765 | −0·436 | −1·323 | +12·328 | 51·428 | |
| 7 | E | 60° α | 35·525 | +2·316 | +11·764 | −0·195 | −1·268 | +12·617 | 48·142 | 49·821 |
| 8 | W | | 37·875 | +2·315 | +11·761 | −0·436 | +0·901 | +14·541 | 52·416 | |
| 9 | E | | 34·300 | +2·310 | +11·758 | −0·554 | −0·515 | +12·999 | 47·299 | |
| 10 | W | | 36·450 | +2·293 | +11·755 | +1·135 | +1·195 | +16·378 | 52·828 | |
| 11 | E | 30° α (i) | 34·475 | +2·291 | +11·751 | −1·705 | +2·095 | +14·432 | 48·907 | 50·796 |
| 12 | W | | 35·100 | +2·309 | +11·745 | +1·336 | +1·746 | +17·136 | 52·236 | |
| 13 | E | | 43·850 | +2·319 | +11·738 | −9·246 | +0·551 | + 5·362 | 49·212 | |
| 14 | W | | 41·100 | +2·309 | +11·732 | −0·224 | 0·000 | +13·817 | 54·917 | |
| 15 | E | 50° α (i) | 37·825 | +2·295 | +11·725 | −0·333 | −0·331 | +13·356 | 51·181 | 51·490 |
| 16 | W | | 37·100 | +2·272 | +11·717 | −0·183 | −1·195 | +12·611 | 49·711 | |
| 17 | E | | 36·325 | +2·269 | +11·707 | +0·108 | −0·257 | +13·827 | 50·152 | |
| 18 | W | | 37·225 | +2·251 | +11·696 | +0·254 | −0·790 | +13·411 | 50·636 | |
| 19 | E | | 36·825 | +2·265 | +11·687 | −0·849 | +0·239 | +13·342 | 50·167 | |
| 20 | W | 70° α (i) | 34·425 | +2·273 | +11·676 | +1·645 | +0·478 | +16·072 | 50·497 | 50·548 |
| 21 | E | | 37·250 | +2·252 | +11·663 | −1·203 | +1·158 | +13·870 | 51·120 | |
| 22 | E | | 38·100 | +2·253 | +11·651 | −1·291 | −0·110 | +12·503 | 50·603 | |
| 23 | W | | 35·225 | +2·249 | +11·637 | +1·151 | 0·000 | +15·037 | 50·262 | |

Mean 2° 28′ 50″·4065

Mean Result of both Faces ..... 2° 28′ 50″·2494

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No. 8 (471) 50 TAURI $\omega^2$. South 3° 56′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 30 | E | | 6″·850 | +3″·655 | +11″·094 | +3″·206 | +1″·121 | +19″·076 | 25″·926 | |
| Dec. 1 | W | | 12·025 | +3·658 | +11·104 | −3·550 | +1·764 | +12·976 | 25·001 | |
| 2 | E | | 4·950 | +3·676 | +11·115 | +1·654 | +2·812 | +19·257 | 24·207 | |
| 3 | W | 60° $\alpha$ | 12·525 | +3·665 | +11·124 | −1·960 | +0·974 | +13·803 | 26·328 | 26″·160 |
| 4 | E | | 9·600 | +3·670 | +11·133 | +1·663 | +0·147 | +16·613 | 26·213 | |
| 5 | W | | 11·500 | +3·660 | +11·142 | −0·092 | +1·342 | +16·052 | 27·552 | |
| 6 | E | | 13·775 | +3·634 | +11·149 | −3·340 | +1·066 | +12·509 | 26·284 | |
| 7 | W | | 10·275 | +3·628 | +11·156 | +2·288 | +0·423 | +17·495 | 27·770 | |
| 8 | E | | 13·650 | +3·648 | +11·163 | −2·348 | −1·084 | +11·379 | 25·029 | |
| 9 | W | 40° $\alpha$ | 9·750 | +3·648 | +11·170 | +3·571 | +0·570 | +18·959 | 28·709 | 27·054 |
| 10 | E | | 13·475 | +3·660 | +11·175 | −4·252 | +0·092 | +10·675 | 24·150 | |
| 11 | W | | 9·700 | +3·660 | +11·181 | +4·371 | +1·415 | +20·627 | 30·327 | |
| 12 | E | | 13·400 | +3·635 | +11·186 | −1·756 | −0·937 | +12·128 | 25·528 | |
| 13 | W | 20° $\alpha$ | 11·700 | +3·639 | +11·190 | +0·408 | +0·717 | +15·954 | 27·654 | 27·191 |
| 14 | E | | 10·525 | +3·619 | +11·193 | −1·217 | +0·974 | +14·569 | 25·094 | |
| 15 | W | | 11·300 | +3·651 | +11·196 | +1·454 | +2·885 | +19·186 | 30·486 | |
| 16 | E | | 8·250 | +3·636 | +11·200 | +0·970 | +1·966 | +17·772 | 26·022 | |
| 17 | W | 30° $\alpha$ (1) | 14·475 | +3·637 | +11·204 | −0·788 | +0·165 | +14·218 | 28·693 | 27·521 |
| 18 | E | | 9·800 | +3·664 | +11·205 | −0·076 | +1·268 | +16·061 | 25·861 | |
| 19 | W | | 12·525 | +3·693 | +11·206 | −0·306 | +2·389 | +16·982 | 29·507 | |
| 20 | E | | 8·750 | +3·698 | +11·207 | +1·174 | +1·397 | +17·476 | 26·226 | |
| 21 | W | 50° $\alpha$ (1) | 16·000 | +3·675 | +11·209 | −1·218 | +0·717 | +14·383 | 30·383 | 28·199 |
| 22 | E | | 8·325 | +3·701 | +11·208 | +0·991 | +1·139 | +17·039 | 25·364 | |
| 23 | W | | 15·650 | +3·693 | +11·208 | −0·426 | +0·698 | +15·173 | 30·823 | |
| 24 | E | | 8·275 | +3·662 | +11·209 | +0·391 | +0·276 | +15·538 | 23·813 | |
| 25 | W | 70° $\alpha$ (1) | 12·350 | +3·691 | +11·207 | +0·231 | +2·077 | +17·206 | 29·556 | |
| 26 | E | | 7·375 | +3·703 | +11·207 | +1·171 | +0·257 | +16·338 | 23·713 | 26·889 |
| 27 | W | | 16·750 | +3·709 | +11·205 | −0·853 | −0·937 | +13·124 | 29·874 | |
| 28 | E | | 11·225 | +3·718 | +11·201 | −0·068 | −1·415 | +13·436 | 24·661 | |

Mean 3° 56′ 27″·1690

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 10″·625 | +3″·704 | +11″·198 | +1″·516 | −1″·452 | +14″·966 | 25″·591 | |
| 30 | W | 20° $\alpha$ | 13·850 | +3·689 | +11·195 | −1·006 | +0·092 | +13·970 | 27·820 | 26″·883 |
| 31 | E | | 9·825 | +3·719 | +11·191 | +1·854 | +0·423 | +17·187 | 27·012 | |
| Jan. 1 | W | | 16·775 | +3·715 | +11·233 | −6·471 | +1·856 | +10·333 | 27·108 | |
| 2 | E | | 10·350 | +3·737 | +11·229 | −0·601 | +0·257 | +14·622 | 24·972 | |
| 3 | W | 40° $\alpha$ | 12·475 | +3·724 | +11·224 | −0·019 | +0·570 | +15·499 | 27·974 | 27·141 |
| 4 | E | | 10·725 | +3·717 | +11·219 | +0·853 | +1·452 | +17·241 | 27·966 | |
| 5 | W | | 12·925 | +3·699 | +11·212 | +0·145 | −0·331 | +14·725 | 27·650 | |
| 6 | E | | 10·050 | +3·696 | +11·206 | +0·436 | −1·158 | +14·180 | 24·230 | |
| 7 | W | 60° $\alpha$ | 16·125 | +3·685 | +11·199 | +0·195 | −0·625 | +14·454 | 30·579 | 27·641 |
| 8 | E | | 9·025 | +3·685 | +11·191 | +0·436 | +0·864 | +16·176 | 25·201 | |
| 9 | W | | 14·475 | +3·681 | +11·183 | +0·554 | +0·662 | +16·080 | 30·555 | |
| 10 | E | | 11·000 | +3·651 | +11·176 | −1·135 | +1·139 | +14·831 | 25·831 | |
| 12 | E | 30° $\alpha$ (1) | 9·850 | +3·677 | +11·157 | −1·336 | +2·573 | +16·071 | 25·921 | 27·215 |
| 13 | W | | 3·475 | +3·694 | +11·147 | +9·246 | +0·992 | +25·079 | 28·554 | |
| 14 | E | | 14·700 | +3·675 | +11·137 | +0·224 | −0·202 | +14·834 | 29·534 | |
| 15 | W | 50° $\alpha$ (1) | 12·925 | +3·654 | +11·126 | +0·333 | +0·055 | +15·168 | 28·093 | 28·232 |
| 16 | E | | 14·400 | +3·616 | +11·115 | +0·183 | −1·011 | +13·903 | 28·303 | |
| 17 | W | | 12·500 | +3·614 | +11·102 | −0·108 | −0·110 | +14·498 | 26·998 | |
| 18 | E | | 14·950 | +3·582 | +11·089 | −0·254 | −1·029 | +13·388 | 28·338 | |
| 19 | W | 70° $\alpha$ (1) | 10·850 | +3·608 | +11·077 | +0·849 | −0·257 | +15·277 | 26·127 | |
| 20 | E | | 14·900 | +3·618 | +11·064 | −1·645 | +1·048 | +14·085 | 28·985 | 28·155 |
| 21 | W | | 13·050 | +3·587 | +11·049 | +1·203 | +0·202 | +16·041 | 29·091 | |
| 22 | W | | 11·800 | +3·589 | +11·035 | +1·291 | −0·459 | +15·456 | 27·256 | |
| 23 | E | | 15·700 | +3·579 | +11·020 | −1·151 | −0·018 | +13·430 | 29·130 | |

Mean 3° 56′ 27″·5445

Mean Result of both Faces ..... 3° 56′ 27″·3568

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## G. T. STATION KALIANPUR.

No. 9 (497) Tauri. North 6° 57′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | 60° α | 8″·225 | +6″·505 | −11″·366 | +1″·663 | +0″·110 | − 3″·088 | 5″·137 | 5″·591 |
| 5 | E | | 12·800 | +6·487 | −11·441 | −0·092 | −1·231 | − 6·277 | 6·523 | |
| 6 | W | | 13·675 | +6·442 | −11·514 | −3·340 | −1·139 | − 9·551 | 4·124 | |
| 7 | E | | 9·850 | +6·430 | −11·586 | +2·288 | −0·404 | − 3·272 | 6·578 | |
| 8 | W | 40° α | 10·100 | +6·465 | −11·659 | −2·348 | +1·489 | − 6·053 | 4·047 | 5·062 |
| 9 | E | | 8·075 | +6·464 | −11·731 | +3·571 | +0·129 | − 1·567 | 6·508 | |
| 10 | W | | 13·475 | +6·486 | −11·802 | −4·252 | −0·386 | − 9·954 | 3·521 | |
| 11 | E | | 8·125 | +6·485 | −11·873 | +4·371 | −0·937 | − 1·954 | 6·171 | |
| 12 | W | 20° α | 11·450 | +6·442 | −11·943 | −1·756 | +1·250 | − 6·007 | 5·443 | 5·921 |
| 13 | E | | 13·925 | +6·447 | −12·012 | +0·408 | −1·636 | − 6·793 | 7·132 | |
| 14 | W | | 12·600 | +6·417 | −12·079 | −1·217 | −1·048 | − 7·927 | 4·673 | |
| 15 | E | | 13·475 | +6·467 | −12·147 | +1·454 | −2·812 | − 7·038 | 6·437 | |
| 16 | W | 30° α (1) | 9·125 | +6·444 | −12·215 | +0·970 | −1·985 | − 6·786 | 2·339 | 4·955 |
| 17 | E | | 13·525 | +6·447 | −12·283 | −0·788 | +0·496 | − 6·128 | 7·397 | |
| 18 | W | | 10·975 | +6·498 | −12·348 | −0·076 | −0·809 | − 6·735 | 4·240 | |
| 19 | E | | 14·350 | +6·545 | −12·412 | −0·306 | −2·334 | − 8·507 | 5·843 | |
| 20 | W | 50° α (1) | 8·275 | +6·556 | −12·476 | +1·174 | −0·184 | − 4·930 | 3·345 | 5·904 |
| 21 | E | | 16·325 | +6·514 | −12·540 | −1·218 | −0·202 | − 7·446 | 8·879 | |
| 22 | W | | 8·225 | +6·561 | −12·601 | +0·991 | −0·956 | − 6·005 | 2·220 | |
| 23 | E | | 15·550 | +6·546 | −12·663 | −0·426 | +0·165 | − 6·378 | 9·172 | |
| 24 | W | 70° α (1) | 7·200 | +6·492 | −12·725 | +0·391 | −0·074 | − 5·916 | 1·284 | 4·740 |
| 25 | E | | 15·350 | +6·541 | −12·784 | +0·231 | −1·783 | − 7·795 | 7·555 | |
| 26 | W | | 6·500 | +6·564 | −12·844 | +1·171 | +0·625 | − 4·484 | 2·016 | |
| 27 | E | | 13·400 | +6·577 | −12·902 | −0·853 | +0·864 | − 6·314 | 7·086 | |
| 28 | W | | 8·050 | +6·587 | −12·958 | −0·068 | +1·562 | − 4·877 | 3·173 | |

Mean 6° 57′ 5″·3622

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° α | 7″·625 | +6″·563 | −13″·013 | +1″·516 | +1″·544 | − 3″·390 | 4″·235 | 4″·862 |
| 30 | E | | 13·575 | +6·540 | −13·069 | −1·006 | −0·184 | − 7·719 | 5·856 | |
| 31 | W | | 10·375 | +6·592 | −13·123 | +1·854 | −0·202 | − 4·879 | 5·496 | |
| Jan. 1 | E | | 18·625 | +6·587 | −13·228 | −6·471 | −1·654 | −14·766 | 3·859 | |
| 2 | W | 40° α | 10·350 | +6·623 | −13·281 | −0·601 | +0·147 | − 7·112 | 3·238 | 5·149 |
| 3 | E | | 13·800 | +6·601 | −13·332 | −0·019 | +0·110 | − 6·640 | 7·160 | |
| 4 | W | | 9·975 | +6·590 | −13·382 | +0·853 | −0·423 | − 6·362 | 3·613 | |
| 5 | E | | 13·975 | +6·555 | −13·430 | +0·145 | −0·662 | − 7·392 | 6·583 | |
| 6 | W | 60° α | 8·325 | +6·548 | −13·478 | +0·436 | +0·680 | − 5·814 | 2·511 | 5·155 |
| 7 | E | | 14·525 | +6·530 | −13·525 | +0·195 | +0·919 | − 5·881 | 8·644 | |
| 8 | W | | 8·000 | +6·531 | −13·570 | +0·436 | −0·074 | − 6·677 | 1·323 | |
| 9 | E | | 14·050 | +6·525 | −13·614 | +0·554 | +0·625 | − 5·910 | 8·140 | |
| 10 | W | 30° α (1) | 12·325 | +6·476 | −13·657 | −1·135 | −0·845 | − 9·161 | 3·164 | 4·533 |
| 11 | E | | 13·825 | +6·468 | −13·699 | +1·705 | −1·801 | − 7·327 | 6·498 | |
| 12 | W | | 12·675 | +6·519 | −13·739 | −1·336 | −1·507 | −10·063 | 2·612 | |
| 13 | E | | 5·200 | +6·548 | −13·778 | +9·246 | −1·360 | − 0·656 | 5·856 | |
| 14 | W | 50° α (1) | 12·850 | +6·513 | −13·816 | +0·224 | +1·029 | − 6·050 | 6·800 | 5·595 |
| 15 | E | | 11·875 | +6·474 | −13·853 | +0·333 | +0·882 | − 6·164 | 5·711 | |
| 16 | W | | 12·200 | +6·412 | −13·888 | +0·183 | +0·606 | − 6·687 | 5·513 | |
| 17 | E | | 11·850 | +6·406 | −13·920 | −0·108 | +0·129 | − 7·493 | 4·357 | |
| 18 | W | 70° α (1) | 13·200 | +6·350 | −13·952 | −0·254 | +0·441 | − 7·415 | 5·785 | 5·540 |
| 19 | E | | 11·250 | +6·395 | −13·984 | +0·849 | +0·680 | − 6·060 | 5·190 | |
| 20 | W | | 14·525 | +6·411 | −14·014 | −1·645 | −0·662 | − 9·910 | 4·615 | |
| 22 | E | | 11·450 | +6·363 | −14·068 | +1·291 | +0·772 | − 5·642 | 5·808 | |
| 23 | W | | 14·375 | +6·344 | −14·093 | −1·151 | +0·864 | − 8·036 | 6·339 | |

Mean 6° 57′ 5″·1390

Mean Result of both Faces..... 6° 57′ 5″·2506

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No. 10 (543) TAURI τ. South 1° 28′+

## Face A to the Fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 18″·725 | +1″·372 | +10″·761 | +1″·663 | −0″·092 | +13″·704 | 32″·429 | |
| 5 | W | α | 21·250 | +1·368 | +10·778 | −0·092 | +1·286 | +13·340 | 34·590 | 33″·597 |
| 6 | E | 60° | 23·975 | +1·359 | +10·795 | −3·340 | +0·992 | + 9·806 | 33·781 | |
| 7 | W | | 18·400 | +1·356 | +10·810 | +2·288 | +0·735 | +15·189 | 33·589 | |
| 8 | E | | 22·900 | +1·363 | +10·827 | −2·348 | −0·790 | + 9·052 | 31·952 | |
| 9 | W | α | 18·925 | +1·363 | +10·843 | +3·571 | −1·139 | +14·638 | 33·563 | 33·121 |
| 10 | E | 40° | 23·300 | +1·368 | +10·858 | −4·252 | +0·735 | + 8·709 | 32·009 | |
| 11 | W | | 16·400 | +1·367 | +10·874 | +4·371 | +1·948 | +18·560 | 34·960 | |
| 12 | E | | 24·375 | +1·359 | +10·889 | −1·756 | −0·864 | + 9·628 | 34·003 | |
| 13 | W | α | 19·975 | +1·358 | +10·904 | +0·408 | +2·610 | +15·280 | 35·255 | 34·261 |
| 14 | E | 20° | 18·175 | +1·355 | +10·917 | −1·217 | +2·389 | +13·444 | 31·619 | |
| 15 | W | | 19·700 | +1·363 | +10·931 | +1·454 | +2·720 | +16·468 | 36·168 | |
| 16 | E | | 17·925 | +1·359 | +10·946 | +0·970 | +1·966 | +15·241 | 33·166 | |
| 17 | W | α (1) | 22·175 | +1·360 | +10·961 | −0·788 | −0·129 | +11·404 | 33·579 | 33·362 |
| 18 | E | 30° | 19·250 | +1·372 | +10·974 | −0·076 | +0·992 | +13·262 | 32·512 | |
| 19 | W | | 18·400 | +1·381 | +10·986 | −0·306 | +3·731 | +15·792 | 34·192 | |
| 20 | E | | 20·300 | +1·383 | +10·999 | +1·174 | −0·386 | +13·170 | 33·470 | |
| 21 | W | α (1) | 23·100 | +1·374 | +11·012 | −1·218 | +0·588 | +11·756 | 34·856 | 34·024 |
| 22 | E | 50° | 17·875 | +1·384 | +11·023 | +0·991 | +1·084 | +14·482 | 32·357 | |
| 23 | W | | 23·275 | +1·381 | +11·035 | −0·426 | +0·147 | +12·137 | 35·412 | |
| 24 | E | | 18·700 | +1·370 | +11·048 | +0·391 | +0·368 | +13·177 | 31·877 | |
| 25 | W | α (1) | 19·825 | +1·379 | +11·059 | +0·231 | +2·260 | +14·929 | 34·754 | |
| 26 | E | 70° | 17·775 | +1·385 | +11·071 | +1·171 | −0·809 | +12·818 | 30·593 | 33·535 |
| 27 | W | | 25·475 | +1·388 | +11·081 | −0·853 | −0·515 | +11·101 | 36·576 | |
| 28 | E | | 21·150 | +1·389 | +11·091 | −0·068 | −1·819 | +10·593 | 31·743 | |

Mean 1° 28′ 33″·6500

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 18″·500 | +1″·384 | +11″·101 | +1″·516 | −1″·121 | +12″·880 | 31″·380 | |
| 30 | W | α | 22·775 | +1·380 | +11·111 | −1·006 | +0·404 | +11·889 | 34·664 | 33″·672 |
| 31 | E | 20° | 19·675 | +1·391 | +11·120 | +1·854 | +0·680 | +15·045 | 34·720 | |
| Jan. 1 | W | | 25·675 | +1·391 | +11·177 | −6·471 | +2·150 | + 8·247 | 33·922 | |
| 2 | E | | 20·250 | +1·397 | +11·186 | −0·601 | +0·570 | +12·552 | 32·802 | |
| 3 | W | α | 22·575 | +1·392 | +11·195 | −0·019 | −0·147 | +12·421 | 34·996 | 34·312 |
| 4 | E | 40° | 20·450 | +1·390 | +11·203 | +0·853 | +0·202 | +13·648 | 34·098 | |
| 5 | W | | 21·825 | +1·382 | +11·210 | +0·145 | +0·790 | +13·527 | 35·352 | |
| 6 | E | | 19·525 | +1·380 | +11·218 | +0·436 | −1·305 | +11·729 | 31·254 | |
| 7 | W | α | 23·875 | +1·377 | +11·225 | +0·195 | −0·827 | +11·970 | 35·845 | 33·298 |
| 8 | E | 60° | 17·675 | +1·378 | +11·231 | +0·436 | −0·092 | +12·953 | 30·628 | |
| 9 | W | | 22·350 | +1·377 | +11·237 | +0·554 | −0·055 | +13·113 | 35·463 | |
| 10 | E | | 19·175 | +1·368 | +11·243 | −1·135 | +1·544 | +13·020 | 32·195 | |
| 11 | W | α (1) | 18·250 | +1·366 | +11·249 | +1·705 | +2·022 | +16·342 | 34·592 | 33·606 |
| 12 | E | 30° | 20·450 | +1·376 | +11·253 | −1·336 | +0·882 | +12·175 | 32·625 | |
| 13 | W | | 11·750 | +1·381 | +11·257 | +9·246 | +1·378 | +23·262 | 35·012 | |
| 14 | E | | 23·075 | +1·374 | +11·261 | +0·224 | −1·231 | +11·628 | 34·703 | |
| 15 | W | α (1) | 20·675 | +1·365 | +11·265 | +0·333 | −0·606 | +12·357 | 33·032 | 34·115 |
| 16 | E | 50° | 23·200 | +1·354 | +11·268 | +0·183 | −0·257 | +12·548 | 35·748 | |
| 17 | W | | 21·275 | +1·351 | +11·269 | −0·108 | −0·809 | +11·703 | 32·978 | |
| 18 | E | | 23·250 | +1·339 | +11·270 | −0·254 | −0·239 | +12·116 | 35·366 | |
| 19 | W | | 19·450 | +1·349 | +11·272 | +0·849 | +0·165 | +13·635 | 33·085 | |
| 20 | E | α (1) | 24·225 | +1·351 | +11·273 | −1·645 | +0·331 | +11·310 | 35·535 | 34·446 |
| 21 | W | 70° | 20·125 | +1·341 | +11·273 | +1·203 | +1·066 | +14·883 | 35·008 | |
| 22 | W | | 19·825 | +1·343 | +11·273 | +1·291 | −0·901 | +13·006 | 32·831 | |
| 23 | E | | 23·925 | +1·338 | +11·272 | −1·151 | −0·533 | +10·926 | 34·851 | |

Mean 1° 28′ 33″·9082

Mean Result of both Faces..... 1° 28′ 33″·7791

5 E

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## G. T. STATION KALIANPUR.

### No. 11 (570) 3 Aurigæ *i*. North 8° 47′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | 60° *a* | 8″·050 | +8″·253 | −10″·327 | +1″·663 | −0″·386 | − 0″·797 | 7″·253 | 8″·062 |
| 5 | E | | 13·525 | +8·227 | −10·404 | −0·092 | −1·636 | − 3·905 | 9·620 | |
| 6 | W | | 12·075 | +8·173 | −10·480 | −3·340 | −0·496 | − 6·143 | 5·932 | |
| 7 | E | | 10·125 | +8·155 | −10·556 | +2·288 | −0·570 | − 0·683 | 9·442 | |
| 8 | W | 40° *a* | 10·200 | +8·194 | −10·633 | −2·348 | +0·276 | − 4·511 | 5·689 | 8·311 |
| 9 | E | | 9·350 | +8·195 | −10·709 | +3·571 | +0·239 | + 1·296 | 10·646 | |
| 10 | W | | 15·425 | +8·223 | −10·785 | −4·252 | −0·515 | − 7·329 | 8·096 | |
| 11 | E | | 8·850 | +8·218 | −10·861 | +4·371 | −1·764 | − 0·036 | 8·814 | |
| 12 | W | 20° *a* | 11·325 | +8·170 | −10·937 | −1·756 | +0·937 | − 3·586 | 7·739 | 8·185 |
| 13 | E | | 13·475 | +8·163 | −11·011 | +0·408 | −2·389 | − 4·829 | 8·646 | |
| 14 | W | | 12·575 | +8·152 | −11·085 | −1·217 | −3·106 | − 7·256 | 5·319 | |
| 15 | E | | 13·275 | +8·187 | −11·160 | +1·454 | −2·720 | − 4·239 | 9·036 | |
| 16 | W | 30° *a* (1) | 11·250 | +8·174 | −11·236 | +0·970 | −1·728 | − 3·820 | 7·430 | 8·310 |
| 17 | E | | 15·425 | +8·178 | −11·311 | −0·788 | −0·845 | − 4·766 | 10·659 | |
| 18 | W | | 11·800 | +8·259 | −11·384 | −0·076 | −1·084 | − 4·285 | 7·515 | |
| 19 | E | | 13·925 | +8·304 | −11·457 | −0·306 | −2·830 | − 6·289 | 7·636 | |
| 20 | W | 50° *a* (1) | 11·275 | +8·320 | −11·530 | +1·174 | −0·588 | − 2·624 | 8·651 | 8·701 |
| 21 | E | | 14·625 | +8·266 | −11·603 | −1·218 | −1·011 | − 5·566 | 9·059 | |
| 22 | W | | 9·825 | +8·329 | −11·674 | +0·991 | −0·588 | − 2·942 | 6·883 | |
| 23 | E | | 15·275 | +8·302 | −11·745 | −0·426 | −1·195 | − 5·064 | 10·211 | |
| 24 | W | 70° *a* (1) | 10·425 | +8·245 | −11·818 | +0·391 | −0·717 | − 3·899 | 6·526 | 8·706 |
| 25 | E | | 17·550 | +8·288 | −11·888 | +0·231 | −4·411 | − 7·780 | 9·770 | |
| 26 | W | | 8·425 | +8·332 | −11·959 | +1·171 | +0·625 | − 1·831 | 6·594 | |
| 27 | E | | 15·250 | +8·354 | −12·028 | −0·853 | +0·147 | − 4·380 | 10·870 | |
| 28 | W | | 10·100 | +8·346 | −12·097 | −0·068 | +1·875 | − 1·944 | 8·156 | |

Mean 8° 47′ 8″·3792

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° *a* | 10″·600 | +8″·318 | −12″·165 | +1″·516 | −0″·110 | − 2″·441 | 8″·159 | 8″·148 |
| 30 | E | | 13·625 | +8·303 | −12·233 | −1·006 | −0·129 | − 5·065 | 8·560 | |
| 31 | W | | 11·350 | +8·365 | −12·300 | +1·854 | −0·368 | − 2·449 | 8·901 | |
| Jan. 1 | E | | 18·225 | +8·369 | −12·418 | −6·471 | −0·735 | −11·255 | 6·970 | |
| 2 | W | 40° *a* | 14·700 | +8·404 | −12·484 | −0·601 | −0·717 | − 5·398 | 9·302 | 8·972 |
| 3 | E | | 13·375 | +8·371 | −12·550 | −0·019 | +0·147 | − 4·051 | 9·324 | |
| 4 | W | | 12·925 | +8·364 | −12·614 | +0·853 | −1·231 | − 4·628 | 8·297 | |
| 5 | E | | 13·775 | +8·309 | −12·677 | +0·145 | −0·588 | − 4·811 | 8·964 | |
| 6 | W | 60° *a* | 10·125 | +8·295 | −12·740 | +0·436 | +1·672 | − 2·337 | 7·788 | 9·065 |
| 7 | E | | 13·350 | +8·275 | −12·802 | +0·195 | +1·084 | − 3·248 | 10·102 | |
| 8 | W | | 10·525 | +8·286 | −12·863 | +0·436 | −0·055 | − 4·196 | 6·329 | |
| 9 | E | | 16·200 | +8·283 | −12·923 | +0·554 | −0·074 | − 4·160 | 12·040 | |
| 10 | W | 30° *a* (1) | 13·075 | +8·237 | −12·982 | −1·135 | −1·286 | − 7·166 | 5·909 | 8·044 |
| 11 | E | | 14·650 | +8·226 | −13·041 | +1·705 | −1·709 | − 4·819 | 9·831 | |
| 12 | W | | 13·875 | +8·277 | −13·097 | −1·336 | −1·268 | − 7·424 | 6·451 | |
| 13 | E | | 6·775 | +8·310 | −13·153 | +9·246 | −1·195 | + 3·208 | 9·983 | |
| 14 | W | 50° *a* (1) | 15·575 | +8·261 | −13·209 | +0·224 | +0·680 | − 4·044 | 11·531 | 9·530 |
| 15 | E | | 13·125 | +8·202 | −13·263 | +0·333 | +0·037 | − 4·691 | 8·434 | |
| 16 | W | | 13·425 | +8·146 | −13·317 | +0·183 | +0·478 | − 4·510 | 8·915 | |
| 17 | E | | 13·500 | +8·129 | −13·367 | −0·108 | +1·084 | − 4·262 | 9·238 | |
| 18 | W | 70° *a* (1) | 14·625 | +8·056 | −13·417 | −0·254 | −0·165 | − 5·780 | 8·845 | 8·759 |
| 19 | E | | 13·100 | +8·110 | −13·467 | +0·849 | −0·515 | − 5·023 | 8·077 | |
| 20 | W | | 16·200 | +8·122 | −13·516 | −1·645 | −0·221 | − 7·260 | 8·940 | |
| 22 | E | | 12·525 | +8·083 | −13·609 | +1·291 | +0·735 | − 3·500 | 9·025 | |
| 23 | W | | 15·925 | +8·050 | −13·653 | −1·151 | −0·055 | − 6·809 | 9·116 | |

Mean 8° 47′ 8″·7530

Mean Result of both Faces..... 8° 47′ 8″·5661

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## No. 12 (585) 102 Tauri. South 2° 45′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | E | 60° α | 37″·475 | +2″·576 | +10″·288 | +1″·663 | +0″·459 | +14″·986 | 52″·461 | 53″·397 |
| 5 | W | | 40·600 | +2·567 | +10·291 | −0·092 | +1·783 | +14·549 | 55·149 | |
| 6 | E | | 41·500 | +2·551 | +10·292 | −3·340 | +0·459 | + 9·962 | 51·462 | |
| 7 | W | | 39·150 | +2·545 | +10·294 | +2·288 | +0·239 | +15·366 | 54·516 | |
| 8 | E | 40° α | 41·025 | +2·557 | +10·296 | −2·348 | −0·129 | +10·376 | 51·401 | 53·082 |
| 9 | W | | 37·800 | +2·557 | +10·298 | +3·571 | +0·698 | +17·124 | 54·924 | |
| 10 | E | | 42·200 | +2·566 | +10·300 | −4·252 | +0·459 | + 9·073 | 51·273 | |
| 11 | W | | 36·225 | +2·564 | +10·302 | +4·371 | +1·268 | +18·505 | 54·730 | |
| 12 | E | 20° α | 40·075 | +2·550 | +10·304 | −1·756 | −0·606 | +10·492 | 50·567 | 53·169 |
| 13 | W | | 40·000 | +2·546 | +10·305 | +0·408 | +2·316 | +15·575 | 55·575 | |
| 14 | E | | 35·850 | +2·545 | +10·305 | −1·217 | +2·444 | +14·077 | 49·927 | |
| 15 | W | | 39·625 | +2·554 | +10·307 | +1·454 | +2·665 | +16·980 | 56·605 | |
| 16 | E | 30° α (1) | 36·900 | +2·551 | +10·309 | +0·970 | +2·095 | +15·925 | 52·825 | 53·448 |
| 17 | W | | 41·900 | +2·552 | +10·312 | −0·788 | +0·864 | +12·940 | 54·840 | |
| 18 | E | | 37·675 | +2·578 | +10·313 | −0·076 | +1·434 | +14·249 | 51·924 | |
| 19 | W | | 40·300 | +2·592 | +10·313 | −0·306 | +1·305 | +13·904 | 54·204 | |
| 20 | E | 50° α (1) | 39·075 | +2·597 | +10·315 | +1·174 | +1·231 | +15·317 | 54·392 | 54·138 |
| 21 | W | | 42·250 | +2·580 | +10·317 | −1·218 | +1·066 | +12·745 | 54·995 | |
| 22 | E | | 38·125 | +2·600 | +10·317 | +0·991 | +0·184 | +14·092 | 52·217 | |
| 23 | W | | 40·775 | +2·591 | +10·318 | −0·426 | +1·691 | +14·174 | 54·949 | |
| 24 | E | 70° α (1) | 36·875 | +2·574 | +10·320 | +0·391 | +0·698 | +13·983 | 50·858 | 53·196 |
| 25 | W | | 40·975 | +2·586 | +10·321 | +0·231 | +3·382 | +16·520 | 57·495 | |
| 26 | E | | 36·800 | +2·601 | +10·324 | +1·171 | −0·974 | +13·122 | 49·922 | |
| 27 | W | | 42·300 | +2·608 | +10·324 | −0·853 | +0·423 | +12·502 | 54·802 | |
| 28 | E | | 38·150 | +2·604 | +10·325 | −0·068 | −1·066 | +11·795 | 49·945 | |

Mean 2° 45′ 53″·4050

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | 20° α | 37″·125 | +2″·595 | +10″·326 | +1″·516 | +1″·452 | +15″·889 | 53″·014 | 53″·200 |
| 30 | W | | 42·125 | +2·592 | +10·328 | −1·006 | +0·129 | +12·043 | 54·168 | |
| 31 | E | | 38·225 | +2·611 | +10·329 | +1·854 | +0·662 | +15·456 | 53·681 | |
| Jan. 1 | W | | 45·050 | +2·613 | +10·378 | −6·471 | +0·368 | + 6·888 | 51·938 | |
| 2 | E | 40° α | 38·900 | +2·623 | +10·380 | −0·601 | +1·544 | +13·946 | 52·846 | 53·271 |
| 3 | W | | 38·875 | +2·612 | +10·381 | −0·019 | +0·349 | +13·323 | 52·198 | |
| 4 | E | | 38·975 | +2·611 | +10·382 | +0·853 | +1·764 | +15·610 | 54·585 | |
| 5 | W | | 40·150 | +2·593 | +10·382 | +0·145 | +0·184 | +13·304 | 53·454 | |
| 6 | E | 60° α | 38·850 | +2·588 | +10·383 | +0·436 | −1·084 | +12·323 | 51·173 | 52·696 |
| 7 | W | | 42·050 | +2·582 | +10·384 | +0·195 | −1·066 | +12·095 | 54·145 | |
| 8 | E | | 37·475 | +2·586 | +10·384 | +0·436 | +0·037 | +13·443 | 50·918 | |
| 9 | W | | 41·650 | +2·585 | +10·385 | +0·554 | −0·625 | +12·899 | 54·549 | |
| 10 | E | 30° α (1) | 37·875 | +2·572 | +10·385 | −1·135 | +1·268 | +13·090 | 50·965 | 53·083 |
| 11 | W | | 38·325 | +2·569 | +10·386 | +1·705 | +0·423 | +15·083 | 53·408 | |
| 12 | E | | 38·100 | +2·584 | +10·385 | −1·336 | +2·224 | +13·857 | 51·957 | |
| 13 | W | | 31·000 | +2·594 | +10·385 | +9·246 | +2·775 | +25·000 | 56·000 | |
| 14 | E | 50° α (1) | 41·300 | +2·578 | +10·385 | +0·224 | +0·588 | +13·775 | 55·075 | 53·350 |
| 15 | W | | 40·050 | +2·559 | +10·385 | +0·333 | −1·599 | +11·678 | 51·728 | |
| 16 | E | | 41·725 | +2·543 | +10·385 | +0·183 | −0·588 | +12·523 | 54·248 | |
| 17 | W | | 39·925 | +2·537 | +10·382 | −0·108 | −0·386 | +12·425 | 52·350 | |
| 18 | E | 70° α (1) | 40·600 | +2·514 | +10·381 | −0·254 | +1·544 | +14·185 | 54·785 | 53·651 |
| 20 | E | | 42·950 | +2·534 | +10·380 | −1·645 | −0·257 | +11·012 | 53·962 | |
| 21 | W | | 38·675 | +2·517 | +10·378 | +1·203 | +0·882 | +14·980 | 53·655 | |
| 22 | W | | 38·050 | +2·523 | +10·376 | +1·291 | −0·037 | +14·153 | 52·203 | |

Mean 2° 45′ 53″·2085

Mean Result of both Faces ..... 2° 45′ 53″·3068



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## G. T. STATION KALIANPUR.

### No. 13 (594) Tauri. South 0° 4′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | 60° α | 11″·125 | +0″·065 | +10″·110 | −1″·663 | +1″·709 | +10″·221 | 21″·346 | 21″·236 |
| 5 | E | | 9·950 | +0·065 | +10·128 | +0·092 | +1·783 | +12·068 | 22·018 | |
| 6 | W | | 7·075 | +0·064 | +10·145 | +3·340 | +0·956 | +14·505 | 21·580 | |
| 7 | E | | 11·325 | +0·064 | +10·162 | −2·288 | +0·735 | + 8·673 | 19·998 | |
| 8 | W | 40° α | 11·375 | +0·065 | +10·179 | +2·348 | +0·533 | +13·125 | 24·500 | 21·424 |
| 9 | E | | 14·825 | +0·065 | +10·197 | −3·571 | −0·037 | + 6·654 | 21·479 | |
| 10 | W | | 6·250 | +0·065 | +10·213 | +4·252 | −1·323 | +13·207 | 19·457 | |
| 11 | E | | 13·875 | +0·065 | +10·231 | −4·371 | +0·459 | + 6·384 | 20·259 | |
| 12 | W | 20° α | 9·775 | +0·064 | +10·248 | +1·756 | −0·202 | +11·866 | 21·641 | 21·242 |
| 13 | E | | 9·625 | +0·064 | +10·265 | −0·408 | +1·066 | +10·987 | 20·612 | |
| 14 | W | | 9·225 | +0·064 | +10·281 | +1·217 | +2·187 | +13·749 | 22·974 | |
| 15 | E | | 9·125 | +0·064 | +10·298 | −1·454 | +1·709 | +10·617 | 19·742 | |
| 16 | W | 30° α (3) | 11·475 | +0·064 | +10·316 | −0·970 | +2·242 | +11·652 | 23·127 | 22·009 |
| 17 | E | | 10·850 | +0·064 | +10·334 | +0·788 | +0·074 | +11·260 | 22·110 | |
| 18 | W | | 10·275 | +0·065 | +10·351 | +0·076 | +1·213 | +11·705 | 21·980 | |
| 19 | E | | 9·200 | +0·065 | +10·367 | +0·306 | +0·882 | +11·620 | 20·820 | |
| 20 | W | 50° α (3) | 11·775 | +0·066 | +10·384 | −1·174 | +1·746 | +11·022 | 22·797 | 21·608 |
| 21 | E | | 7·800 | +0·065 | +10·402 | +1·218 | +1·121 | +12·806 | 20·606 | |
| 22 | W | | 12·100 | +0·066 | +10·417 | −0·991 | +0·827 | +10·319 | 22·419 | |
| 23 | E | | 8·600 | +0·065 | +10·434 | +0·426 | +1·084 | +12·009 | 20·609 | |
| 24 | W | 70° α (3) | 11·175 | +0·065 | +10·453 | −0·391 | +1·250 | +11·377 | 22·552 | 21·331 |
| 25 | E | | 8·750 | +0·065 | +10·469 | −0·231 | +0·864 | +11·167 | 19·917 | |
| 26 | W | | 12·675 | +0·066 | +10·486 | −1·171 | −0·533 | + 8·848 | 21·523 | |
| 27 | E | | 9·800 | +0·066 | +10·502 | +0·853 | +0·110 | +11·531 | 21·331 | |
| 28 | W | | 11·200 | +0·066 | +10·518 | +0·068 | +0·184 | +10·836 | 22·036 | |

Mean 0° 4′ 21″·4750

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° α | 12″·200 | +0″·065 | +10″·534 | −1″·516 | +1″·434 | +10″·517 | 22″·717 | 21″·604 |
| 30 | E | | 8·600 | +0·065 | +10·551 | +1·006 | +0·809 | +12·431 | 21·031 | |
| 31 | W | | 10·975 | +0·066 | +10·567 | −1·854 | +1·378 | +10·157 | 21·132 | |
| Jan. 1 | E | | 3·375 | +0·066 | +10·631 | +6·471 | +0·992 | +18·160 | 21·535 | |
| 2 | W | 40° α | 10·325 | +0·066 | +10·648 | +0·601 | +1·636 | +12·951 | 23·276 | 22·044 |
| 3 | E | | 9·050 | +0·066 | +10·664 | +0·019 | −0·478 | +10·271 | 19·321 | |
| 4 | W | | 12·200 | +0·066 | +10·680 | −0·853 | +0·698 | +10·591 | 22·791 | |
| 5 | E | | 12·925 | +0·065 | +10·695 | −0·145 | −0·753 | + 9·862 | 22·787 | |
| 6 | W | 60° α | 12·575 | +0·065 | +10·711 | −0·436 | −0·974 | + 9·366 | 21·941 | 19·798 |
| 7 | E | | 6·200 | +0·065 | +10·726 | −0·195 | −0·735 | + 9·861 | 16·061 | |
| 8 | W | | 13·000 | +0·065 | +10·740 | −0·436 | −0·386 | + 9·983 | 22·983 | |
| 9 | E | | 9·025 | +0·065 | +10·755 | −0·554 | −1·084 | + 9·182 | 18·207 | |
| 10 | W | 30° α (3) | 9·575 | +0·065 | +10·770 | +1·135 | +1·103 | +13·073 | 22·648 | 21·797 |
| 11 | E | | 8·525 | +0·065 | +10·785 | −1·705 | +1·139 | +10·284 | 18·809 | |
| 12 | W | | 9·150 | +0·065 | +10·798 | +1·336 | +1·378 | +13·577 | 22·727 | |
| 13 | E | | 18·175 | +0·065 | +10·812 | −9·246 | +3·198 | + 4·829 | 23·004 | |
| 14 | W | 50° α (3) | 15·050 | +0·065 | +10·826 | −0·224 | +0·165 | +10·832 | 25·882 | 22·414 |
| 15 | E | | 10·850 | +0·065 | +10·839 | −0·333 | −0·827 | + 9·744 | 20·594 | |
| 16 | W | | 10·975 | +0·064 | +10·853 | −0·183 | −0·790 | + 9·944 | 20·919 | |
| 17 | E | | 11·300 | +0·064 | +10·863 | +0·108 | −0·074 | +10·961 | 22·261 | |
| 18 | W | 70° α (3) | 9·550 | +0·063 | +10·875 | +0·254 | +1·268 | +12·460 | 22·010 | 21·964 |
| 20 | W | | 7·800 | +0·064 | +10·900 | +1·645 | −0·276 | +12·333 | 20·133 | |
| 22 | E | | 13·350 | +0·064 | +10·922 | −1·291 | −0·606 | + 9·089 | 22·439 | |
| 23 | E | | 13·300 | +0·063 | +10·931 | −1·151 | +0·129 | + 9·972 | 23·272 | |

Mean 0° 4′ 21″·6035

Mean Result of both Faces ..... 0° 4′ 21″·5393

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No. 14 (612) 14 AURIGÆ *a*. North 8° 22′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | E | 60° *a* | 36″·750 | +7″·866 | — 9″·614 | —1″·663 | —1″·709 | — 5″·120 | 31″·630 | 30″·285 |
| 5 | W | | 32·350 | +7·840 | — 9·682 | +0·092 | —1·599 | — 3·349 | 29·001 | |
| 6 | E | | 30·775 | +7·791 | — 9·749 | +3·340 | —1·048 | + 0·334 | 31·109 | |
| 7 | W | | 34·800 | +7·771 | — 9·816 | —2·288 | —1·066 | — 5·399 | 29·401 | |
| 8 | E | 40° *a* | 31·775 | +7·806 | — 9·885 | +2·348 | —0·331 | — 0·062 | 31·713 | 31·807 |
| 9 | W | | 35·775 | +7·807 | — 9·953 | —3·571 | +0·459 | — 5·258 | 30·517 | |
| 10 | E | | 31·750 | +7·835 | —10·020 | +4·252 | +0·055 | + 2·122 | 33·872 | |
| 11 | W | | 37·775 | +7·827 | —10·088 | —4·371 | —0·018 | — 6·650 | 31·125 | |
| 12 | E | 20° *a* | 33·925 | +7·786 | —10·157 | +1·756 | —0·331 | — 0·946 | 32·979 | 31·315 |
| 13 | W | | 32·750 | +7·771 | —10·224 | —0·408 | —1·195 | — 4·056 | 28·694 | |
| 14 | E | | 37·250 | +7·776 | —10·291 | +1·217 | —2·591 | — 3·889 | 33·361 | |
| 15 | W | | 35·350 | +7·793 | —10·359 | —1·454 | —1·103 | — 5·123 | 30·227 | |
| 16 | E | 30° *a* (1) | 36·800 | +7·791 | —10·428 | —0·970 | —2·058 | — 5·665 | 31·135 | 31·084 |
| 17 | W | | 32·200 | +7·795 | —10·497 | +0·788 | +0·956 | — 0·958 | 31·242 | |
| 18 | E | | 34·625 | +7·880 | —10·565 | +0·076 | —0·515 | — 3·124 | 31·501 | |
| 19 | W | | 33·675 | +7·916 | —10·632 | +0·306 | —0·809 | — 3·219 | 30·456 | |
| 20 | E | 50° *a* (1) | 36·125 | +7·932 | —10·700 | —1·174 | —1·415 | — 3·357 | 32·768 | 30·155 |
| 21 | W | | 30·175 | +7·879 | —10·768 | +1·218 | —0·423 | — 2·094 | 28·081 | |
| 22 | E | | 35·550 | +7·943 | —10·834 | —0·991 | —1·158 | — 5·040 | 30·510 | |
| 23 | W | | 31·825 | +7·912 | —10·901 | +0·426 | 0·000 | — 2·563 | 29·262 | |
| 24 | E | 70° *a* (1) | 37·725 | +7·864 | —10·970 | —0·391 | —1·415 | — 4·912 | 32·813 | 30·491 |
| 25 | W | | 32·275 | +7·894 | —11·036 | —0·231 | —0·570 | — 3·943 | 28·332 | |
| 26 | E | | 36·150 | +7·944 | —11·103 | —1·171 | +0·698 | — 3·632 | 32·518 | |
| 27 | W | | 30·875 | +7·969 | —11·169 | +0·853 | +0·055 | — 2·292 | 28·583 | |
| 28 | E | | 35·350 | +7·949 | —11·235 | +0·068 | +0·110 | — 3·108 | 32·242 | |

Mean 8° 22′ 30″·8562

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | 20° *a* | 37″·275 | +7″·924 | —11″·301 | —1″·516 | —0″·018 | — 4″·911 | 32″·364 | 30″·136 |
| 30 | W | | 31·650 | +7·917 | —11·367 | +1·006 | —0·129 | — 2·573 | 29·077 | |
| 31 | E | | 35·475 | +7·974 | —11·432 | —1·854 | —1·360 | — 6·672 | 28·803 | |
| Jan. 1 | W | | 27·300 | +7·984 | —11·548 | +6·471 | +0·092 | + 2·999 | 30·299 | |
| 2 | E | 40° *a* | 34·150 | +8·011 | —11·613 | +0·601 | —0·606 | — 3·607 | 30·543 | 30·232 |
| 3 | W | | 33·525 | +7·977 | —11·677 | +0·019 | +0·882 | — 2·799 | 30·726 | |
| 4 | E | | 34·650 | +7·974 | —11·741 | —0·853 | +0·864 | — 3·756 | 30·894 | |
| 5 | W | | 32·375 | +7·916 | —11·803 | —0·145 | +0·423 | — 3·609 | 28·766 | |
| 6 | E | 60° *a* | 35·950 | +7·899 | —11·866 | —0·436 | +1·581 | — 2·822 | 33·128 | 31·078 |
| 7 | W | | 32·450 | +7·883 | —11·928 | —0·195 | +0·386 | — 3·854 | 28·596 | |
| 8 | E | | 36·575 | +7·898 | —11·989 | —0·436 | +0·937 | — 3·590 | 32·985 | |
| 9 | W | | 33·225 | +7·898 | —12·050 | —0·554 | +1·084 | — 3·622 | 29·603 | |
| 10 | E | 30° *a* (1) | 37·075 | +7·863 | —12·111 | +1·135 | —0·753 | — 3·866 | 33·209 | 30·549 |
| 11 | W | | 35·700 | +7·853 | —12·170 | —1·705 | —1·746 | — 7·768 | 27·932 | |
| 12 | E | | 35·925 | +7·893 | —12·228 | +1·336 | —0·459 | — 3·458 | 32·467 | |
| 13 | W | | 44·200 | +7·922 | —12·286 | —9·246 | —2·003 | —15·613 | 28·587 | |
| 14 | E | 50° *a* (1) | 38·000 | +7·874 | —12·344 | —0·224 | +1·250 | — 3·444 | 34·556 | 31·482 |
| 15 | W | | 33·750 | +7·811 | —12·400 | —0·333 | +0·625 | — 4·297 | 29·453 | |
| 16 | E | | 34·150 | +7·771 | —12·457 | —0·183 | +1·011 | — 3·858 | 30·292 | |
| 17 | W | | 34·700 | +7·749 | —12·510 | +0·108 | +1·581 | — 3·072 | 31·628 | |
| 18 | E | 70° *a* (1) | 34·875 | +7·679 | —12·563 | +0·254 | —0·184 | — 4·814 | 30·061 | 30·574 |
| 20 | E | | 33·950 | +7·735 | —12·670 | +1·645 | +0·257 | — 3·033 | 30·917 | |
| 21 | W | | 36·225 | +7·688 | —12·721 | —1·203 | +1·213 | — 5·023 | 31·202 | |
| 22 | W | | 36·200 | +7·710 | —12·771 | —1·291 | +1·121 | — 5·231 | 30·969 | |
| 23 | W | | 36·525 | +7·674 | —12·820 | —1·151 | —0·423 | — 6·720 | 29·805 | |

Mean 8° 22′ 30″·6752

Mean Result of both Faces ..... 8° 22′ 30″·7657

5 F

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## G. T. STATION KALIANPUR.

### No. 15 (637) AURIGÆ. North 6° 51′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 61″·125 | +6″·433 | − 9″·309 | +1″·663 | −0″·790 | − 2″·003 | 59″·122 | |
| 5 | E | 60° α | 67·375 | +6·412 | − 9·363 | −0·092 | −1·911 | − 4·954 | 62·421 | 60″·732 |
| 6 | W | | 66·375 | +6·374 | − 9·418 | −3·340 | −0·680 | − 7·064 | 59·311 | |
| 7 | E | | 63·600 | +6·357 | − 9·472 | +2·288 | −0·698 | − 1·525 | 62·075 | |
| 8 | W | | 62·900 | +6·388 | − 9·527 | −2·348 | +0·368 | − 5·119 | 57·781 | |
| 9 | E | 40° α | 59·850 | +6·385 | − 9·582 | +3·571 | −0·459 | − 0·085 | 59·765 | 59·638 |
| 10 | W | | 67·475 | +6·408 | − 9·637 | −4·252 | −1·728 | − 9·209 | 58·266 | |
| 11 | E | | 61·950 | +6·404 | − 9·693 | +4·371 | −0·294 | + 0·788 | 62·738 | |
| 12 | W | | 65·950 | +6·369 | − 9·749 | −1·756 | −0·257 | − 5·393 | 60·557 | |
| 13 | E | 20° α | 66·750 | +6·357 | − 9·804 | +0·408 | −2·389 | − 5·428 | 61·322 | 60·896 |
| 14 | W | | 65·800 | +6·360 | − 9·859 | −1·217 | −2·628 | − 7·344 | 58·456 | |
| 15 | E | | 67·375 | +6·375 | − 9·915 | +1·454 | −2·040 | − 4·126 | 63·249 | |
| 16 | W | | 62·500 | +6·374 | − 9·972 | +0·970 | −2·555 | − 5·183 | 57·317 | |
| 17 | E | 30° α (1) | 68·350 | +6·379 | −10·029 | −0·788 | +0·496 | − 3·942 | 64·408 | 61·013 |
| 18 | W | | 62·425 | +6·449 | −10·085 | −0·076 | +0·110 | − 3·602 | 58·823 | |
| 19 | E | | 68·450 | +6·475 | −10·141 | −0·306 | −0·974 | − 4·946 | 63·504 | |
| 20 | W | | 63·450 | +6·487 | −10·198 | +1·174 | −1·342 | − 3·879 | 59·571 | |
| 21 | E | 50° α (1) | 69·775 | +6·445 | −10·255 | −1·218 | −0·423 | − 5·451 | 64·324 | 61·703 |
| 22 | W | | 62·150 | +6·498 | −10·310 | +0·991 | −0·368 | − 3·189 | 58·961 | |
| 23 | E | | 68·550 | +6·475 | −10·367 | −0·426 | −0·276 | − 4·594 | 63·956 | |
| 24 | W | | 61·750 | +6·436 | −10·425 | +0·391 | −1·195 | − 4·793 | 56·957 | |
| 25 | E | | 68·600 | +6·459 | −10·481 | +0·231 | −1·893 | − 5·684 | 62·916 | |
| 26 | W | 70° α (1) | 59·975 | +6·498 | −10·538 | +1·171 | +1·029 | − 1·840 | 58·135 | 60·174 |
| 27 | E | | 67·250 | +6·517 | −10·594 | −0·853 | −0·551 | − 5·481 | 61·769 | |
| 28 | W | | 62·425 | +6·502 | −10·650 | −0·068 | +0·717 | − 3·499 | 58·926 | |

Mean 6° 52′ 0″·6927

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 62″·575 | +6″·485 | −10″·706 | +1″·516 | +1″·911 | − 0″·794 | 61″·781 | |
| 30 | E | 20° α | 67·575 | +6·480 | −10·763 | −1·006 | +0·680 | − 4·609 | 62·966 | 61″·643 |
| 31 | W | | 61·800 | +6·523 | −10·818 | +1·854 | 0·000 | − 2·441 | 59·359 | |
| Jan. 1 | E | | 72·500 | +6·531 | −10·923 | −6·471 | +0·827 | −10·036 | 62·464 | |
| 2 | W | | 64·925 | +6·554 | −10·979 | −0·601 | −0·441 | − 5·467 | 59·458 | |
| 3 | E | 40° α | 67·875 | +6·528 | −11·035 | −0·019 | +0·202 | − 4·324 | 63·551 | 61·181 |
| 5 | E | | 66·650 | +6·479 | −11·145 | +0·145 | +0·129 | − 4·392 | 62·258 | |
| 6 | W | | 62·225 | +6·468 | −11·200 | +0·436 | +1·636 | − 2·660 | 59·565 | |
| 7 | E | 60° α | 67·575 | +6·452 | −11·254 | +0·195 | +0·680 | − 3·927 | 63·648 | 61·351 |
| 8 | W | | 61·900 | +6·460 | −11·307 | +0·436 | +0·533 | − 3·878 | 58·022 | |
| 9 | E | | 67·575 | +6·465 | −11·361 | +0·554 | +0·937 | − 3·405 | 64·170 | |
| 10 | W | | 66·475 | +6·440 | −11·414 | −1·135 | −1·139 | − 7·248 | 59·227 | |
| 11 | E | 30° α (1) | 66·825 | +6·423 | −11·467 | +1·705 | −0·496 | − 3·835 | 62·990 | 60·941 |
| 12 | W | | 66·900 | +6·458 | −11·518 | −1·336 | −1·525 | − 7·921 | 58·979 | |
| 13 | E | | 60·300 | +6·483 | −11·570 | +9·246 | −1·893 | + 2·266 | 62·566 | |
| 14 | W | | 66·050 | +6·442 | −11·621 | +0·224 | +0·901 | − 4·054 | 61·996 | |
| 15 | E | 50° α (1) | 65·950 | +6·392 | −11·672 | +0·333 | +1·452 | − 3·495 | 62·455 | 61·792 |
| 16 | W | | 65·750 | +6·362 | −11·722 | +0·183 | +0·827 | − 4·350 | 61·400 | |
| 17 | E | | 65·625 | +6·338 | −11·770 | −0·108 | +1·231 | − 4·309 | 61·316 | |
| 18 | W | | 67·625 | +6·289 | −11·818 | −0·254 | −0·037 | − 5·820 | 61·805 | |
| 20 | W | | 68·350 | +6·328 | −11·915 | −1·645 | +0·625 | − 6·607 | 61·743 | |
| 21 | E | 70° α (1) | 65·175 | +6·289 | −11·961 | +1·203 | +1·323 | − 3·146 | 62·029 | 61·479 |
| 22 | E | | 64·775 | +6·308 | −12·007 | +1·291 | +1·029 | − 3·379 | 61·396 | |
| 23 | E | | 64·900 | +6·277 | −12·052 | +1·151 | −0·147 | − 4·771 | 60·129 | |

Mean 6° 52′ 1″·3978

Mean Result of both Faces ..... 6° 52′ 1″·0453

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No. 16 (661) 25 Aurigæ χ. North 7° 56′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | E | 60° α | 53″·550 | +7″·455 | — 8″·938 | —1″·663 | —0″·404 | — 3″·550 | 50″·000 | 47″·998 |
| 5 | W | | 49·100 | +7·432 | — 8·996 | +0·092 | —1·746 | — 3·218 | 45·882 | |
| 6 | E | | 48·100 | +7·390 | — 9·053 | +3·340 | —0·901 | + 0·776 | 48·876 | |
| 7 | W | | 51·300 | +7·368 | — 9·111 | —2·288 | —0·037 | — 4·068 | 47·232 | |
| 8 | E | 40° α | 47·300 | +7·407 | — 9·170 | +2·348 | +0·680 | + 1·265 | 48·565 | 48·103 |
| 9 | W | | 53·500 | +7·398 | — 9·229 | —3·571 | —0·441 | — 5·843 | 47·657 | |
| 10 | E | | 48·425 | +7·427 | — 9·287 | +4·252 | —1·672 | + 0·720 | 49·145 | |
| 11 | W | | 53·725 | +7·424 | — 9·347 | —4·371 | —0·386 | — 6·680 | 47·045 | |
| 12 | E | 20° α | 50·475 | +7·382 | — 9·407 | +1·756 | +0·221 | — 0·048 | 50·427 | 47·826 |
| 13 | W | | 51·250 | +7·368 | — 9·466 | —0·408 | —2·334 | — 4·840 | 46·410 | |
| 14 | E | | 53·500 | +7·371 | — 9·525 | +1·217 | —3·124 | — 4·061 | 49·439 | |
| 15 | W | | 51·325 | +7·390 | — 9·586 | —1·454 | —2·646 | — 6·296 | 45·029 | |
| 16 | E | 30° α (1) | 54·100 | +7·389 | — 9·647 | —0·970 | —3·437 | — 6·665 | 47·435 | 47·195 |
| 17 | W | | 46·525 | +7·395 | — 9·709 | +0·788 | +0·202 | — 1·324 | 45·201 | |
| 18 | E | | 52·225 | +7·477 | — 9·770 | +0·076 | 0·000 | — 2·217 | 50·008 | |
| 19 | W | | 49·475 | +7·506 | — 9·830 | +0·306 | —1·323 | — 3·341 | 46·134 | |
| 20 | E | 50° α (1) | 52·925 | +7·517 | — 9·892 | —1·174 | —1·011 | — 4·560 | 48·365 | 47·221 |
| 21 | W | | 47·750 | +7·471 | — 9·954 | +1·218 | —0·974 | — 2·239 | 45·511 | |
| 22 | E | | 53·725 | +7·532 | —10·014 | —0·991 | —0·441 | — 3·914 | 49·811 | |
| 23 | W | | 47·450 | +7·507 | —10·076 | +0·426 | —0·110 | — 2·253 | 45·197 | |
| 24 | E | 70° α (1) | 53·750 | +7·462 | —10·139 | —0·391 | +0·257 | — 2·811 | 50·939 | 47·158 |
| 25 | W | | 50·025 | +7·488 | —10·201 | —0·231 | —2·352 | — 5·296 | 44·729 | |
| 26 | E | | 53·000 | +7·532 | —10·263 | —1·171 | +0·974 | — 2·928 | 50·072 | |
| 27 | W | | 46·875 | +7·552 | —10·324 | +0·853 | —0·680 | — 2·599 | 44·276 | |
| 28 | E | | 51·175 | +7·537 | —10·386 | +0·068 | +0·037 | — 2·744 | 48·431 | |

Mean 7° 56′ 47″·5835

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | 30° α | 53″·700 | +7″·520 | —10″·448 | —1″·516 | +0″·919 | — 3″·525 | 50″·175 | 48″·258 |
| 30 | W | | 47·725 | +7·515 | —10·511 | +1·006 | +0·698 | — 1·292 | 46·433 | |
| 31 | E | | 53·725 | +7·560 | —10·572 | —1·854 | —0·165 | — 5·031 | 48·694 | |
| Jan. 1 | W | | 43·350 | +7·571 | —10·674 | +6·471 | +1·011 | + 4·379 | 47·729 | |
| 2 | E | 40° α | 52·200 | +7·598 | —10·736 | +0·601 | —0·717 | — 3·254 | 48·946 | 47·110 |
| 3 | W | | 49·700 | +7·569 | —10·798 | +0·019 | —0·423 | — 3·633 | 46·067 | |
| 4 | E | | 51·750 | +7·564 | —10·860 | —0·853 | +0·772 | — 3·377 | 48·373 | |
| 5 | W | | 47·650 | +7·513 | —10·920 | —0·145 | +0·956 | — 2·596 | 45·054 | |
| 6 | E | 60° α | 53·400 | +7·504 | —10·981 | —0·436 | +1·250 | — 2·663 | 50·737 | 47·511 |
| 7 | W | | 47·650 | +7·482 | —11·042 | —0·195 | +1·176 | — 2·579 | 45·071 | |
| 8 | E | | 53·575 | +7·487 | —11·102 | —0·436 | +0·184 | — 3·867 | 49·708 | |
| 9 | W | | 48·600 | +7·497 | —11·162 | —0·554 | +0·147 | — 4·072 | 44·528 | |
| 10 | E | 30° α (1) | 53·225 | +7·473 | —11·222 | +1·135 | —1·525 | — 4·139 | 49·086 | 47·451 |
| 11 | W | | 54·150 | +7·444 | —11·281 | —1·705 | —1·728 | — 7·270 | 46·880 | |
| 12 | E | | 52·050 | +7·487 | —11·339 | +1·336 | —0·772 | — 3·288 | 48·762 | |
| 13 | W | | 60·925 | +7·516 | —11·398 | —9·246 | —2·720 | —15·848 | 45·077 | |
| 14 | E | 50° α (1) | 53·525 | +7·469 | —11·456 | —0·224 | +0·643 | — 3·568 | 49·957 | 47·616 |
| 15 | W | | 52·225 | +7·412 | —11·513 | —0·333 | —1·562 | — 5·996 | 46·229 | |
| 16 | E | | 50·750 | +7·379 | —11·571 | —0·183 | +0·992 | — 3·383 | 47·367 | |
| 17 | W | | 50·550 | +7·345 | —11·625 | +0·108 | +0·533 | — 3·639 | 46·911 | |
| 18 | E | 70° α (1) | 50·775 | +7·296 | —11·680 | +0·254 | +0·221 | — 3·909 | 46·866 | 47·870 |
| 20 | E | | 50·000 | +7·336 | —11·791 | +1·645 | +0·533 | — 2·277 | 47·723 | |
| 22 | W | | 53·925 | +7·313 | —11·898 | —1·291 | +0·459 | — 5·417 | 48·508 | |
| 23 | W | | 53·950 | +7·275 | —11·950 | —1·151 | +0·257 | — 5·569 | 48·381 | |

Mean 7° 56′ 47″·6360

Mean Result of both Faces..... 7° 56′ 47″·6098





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## G. T. STATION KALIANPUR.

No. 17 (687) 26 Aurigæ *l*. North 6° 16′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 14″·475 | +5″·867 | — 8″·779 | +1″·663 | —0″·956 | — 2″·205 | 12″·270 | |
| 5 | E | 60° *a* | 18·475 | +5·850 | — 8·824 | —0·092 | —1·139 | — 4·205 | 14·270 | |
| 6 | W | | 18·875 | +5·818 | — 8·868 | —3·340 | —1·029 | — 7·419 | 11·456 | 13″·081 |
| 7 | E | | 15·575 | +5·800 | — 8·912 | +2·288 | —0·423 | — 1·247 | 14·328 | |
| 8 | W | | 15·825 | +5·832 | — 8·958 | —2·348 | +0·368 | — 5·106 | 10·719 | |
| 9 | E | 40° *a* | 14·325 | +5·823 | — 9·004 | +3·571 | —0·680 | — 0·290 | 14·035 | 12·444 |
| 10 | W | | 20·225 | +5·846 | — 9·050 | —4·252 | —1·305 | — 8·761 | 11·464 | |
| 11 | E | | 13·450 | +5·845 | — 9·097 | +4·371 | —1·011 | + 0·108 | 13·558 | |
| 12 | W | | 15·950 | +5·811 | — 9·144 | —1·756 | +0·037 | — 5·052 | 10·898 | |
| 13 | E | 20° *a* | 18·850 | +5·800 | — 9·191 | +0·408 | —2·077 | — 5·060 | 13·790 | 12·250 |
| 14 | W | | 17·425 | +5·802 | — 9·237 | —1·217 | —2·904 | — 7·556 | 9·869 | |
| 15 | E | | 18·900 | +5·817 | — 9·285 | +1·454 | —2·444 | — 4·458 | 14·442 | |
| 16 | W | | 15·125 | +5·817 | — 9·334 | +0·970 | —3·473 | — 6·020 | 9·105 | |
| 17 | E | 30° *a* (2) | 18·500 | +5·823 | — 9·384 | —0·788 | —0·606 | — 4·955 | 13·545 | 12·132 |
| 18 | W | | 15·500 | +5·887 | — 9·432 | —0·076 | —0·018 | — 3·639 | 11·861 | |
| 19 | E | | 19·550 | +5·909 | — 9·481 | —0·306 | —1·654 | — 5·532 | 14·018 | |
| 20 | W | | 16·750 | +5·916 | — 9·530 | +1·174 | —0·864 | — 3·304 | 13·446 | |
| 21 | E | 50° *a* (1) | 20·250 | +5·881 | — 9·580 | —1·218 | —0·680 | — 5·597 | 14·653 | 13·739 |
| 22 | W | | 14·725 | +5·930 | — 9·629 | +0·991 | —0·882 | — 3·590 | 11·135 | |
| 23 | E | | 20·225 | +5·912 | — 9·679 | —0·426 | —0·312 | — 4·505 | 15·720 | |
| 24 | W | | 15·400 | +5·876 | — 9·731 | +0·391 | —0·110 | — 3·574 | 11·826 | |
| 25 | E | 70° *a* (1) | 20·750 | +5·895 | — 9·781 | +0·231 | —2·573 | — 6·228 | 14·522 | |
| 26 | W | | 12·575 | +5·929 | — 9·832 | +1·171 | +0·753 | — 1·979 | 10·596 | 13·060 |
| 27 | E | | 19·450 | +5·943 | — 9·882 | —0·853 | 0·000 | — 4·792 | 14·658 | |
| 28 | W | | 16·250 | +5·933 | — 9·933 | —0·068 | —0·018 | — 4·086 | 12·164 | |

Mean 6° 16′ 12″·7843

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 15″·800 | +5″·921 | — 9″·984 | +1″·516 | —0″·974 | — 3″·521 | 12″·279 | |
| 30 | E | 20° *a* | 18·550 | +5·918 | —10·036 | —1·006 | +0·386 | — 4·738 | 13·812 | 13″·120 |
| 31 | W | | 17·200 | +5·952 | —10·087 | +1·854 | —0·625 | — 2·906 | 14·294 | |
| Jan. 1 | E | | 23·050 | +5·961 | —10·187 | —6·471 | —0·257 | —10·954 | 12·096 | |
| 2 | W | | 16·350 | +5·981 | —10·239 | —0·601 | —0·717 | — 5·576 | 10·774 | |
| 3 | E | 40° *a* | 18·100 | +5·960 | —10·291 | —0·019 | —0·423 | — 4·773 | 13·327 | 12·858 |
| 4 | W | | 16·100 | +5·955 | —10·342 | +0·853 | —0·147 | — 3·681 | 12·419 | |
| 5 | E | | 18·875 | +5·916 | —10·393 | +0·145 | +0·368 | — 3·964 | 14·911 | |
| 6 | W | | 15·825 | +5·912 | —10·444 | +0·436 | +0·074 | — 4·022 | 11·803 | |
| 7 | E | 60° *a* | 19·400 | +5·892 | —10·495 | +0·195 | +0·570 | — 3·838 | 15·562 | 13·206 |
| 8 | W | | 15·175 | +5·894 | —10·546 | +0·436 | —0·147 | — 4·363 | 10·812 | |
| 9 | E | | 18·475 | +5·904 | —10·597 | +0·554 | +0·312 | — 3·827 | 14·648 | |
| 10 | W | | 18·250 | +5·887 | —10·648 | —1·135 | —2·481 | — 8·377 | 9·873 | |
| 11 | E | 30° *a* (2) | 17·925 | +5·860 | —10·698 | +1·705 | —2·224 | — 5·357 | 12·568 | 11·338 |
| 12 | W | | 17·800 | +5·895 | —10·748 | —1·336 | —1·103 | — 7·292 | 10·508 | |
| 13 | E | | 10·500 | +5·918 | —10·798 | +9·246 | —2·463 | + 1·903 | 12·403 | |
| 14 | W | | 19·000 | +5·881 | —10·848 | +0·224 | +1·195 | — 3·548 | 15·452 | |
| 15 | E | 50° *a* (1) | 17·475 | +5·836 | —10·897 | +0·333 | +0·790 | — 3·938 | 13·537 | 13·608 |
| 16 | W | | 17·750 | +5·812 | —10·946 | +0·183 | +0·992 | — 3·959 | 13·791 | |
| 17 | E | | 16·775 | +5·781 | —10·993 | —0·108 | +1·195 | — 4·125 | 11·650 | |
| 18 | W | | 19·250 | +5·748 | —11·041 | —0·254 | +0·037 | — 5·510 | 13·740 | |
| 20 | W | 70° *a* (1) | 21·100 | +5·776 | —11·137 | —1·645 | —0·165 | — 7·171 | 13·929 | |
| 21 | E | | 17·650 | +5·739 | —11·184 | +1·203 | —0·643 | — 4·885 | 12·765 | 13·367 |
| 22 | E | | 17·350 | +5·757 | —11·230 | +1·291 | +0·331 | — 3·851 | 13·499 | |
| 23 | E | | 16·575 | +5·727 | —11·276 | +1·151 | +0·257 | — 4·141 | 12·434 | |

Mean 6° 16′ 12″·9162

Mean Result of both Faces..... 6° 16′ 12″·8503

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## G. T. STATION KALIANPUR.

### No. 18 (727) AURIGÆ. North 7° 32′+

#### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 64″·925 | +7″·073 | — 7″·989 | —1″·663 | —1″·139 | — 3″·718 | 61″·207 | |
| 5 | W | 60° *a* | 59·425 | +7·055 | — 8·033 | +0·092 | —0·662 | — 1·548 | 57·877 | 59″·391 |
| 6 | E | | 59·425 | +7·020 | — 8·078 | +3·340 | —0·735 | + 1·547 | 60·972 | |
| 7 | W | | 61·400 | +6·996 | — 8·122 | —2·288 | —0·478 | — 3·892 | 57·508 | |
| 8 | E | | 59·275 | +7·039 | — 8·168 | +2·348 | +0·074 | + 1·293 | 60·568 | |
| 9 | W | 40° *a* | 63·675 | +7·020 | — 8·215 | —3·571 | —0·239 | — 5·005 | 58·670 | 59·353 |
| 10 | E | | 58·200 | +7·049 | — 8·261 | +4·252 | —0·809 | + 2·231 | 60·431 | |
| 11 | W | | 64·750 | +7·052 | — 8·309 | —4·371 | —1·378 | — 7·006 | 57·744 | |
| 12 | E | | 60·925 | +7·009 | — 8·358 | +1·756 | —0·221 | + 0·186 | 61·111 | |
| 13 | W | 20° *a* | 61·725 | +6·996 | — 8·406 | —0·408 | —1·323 | — 3·141 | 58·584 | 59·679 |
| 14 | E | | 65·050 | +6·997 | — 8·454 | +1·217 | —2·444 | — 2·684 | 62·366 | |
| 15 | W | | 62·075 | +7·017 | — 8·504 | —1·454 | —2·481 | — 5·422 | 56·653 | |
| 16 | E | | 64·825 | +7·018 | — 8·556 | —0·970 | —3·400 | — 5·908 | 58·917 | |
| 17 | W | 30° *a* (1) | 57·475 | +7·027 | — 8·608 | +0·788 | 0·000 | — 0·793 | 56·682 | 58·992 |
| 18 | E | | 64·650 | +7·106 | — 8·659 | +0·076 | —0·974 | — 2·451 | 62·199 | |
| 19 | W | | 61·175 | +7·127 | — 8·710 | +0·306 | —1·728 | — 3·005 | 58·170 | |
| 20 | E | | 66·500 | +7·133 | — 8·763 | —1·174 | —1·342 | — 4·146 | 62·354 | |
| 21 | W | 50° *a* (1) | 58·875 | +7·094 | — 8·816 | +1·218 | +0·221 | — 0·283 | 58·592 | 59·962 |
| 22 | E | | 65·050 | +7·153 | — 8·869 | —0·991 | —0·901 | — 3·608 | 61·442 | |
| 23 | W | | 60·275 | +7·135 | — 8·923 | +0·426 | —1·452 | — 2·814 | 57·461 | |
| 24 | E | | 64·725 | +7·092 | — 8·978 | —0·391 | —0·202 | — 2·479 | 62·246 | |
| 25 | W | 70° *a* (1) | 62·350 | +7·114 | — 9·033 | —0·231 | —2·996 | — 5·146 | 57·204 | |
| 26 | E | | 62·425 | +7·151 | — 9·088 | —1·171 | +1·378 | — 1·730 | 60·695 | 59·065 |
| 27 | W | | 56·825 | +7·165 | — 9·143 | +0·853 | +0·937 | — 0·188 | 56·637 | |
| 28 | E | | 62·700 | +7·155 | — 9·199 | +0·068 | —0·037 | — 2·013 | 60·687 | |

Mean 7° 32′ 59″·4070

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 64″·825 | +7″·148 | — 9″·255 | —1″·516 | —0″·809 | — 4″·432 | 60″·393 | |
| 30 | W | 20° *a* | 58·175 | +7·147 | — 9·313 | +1·006 | +0·110 | — 1·050 | 57·125 | |
| 31 | E | | 64·025 | +7·178 | — 9·369 | —1·854 | +0·202 | — 3·843 | 60·182 | 58″·681 |
| Jan. 1 | W | | 54·325 | +7·191 | — 9·474 | +6·471 | —1·489 | + 2·699 | 57·024 | |
| 2 | E | | 63·925 | +7·216 | — 9·532 | +0·601 | —0·827 | — 2·542 | 61·383 | |
| 3 | W | 40° *a* | 60·825 | +7·193 | — 9·590 | +0·019 | —0·257 | — 2·635 | 58·190 | 58·671 |
| 4 | E | | 62·375 | +7·185 | — 9·648 | —0·853 | —0·184 | — 3·500 | 58·875 | |
| 5 | W | | 59·550 | +7·143 | — 9·705 | —0·145 | —0·606 | — 3·313 | 56·237 | |
| 6 | E | | 64·550 | +7·144 | — 9·763 | —0·436 | —0·221 | — 3·276 | 61·274 | |
| 7 | W | 60° *a* | 57·900 | +7·113 | — 9·822 | —0·195 | +0·257 | — 2·647 | 55·253 | 58·680 |
| 8 | E | | 66·000 | +7·108 | — 9·879 | —0·436 | —0·533 | — 3·740 | 62·260 | |
| 9 | W | | 59·350 | +7·129 | — 9·938 | —0·554 | —0·055 | — 3·418 | 55·932 | |
| 10 | E | | 66·075 | +7·117 | — 9·996 | +1·135 | —2·444 | — 4·188 | 61·887 | |
| 11 | W | 30° *a* (1) | 63·325 | +7·067 | —10·054 | —1·705 | —1·581 | — 6·273 | 57·052 | 59·395 |
| 12 | E | | 63·725 | +7·114 | —10·112 | +1·336 | —2·260 | — 3·922 | 59·803 | |
| 13 | W | | 73·925 | +7·142 | —10·170 | —9·246 | —2·812 | —15·086 | 58·839 | |
| 14 | E | | 62·975 | +7·096 | —10·228 | —0·224 | +0·845 | — 2·511 | 60·464 | |
| 15 | W | 50° *a* (1) | 62·050 | +7·044 | —10·286 | —0·333 | +0·956 | — 2·619 | 59·431 | 59·769 |
| 16 | E | | 61·650 | +7·019 | —10·344 | —0·183 | +1·066 | — 2·442 | 59·208 | |
| 17 | W | | 62·450 | +6·970 | —10·400 | +0·108 | +0·845 | — 2·477 | 59·973 | |
| 18 | E | | 62·525 | +6·947 | —10·456 | +0·254 | —0·956 | — 4·211 | 58·314 | |
| 20 | E | 70° *a* (1) | 61·500 | +6·968 | —10·571 | +1·645 | —0·239 | — 2·197 | 59·303 | 59·702 |
| 21 | W | | 65·700 | +6·922 | —10·627 | —1·203 | +0·018 | — 4·890 | 60·810 | |
| 22 | W | | 64·875 | +6·946 | —10·683 | —1·291 | +0·533 | — 4·495 | 60·380 | |

Mean 7° 32′ 59″·1497

Mean Result of both Faces ..... 7° 32′ 59″·2784

5 G

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## G. T. STATION KALIANPUR.

No. 19 (749) 1 GEMINOR *H*. South 0° 50′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 5 | E | 60° α | 66″·700 | +0″·791 | + 8″·398 | +0″·092 | +1″·158 | +10″·439 | 77″·139 | |
| 6 | W | | 64·025 | +0·788 | + 8·386 | +3·340 | +0·992 | +13·506 | 77·531 | 77″·165 |
| 7 | E | | 69·200 | +0·785 | + 8·375 | −2·288 | +0·386 | + 7·258 | 76·458 | |
| 8 | W | 40° α | 66·550 | +0·790 | + 8·364 | +2·348 | +0·423 | +11·925 | 78·475 | |
| 9 | E | | 71·800 | +0·787 | + 8·355 | −3·571 | −0·643 | + 4·928 | 76·728 | 77·063 |
| 10 | W | | 61·775 | +0·791 | + 8·345 | +4·252 | +1·525 | +14·913 | 76·688 | |
| 11 | E | | 70·500 | +0·791 | + 8·336 | −4·371 | +1·103 | + 5·859 | 76·359 | |
| 12 | W | 20° α | 67·675 | +0·786 | + 8·328 | +1·756 | +0·441 | +11·311 | 78·986 | |
| 13 | E | | 65·525 | +0·785 | + 8·320 | −0·408 | +0·441 | + 9·138 | 74·663 | 77·008 |
| 14 | W | | 65·750 | +0·785 | + 8·312 | +1·217 | +2·702 | +13·016 | 78·766 | |
| 15 | E | | 65·425 | +0·787 | + 8·305 | −1·454 | +2·555 | +10·193 | 75·618 | |
| 16 | W | 30° α (2) | 68·125 | +0·788 | + 8·300 | −0·970 | +3·602 | +11·720 | 79·845 | |
| 17 | E | | 67·800 | +0·789 | + 8·296 | +0·788 | −1·893 | + 7·980 | 75·780 | 76·839 |
| 18 | W | | 66·075 | +0·798 | + 8·291 | +0·076 | +1·250 | +10·415 | 76·490 | |
| 19 | E | | 63·825 | +0·800 | + 8·286 | +0·306 | +2·022 | +11·414 | 75·239 | |
| 20 | W | 50° α (1) | 67·725 | +0·800 | + 8·283 | −1·174 | +2·407 | +10·316 | 78·041 | |
| 21 | E | | 65·850 | +0·796 | + 8·280 | +1·218 | −0·588 | + 9·706 | 75·556 | |
| 22 | W | | 69·625 | +0·803 | + 8·277 | −0·991 | +1·048 | + 9·137 | 78·762 | 77·413 |
| 23 | E | | 66·725 | +0·801 | + 8·275 | +0·426 | +1·066 | +10·568 | 77·293 | |
| 24 | W | 70° α (1) | 69·425 | +0·796 | + 8·276 | −0·391 | +0·662 | + 9·343 | 78·768 | |
| 25 | E | | 63·950 | +0·798 | + 8·275 | −0·231 | +2·536 | +11·378 | 75·328 | |
| 26 | W | | 71·025 | +0·802 | + 8·275 | −1·171 | −1·176 | + 6·730 | 77·755 | 76·337 |
| 27 | E | | 65·275 | +0·804 | + 8·276 | +0·853 | −1·121 | + 8·811 | 74·086 | |
| 28 | W | | 67·625 | +0·803 | + 8·277 | +0·068 | +0·662 | + 9·810 | 77·435 | |

Mean 0° 51′ 16″·9708

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° α | 68″·425 | +0″·802 | + 8″·279 | −1″·516 | 0″·000 | + 7″·565 | 75″·990 | |
| 30 | E | | 65·875 | +0·802 | + 8·282 | +1·006 | +0·092 | +10·182 | 76·057 | 75″·890 |
| 31 | W | | 68·125 | +0·805 | + 8·284 | −1·854 | +0·349 | + 7·584 | 75·709 | |
| Jan. 1 | E | | 59·125 | +0·807 | + 8·333 | +6·471 | +1·066 | +16·677 | 75·802 | |
| 2 | W | 40° α | 66·125 | +0·810 | + 8·338 | +0·601 | +1·397 | +11·146 | 77·271 | |
| 3 | E | | 67·875 | +0·807 | + 8·343 | +0·019 | +0·037 | + 9·206 | 77·081 | 76·859 |
| 4 | W | | 69·150 | +0·806 | + 8·349 | −0·853 | −0·533 | + 7·769 | 76·919 | |
| 5 | E | | 67·025 | +0·802 | + 8·354 | −0·145 | +0·129 | + 9·140 | 76·165 | |
| 6 | W | 60° α | 70·075 | +0·802 | + 8·361 | −0·436 | −0·496 | + 8·231 | 78·306 | |
| 7 | E | | 66·450 | +0·798 | + 8·368 | −0·195 | −0·625 | + 8·346 | 74·796 | 76·761 |
| 8 | W | | 70·400 | +0·797 | + 8·375 | −0·436 | −0·441 | + 8·295 | 78·695 | |
| 9 | E | | 66·250 | +0·800 | + 8·383 | −0·554 | +0·368 | + 8·997 | 75·247 | |
| 10 | W | 30° α (2) | 61·175 | +0·800 | + 8·392 | +1·135 | +3·584 | +13·911 | 75·086 | |
| 11 | E | | 66·075 | +0·793 | + 8·401 | −1·705 | +1·764 | + 9·253 | 75·328 | 76·398 |
| 12 | W | | 65·125 | +0·798 | + 8·410 | +1·336 | +2·095 | +12·639 | 77·764 | |
| 13 | E | | 74·000 | +0·802 | + 8·420 | −9·246 | +3·437 | + 3·413 | 77·413 | |
| 14 | W | 50° α (1) | 67·025 | +0·796 | + 8·430 | −0·224 | +0·110 | + 9·112 | 76·137 | |
| 15 | E | | 68·800 | +0·791 | + 8·441 | −0·333 | −0·551 | + 8·348 | 77·148 | 76·797 |
| 17 | E | | 69·000 | +0·782 | + 8·462 | +0·108 | −0·588 | + 8·764 | 77·764 | |
| 18 | W | 70° α (1) | 66·125 | +0·780 | + 8·473 | +0·254 | +0·092 | + 9·599 | 75·724 | |
| 20 | W | | 64·250 | +0·782 | + 8·499 | +1·645 | +0·074 | +11·000 | 75·250 | 77·307 |
| 21 | E | | 71·525 | +0·777 | + 8·511 | −1·203 | −0·680 | + 7·405 | 78·930 | |
| 22 | E | | 71·900 | +0·779 | + 8·525 | −1·291 | −0·588 | + 7·425 | 79·325 | |

Mean 0° 51′ 16″·6687

Mean Result of both Faces ..... 0° 51′ 16″·8198

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## G. T. STATION KALIANPUR.

No. 20 (760) 3 GEMINOR. South 0° 58′ +

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | E | | 60″·250 | +0″·917 | + 8″·228 | +1″·663 | +1″·470 | +12″·278 | 72″·528 | |
| 5 | W | α 60° | 62·700 | +0·914 | + 8·213 | −0·092 | +2·058 | +11·093 | 73·793 | 72″·682 |
| 6 | E | | 64·975 | +0·910 | + 8·198 | −3·340 | +0·386 | + 6·154 | 71·129 | |
| 7 | W | | 61·250 | +0·907 | + 8·183 | +2·288 | +0·643 | +12·026 | 73·276 | |
| 8 | E | | 64·975 | +0·913 | + 8·169 | −2·348 | +0·239 | + 6·973 | 71·948 | |
| 9 | W | α 40° | 62·250 | +0·910 | + 8·156 | +3·571 | −0·533 | +12·104 | 74·354 | 73·098 |
| 10 | E | | 66·050 | +0·914 | + 8·142 | −4·252 | +0·753 | + 5·557 | 71·607 | |
| 11 | W | | 59·650 | +0·914 | + 8·131 | +4·371 | +1·415 | +14·831 | 74·481 | |
| 12 | E | | 66·250 | +0·909 | + 8·119 | −1·756 | −0·221 | + 7·051 | 73·301 | |
| 13 | W | α 20° | 63·500 | +0·907 | + 8·108 | +0·408 | +1·783 | +11·206 | 74·706 | 74·083 |
| 14 | E | | 62·150 | +0·907 | + 8·097 | −1·217 | +2·518 | +10·305 | 72·455 | |
| 15 | W | | 62·975 | +0·910 | + 8·087 | +1·454 | +2·444 | +12·895 | 75·870 | |
| 16 | E | | 61·325 | +0·910 | + 8·079 | +0·970 | +2·352 | +12·311 | 73·636 | |
| 17 | W | α (1) 30° | 65·900 | +0·911 | + 8·071 | −0·788 | −1·029 | + 7·165 | 73·065 | 73·365 |
| 18 | E | | 62·275 | +0·922 | + 8·063 | −0·076 | +0·368 | + 9·277 | 71·552 | |
| 19 | W | | 64·125 | +0·924 | + 8·056 | −0·306 | +2·407 | +11·081 | 75·206 | |
| 20 | E | | 62·475 | +0·924 | + 8·050 | +1·174 | +2·242 | +12·390 | 74·865 | |
| 21 | W | α (1) 50° | 66·300 | +0·920 | + 8·044 | −1·218 | +0·496 | + 8·242 | 74·542 | 74·134 |
| 22 | E | | 60·725 | +0·927 | + 8·038 | +0·991 | +0·919 | +10·875 | 71·600 | |
| 23 | W | | 66·150 | +0·926 | + 8·034 | −0·426 | +0·845 | + 9·379 | 75·529 | |
| 24 | E | | 62·300 | +0·920 | + 8·031 | +0·391 | +0·864 | +10·206 | 72·506 | |
| 25 | W | α (1) 70° | 64·575 | +0·923 | + 8·028 | +0·231 | +2·555 | +11·737 | 76·312 | |
| 26 | E | | 61·950 | +0·927 | + 8·025 | +1·171 | −0·551 | + 9·572 | 71·522 | 73·651 |
| 27 | W | | 66·550 | +0·928 | + 8·023 | −0·853 | −0·698 | + 7·400 | 73·950 | |
| 28 | E | | 62·975 | +0·928 | + 8·023 | −0·068 | +0·625 | + 9·508 | 72·483 | |

Mean 0° 59′ 13″·5022

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | | 62″·625 | +0″·927 | + 8″·023 | +1″·516 | −0″·037 | +10″·429 | 73″·054 | |
| 30 | W | α 20° | 65·525 | +0·928 | + 8·024 | −1·006 | +0·423 | + 8·369 | 73·894 | 73·427 |
| 31 | E | | 62·650 | +0·931 | + 8·024 | +1·854 | +0·735 | +11·544 | 74·194 | |
| Jan. 1 | W | | 68·950 | +0·932 | + 8·071 | −6·471 | +1·084 | + 3·616 | 72·566 | |
| 2 | E | | 64·050 | +0·936 | + 8·074 | −0·601 | +1·011 | + 9·420 | 73·470 | |
| 3 | W | α 40° | 63·450 | +0·933 | + 8·078 | −0·019 | +0·790 | + 9·782 | 73·232 | 73·688 |
| 4 | E | | 63·075 | +0·932 | + 8·081 | +0·853 | −0·110 | + 9·756 | 72·831 | |
| 5 | W | | 66·100 | +0·927 | + 8·085 | +0·145 | −0·037 | + 9·120 | 75·220 | |
| 6 | E | | 62·450 | +0·928 | + 8·090 | +0·436 | −0·882 | + 8·572 | 71·022 | |
| 7 | W | α 60° | 67·875 | +0·923 | + 8·095 | +0·195 | −1·176 | + 8·037 | 75·912 | 73·480 |
| 8 | E | | 62·475 | +0·921 | + 8·101 | +0·436 | −0·533 | + 8·925 | 71·400 | |
| 9 | W | | 66·475 | +0·925 | + 8·108 | +0·554 | −0·478 | + 9·109 | 75·584 | |
| 10 | E | | 63·325 | +0·925 | + 8·115 | −1·135 | +3·676 | +11·581 | 74·906 | |
| 11 | W | α (1) 30° | 61·425 | +0·916 | + 8·123 | +1·705 | +2·316 | +13·060 | 74·485 | 75·044 |
| 12 | E | | 65·650 | +0·923 | + 8·130 | −1·336 | +0·312 | + 8·029 | 73·679 | |
| 13 | W | | 56·150 | +0·926 | + 8·139 | +9·246 | +2·646 | +20·957 | 77·107 | |
| 14 | E | | 64·800 | +0·920 | + 8·148 | +0·224 | +0·257 | + 9·549 | 74·349 | |
| 15 | W | α (1) 50° | 63·100 | +0·914 | + 8·158 | +0·333 | +1·544 | +10·949 | 74·049 | 73·540 |
| 16 | E | | 66·700 | +0·911 | + 8·168 | +0·183 | −1·525 | + 7·737 | 74·437 | |
| 17 | W | | 62·850 | +0·903 | + 8·177 | −0·108 | −0·496 | + 8·476 | 71·326 | |
| 18 | E | | 68·200 | +0·902 | + 8·187 | −0·254 | −2·003 | + 6·832 | 75·032 | |
| 20 | E | α (1) 70° | 67·725 | +0·904 | + 8·212 | −1·645 | +0·110 | + 7·581 | 75·306 | 73·216 |
| 21 | W | | 61·050 | +0·897 | + 8·224 | +1·203 | −0·570 | + 9·754 | 70·804 | |
| 22 | W | | 62·100 | +0·901 | + 8·237 | +1·291 | −0·809 | + 9·620 | 71·720 | |

Mean 0° 59′ 13″·7325

Mean Result of both Faces ..... 0° 59′ 13″·6174

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## G. T. STATION KALIANPUR.

No. 21 (774) 44 Aurigæ *n*. North 5° 25′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 47″·650 | +5″·070 | — 7″·300 | +1″·663 | —0″·864 | — 1″·431 | 46″·219 | |
| 5 | E | α 60° | 51·275 | +5·059 | — 7·320 | —0·092 | —1·323 | — 3·676 | 47·599 | 47″·300 |
| 6 | W | | 53·425 | +5·037 | — 7·341 | —3·340 | —0·165 | — 5·809 | 47·616 | |
| 7 | E | | 48·300 | +5·018 | — 7·362 | +2·288 | —0·478 | — 0·534 | 47·766 | |
| 8 | W | | 49·700 | +5·053 | — 7·384 | —2·348 | +0·221 | — 4·458 | 45·242 | |
| 9 | E | α 40° | 47·925 | +5·032 | — 7·408 | +3·571 | +0·772 | + 1·967 | 49·892 | 47·453 |
| 10 | W | | 52·825 | +5·055 | — 7·431 | —4·252 | —0·368 | — 6·996 | 45·829 | |
| 11 | E | | 48·400 | +5·060 | — 7·456 | +4·371 | —1·525 | + 0·450 | 48·850 | |
| 12 | W | | 50·425 | +5·027 | — 7·482 | —1·756 | +0·735 | — 3·476 | 46·949 | |
| 13 | E | α 20° | 53·975 | +5·018 | — 7·508 | +0·408 | —2·316 | — 4·398 | 49·577 | 47·799 |
| 14 | W | | 51·225 | +5·017 | — 7·534 | —1·217 | —2·371 | — 6·105 | 45·120 | |
| 15 | E | | 52·975 | +5·033 | — 7·562 | +1·454 | —2·352 | — 3·427 | 49·548 | |
| 16 | W | | 49·325 | +5·036 | — 7·592 | +0·970 | —1·764 | — 3·350 | 45·975 | |
| 17 | E | α (3) 30° | 51·525 | +5·043 | — 7·623 | —0·788 | +0·404 | — 2·964 | 48·561 | 47·568 |
| 18 | W | | 49·775 | +5·101 | — 7·653 | —0·076 | —0·110 | — 2·738 | 47·037 | |
| 19 | E | | 53·525 | +5·112 | — 7·684 | —0·306 | —1·948 | — 4·826 | 48·699 | |
| 20 | W | | 49·850 | +5·113 | — 7·716 | +1·174 | —1·893 | — 3·322 | 46·528 | |
| 21 | E | α (1) 50° | 53·475 | +5·089 | — 7·748 | —1·218 | —1·103 | — 4·980 | 48·495 | 47·258 |
| 22 | W | | 48·400 | +5·131 | — 7·781 | +0·991 | —0·827 | — 2·486 | 45·914 | |
| 23 | E | | 52·500 | +5·123 | — 7·816 | —0·426 | —1·286 | — 4·405 | 48·095 | |
| 24 | W | | 49·100 | +5·091 | — 7·852 | +0·391 | —0·276 | — 2·646 | 46·454 | |
| 25 | E | α (1) 70° | 53·225 | +5·105 | — 7·887 | +0·231 | —2·316 | — 4·867 | 48·358 | |
| 26 | W | | 47·750 | +5·129 | — 7·923 | +1·171 | +0·551 | — 1·072 | 46·678 | 47·735 |
| 27 | E | | 52·400 | +5·135 | — 7·960 | —0·853 | +0·717 | — 2·961 | 49·439 | |
| 28 | W | | 49·500 | +5·132 | — 7·998 | —0·068 | +0·018 | — 2·916 | 46·584 | |

Mean 5° 25′ 47″·5188

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 49″·625 | +5″·132 | — 8″·037 | +1″·516 | +0″·625 | — 0″·764 | 48″·861 | |
| 30 | E | α 60° | 51·675 | +5·133 | — 8·077 | —1·006 | —0·221 | — 4·171 | 47·504 | 48″·026 |
| 31 | W | | 50·250 | +5·149 | — 8·116 | +1·854 | 0·000 | — 1·113 | 49·137 | |
| Jan. 1 | E | | 56·925 | +5·159 | — 8·202 | —6·471 | —0·809 | —10·323 | 46·602 | |
| 2 | W | | 52·250 | +5·177 | — 8·244 | —0·601 | —0·129 | — 3·797 | 48·453 | |
| 3 | E | α 40° | 50·725 | +5·164 | — 8·286 | —0·019 | —0·239 | — 3·380 | 47·345 | 47·765 |
| 4 | W | | 48·675 | +5·156 | — 8·328 | +0·853 | 0·000 | — 2·319 | 46·356 | |
| 5 | E | | 52·000 | +5·129 | — 8·370 | +0·145 | 0·000 | — 3·096 | 48·904 | |
| 6 | W | | 48·100 | +5·136 | — 8·414 | +0·436 | +0·790 | — 2·052 | 46·048 | |
| 7 | E | α 60° | 51·925 | +5·108 | — 8·457 | +0·195 | +2·132 | — 1·022 | 50·903 | 48·380 |
| 8 | W | | 47·950 | +5·098 | — 8·501 | +0·436 | +1·434 | — 1·533 | 46·417 | |
| 9 | E | | 51·975 | +5·120 | — 8·546 | +0·554 | +1·048 | — 1·824 | 50·151 | |
| 10 | W | | 51·850 | +5·119 | — 8·591 | —1·135 | —1·617 | — 6·224 | 45·626 | |
| 11 | E | α (3) 30° | 52·500 | +5·067 | — 8·636 | +1·705 | —2·352 | — 4·216 | 48·284 | 47·704 |
| 12 | W | | 52·450 | +5·105 | — 8·680 | —1·336 | +1·268 | — 3·643 | 48·807 | |
| 13 | E | | 45·175 | +5·126 | — 8·727 | +9·246 | —2·720 | + 2·925 | 48·100 | |
| 14 | W | | 50·600 | +5·093 | — 8·773 | +0·224 | +0·809 | — 2·647 | 47·953 | |
| 15 | E | α (1) 50° | 51·125 | +5·057 | — 8·819 | +0·333 | +0·092 | — 3·337 | 47·788 | 48·105 |
| 16 | W | | 50·450 | +5·043 | — 8·866 | +0·183 | +2·003 | — 1·637 | 48·813 | |
| 17 | E | | 51·575 | +4·997 | — 8·911 | —0·108 | +0·312 | — 3·710 | 47·865 | |
| 18 | W | | 53·575 | +4·995 | — 8·958 | —0·254 | +0·937 | — 3·280 | 50·295 | |
| 20 | W | α (1) 70° | 54·675 | +4·999 | — 9·054 | —1·645 | —0·092 | — 5·792 | 48·883 | 48·793 |
| 21 | E | | 51·450 | +4·965 | — 9·100 | +1·203 | —0·312 | — 3·244 | 48·206 | |
| 22 | E | | 49·925 | +4·984 | — 9·148 | +1·291 | +0·735 | — 2·138 | 47·787 | |

Mean 5° 25′ 48″·1288

Mean Result of both Faces ..... 5° 25′ 47″·8238

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## No. 22 (790) 13 GEMINOR $\mu$. South 1° 31′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | 60° $\alpha$ | 39″·700 | +1″·423 | + 7″·826 | +1″·663 | +0″·882 | +11″·794 | 51″·494 | 50″·927 |
| 5 | W | | 41·425 | +1·420 | + 7·801 | −0·092 | +0·974 | +10·103 | 51·528 | |
| 6 | E | | 42·900 | +1·414 | + 7·776 | −3·340 | +0·386 | + 6·236 | 49·136 | |
| 7 | W | | 39·275 | +1·408 | + 7·751 | +2·288 | +0·827 | +12·274 | 51·549 | |
| 8 | E | 40° $\alpha$ | 43·625 | +1·419 | + 7·727 | −2·348 | −0·423 | + 6·375 | 50·000 | 49·895 |
| 9 | W | | 38·025 | +1·412 | + 7·704 | +3·571 | −0·331 | +12·356 | 50·381 | |
| 10 | E | | 42·175 | +1·418 | + 7·681 | −4·252 | +1·066 | + 5·913 | 48·088 | |
| 11 | W | | 35·875 | +1·420 | + 7·660 | +4·371 | +1·783 | +15·234 | 51·109 | |
| 12 | E | 20° $\alpha$ | 40·725 | +1·411 | + 7·639 | −1·756 | +0·147 | + 7·441 | 48·166 | 50·239 |
| 13 | W | | 39·500 | +1·408 | + 7·618 | +0·408 | +2·389 | +11·823 | 51·323 | |
| 14 | E | | 39·375 | +1·408 | + 7·598 | −1·217 | +2·444 | +10·233 | 49·608 | |
| 15 | W | | 38·875 | +1·413 | + 7·579 | +1·454 | +2·536 | +12·982 | 51·857 | |
| 16 | E | 30° $\alpha$ (1) | 38·925 | +1·414 | + 7·562 | +0·970 | +2·555 | +12·501 | 51·426 | 50·589 |
| 17 | W | | 43·750 | +1·416 | + 7·545 | −0·788 | −0·717 | + 7·456 | 51·206 | |
| 18 | E | | 39·075 | +1·432 | + 7·529 | −0·076 | +0·276 | + 9·161 | 48·236 | |
| 19 | W | | 40·475 | +1·435 | + 7·513 | −0·306 | +2·371 | +11·013 | 51·488 | |
| 20 | E | 50° $\alpha$ (1) | 40·225 | +1·435 | + 7·498 | +1·174 | +2·003 | +12·110 | 52·335 | 51·731 |
| 21 | W | | 43·025 | +1·428 | + 7·484 | −1·218 | +1·470 | + 9·164 | 52·189 | |
| 22 | E | | 39·025 | +1·440 | + 7·470 | +0·991 | +0·772 | +10·673 | 49·698 | |
| 23 | W | | 42·300 | +1·438 | + 7·458 | −0·426 | +1·930 | +10·400 | 52·700 | |
| 24 | E | 70° $\alpha$ (1) | 39·275 | +1·429 | + 7·448 | +0·391 | +0·717 | + 9·985 | 49·260 | 50·864 |
| 25 | W | | 40·650 | +1·433 | + 7·436 | +0·231 | +2·316 | +11·416 | 52·066 | |
| 26 | E | | 38·950 | +1·439 | + 7·426 | +1·171 | −0·276 | + 9·760 | 48·710 | |
| 27 | W | | 44·800 | +1·441 | + 7·417 | −0·853 | +0·386 | + 8·391 | 53·191 | |
| 28 | E | | 40·050 | +1·440 | + 7·409 | −0·068 | +0·496 | + 9·277 | 49·327 | |

Mean 1° 31′ 50″·7075

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | 20° $\alpha$ | 38″·875 | +1″·441 | + 7″·402 | +1″·516 | −0″·129 | +10″·230 | 49″·105 | 50″·727 |
| 30 | W | | 44·450 | +1·441 | + 7·396 | −1·006 | +0·221 | + 8·052 | 52·502 | |
| 31 | E | | 38·725 | +1·445 | + 7·389 | +1·854 | +1·066 | +11·754 | 50·479 | |
| Jan. 1 | W | | 47·075 | +1·448 | + 7·428 | −6·471 | +1·342 | + 3·747 | 50·822 | |
| 2 | E | 40° $\alpha$ | 40·250 | +1·453 | + 7·425 | −0·601 | +0·110 | + 8·387 | 48·637 | 50·687 |
| 3 | W | | 41·850 | +1·450 | + 7·422 | −0·019 | +0·331 | + 9·184 | 51·034 | |
| 4 | E | | 40·725 | +1·447 | + 7·419 | +0·853 | −0·257 | + 9·462 | 50·187 | |
| 5 | W | | 43·300 | +1·440 | + 7·417 | +0·145 | +0·588 | + 9·590 | 52·890 | |
| 6 | E | 60° $\alpha$ | 39·850 | +1·443 | + 7·416 | +0·436 | −0·845 | + 8·450 | 48·300 | 50·255 |
| 7 | W | | 43·700 | +1·434 | + 7·416 | +0·195 | −0·974 | + 8·071 | 51·771 | |
| 8 | E | | 38·925 | +1·431 | + 7·416 | +0·436 | −0·772 | + 8·511 | 47·436 | |
| 9 | W | | 44·525 | +1·438 | + 7·418 | +0·554 | −0·423 | + 8·987 | 53·512 | |
| 10 | E | 30° $\alpha$ (1) | 41·050 | +1·438 | + 7·420 | −1·135 | +0·956 | + 8·679 | 49·729 | 50·995 |
| 11 | W | | 39·650 | +1·422 | + 7·422 | +1·705 | +1·893 | +12·442 | 52·092 | |
| 12 | E | | 40·875 | +1·433 | + 7·425 | −1·336 | +0·349 | + 7·871 | 48·746 | |
| 13 | W | | 32·100 | +1·439 | + 7·429 | +9·246 | +3·198 | +21·312 | 53·412 | |
| 14 | E | 50° $\alpha$ (1) | 42·175 | +1·430 | + 7·434 | +0·224 | −0·368 | + 8·720 | 50·895 | 49·693 |
| 15 | W | | 41·100 | +1·420 | + 7·439 | +0·333 | −1·360 | + 7·832 | 48·932 | |
| 16 | E | | 42·575 | +1·416 | + 7·446 | +0·183 | −2·095 | + 6·950 | 49·525 | |
| 17 | W | | 41·025 | +1·402 | + 7·451 | −0·108 | −0·349 | + 8·396 | 49·421 | |
| 18 | E | 70° $\alpha$ (1) | 44·675 | +1·403 | + 7·458 | −0·254 | −0·349 | + 8·258 | 52·933 | 51·020 |
| 19 | W | | 39·350 | +1·402 | + 7·467 | +0·849 | +0·202 | + 9·920 | 49·270 | |
| 20 | E | | 44·525 | +1·403 | + 7·476 | −1·645 | −0·018 | + 7·216 | 51·741 | |
| 21 | W | | 39·850 | +1·394 | + 7·484 | +1·203 | +0·331 | +10·412 | 50·262 | |
| 22 | W | | 40·075 | +1·399 | + 7·494 | +1·291 | −0·680 | + 9·504 | 49·579 | |

Mean 1° 31′ 50″·5628

**Mean Result of both Faces ..... 1° 31′ 50″·6352**

5 H

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## G. T. STATION KALIANPUR.

No. 23 (800) 48 Aurigæ *z*. North 6° 27′+

### Face A to the Fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | 60° *a* | 51″·400 | +6″·043 | − 6″·581 | +1″·663 | −0″·570 | + 0″·555 | 51″·955 | 53″·277 |
| 5 | E | | 57·075 | +6·030 | − 6·600 | −0·092 | −1·562 | − 2·224 | 54·851 | |
| 6 | W | | 56·700 | +6·006 | − 6·619 | −3·340 | −0·459 | − 4·412 | 52·288 | |
| 7 | E | | 53·025 | +5·983 | − 6·639 | +2·288 | −0·643 | + 0·989 | 54·014 | |
| 8 | W | 40° *a* | 53·975 | +6·024 | − 6·660 | −2·348 | +0·239 | − 2·745 | 51·230 | 52·420 |
| 9 | E | | 51·425 | +5·998 | − 6·682 | +3·571 | +0·110 | + 2·997 | 54·422 | |
| 10 | W | | 56·850 | +6·027 | − 6·705 | −4·252 | −1·103 | − 6·033 | 50·817 | |
| 11 | E | | 51·450 | +6·032 | − 6·730 | +4·371 | −1·911 | + 1·762 | 53·212 | |
| 12 | W | 20° *a* | 55·225 | +5·993 | − 6·755 | −1·756 | +0·423 | − 2·095 | 53·130 | 52·877 |
| 13 | E | | 56·750 | +5·983 | − 6·781 | +0·408 | −2·352 | − 2·742 | 54·008 | |
| 14 | W | | 54·500 | +5·982 | − 6·807 | −1·217 | −2·334 | − 4·376 | 50·124 | |
| 15 | E | | 56·675 | +6·002 | − 6·835 | +1·454 | −3·051 | − 2·430 | 54·245 | |
| 16 | W | 30° *a* | 51·925 | +6·003 | − 6·865 | +0·970 | −2·793 | − 2·685 | 49·240 | 52·495 |
| 17 | E | | 57·375 | +6·014 | − 6·896 | −0·788 | 0·000 | − 1·670 | 55·705 | |
| 18 | W | | 53·775 | +6·083 | − 6·928 | −0·076 | −0·753 | − 1·674 | 52·101 | |
| 19 | E | | 56·750 | +6·096 | − 6·959 | −0·306 | −2·646 | − 3·815 | 52·935 | |
| 20 | W | 50° *a* (1) | 51·925 | +6·092 | − 6·993 | +1·174 | −1·213 | − 0·940 | 50·985 | 52·644 |
| 21 | E | | 58·150 | +6·066 | − 7·026 | −1·218 | −1·434 | − 3·612 | 54·538 | |
| 22 | W | | 52·150 | +6·117 | − 7·061 | +0·991 | −0·386 | − 0·339 | 51·811 | |
| 23 | E | | 56·400 | +6·110 | − 7·097 | −0·426 | −1·746 | − 3·159 | 53·241 | |
| 24 | W | 70° *a* (1) | 52·500 | +6·071 | − 7·135 | +0·391 | −0·625 | − 1·298 | 51·202 | 53·085 |
| 25 | E | | 58·325 | +6·086 | − 7·172 | +0·231 | −1·728 | − 2·583 | 55·742 | |
| 26 | W | | 51·150 | +6·115 | − 7·210 | +1·171 | +0·276 | + 0·352 | 51·502 | |
| 27 | E | | 56·550 | +6·122 | − 7·250 | −0·853 | −0·368 | − 2·349 | 54·201 | |
| 28 | W | | 52·625 | +6·118 | − 7·290 | −0·068 | −0·496 | − 1·736 | 50·889 | |

Mean 6° 27′ 52″·7997

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° *a* | 52″·900 | +6″·120 | − 7″·332 | +1″·516 | −1″·562 | − 1″·258 | 51″·642 | 52″·432 |
| 30 | E | | 56·575 | +6·124 | − 7·375 | −1·006 | −0·037 | − 2·294 | 54·281 | |
| Jan. 1 | E | | 60·375 | +6·150 | − 7·506 | −6·471 | −0·386 | − 8·213 | 52·162 | |
| 2 | W | 40° *a* | 53·675 | +6·173 | − 7·551 | −0·601 | 0·000 | − 1·979 | 51·696 | 52·514 |
| 3 | E | | 55·300 | +6·158 | − 7·597 | −0·019 | −0·864 | − 2·322 | 52·978 | |
| 4 | W | | 53·025 | +6·147 | − 7·643 | +0·853 | −0·129 | − 0·772 | 52·253 | |
| 5 | E | | 53·875 | +6·119 | − 7·689 | +0·145 | +0·680 | − 0·745 | 53·130 | |
| 6 | W | 60° *a* | 51·775 | +6·126 | − 7·737 | +0·436 | +1·176 | + 0·001 | 51·776 | 52·413 |
| 7 | E | | 55·800 | +6·094 | − 7·785 | +0·195 | −0·129 | − 1·625 | 54·175 | |
| 8 | W | | 49·825 | +6·077 | − 7·833 | +0·436 | +0·735 | − 0·585 | 49·240 | |
| 9 | E | | 55·625 | +6·107 | − 7·882 | +0·554 | +0·055 | − 1·166 | 54·459 | |
| 10 | W | 30° *a* | 56·000 | +6·110 | − 7·932 | −1·135 | −2·077 | − 5·034 | 50·966 | 51·911 |
| 11 | E | | 55·375 | +6·041 | − 7·982 | +1·705 | −1·544 | − 1·780 | 53·595 | |
| 12 | W | | 54·725 | +6·087 | − 8·032 | −1·336 | −1·691 | − 4·972 | 49·753 | |
| 13 | E | | 47·800 | +6·112 | − 8·083 | +9·246 | −1·746 | + 5·529 | 53·329 | |
| 14 | W | 50° *a* (1) | 54·550 | +6·071 | − 8·135 | +0·224 | −0·570 | − 2·410 | 52·140 | 52·679 |
| 15 | E | | 53·500 | +6·031 | − 8·187 | +0·333 | +1·084 | − 0·739 | 52·761 | |
| 16 | W | | 54·450 | +6·018 | − 8·240 | +0·183 | +1·066 | − 0·973 | 53·477 | |
| 17 | E | | 53·600 | +5·959 | − 8·291 | −0·108 | +1·176 | − 1·264 | 52·336 | |
| 18 | W | 70° *a* (1) | 55·550 | +5·958 | − 8·343 | −0·254 | +1·341 | − 1·298 | 54·252 | 53·304 |
| 19 | E | | 53·800 | +5·953 | − 8·398 | +0·849 | −0·276 | − 1·872 | 51·928 | |
| 20 | W | | 58·775 | +5·959 | − 8·452 | −1·645 | +0·037 | − 4·101 | 54·674 | |
| 21 | E | | 53·375 | +5·920 | − 8·505 | +1·203 | −0·018 | − 1·400 | 51·975 | |
| 22 | E | | 52·975 | +5·942 | − 8·560 | +1·291 | +0·882 | − 0·445 | 52·530 | |

Mean 6° 27′ 52″·5422

Mean Result of both Faces..... 6° 27′ 52″·6710

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No. 24 (846) 34 GEMINOR $\theta$. North 10° 1′+

Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 34″·375 | +9″·432 | — 4″·884 | —1″·663 | —0″·423 | + 2″·462 | 36″·837 | |
| 5 | W | 60° $\alpha$ | 32·575 | +9·410 | — 4·907 | +0·092 | —2·003 | + 2·592 | 35·167 | 36″·157 |
| 6 | E | | 30·550 | +9·378 | — 4·931 | +3·340 | —1·011 | + 6·776 | 37·326 | |
| 7 | W | | 33·600 | +9·347 | — 4·956 | —2·288 | —0·404 | + 1·699 | 35·299 | |
| 8 | E | | 29·300 | +9·393 | — 4·983 | +2·348 | +0·515 | + 7·273 | 36·573 | |
| 9 | W | 40° $\alpha$ | 35·200 | +9·366 | — 5·011 | —3·571 | +1·672 | + 2·456 | 37·656 | 37·590 |
| 10 | E | | 31·450 | +9·419 | — 5·040 | +4·252 | —2·040 | + 6·591 | 38·041 | |
| 11 | W | | 39·500 | +9·410 | — 5·072 | —4·371 | —1·378 | — 1·411 | 38·089 | |
| 12 | E | | 32·200 | +9·353 | — 5·105 | +1·756 | +0·110 | + 6·114 | 38·314 | |
| 13 | W | 20° $\alpha$ | 34·050 | +9·338 | — 5·138 | —0·408 | —1·489 | + 2·303 | 36·353 | 36·666 |
| 14 | E | | 34·275 | +9·345 | — 5·173 | +1·217 | —2·977 | + 2·412 | 36·687 | |
| 15 | W | | 35·200 | +9·381 | — 5·209 | —1·454 | —2·610 | + 0·108 | 35·308 | |
| 16 | E | | 37·125 | +9·360 | — 5·249 | —0·970 | —3·363 | — 0·222 | 36·903 | |
| 17 | W | 30° $\alpha$ (1) | 31·575 | +9·384 | — 5·289 | +0·788 | +0·404 | + 5·287 | 36·862 | 37·261 |
| 18 | E | | 34·000 | +9·491 | — 5·330 | +0·076 | —0·937 | + 3·300 | 37·300 | |
| 19 | W | | 35·725 | +9·523 | — 5·372 | +0·306 | —2·205 | + 2·252 | 37·977 | |
| 20 | E | | 37·100 | +9·494 | — 5·416 | —1·174 | —1·268 | + 1·636 | 38·736 | |
| 21 | W | 50° $\alpha$ (1) | 30·500 | +9·468 | — 5·461 | +1·218 | —0·992 | + 4·233 | 34·733 | 36·752 |
| 22 | E | | 35·750 | +9·539 | — 5·507 | —0·991 | —1·066 | + 1·975 | 37·725 | |
| 23 | W | | 32·425 | +9·547 | — 5·555 | +0·426 | —1·029 | + 3·389 | 35·814 | |
| 24 | E | | 37·025 | +9·470 | — 5·605 | —0·391 | —0·882 | + 2·592 | 39·617 | |
| 25 | W | 70° $\alpha$ (1) | 32·825 | +9·494 | — 5·655 | —0·231 | —0·459 | + 3·149 | 35·974 | |
| 26 | E | | 33·525 | +9·548 | — 5·706 | —1·171 | +1·048 | + 3·719 | 37·244 | 37·116 |
| 27 | W | | 30·200 | +9·570 | — 5·758 | +0·853 | +1·856 | + 6·521 | 36·721 | |
| 28 | E | | 33·850 | +9·554 | — 5·813 | +0·068 | —0·864 | + 2·945 | 36·795 | |

Mean 10° 1′ 36″·9237

Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 36″·500 | +9″·547 | — 5″·869 | —1″·516 | —1″·048 | + 1″·114 | 37″·614 | |
| 30 | W | 20° $\alpha$ | 32·025 | +9·564 | — 5·927 | +1·006 | —0·478 | + 4·165 | 36·190 | 37″·393 |
| 31 | E | | 35·450 | +9·589 | — 5·984 | —1·854 | +0·202 | + 1·953 | 37·403 | |
| Jan. 1 | W | | 28·600 | +9·600 | — 6·087 | +6·471 | —0·221 | + 9·763 | 38·363 | |
| 2 | E | | 33·850 | +9·636 | — 6·147 | +0·601 | —0·184 | + 3·906 | 37·756 | |
| 3 | W | 40° $\alpha$ | 31·700 | +9·615 | — 6·209 | +0·019 | —0·368 | + 3·057 | 34·757 | 35·801 |
| 4 | E | | 33·575 | +9·595 | — 6·271 | —0·853 | +0·331 | + 2·802 | 36·377 | |
| 5 | W | | 30·075 | +9·559 | — 6·334 | —0·145 | +1·158 | + 4·238 | 34·313 | |
| 6 | E | | 34·525 | +9·549 | — 6·398 | —0·436 | +1·029 | + 3·744 | 38·269 | |
| 7 | W | 60° $\alpha$ | 28·050 | +9·523 | — 6·464 | —0·195 | +1·434 | + 4·298 | 32·348 | 36·090 |
| 8 | E | | 35·525 | +9·493 | — 6·529 | —0·436 | +1·323 | + 3·851 | 39·376 | |
| 9 | W | | 32·150 | +9·532 | — 6·596 | —0·554 | —0·165 | + 2·217 | 34·367 | |
| 10 | E | | 36·650 | +9·546 | — 6·664 | +1·135 | —2·113 | + 1·904 | 38·554 | |
| 11 | W | 30° $\alpha$ (1) | 35·550 | +9·435 | — 6·732 | —1·705 | —1·470 | — 0·472 | 35·078 | 37·398 |
| 12 | E | | 35·900 | +9·500 | — 6·801 | +1·336 | —1·801 | + 2·234 | 38·134 | |
| 13 | W | | 43·800 | +9·536 | — 6·871 | —9·246 | +0·606 | — 5·975 | 37·825 | |
| 14 | E | | 34·375 | +9·467 | — 6·942 | —0·224 | +0·129 | + 2·430 | 36·805 | |
| 15 | W | 50° $\alpha$ (1) | 35·650 | +9·411 | — 7·013 | —0·333 | +1·893 | + 3·958 | 39·608 | 37·491 |
| 16 | E | | 33·475 | +9·403 | — 7·086 | —0·183 | +0·257 | + 2·391 | 35·866 | |
| 17 | W | | 34·050 | +9·325 | — 7·157 | +0·108 | +1·360 | + 3·636 | 37·686 | |
| 18 | E | | 30·900 | +9·277 | — 7·230 | +0·254 | +1·709 | + 4·010 | 34·910 | |
| 19 | W | 70° $\alpha$ (1) | 37·550 | +9·288 | — 7·305 | —0·849 | —0·423 | + 0·711 | 38·261 | |
| 20 | E | | 31·400 | +9·297 | — 7·380 | +1·645 | +0·441 | + 4·003 | 35·403 | 36·404 |
| 21 | W | | 36·725 | +9·242 | — 7·453 | —1·203 | +0·165 | + 0·751 | 37·476 | |
| 22 | W | | 36·250 | +9·272 | — 7·529 | —1·291 | +0·515 | + 0·967 | 37·217 | |

Mean 10° 1′ 36″·7628

Mean Result of both Faces..... 10° 1′ 36″·8433

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## G. T. STATION KALIANPUR.

No. 25 (871) GEMINOR. North 5° 28′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 41″·450 | +5″·118 | — 5″·086 | +1″·663 | —0″·570 | + 1″·125 | 42″·575 | |
| 5 | E | 60° α | 45·300 | +5·106 | — 5·077 | —0·092 | —1·966 | — 2·029 | 43·271 | 42″·824 |
| 6 | W | | 45·575 | +5·089 | — 5·068 | —3·340 | —0·625 | — 3·944 | 41·631 | |
| 7 | E | | 42·325 | +5·074 | — 5·060 | +2·288 | —0·809 | + 1·493 | 43·818 | |
| 8 | W | | 42·800 | +5·094 | — 5·054 | —2·348 | +1·672 | — 0·636 | 42·164 | |
| 9 | E | 40° α | 42·075 | +5·083 | — 5·049 | +3·571 | +1·562 | + 5·167 | 47·242 | 44·280 |
| 10 | W | | 49·975 | +5·114 | — 5·045 | —4·252 | —3·198 | — 7·381 | 42·594 | |
| 11 | E | | 42·725 | +5·105 | — 5·043 | +4·371 | —2·040 | + 2·393 | 45·118 | |
| 12 | W | | 43·650 | +5·075 | — 5·043 | —1·756 | —0·772 | — 2·496 | 41·154 | |
| 13 | E | 20° α | 46·250 | +5·067 | — 5·043 | +0·408 | —1·930 | — 1·498 | 44·752 | 42·900 |
| 14 | W | | 44·700 | +5·073 | — 5·044 | —1·217 | —2·812 | — 4·000 | 40·700 | |
| 15 | E | | 45·975 | +5·093 | — 5·047 | +1·454 | —2·481 | — 0·981 | 44·994 | |
| 16 | W | | 43·325 | +5·076 | — 5·053 | +0·970 | —3·235 | — 2·242 | 41·083 | |
| 17 | E | 30° α (3) | 45·200 | +5·092 | — 5·060 | —0·788 | +0·772 | + 0·016 | 45·216 | 43·556 |
| 18 | W | | 44·850 | +5·149 | — 5·068 | —0·076 | —1·581 | — 1·576 | 43·274 | |
| 19 | E | | 46·700 | +5·170 | — 5·077 | —0·306 | —1·838 | — 2·051 | 44·649 | |
| 20 | W | | 42·750 | +5·148 | — 5·087 | +1·174 | —1·728 | — 0·493 | 42·257 | |
| 21 | E | 50° α (1) | 46·025 | +5·137 | — 5·099 | —1·218 | —0·441 | — 1·621 | 44·404 | 42·939 |
| 22 | W | | 42·050 | +5·174 | — 5·112 | +0·991 | —1·654 | — 0·601 | 41·449 | |
| 23 | E | | 44·675 | +5·183 | — 5·126 | —0·426 | —0·662 | — 1·031 | 43·644 | |
| 24 | W | | 40·950 | +5·137 | — 5·143 | +0·391 | —1·966 | — 1·581 | 39·369 | |
| 25 | E | 70° α (1) | 43·550 | +5·150 | — 5·160 | +0·231 | +0·625 | + 0·846 | 44·396 | |
| 26 | W | | 40·225 | +5·182 | — 5·178 | +1·171 | +1·801 | + 2·976 | 43·201 | 43·479 |
| 27 | E | | 45·100 | +5·196 | — 5·198 | —0·853 | +2·187 | + 1·332 | 46·432 | |
| 28 | W | | 43·325 | +5·185 | — 5·220 | —0·068 | —1·158 | — 1·261 | 42·064 | |

Mean 5° 28′ 43″·3297

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 41″·750 | +5″·179 | — 5″·244 | +1″·516 | +0″·018 | + 1″·469 | 43″·219 | |
| 30 | E | 90° α | 45·250 | +5·191 | — 5·269 | —1·006 | —0·643 | — 1·727 | 43·523 | 43″·084 |
| 31 | W | | 42·350 | +5·205 | — 5·293 | +1·854 | —0·735 | + 1·031 | 43·381 | |
| Jan. 1 | E | | 50·250 | +5·209 | — 5·359 | —6·471 | —1·415 | — 8·036 | 42·214 | |
| 2 | W | | 45·050 | +5·229 | — 5·388 | —0·601 | —1·158 | — 1·918 | 43·132 | |
| 3 | E | 40° α | 43·625 | +5·218 | — 5·418 | —0·019 | +0·037 | — 0·182 | 43·443 | 43·502 |
| 4 | W | | 42·975 | +5·207 | — 5·448 | +0·853 | —0·184 | + 0·428 | 43·403 | |
| 5 | E | | 43·625 | +5·189 | — 5·479 | +0·145 | +0·551 | + 0·406 | 44·031 | |
| 6 | W | | 41·150 | +5·178 | — 5·513 | +0·436 | —0·055 | + 0·046 | 41·196 | |
| 7 | E | 60° α | 45·550 | +5·170 | — 5·547 | +0·195 | +1·489 | + 1·307 | 46·857 | 43·447 |
| 8 | W | | 40·550 | +5·153 | — 5·582 | +0·436 | +0·221 | + 0·228 | 40·778 | |
| 9 | E | | 44·775 | +5·172 | — 5·619 | +0·554 | +0·074 | + 0·181 | 44·956 | |
| 10 | W | | 46·650 | +5·182 | — 5·656 | —1·135 | —2·389 | — 3·998 | 42·652 | |
| 11 | E | 30° α (3) | 44·875 | +5·121 | — 5·694 | +1·705 | —2·113 | — 0·981 | 43·894 | 43·489 |
| 12 | W | | 45·175 | +5·154 | — 5·733 | —1·336 | —2·224 | — 4·139 | 41·036 | |
| 13 | E | | 37·950 | +5·173 | — 5·774 | +9·246 | —0·221 | + 8·424 | 46·374 | |
| 14 | W | | 44·075 | +5·135 | — 5·812 | +0·224 | +0·643 | + 0·190 | 44·265 | |
| 15 | E | 50° α (1) | 43·675 | +5·106 | — 5·857 | +0·333 | +1·875 | + 1·457 | 45·132 | 43·853 |
| 16 | W | | 43·975 | +5·104 | — 5·903 | +0·183 | —0·129 | — 0·745 | 43·230 | |
| 17 | E | | 43·550 | +5·066 | — 5·945 | —0·108 | +0·221 | — 0·766 | 42·784 | |
| 18 | W | | 45·550 | +5·029 | — 5·990 | —0·254 | +0·919 | — 0·296 | 45·254 | |
| 19 | E | 70° α (1) | 43·800 | +5·039 | — 6·038 | +0·849 | —0·753 | — 0·903 | 42·897 | 44·067 |
| 20 | W | | 47·525 | +5·043 | — 6·085 | —1·645 | +0·239 | — 2·448 | 45·077 | |
| 22 | E | | 42·475 | +5·031 | — 6·181 | +1·291 | +0·423 | + 0·564 | 43·039 | |

Mean 5° 28′ 43″·5737

Mean Result of both Faces ..... 5° 28′ 43″·4517

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No. 26 (881) 46 Geminor r. North 6° 22′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 51″·100 | +5″·968 | — 4″·558 | —1″·663 | —0″·570 | — 0″·823 | 50″·277 | |
| 5 | W | 60° α | 49·725 | +5·953 | — 4·548 | +0·092 | —2·113 | — 0·616 | 49·109 | 50″·553 |
| 6 | E | | 48·700 | +5·934 | — 4·539 | +3·340 | —0·662 | + 4·073 | 52·773 | |
| 7 | W | | 51·300 | +5·918 | — 4·530 | —2·288 | —0·349 | — 1·249 | 50·051 | |
| 8 | E | | 46·450 | +5·938 | — 4·524 | +2·348 | +2·077 | + 5·839 | 52·289 | |
| 9 | W | 40° α | 50·250 | +5·928 | — 4·519 | —3·571 | +0·588 | — 1·574 | 48·676 | 50·534 |
| 10 | E | | 49·000 | +5·965 | — 4·515 | +4·252 | —3·823 | + 1·879 | 50·879 | |
| 11 | W | | 55·450 | +5·951 | — 4·514 | —4·371 | —2·224 | — 5·158 | 50·292 | |
| 12 | E | | 49·450 | +5·917 | — 4·514 | +1·756 | —0·809 | + 2·350 | 51·800 | |
| 13 | W | 20° α | 50·625 | +5·908 | — 4·515 | —0·408 | —1·672 | — 0·687 | 49·938 | 51·057 |
| 14 | E | | 52·300 | +5·917 | — 4·516 | +1·217 | —2·573 | + 0·045 | 52·345 | |
| 15 | W | | 52·550 | +5·941 | — 4·520 | —1·454 | —2·371 | — 2·404 | 50·146 | |
| 16 | E | | 53·075 | +5·917 | — 4·527 | —0·970 | —2·334 | — 1·914 | 51·161 | |
| 17 | W | 30° α (1) | 47·900 | +5·937 | — 4·535 | +0·788 | +0·496 | + 2·686 | 50·586 | 50·653 |
| 18 | E | | 51·200 | +6·003 | — 4·544 | +0·076 | —2·242 | — 0·707 | 50·493 | |
| 19 | W | | 50·500 | +6·029 | — 4·554 | +0·306 | —1·911 | — 0·130 | 50·370 | |
| 20 | E | | 53·925 | +5·999 | — 4·566 | —1·174 | —1·856 | — 1·597 | 52·328 | |
| 21 | W | 50° α (1) | 48·450 | +5·990 | — 4·579 | +1·218 | —0·368 | + 2·261 | 50·711 | 51·139 |
| 22 | E | | 52·300 | +6·031 | — 4·593 | —0·991 | —0·423 | + 0·024 | 52·324 | |
| 23 | W | | 47·975 | +6·045 | — 4·610 | +0·426 | —0·643 | + 1·218 | 49·193 | |
| 24 | E | | 53·475 | +5·989 | — 4·628 | —0·391 | —1·819 | — 0·849 | 52·626 | |
| 25 | W | | 47·800 | +6·004 | — 4·648 | —0·231 | +1·966 | + 3·091 | 50·891 | |
| 26 | E | 70° α (1) | 51·525 | +6·043 | — 4·667 | —1·171 | +1·452 | + 1·657 | 53·182 | 51·917 |
| 27 | W | | 48·175 | +6·062 | — 4·690 | +0·853 | +1·048 | + 3·273 | 51·448 | |
| 28 | E | | 51·225 | +6·047 | — 4·714 | +0·068 | —0·441 | + 0·960 | 52·185 | |

Mean 6° 22′ 50″·9755

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 52″·525 | +6″·038 | — 4″·740 | —1″·516 | +0″·698 | + 0″·480 | 53″·005 | |
| 30 | W | 20° α | 46·650 | +6·054 | — 4·768 | +1·006 | +1·286 | + 3·578 | 50·228 | 51″·573 |
| 31 | E | | 52·875 | +6·070 | — 4·795 | —1·854 | —0·827 | — 1·406 | 51·469 | |
| Jan. 1 | W | | 43·875 | +6·073 | — 4·865 | +6·471 | +0·037 | + 7·716 | 51·591 | |
| 2 | E | | 50·550 | +6·097 | — 4·896 | +0·601 | —0·533 | + 1·269 | 51·819 | |
| 3 | W | 40° α | 49·525 | +6·084 | — 4·929 | +0·019 | 0·000 | + 1·174 | 50·699 | 50·433 |
| 4 | E | | 49·975 | +6·071 | — 4·963 | —0·853 | —0·092 | + 0·163 | 50·138 | |
| 5 | W | | 47·650 | +6·052 | — 4·997 | —0·145 | +0·515 | + 1·425 | 49·075 | |
| 6 | E | | 51·075 | +6·035 | — 5·034 | —0·436 | +0·827 | + 1·392 | 52·467 | |
| 7 | W | 60° α | 45·600 | +6·030 | — 5·071 | —0·195 | +0·827 | + 1·591 | 47·191 | 50·276 |
| 8 | E | | 52·575 | +6·009 | — 5·110 | —0·436 | +0·312 | + 0·775 | 53·350 | |
| 9 | W | | 46·850 | +6·031 | — 5·150 | —0·554 | +0·919 | + 1·246 | 48·096 | |
| 10 | E | | 51·500 | +6·044 | — 5·192 | +1·135 | —2·187 | — 0·200 | 51·300 | |
| 11 | W | 30° α (1) | 52·225 | +5·972 | — 5·233 | —1·705 | —2·077 | — 3·043 | 49·182 | 49·446 |
| 12 | E | | 49·875 | +6·010 | — 5·276 | +1·336 | —1·985 | + 0·085 | 49·960 | |
| 13 | W | | 58·100 | +6·031 | — 5·321 | —9·246 | —2·224 | —10·760 | 47·340 | |
| 14 | E | | 50·275 | +5·986 | — 5·367 | —0·224 | +0·625 | + 1·020 | 51·295 | |
| 15 | W | 50° α (1) | 50·475 | +5·953 | — 5·414 | —0·333 | +0·643 | + 0·849 | 51·324 | 50·976 |
| 16 | E | | 49·950 | +5·954 | — 5·462 | —0·183 | +0·901 | + 1·210 | 51·160 | |
| 17 | W | | 49·725 | +5·912 | — 5·509 | +0·108 | —0·110 | + 0·401 | 50·126 | |
| 18 | E | | 49·550 | +5·859 | — 5·559 | +0·254 | +0·202 | + 0·756 | 50·306 | |
| 19 | W | 70° α (1) | 52·550 | +5·875 | — 5·611 | —0·849 | —0·717 | — 1·302 | 51·248 | |
| 20 | E | | 48·450 | +5·880 | — 5·663 | +1·645 | +0·074 | + 1·936 | 50·386 | 51·238 |
| 21 | W | | 53·550 | +5·849 | — 5·715 | —1·203 | +0·092 | — 0·977 | 52·573 | |
| 22 | W | | 52·750 | +5·865 | — 5·769 | —1·291 | +1·011 | — 0·184 | 52·566 | |

Mean 6° 22′ 50″·6570

Mean Result of both Faces ..... 6° 22′ 50″·8163





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## G. T. STATION KALIANPUR.

No. 27 (900) 55 Geminor δ. South 1° 50′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 51″·000 | +1″·722 | + 5″·704 | −1″·663 | +1″·121 | + 6″·884 | 57″·884 | |
| 5 | E | 0° a | 47·050 | +1·717 | + 5·644 | +0·092 | +2·389 | + 9·842 | 56·892 | 57″·047 |
| 6 | W | | 46·150 | +1·712 | + 5·584 | +3·340 | +2·058 | +12·694 | 58·844 | |
| 7 | E | | 49·200 | +1·708 | + 5·525 | −2·288 | +0·423 | + 5·368 | 54·568 | |
| 8 | W | | 49·575 | +1·712 | + 5·467 | +2·348 | −1·489 | + 8·038 | 57·613 | |
| 9 | E | 40° a | 53·500 | +1·710 | + 5·411 | −3·571 | −0·882 | + 2·668 | 56·168 | 57·637 |
| 10 | W | | 44·400 | +1·722 | + 5·355 | +4·252 | +3·951 | +15·280 | 59·680 | |
| 11 | E | | 53·025 | +1·716 | + 5·301 | −4·371 | +1·415 | + 4·061 | 57·086 | |
| 12 | W | | 49·475 | +1·707 | + 5·249 | +1·756 | +1·011 | + 9·723 | 59·198 | |
| 13 | E | 20° a | 49·275 | +1·704 | + 5·197 | −0·408 | +0·864 | + 7·357 | 56·632 | 57·809 |
| 14 | W | | 48·275 | +1·707 | + 5·145 | +1·217 | +3·676 | +11·745 | 60·020 | |
| 15 | E | | 48·175 | +1·715 | + 5·095 | −1·454 | +1·856 | + 7·212 | 55·387 | |
| 16 | W | | 50·500 | +1·706 | + 5·048 | −0·970 | +2·591 | + 8·375 | 58·875 | |
| 17 | E | 30° a (1) | 48·900 | +1·712 | + 5·002 | +0·788 | −0·459 | + 7·043 | 55·943 | 56·625 |
| 18 | W | | 49·100 | +1·731 | + 4·958 | +0·076 | +2·095 | + 8·860 | 57·960 | |
| 19 | E | | 45·000 | +1·740 | + 4·913 | +0·306 | +1·764 | + 8·723 | 53·723 | |
| 20 | W | | 51·200 | +1·730 | + 4·870 | −1·174 | +1·966 | + 7·392 | 58·592 | |
| 21 | E | 50° a (1) | 47·925 | +1·728 | + 4·828 | +1·218 | +0·276 | + 8·050 | 55·975 | 56·710 |
| 22 | W | | 51·200 | +1·739 | + 4·788 | −0·991 | +0·698 | + 6·234 | 57·434 | |
| 23 | E | | 47·350 | +1·744 | + 4·750 | +0·426 | +0·570 | + 7·490 | 54·840 | |
| 24 | W | | 51·950 | +1·727 | + 4·713 | −0·391 | +1·836 | + 7·887 | 59·837 | |
| 25 | E | | 49·650 | +1·732 | + 4·677 | −0·231 | −1·617 | + 4·561 | 54·211 | |
| 26 | W | 70° a (1) | 53·825 | +1·743 | + 4·642 | −1·171 | −1·434 | + 3·780 | 57·605 | 56·709 |
| 27 | E | | 48·650 | +1·750 | + 4·609 | +0·853 | −0·184 | + 7·028 | 55·678 | |
| 28 | W | | 51·000 | +1·745 | + 4·578 | +0·063 | +0·588 | + 6·979 | 57·979 | |

Mean 1° 50′ 57″·0895

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 54″·775 | +1″·741 | + 4″·549 | −1″·516 | −0″·735 | + 4″·039 | 58″·814 | |
| 30 | E | 0° a | 48·025 | +1·747 | + 4·521 | +1·006 | −1·544 | + 5·730 | 53·755 | 56″·574 |
| 31 | W | | 51·925 | +1·752 | + 4·493 | −1·854 | +1·305 | + 5·696 | 57·621 | |
| Jan. 1 | E | | 43·800 | +1·752 | + 4·504 | +6·471 | −0·423 | +12·304 | 56·104 | |
| 2 | W | | 49·900 | +1·759 | + 4·480 | +0·601 | +0·533 | + 7·373 | 57·273 | |
| 3 | E | 40° a | 50·100 | +1·755 | + 4·458 | +0·019 | +0·404 | + 6·636 | 56·736 | 57·199 |
| 4 | W | | 52·425 | +1·751 | + 4·437 | −0·853 | +0·110 | + 5·445 | 57·870 | |
| 5 | E | | 51·800 | +1·747 | + 4·416 | −0·145 | −0·901 | + 5·117 | 56·917 | |
| 6 | W | | 54·300 | +1·740 | + 4·398 | −0·436 | −1·672 | + 4·030 | 58·330 | |
| 7 | E | 60° a | 47·475 | +1·740 | + 4·381 | −0·195 | −0·478 | + 5·448 | 52·923 | 56·534 |
| 8 | W | | 53·875 | +1·734 | + 4·364 | −0·436 | +0·901 | + 6·563 | 60·438 | |
| 9 | E | | 49·900 | +1·740 | + 4·350 | −0·554 | −0·992 | + 4·544 | 54·444 | |
| 10 | W | | 49·175 | +1·744 | + 4·338 | +1·135 | +3·253 | +10·470 | 59·645 | |
| 11 | E | 30° a (1) | 50·400 | +1·723 | + 4·325 | −1·705 | +1·213 | + 5·556 | 55·956 | 57·387 |
| 12 | W | | 48·875 | +1·734 | + 4·315 | +1·336 | +2·371 | + 9·756 | 58·631 | |
| 13 | E | | 58·350 | +1·739 | + 4·306 | −9·246 | +0·165 | − 3·036 | 55·314 | |
| 14 | W | | 51·000 | +1·726 | + 4·299 | −0·224 | −0·423 | + 5·378 | 56·378 | |
| 15 | E | 50° a (1) | 52·850 | +1·717 | + 4·292 | −0·333 | −1·654 | + 4·022 | 56·872 | 56·898 |
| 16 | W | | 50·800 | +1·718 | + 4·289 | −0·183 | +0·055 | + 5·879 | 56·679 | |
| 17 | E | | 51·750 | +1·707 | + 4·283 | +0·108 | −0·184 | + 5·914 | 57·664 | |
| 18 | W | | 51·150 | +1·689 | + 4·281 | +0·254 | −1·268 | + 4·956 | 56·106 | |
| 19 | E | 70° a (1) | 54·100 | +1·694 | + 4·281 | −0·849 | +0·368 | + 5·494 | 59·594 | 57·474 |
| 20 | W | | 48·925 | +1·696 | + 4·282 | +1·645 | +0·202 | + 7·825 | 56·750 | |
| 21 | E | | 54·225 | +1·687 | + 4·283 | −1·203 | +0·018 | + 4·785 | 59·010 | |
| 22 | E | | 51·700 | +1·692 | + 4·286 | −1·291 | +0·570 | + 5·257 | 56·957 | |

Mean 1° 50′ 57″·0110

Mean Result of both Faces ..... 1° 50′ 57″·0503

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No. 28 (918) 62 Geminor ρ. North 7° 58′ +

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 31″·675 | +7″·480 | — 3″·355 | —1″·663 | —0″·992 | + 1″·470 | 33″·145 | |
| 5 | W | 60° α | 29·100 | +7·458 | — 3·340 | +0·092 | —1·562 | + 2·648 | 31·748 | |
| 6 | E | | 27·700 | +7·437 | — 3·326 | +3·340 | —1·691 | + 5·760 | 33·460 | 32″·432 |
| 7 | W | | 30·400 | +7·423 | — 3·314 | —2·288 | —0·845 | + 0·976 | 31·376 | |
| 8 | E | | 27·350 | +7·437 | — 3·303 | +2·348 | +1·323 | + 7·805 | 35·155 | |
| 9 | W | 40° α | 29·550 | +7·428 | — 3·295 | —3·571 | +1·176 | + 1·738 | 31·288 | 32·984 |
| 10 | E | | 27·625 | +7·474 | — 3·287 | +4·252 | —3·014 | + 5·425 | 33·050 | |
| 11 | W | | 34·550 | +7·457 | — 3·283 | —4·371 | —1·911 | — 2·108 | 32·442 | |
| 12 | E | | 30·750 | +7·412 | — 3·280 | +1·756 | —0·753 | + 5·135 | 35·885 | |
| 13 | W | 20° α | 28·850 | +7·402 | — 3·278 | —0·408 | —0·845 | + 2·871 | 31·721 | 33·272 |
| 14 | E | | 32·450 | +7·417 | — 3·277 | +1·217 | —3·639 | + 1·718 | 34·168 | |
| 15 | W | | 30·400 | +7·449 | — 3·279 | —1·454 | —1·801 | + 0·915 | 31·315 | |
| 16 | E | | 32·325 | +7·407 | — 3·284 | —0·970 | —3·106 | + 0·047 | 32·372 | |
| 17 | W | 30° α (?) | 27·025 | +7·442 | — 3·290 | +0·788 | +0·588 | + 5·528 | 32·553 | |
| 18 | E | | 31·325 | +7·521 | — 3·298 | +0·076 | —2·279 | + 2·020 | 33·345 | 32·991 |
| 19 | W | | 30·675 | +7·562 | — 3·307 | +0·306 | —1·544 | + 3·017 | 33·692 | |
| 20 | E | | 31·675 | +7·516 | — 3·318 | —1·174 | —2·113 | + 0·911 | 32·586 | |
| 21 | W | 50° α (?) | 26·750 | +7·512 | — 3·330 | +1·218 | —0·331 | + 5·069 | 31·819 | |
| 22 | E | | 30·525 | +7·560 | — 3·345 | —0·991 | —0·864 | + 2·360 | 32·885 | 32·358 |
| 23 | W | | 27·975 | +7·580 | — 3·361 | +0·426 | —0·478 | + 4·167 | 32·142 | |
| 24 | E | | 33·675 | +7·506 | — 3·380 | —0·391 | —1·819 | + 1·916 | 35·591 | |
| 25 | W | 70° α (?) | 27·150 | +7·520 | — 3·400 | —0·231 | +0·074 | + 3·963 | 31·113 | |
| 26 | E | | 30·250 | +7·577 | — 3·420 | —1·171 | +1·213 | + 4·199 | 34·449 | 32·695 |
| 27 | W | | 25·650 | +7·602 | — 3·444 | +0·853 | 0·000 | + 5·011 | 30·661 | |
| 28 | E | | 30·225 | +7·582 | — 3·470 | +0·068 | —0·937 | + 3·243 | 33·468 | |

Mean 7° 58′ 32″·7887

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 29″·275 | +7″·567 | — 3″·498 | —1″·516 | +0″·992 | + 3″·545 | 32″·820 | |
| 30 | W | 20° α | 25·475 | +7·589 | — 3·528 | +1·006 | +1·415 | + 6·482 | 31·957 | |
| 31 | E | | 30·400 | +7·611 | — 3·557 | —1·854 | —0·588 | + 1·612 | 32·012 | 32″·348 |
| Jan. 1 | W | | 21·950 | +7·609 | — 3·628 | +6·471 | +0·202 | +10·654 | 32·604 | |
| 2 | E | | 29·925 | +7·644 | — 3·663 | +0·601 | —1·378 | + 3·204 | 33·129 | |
| 3 | W | 40° α | 27·850 | +7·625 | — 3·699 | +0·019 | —0·588 | + 3·357 | 31·207 | 31·799 |
| 4 | E | | 29·725 | +7·611 | — 3·735 | —0·853 | —0·956 | + 2·067 | 31·792 | |
| 5 | W | | 26·550 | +7·590 | — 3·774 | —0·145 | +0·845 | + 4·516 | 31·066 | |
| 6 | E | | 30·750 | +7·562 | — 3·814 | —0·436 | +0·790 | + 4·102 | 34·852 | |
| 7 | W | 60° α | 24·850 | +7·565 | — 3·856 | —0·195 | +0·845 | + 4·359 | 29·209 | 32·330 |
| 8 | E | | 31·350 | +7·537 | — 3·899 | —0·436 | —0·221 | + 2·981 | 34·331 | |
| 9 | W | | 27·775 | +7·560 | — 3·944 | —0·554 | +0·092 | + 3·154 | 30·929 | |
| 10 | E | | 32·775 | +7·574 | — 3·990 | +1·135 | —3·106 | + 1·613 | 34·388 | |
| 11 | W | 30° α (?) | 30·250 | +7·486 | — 4·037 | —1·705 | —0·992 | + 0·752 | 31·002 | 32·381 |
| 12 | E | | 30·825 | +7·535 | — 4·085 | +1·336 | —2·481 | + 2·305 | 33·130 | |
| 14 | E | | 30·225 | +7·503 | — 4·188 | —0·224 | +0·459 | + 3·550 | 33·775 | |
| 15 | W | 50° α (?) | 29·350 | +7·460 | — 4·241 | —0·333 | +1·470 | + 4·356 | 33·706 | |
| 16 | E | | 29·050 | +7·466 | — 4·296 | —0·183 | —0·643 | + 2·344 | 31·394 | 32·948 |
| 17 | W | | 29·775 | +7·420 | — 4·350 | +0·108 | —0·037 | + 3·141 | 32·916 | |
| 18 | E | | 29·900 | +7·337 | — 4·406 | +0·254 | +1·507 | + 4·692 | 34·592 | |
| 19 | W | 70° α (?) | 31·700 | +7·369 | — 4·465 | —0·849 | —0·368 | + 1·687 | 33·387 | |
| 20 | E | | 29·500 | +7·366 | — 4·525 | +1·645 | —0·772 | + 3·714 | 33·214 | 33·426 |
| 21 | W | | 31·525 | +7·329 | — 4·584 | —1·203 | +0·276 | + 1·818 | 33·343 | |
| 22 | W | | 32·225 | +7·352 | — 4·646 | —1·291 | —1·525 | — 0·110 | 32·115 | |

Mean 7° 58′ 32″·5387

Mean Result of both Faces..... 7° 58′ 32″·6637



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## G. T. STATION KALIANPUR.

No. 29 (927) 66 Geminor $\alpha$. North 8° 6′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | 60° $\alpha$ | 38″·525 | +7″·611 | − 3″·042 | +1″·663 | −0″·202 | + 6″·030 | 44″·555 | 45″·882 |
| 5 | E | | 44·175 | +7·587 | − 3·023 | −0·092 | −1·764 | + 2·708 | 46·883 | |
| 6 | W | | 43·300 | +7·566 | − 3·006 | −3·340 | +0·276 | + 1·496 | 44·796 | |
| 7 | E | | 40·900 | +7·555 | − 2·990 | +2·288 | −0·459 | + 6·394 | 47·294 | |
| 8 | W | 40° $\alpha$ | 42·550 | +7·566 | − 2·976 | −2·348 | +1·084 | + 3·326 | 45·876 | 45·056 |
| 9 | E | | 36·900 | +7·557 | − 2·964 | +3·571 | +0·533 | + 8·697 | 45·597 | |
| 10 | W | | 46·050 | +7·601 | − 2·954 | −4·252 | −2·885 | − 2·490 | 43·560 | |
| 11 | E | | 39·025 | +7·588 | − 2·946 | +4·371 | −2·849 | + 6·164 | 45·189 | |
| 12 | W | 20° $\alpha$ | 40·050 | +7·540 | − 2·940 | −1·756 | −0·386 | + 2·458 | 42·508 | 45·317 |
| 13 | E | | 42·900 | +7·530 | − 2·935 | +0·408 | −1·121 | + 3·882 | 46·782 | |
| 14 | W | | 43·700 | +7·546 | − 2·931 | −1·217 | −3·308 | + 0·090 | 43·790 | |
| 15 | E | | 44·750 | +7·579 | − 2·930 | +1·454 | −2·665 | + 3·438 | 48·188 | |
| 16 | W | 30° $\alpha$ (1) | 41·650 | +7·534 | − 2·932 | +0·970 | −1·617 | + 3·955 | 45·605 | 45·373 |
| 17 | E | | 42·325 | +7·574 | − 2·935 | −0·788 | +0·643 | + 4·494 | 46·819 | |
| 18 | W | | 41·000 | +7·651 | − 2·940 | −0·076 | −2·775 | + 1·860 | 42·860 | |
| 19 | E | | 43·875 | +7·696 | − 2·946 | −0·306 | −2·113 | + 2·331 | 46·206 | |
| 20 | W | 50° $\alpha$ (1) | 39·575 | +7·649 | − 2·955 | +1·174 | −1·801 | + 4·067 | 43·642 | 45·083 |
| 21 | E | | 43·775 | +7·648 | − 2·965 | −1·218 | −0·845 | + 2·620 | 46·395 | |
| 22 | W | | 38·200 | +7·695 | − 2·977 | +0·991 | −0·533 | + 5·176 | 43·376 | |
| 23 | E | | 43·025 | +7·714 | − 2·991 | −0·426 | −0·404 | + 3·893 | 46·918 | |
| 24 | W | 70° $\alpha$ (1) | 38·475 | +7·638 | − 3·007 | +0·391 | −1·195 | + 3·827 | 42·302 | 44·953 |
| 25 | E | | 42·550 | +7·651 | − 3·025 | +0·231 | −1·397 | + 3·460 | 46·010 | |
| 26 | W | | 37·075 | +7·712 | − 3·044 | +1·171 | +1·489 | + 7·328 | 44·403 | |
| 27 | E | | 43·100 | +7·735 | − 3·065 | −0·853 | 0·000 | + 3·817 | 46·917 | |
| 28 | W | | 40·075 | +7·715 | − 3·089 | −0·068 | −1·011 | + 3·547 | 43·622 | |

Mean 8° 6′ 45″·2773

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | *'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | 20° $\alpha$ | 39″·275 | +7″·701 | − 3″·115 | +1″·516 | +0″·772 | + 6″·874 | 46″·149 | 46″·448 |
| 30 | E | | 42·800 | +7·722 | − 3·143 | −1·006 | +1·139 | + 4·712 | 47·512 | |
| Jan. 1 | E | | 47·950 | +7·741 | − 3·238 | −6·471 | 0·000 | − 1·968 | 45·982 | |
| 2 | W | 40° $\alpha$ | 41·450 | +7·779 | − 3·270 | −0·601 | −1·470 | + 2·438 | 43·888 | 44·594 |
| 3 | E | | 41·550 | +7·757 | − 3·305 | −0·019 | −0·974 | + 3·459 | 45·009 | |
| 4 | W | | 40·275 | +7·747 | − 3·341 | +0·853 | −1·672 | + 3·587 | 43·862 | |
| 5 | E | | 40·775 | +7·725 | − 3·377 | +0·145 | +0·349 | + 4·842 | 45·617 | |
| 6 | W | 60° $\alpha$ | 38·475 | +7·695 | − 3·416 | +0·436 | +0·459 | + 5·174 | 43·649 | 45·265 |
| 7 | E | | 41·500 | +7·699 | − 3·457 | +0·195 | +1·525 | + 5·962 | 47·462 | |
| 8 | W | | 38·700 | +7·671 | − 3·499 | +0·436 | −0·147 | + 4·461 | 43·161 | |
| 9 | E | | 42·025 | +7·695 | − 3·543 | +0·554 | +0·055 | + 4·761 | 46·786 | |
| 10 | W | 30° $\alpha$ (1) | 41·900 | +7·704 | − 3·589 | −1·135 | −1·636 | + 1·344 | 43·244 | 44·083 |
| 11 | E | | 42·525 | +7·617 | − 3·635 | +1·705 | −1·783 | + 3·904 | 46·429 | |
| 12 | W | | 41·475 | +7·669 | − 3·682 | −1·336 | −2·665 | − 0·014 | 41·461 | |
| 13 | E | | 34·350 | +7·686 | − 3·733 | +9·246 | −2·352 | +10·847 | 45·197 | |
| 14 | W | 50° $\alpha$ (1) | 41·775 | +7·637 | − 3·784 | +0·224 | −0·184 | + 3·893 | 45·668 | 44·964 |
| 15 | E | | 40·675 | +7·591 | − 3·836 | +0·333 | +0·735 | + 4·823 | 45·498 | |
| 16 | W | | 40·975 | +7·598 | − 3·891 | +0·183 | +0·570 | + 4·460 | 45·435 | |
| 17 | E | | 40·875 | +7·552 | − 3·944 | −0·108 | −1·121 | + 2·379 | 43·254 | |
| 18 | W | 70° $\alpha$ (1) | 40·750 | +7·466 | − 4·000 | −0·254 | +1·360 | + 4·572 | 45·322 | 44·965 |
| 20 | W | | 42·625 | +7·495 | − 4·119 | −1·645 | −0·092 | + 1·639 | 44·264 | |
| 21 | E | | 40·875 | +7·457 | − 4·178 | +1·203 | 0·000 | + 4·482 | 45·357 | |
| 22 | E | | 40·275 | +7·483 | − 4·241 | +1·291 | +0·110 | + 4·643 | 44·918 | |

Mean 8° 6′ 45″·0532

Mean Result of both Faces ..... 8° 6′ 45″·1653

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## No. 30 (945) GEMINOR. South 1° 20′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | E | | 49″·575 | +1″·257 | + 4″·644 | +1″·663 | +0″·257 | + 7″·821 | 57″·396 | |
| 5 | W | 60° α | 51·475 | +1·252 | + 4·572 | −0·092 | +2·426 | + 8·158 | 59·633 | 57″·683 |
| 6 | E | | 53·800 | +1·249 | + 4·500 | −3·340 | −0·349 | + 2·060 | 55·860 | |
| 7 | W | | 48·975 | +1·248 | + 4·429 | +2·288 | +0·901 | + 8·866 | 57·841 | |
| 8 | E | | 53·175 | +1·249 | + 4·360 | −2·348 | −1·268 | + 1·993 | 55·168 | |
| 9 | W | 40° α | 51·475 | +1·247 | + 4·292 | +3·571 | −0·165 | + 8·945 | 60·420 | 57·561 |
| 10 | E | | 53·125 | +1·254 | + 4·224 | −4·252 | +2·022 | + 3·248 | 56·373 | |
| 11 | W | | 45·725 | +1·253 | + 4·160 | +4·371 | +2·775 | +12·559 | 58·284 | |
| 12 | E | | 52·625 | +1·244 | + 4·096 | −1·756 | +0·037 | + 3·621 | 56·246 | |
| 13 | W | 20° α | 52·275 | +1·243 | + 4·033 | +0·408 | +0·864 | + 6·548 | 58·823 | 57·655 |
| 14 | E | | 49·250 | +1·246 | + 3·971 | −1·217 | +2·849 | + 6·849 | 56·099 | |
| 15 | W | | 49·250 | +1·251 | + 3·911 | +1·454 | +3·584 | +10·200 | 59·450 | |
| 16 | E | | 48·725 | +1·243 | + 3·853 | +0·970 | +1·066 | + 7·132 | 55·857 | |
| 17 | W | 30° α (1) | 53·000 | +1·251 | + 3·797 | −0·788 | +0·294 | + 4·554 | 57·554 | 56·833 |
| 18 | E | | 49·300 | +1·263 | + 3·743 | −0·076 | +2·499 | + 7·429 | 56·729 | |
| 19 | W | | 50·625 | +1·271 | + 3·689 | −0·306 | +1·911 | + 6·565 | 57·190 | |
| 20 | E | | 48·925 | +1·263 | + 3·637 | +1·174 | +0·956 | + 7·030 | 55·955 | |
| 21 | W | 50° α (1) | 52·925 | +1·264 | + 3·586 | −1·218 | +2·077 | + 5·709 | 58·634 | 57·609 |
| 22 | E | | 50·325 | +1·271 | + 3·537 | +0·991 | +0·165 | + 5·964 | 56·289 | |
| 23 | W | | 54·575 | +1·274 | + 3·490 | −0·426 | +0·643 | + 4·981 | 59·556 | |
| 24 | E | | 49·025 | +1·261 | + 3·444 | +0·391 | +1·084 | + 6·180 | 55·205 | |
| 25 | W | 70° α (1) | 54·450 | +1·263 | + 3·400 | +0·231 | +1·470 | + 6·364 | 60·814 | |
| 26 | E | | 52·600 | +1·274 | + 3·357 | +1·171 | −2·352 | + 3·450 | 56·050 | 57·907 |
| 27 | W | | 55·225 | +1·277 | + 3·316 | −0·853 | +0·018 | + 3·758 | 58·983 | |
| 28 | E | | 52·175 | +1·274 | + 3·278 | −0·068 | −0·165 | + 4·319 | 56·494 | |

Mean 1° 20′ 57″·5413

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | | 54″·025 | +1″·272 | + 3″·242 | +1″·516 | −1″·930 | + 4″·100 | 58″·125 | |
| 30 | W | 20° α | 55·500 | +1·275 | + 3·207 | −1·006 | +0·221 | + 3·697 | 59·197 | 58″·194 |
| 31 | E | | 51·300 | +1·279 | + 3·172 | +1·854 | +0·331 | + 6·636 | 57·936 | |
| Jan. 1 | W | | 59·225 | +1·278 | + 3·172 | −6·471 | +0·312 | − 1·709 | 57·516 | |
| 2 | E | | 51·975 | +1·285 | + 3·142 | −0·601 | +0·588 | + 4·414 | 56·389 | |
| 3 | W | 40° α | 53·800 | +1·281 | + 3·113 | −0·019 | +1·084 | + 5·459 | 59·259 | 58·560 |
| 4 | E | | 53·400 | +1·280 | + 3·086 | +0·853 | +0·533 | + 5·752 | 59·152 | |
| 5 | W | | 55·400 | +1·276 | + 3·060 | +0·145 | −0·441 | + 4·040 | 59·440 | |
| 6 | E | | 51·950 | +1·271 | + 3·036 | +0·436 | −1·195 | + 3·548 | 55·498 | |
| 7 | W | 60° α | 57·750 | +1·272 | + 3·014 | +0·195 | −1·342 | + 3·139 | 60·889 | 57·824 |
| 8 | E | | 50·025 | +1·267 | + 2·993 | +0·436 | +0·055 | + 4·751 | 54·776 | |
| 9 | W | | 55·625 | +1·271 | + 2·975 | +0·554 | −0·294 | + 4·506 | 60·131 | |
| 10 | E | | 51·150 | +1·271 | + 2·958 | −1·135 | +0·992 | + 4·086 | 55·236 | |
| 11 | W | 30° α (1) | 51·300 | +1·258 | + 2·942 | +1·705 | +2·591 | + 8·496 | 59·796 | 58·264 |
| 12 | E | | 53·200 | +1·267 | + 2·927 | −1·336 | +2·389 | + 5·247 | 58·447 | |
| 13 | W | | 44·675 | +1·269 | + 2·916 | +9·246 | +1·470 | +14·901 | 59·576 | |
| 14 | E | | 53·900 | +1·262 | + 2·905 | +0·224 | +0·551 | + 4·942 | 58·842 | |
| 15 | W | 50° α (1) | 53·075 | +1·253 | + 2·896 | +0·333 | −1·158 | + 3·324 | 56·399 | 57·347 |
| 16 | E | | 54·525 | +1·255 | + 2·889 | +0·183 | −1·360 | + 2·967 | 57·492 | |
| 17 | W | | 52·450 | +1·248 | + 2·882 | −0·108 | +0·184 | + 4·206 | 56·656 | |
| 18 | E | | 56·625 | +1·233 | + 2·877 | −0·254 | −1·709 | + 2·147 | 58·772 | |
| 20 | E | 70° α (1) | 56·725 | +1·237 | + 2·875 | −1·645 | −0·533 | + 1·934 | 58·659 | 57·468 |
| 21 | W | | 51·925 | +1·231 | + 2·875 | +1·203 | −0·753 | + 4·556 | 56·481 | |
| 22 | W | | 50·500 | +1·236 | + 2·877 | +1·291 | +0·055 | + 5·459 | 55·959 | |

Mean 1° 20′ 57″·9428

Mean Result of both Faces ..... 1° 20′ 57″·7421

5 K

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## G. T. STATION KALIANPUR.

No. 31 (956) 82 GEMINOR *B*. South 0° 35′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 14″·825 | +0″·548 | + 4″·250 | −1″·663 | +1″·029 | + 4″·164 | 18″·989 | |
| 5 | E | 60° *a* | 13·725 | +0·546 | + 4·178 | +0·092 | +2·132 | + 6·948 | 20·673 | 20″·005 |
| 6 | W | | 11·150 | +0·545 | + 4·106 | +3·340 | +0·790 | + 8·781 | 19·931 | |
| 7 | E | | 16·500 | +0·544 | + 4·036 | −2·288 | +1·636 | + 3·928 | 20·428 | |
| 8 | W | | 13·225 | +0·545 | + 3·967 | +2·348 | −0·606 | + 6·254 | 19·479 | |
| 9 | E | 40° *a* | 19·625 | +0·544 | + 3·900 | −3·571 | −1·103 | − 0·230 | 19·395 | 20·040 |
| 10 | W | | 10·925 | +0·547 | + 3·833 | +4·252 | +2·095 | +10·727 | 21·652 | |
| 11 | E | | 18·000 | +0·546 | + 3·769 | −4·371 | +1·691 | + 1·635 | 19·635 | |
| 12 | W | | 13·075 | +0·542 | + 3·706 | +1·756 | +0·074 | + 6·078 | 19·153 | |
| 13 | E | 20° *a* | 13·275 | +0·542 | + 3·644 | −0·408 | +0·533 | + 4·311 | 17·586 | 19·202 |
| 14 | W | | 12·800 | +0·543 | + 3·583 | +1·217 | +2·407 | + 7·750 | 20·550 | |
| 15 | E | | 14·000 | +0·546 | + 3·524 | −1·454 | +2·904 | + 5·520 | 19·520 | |
| 16 | W | | 18·350 | +0·542 | + 3·468 | −0·970 | +1·231 | + 4·271 | 22·621 | |
| 17 | E | 30° *a* (1) | 13·700 | +0·546 | + 3·413 | +0·788 | +0·956 | + 5·703 | 19·403 | 20·804 |
| 18 | W | | 14·400 | +0·551 | + 3·360 | +0·076 | +2·573 | + 6·560 | 20·960 | |
| 19 | E | | 13·600 | +0·554 | + 3·307 | +0·306 | +2·463 | + 6·630 | 20·230 | |
| 20 | W | | 16·600 | +0·551 | + 3·257 | −1·174 | +1·323 | + 3·957 | 20·557 | |
| 21 | E | 50° *a* (1) | 15·500 | +0·552 | + 3·207 | +1·218 | +1·875 | + 6·852 | 22·352 | 21·117 |
| 22 | W | | 17·525 | +0·555 | + 3·160 | −0·991 | +0·588 | + 3·312 | 20·837 | |
| 23 | E | | 16·000 | +0·556 | + 3·115 | +0·426 | +0·625 | + 4·722 | 20·722 | |
| 24 | W | | 16·625 | +0·550 | + 3·071 | −0·391 | +1·911 | + 5·141 | 21·766 | |
| 25 | E | 70° *a* (1) | 16·425 | +0·551 | + 3·029 | −0·231 | −0·276 | + 3·073 | 19·498 | |
| 26 | W | | 18·775 | +0·556 | + 2·988 | −1·171 | −1·930 | + 0·443 | 19·218 | 19·792 |
| 27 | E | | 14·250 | +0·557 | + 2·949 | +0·853 | +0·037 | + 4·396 | 18·646 | |
| 28 | W | | 17·000 | +0·556 | + 2·913 | +0·068 | +0·018 | + 3·555 | 20·555 | |

Mean 0° 35′ 20″·1600

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 16″·150 | +0″·555 | + 2″·879 | −1″·516 | −1″·048 | + 0″·870 | 17″·020 | |
| 30 | E | 30° *a* | 14·450 | +0·556 | + 2·847 | +1·006 | +0·037 | + 4·446 | 18·896 | 18″·796 |
| 31 | W | | 16·675 | +0·558 | + 2·814 | −1·854 | +0·184 | + 1·702 | 18·377 | |
| Jan. 1 | E | | 10·950 | +0·557 | + 2·819 | +6·471 | +0·092 | + 9·939 | 20·889 | |
| 2 | W | | 15·375 | +0·560 | + 2·791 | +0·601 | +0·809 | + 4·761 | 20·136 | |
| 3 | E | 40° *a* | 15·025 | +0·558 | + 2·765 | +0·019 | +1·011 | + 4·353 | 19·378 | 19·530 |
| 4 | W | | 17·650 | +0·558 | + 2·741 | −0·853 | +0·018 | + 2·464 | 20·114 | |
| 5 | E | | 16·025 | +0·556 | + 2·717 | −0·145 | −0·662 | + 2·466 | 18·491 | |
| 6 | W | | 18·725 | +0·554 | + 2·696 | −0·436 | −0·496 | + 2·318 | 21·043 | |
| 7 | E | 20° *a* | 14·325 | +0·555 | + 2·677 | −0·195 | −0·974 | + 2·063 | 16·388 | 18·684 |
| 8 | W | | 17·600 | +0·553 | + 2·659 | −0·436 | −0·680 | + 2·096 | 19·696 | |
| 9 | E | | 15·350 | +0·554 | + 2·644 | −0·554 | −0·386 | + 2·258 | 17·608 | |
| 10 | W | | 13·650 | +0·554 | + 2·630 | +1·135 | +1·066 | + 5·385 | 19·035 | |
| 11 | E | 30° *a* (1) | 13·450 | +0·548 | + 2·617 | −1·705 | +2·573 | + 4·033 | 17·483 | 19·002 |
| 12 | W | | 14·900 | +0·553 | + 2·606 | +1·336 | +2·040 | + 6·535 | 21·435 | |
| 13 | E | | 23·525 | +0·553 | + 2·597 | −9·246 | +0·625 | − 5·471 | 18·054 | |
| 14 | W | | 16·675 | +0·550 | + 2·590 | −0·224 | +0·221 | + 3·137 | 19·812 | |
| 15 | E | 50° *a* (1) | 18·575 | +0·547 | + 2·583 | −0·333 | −2·003 | + 0·794 | 19·369 | 19·203 |
| 16 | W | | 16·525 | +0·547 | + 2·581 | −0·183 | −0·956 | + 1·989 | 18·514 | |
| 17 | E | | 17·100 | +0·544 | + 2·576 | +0·108 | −1·213 | + 2·015 | 19·115 | |
| 18 | W | | 16·400 | +0·538 | + 2·575 | +0·254 | −1·397 | + 1·970 | 18·370 | |
| 20 | W | 70° *a* (1) | 14·975 | +0·540 | + 2·580 | +1·645 | −0·459 | + 4·306 | 19·281 | 19·705 |
| 21 | E | | 18·800 | +0·537 | + 2·584 | −1·203 | −1·250 | + 0·668 | 19·468 | |
| 22 | E | | 19·475 | +0·539 | + 2·590 | −1·291 | +0·386 | + 2·224 | 21·699 | |

Mean 0° 35′ 19″·1533

Mean Result of both Faces..... 0° 35′ 19″·6567

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No. 32 (989) 9 Cancri $\mu^1$. South 1° 1′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 51″·725 | +0″·963 | + 3″·591 | +1″·663 | +1″·231 | + 7″·448 | 59″·173 | |
| 5 | W | 60° $\alpha$ | 53·175 | +0·959 | + 3·505 | −0·092 | +2·463 | + 6·835 | 60·010 | 59″·271 |
| 6 | E | | 56·900 | +0·956 | + 3·420 | −3·340 | +0·919 | + 1·955 | 58·855 | |
| 7 | W | | 51·050 | +0·957 | + 3·385 | +2·288 | +1·415 | + 7·995 | 59·045 | |
| 8 | E | | 56·625 | +0·956 | + 3·252 | −2·348 | −0·055 | + 1·805 | 58·430 | |
| 9 | W | 40° $\alpha$ | 55·250 | +0·955 | + 3·171 | +3·571 | −1·525 | + 6·172 | 61·422 | 58·735 |
| 10 | E | | 55·150 | +0·959 | + 3·091 | −4·252 | +2·205 | + 2·003 | 57·153 | |
| 11 | W | | 48·175 | +0·960 | + 3·013 | +4·371 | +1·415 | + 9·759 | 57·934 | |
| 12 | E | | 55·200 | +0·952 | + 2·936 | −1·756 | −0·257 | + 1·875 | 57·075 | |
| 13 | W | 20° $\alpha$ | 54·375 | +0·951 | + 2·861 | +0·408 | +0·809 | + 5·029 | 59·404 | 58·422 |
| 14 | E | | 53·025 | +0·954 | + 2·787 | −1·217 | +2·260 | + 4·784 | 57·809 | |
| 15 | W | | 51·500 | +0·958 | + 2·714 | +1·454 | +2·775 | + 7·901 | 59·401 | |
| 16 | E | | 53·075 | +0·951 | + 2·645 | +0·970 | +0·018 | + 4·584 | 57·659 | |
| 17 | W | 30° $\alpha$ (1) | 55·725 | +0·960 | + 2·577 | −0·788 | +1·378 | + 4·127 | 59·852 | 58·935 |
| 18 | E | | 53·675 | +0·967 | + 2·511 | −0·076 | +1·801 | + 5·203 | 58·878 | |
| 19 | W | | 52·725 | +0·975 | + 2·445 | −0·306 | +3·510 | + 6·624 | 59·349 | |
| 20 | E | | 52·775 | +0·969 | + 2·383 | +1·174 | +1·507 | + 6·033 | 58·808 | |
| 21 | W | 50° $\alpha$ (1) | 56·100 | +0·971 | + 2·320 | −1·218 | +2·205 | + 4·278 | 60·378 | 59·521 |
| 22 | E | | 53·375 | +0·975 | + 2·261 | +0·991 | +0·662 | + 4·889 | 58·264 | |
| 23 | W | | 56·500 | +0·977 | + 2·203 | −0·426 | +1·378 | + 4·132 | 60·632 | |
| 24 | E | | 51·700 | +0·967 | + 2·147 | +0·391 | +1·746 | + 5·251 | 56·951 | |
| 25 | W | 70° $\alpha$ (1) | 56·050 | +0·967 | + 2·093 | +0·231 | −0·018 | + 3·273 | 59·323 | |
| 26 | E | | 55·350 | +0·977 | + 2·039 | +1·171 | −2·113 | + 2·074 | 57·424 | 58·557 |
| 27 | W | | 58·700 | +0·979 | + 1·988 | −0·853 | +0·257 | + 2·371 | 61·071 | |
| 28 | E | | 56·425 | +0·977 | + 1·942 | −0·068 | −0·147 | + 2·704 | 59·129 | |

Mean 1° 1′ 58″·9068

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 55″·175 | +0″·975 | + 1″·896 | +1″·516 | +0″·423 | + 4″·810 | 59″·985 | |
| 30 | W | 20° $\alpha$ | 57·775 | +0·977 | + 1·852 | −1·006 | +0·221 | + 2·044 | 59·819 | 59″·390 |
| 31 | E | | 54·225 | +0·980 | + 1·808 | +1·854 | +0·496 | + 5·138 | 59·363 | |
| Jan. 1 | W | | 62·125 | +0·978 | + 1·797 | −6·471 | −0·037 | − 3·733 | 58·392 | |
| 2 | E | | 55·950 | +0·985 | + 1·759 | −0·601 | +1·305 | + 3·448 | 59·398 | |
| 3 | W | 40° $\alpha$ | 54·750 | +0·981 | + 1·723 | −0·019 | +1·084 | + 3·769 | 58·519 | 59·733 |
| 4 | E | | 56·950 | +0·982 | + 1·687 | +0·853 | −0·202 | + 3·320 | 60·270 | |
| 5 | W | | 58·225 | +0·978 | + 1·654 | +0·145 | −0·257 | + 2·520 | 60·745 | |
| 6 | E | | 54·900 | +0·975 | + 1·623 | +0·436 | +0·037 | + 3·071 | 57·971 | |
| 7 | W | 60° $\alpha$ | 60·350 | +0·976 | + 1·594 | +0·195 | −0·662 | + 2·103 | 62·453 | 59·580 |
| 8 | E | | 54·500 | +0·972 | + 1·566 | +0·436 | −0·386 | + 2·588 | 57·088 | |
| 9 | W | | 57·500 | +0·975 | + 1·541 | +0·554 | +0·239 | + 3·309 | 60·809 | |
| 10 | E | | 54·200 | +0·973 | + 1·518 | −1·135 | +1·673 | + 3·029 | 57·229 | |
| 11 | W | 30° $\alpha$ (1) | 52·475 | +0·963 | + 1·495 | +1·705 | +3·032 | + 7·195 | 59·670 | 58·505 |
| 12 | E | | 55·125 | +0·972 | + 1·475 | −1·336 | +1·746 | + 2·857 | 57·982 | |
| 13 | W | | 45·425 | +0·971 | + 1·458 | +9·246 | +2·040 | +13·715 | 59·140 | |
| 14 | E | | 56·100 | +0·968 | + 1·442 | +0·224 | +0·882 | + 3·516 | 59·616 | |
| 15 | W | 50° $\alpha$ (1) | 56·925 | +0·960 | + 1·427 | +0·333 | −2·095 | + 0·625 | 57·550 | 58·400 |
| 16 | E | | 58·325 | +0·962 | + 1·416 | +0·183 | −0·570 | + 1·991 | 60·316 | |
| 17 | W | | 55·150 | +0·957 | + 1·404 | −0·108 | −1·286 | + 0·967 | 56·117 | |
| 18 | E | | 60·675 | +0·945 | + 1·396 | −0·254 | −1·029 | + 1·058 | 61·733 | |
| 20 | E | 70° $\alpha$ (1) | 59·950 | +0·948 | + 1·386 | −1·645 | −0·239 | + 0·450 | 60·400 | 59·393 |
| 21 | W | | 55·075 | +0·943 | + 1·383 | +1·203 | −0·717 | + 2·812 | 57·887 | |
| 22 | W | | 53·525 | +0·948 | + 1·382 | +1·291 | +0·404 | + 4·025 | 57·550 | |

Mean 1° 1′ 59″·1668

Mean Result of both Faces ..... 1° 1′ 59″·0368



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## G. T. STATION KALIANPUR.

No. 33 (999) 15 Cancri $\psi^3$. North 6° o′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 33″·350 | +5″·627 | — 1″·546 | +1″·663 | —0″·423 | + 5″·321 | 38″·671 | |
| 5 | E | 60° α | 35·900 | +5·602 | — 1·487 | —0·092 | —2·481 | + 1·542 | 37·442 | 36″·846 |
| 6 | W | | 34·675 | +5·587 | — 1·429 | —3·340 | —0·625 | + 0·193 | 34·868 | |
| 7 | E | | 31·525 | +5·597 | — 1·372 | +2·288 | —1·636 | + 4·877 | 36·402 | |
| 8 | W | | 34·900 | +5·585 | — 1·318 | —2·348 | +0·459 | + 2·378 | 37·278 | |
| 9 | E | 40° α | 29·575 | +5·579 | — 1·266 | +3·571 | +1·176 | + 9·060 | 38·635 | 36·854 |
| 10 | W | | 36·050 | +5·598 | — 1·215 | —4·252 | —1·875 | — 1·744 | 34·306 | |
| 11 | E | | 30·350 | +5·610 | — 1·168 | +4·371 | —1·966 | + 6·847 | 37·197 | |
| 12 | W | | 33·050 | +5·562 | — 1·122 | —1·756 | +1·360 | + 4·044 | 37·094 | |
| 13 | E | 20° α | 34·475 | +5·557 | — 1·078 | +0·408 | —0·882 | + 4·005 | 38·480 | 38·106 |
| 14 | W | | 36·075 | +5·575 | — 1·035 | —1·217 | —1·801 | + 1·522 | 37·597 | |
| 15 | E | | 36·375 | +5·598 | — 0·995 | +1·454 | —3·179 | + 2·878 | 39·253 | |
| 16 | W | | 33·500 | +5·552 | — 0·959 | +0·970 | —0·074 | + 5·489 | 38·989 | |
| 17 | E | 30° α (1) | 34·125 | +5·609 | — 0·924 | —0·788 | —1·084 | + 2·813 | 36·938 | 37·216 |
| 18 | W | | 33·525 | +5·651 | — 0·892 | —0·076 | —1·397 | + 3·286 | 36·811 | |
| 19 | E | | 35·050 | +5·698 | — 0·860 | —0·306 | —3·455 | + 1·077 | 36·127 | |
| 20 | W | | 31·875 | +5·662 | — 0·832 | +1·174 | —1·342 | + 4·662 | 36·537 | |
| 21 | E | 50° α (1) | 36·775 | +5·677 | — 0·804 | —1·218 | —2·058 | + 1·597 | 38·372 | 37·658 |
| 22 | W | | 31·525 | +5·702 | — 0·781 | +0·991 | —0·257 | + 5·655 | 37·180 | |
| 23 | E | | 35·250 | +5·708 | — 0·758 | —0·426 | —1·231 | + 3·293 | 38·543 | |
| 24 | W | | 31·575 | +5·652 | — 0·739 | +0·391 | —1·176 | + 4·128 | 35·703 | |
| 25 | E | 70° α (1) | 35·125 | +5·648 | — 0·722 | +0·231 | —1·378 | + 3·779 | 38·904 | |
| 26 | W | | 31·900 | +5·711 | — 0·705 | +1·171 | +2·224 | + 8·401 | 40·301 | 38·559 |
| 27 | E | | 34·250 | +5·718 | — 0·692 | —0·853 | +0·092 | + 4·265 | 38·515 | |
| 28 | W | | 33·675 | +5·707 | — 0·683 | —0·068 | +0·588 | + 5·544 | 39·219 | |

Mean 6° o′ 37″·5398

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 31″·325 | +5″·699 | — 0″·675 | +1″·516 | +0″·110 | + 6″·650 | 37″·975 | |
| 30 | E | 20° α | 35·450 | +5·708 | — 0·670 | —1·006 | —0·276 | + 3·756 | 39·206 | 38″·096 |
| 31 | W | | 31·625 | +5·729 | — 0·664 | +1·854 | —0·680 | + 6·239 | 37·864 | |
| Jan. 1 | E | | 38·825 | +5·715 | — 0·693 | —6·471 | —0·037 | — 1·486 | 37·339 | |
| 2 | W | | 33·050 | +5·758 | — 0·694 | —0·601 | —0·956 | + 3·507 | 36·557 | |
| 3 | E | 40° α | 33·475 | +5·730 | — 0·698 | —0·019 | —0·882 | + 4·131 | 37·606 | 38·041 |
| 4 | W | | 31·400 | +5·737 | — 0·702 | +0·853 | +1·084 | + 6·972 | 38·372 | |
| 5 | E | | 34·400 | +5·718 | — 0·709 | +0·145 | +0·074 | + 5·228 | 39·628 | |
| 6 | W | | 28·425 | +5·695 | — 0·718 | +0·436 | +1·158 | + 6·571 | 34·996 | |
| 7 | E | 60° α | 34·550 | +5·703 | — 0·730 | +0·195 | +1·323 | + 6·491 | 41·041 | 37·189 |
| 8 | W | | 30·175 | +5·684 | — 0·743 | +0·436 | —0·202 | + 5·175 | 35·350 | |
| 9 | E | | 32·775 | +5·698 | — 0·759 | +0·554 | —0·901 | + 4·592 | 37·367 | |
| 10 | W | | 34·075 | +5·681 | — 0·777 | —1·135 | —2·922 | + 0·847 | 34·922 | |
| 11 | E | 30° α (1) | 33·325 | +5·629 | — 0·796 | +1·705 | —2·205 | + 4·333 | 37·658 | 36·226 |
| 12 | W | | 32·975 | +5·682 | — 0·816 | —1·336 | —1·819 | + 1·711 | 34·686 | |
| 13 | E | | 26·700 | +5·675 | — 0·842 | +9·246 | —3·143 | +10·936 | 37·636 | |
| 14 | W | | 30·500 | +5·659 | — 0·867 | +0·224 | —0·294 | + 4·722 | 35·222 | |
| 15 | E | 50° α (1) | 32·325 | +5·611 | — 0·895 | +0·333 | +1·103 | + 6·152 | 38·477 | 37·346 |
| 16 | W | | 31·350 | +5·622 | — 0·926 | +0·183 | +1·158 | + 6·037 | 37·387 | |
| 17 | E | | 32·000 | +5·596 | — 0·956 | —0·108 | +1·764 | + 6·296 | 38·296 | |
| 18 | W | | 33·000 | +5·521 | — 0·989 | —0·254 | +1·011 | + 5·289 | 38·289 | |
| 20 | W | 70° α (1) | 33·825 | +5·538 | — 1·064 | —1·645 | +0·717 | + 3·546 | 37·371 | 38·381 |
| 21 | E | | 33·900 | +5·507 | — 1·102 | +1·203 | +0·551 | + 6·159 | 40·059 | |
| 22 | E | | 31·750 | +5·541 | — 1·144 | +1·291 | +0·368 | + 6·056 | 37·806 | |

Mean 6° o′ 37″·5465

Mean Result of both Faces ..... 6° o′ 37″·5432

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No. 34 (1037) 33 Cancri $\eta$. South 3° 8′+

## Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 4 | E | | 13″·900 | +2″·932 | + 3″·018 | +1″·663 | +0″·404 | + 8″·017 | 21″·917 | |
| 5 | W | α 60° | 18·250 | +2·918 | + 2·904 | −0·092 | +1·819 | + 7·549 | 25·799 | 24″·165 |
| 6 | E | | 19·625 | +2·912 | + 2·792 | −3·340 | +0·680 | + 3·044 | 22·669 | |
| 7 | W | | 16·150 | +2·914 | + 2·680 | +2·288 | +2·242 | +10·124 | 26·274 | |
| 8 | E | | 18·300 | +2·912 | + 2·571 | −2·348 | +0·184 | + 3·319 | 21·619 | |
| 9 | W | α 40° | 17·875 | +2·907 | + 2·463 | +3·571 | −0·753 | + 8·188 | 26·063 | 23·707 |
| 10 | E | | 20·200 | +2·916 | + 2·355 | −4·252 | +1·893 | + 2·912 | 23·112 | |
| 11 | W | | 13·000 | +2·924 | + 2·251 | +4·371 | +1·489 | +11·035 | 24·035 | |
| 12 | E | | 20·125 | +2·898 | + 2·147 | −1·756 | −0·515 | + 2·774 | 22·899 | |
| 13 | W | α 20° | 21·150 | +2·896 | + 2·045 | +0·408 | +0·184 | + 5·533 | 26·683 | 24·511 |
| 14 | E | | 16·000 | +2·905 | + 1·943 | −1·217 | +2·187 | + 5·818 | 21·818 | |
| 15 | W | | 17·250 | +2·916 | + 1·844 | +1·454 | +3·179 | + 9·393 | 26·643 | |
| 16 | E | | 18·425 | +2·889 | + 1·747 | +0·970 | +0·202 | + 5·808 | 24·233 | |
| 17 | W | α (1) 30° | 18·925 | +2·922 | + 1·652 | −0·788 | +1·195 | + 4·981 | 23·906 | 23·816 |
| 18 | E | | 17·950 | +2·946 | + 1·560 | −0·076 | +2·316 | + 6·746 | 24·696 | |
| 19 | W | | 14·350 | +2·965 | + 1·467 | −0·306 | +3·951 | + 8·077 | 22·427 | |
| 20 | E | | 15·450 | +2·950 | + 1·378 | +1·174 | +1·893 | + 7·395 | 22·845 | |
| 21 | W | α (1) 50° | 20·225 | +2·955 | + 1·288 | −1·218 | +2·297 | + 5·322 | 25·547 | 24·061 |
| 22 | E | | 17·900 | +2·967 | + 1·202 | +0·991 | +0·147 | + 5·307 | 23·207 | |
| 23 | W | | 20·025 | +2·970 | + 1·118 | −0·426 | +0·956 | + 4·618 | 24·643 | |
| 24 | E | | 14·950 | +2·946 | + 1·035 | +0·391 | +2·095 | + 6·467 | 21·417 | |
| 25 | W | α (1) 70° | 22·075 | +2·943 | + 0·955 | +0·231 | +1·011 | + 5·140 | 27·215 | |
| 26 | E | | 15·425 | +2·978 | + 0·874 | +1·171 | +0·753 | + 5·776 | 21·201 | 24·282 |
| 27 | W | | 22·175 | +2·978 | + 0·798 | −0·853 | +0·074 | + 2·997 | 25·172 | |
| 28 | E | | 20·625 | +2·974 | + 0·725 | −0·068 | +0·239 | + 3·870 | 24·495 | |

Mean 3° 8′ 24″·0903

## Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. | | | | | Corrected Zenith distance. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Each Observ. | Mean at each Zero. |
| Dec. 29 | E | | 17″·625 | +2″·966 | + 0″·653 | +1″·516 | +0″·331 | + 5″·466 | 23″·091 | |
| 30 | W | α 20° | 22·050 | +2·975 | + 0·584 | −1·006 | +0·349 | + 2·902 | 24·952 | 23″·502 |
| 31 | E | | 17·650 | +2·988 | + 0·514 | +1·845 | +0·588 | + 5·935 | 23·585 | |
| Jan. 1 | W | | 25·050 | +2·980 | + 0·473 | −6·471 | +0·349 | − 2·669 | 22·381 | |
| 2 | E | | 18·975 | +2·997 | + 0·409 | −0·601 | +1·672 | + 4·477 | 23·452 | |
| 3 | W | α 40° | 20·825 | +2·988 | + 0·348 | −0·019 | −0·018 | + 3·299 | 24·124 | 24·227 |
| 4 | E | | 19·625 | +2·987 | + 0·287 | +0·853 | +0·368 | + 4·495 | 24·120 | |
| 5 | W | | 21·750 | +2·976 | + 0·229 | +0·145 | +0·110 | + 3·460 | 25·210 | |
| 6 | E | | 19·300 | +2·964 | + 0·173 | +0·436 | −0·845 | + 2·728 | 22·028 | |
| 7 | W | α 60° | 26·125 | +2·972 | + 0·120 | +0·195 | −0·864 | + 2·423 | 28·548 | 24·919 |
| 8 | E | | 18·925 | +2·955 | + 0·068 | +0·436 | +0·441 | + 3·900 | 22·825 | |
| 9 | W | | 21·850 | +2·970 | + 0·019 | +0·554 | +0·882 | + 4·425 | 26·275 | |
| 10 | E | | 18·500 | +2·961 | − 0·029 | −1·135 | +2·150 | + 3·947 | 22·447 | |
| 11 | W | α (1) 30° | 19·425 | +2·934 | − 0·074 | +1·705 | +2·371 | + 6·936 | 26·361 | 24·201 |
| 12 | E | | 18·075 | +2·961 | − 0·118 | −1·336 | +2·132 | + 3·639 | 21·714 | |
| 13 | W | | 11·425 | +2·958 | − 0·158 | +9·246 | +2·812 | +14·858 | 26·283 | |
| 14 | E | | 20·675 | +2·950 | − 0·197 | +0·224 | +0·312 | + 3·289 | 23·964 | |
| 15 | W | α (1) 50° | 22·525 | +2·920 | − 0·234 | +0·333 | −0·919 | + 2·100 | 24·625 | 23·640 |
| 16 | E | | 21·825 | +2·925 | − 0·268 | +0·183 | −1·231 | + 1·609 | 23·434 | |
| 17 | W | | 22·150 | +2·910 | − 0·301 | −0·108 | −2·113 | + 0·388 | 22·538 | |
| 18 | E | | 23·775 | +2·878 | − 0·332 | −0·254 | −0·698 | + 1·594 | 25·369 | |
| 19 | W | α (1) 70° | 19·600 | +2·901 | − 0·358 | +0·849 | +1·305 | + 5·055 | 24·655 | |
| 20 | E | | 25·275 | +2·886 | − 0·384 | −1·645 | −1·636 | − 0·779 | 24·496 | 24·549 |
| 21 | W | | 21·150 | +2·871 | − 0·409 | +1·203 | −0·772 | + 2·893 | 24·043 | |
| 22 | W | | 21·375 | +2·885 | − 0·430 | +1·291 | −1·323 | + 2·423 | 23·798 | |

Mean 3° 8′ 24″·1730

Mean Result of both Faces..... 3° 8′ 24″·1317





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## G. T. STATION KALIANPUR.

### No. 35 (1060) 43 Cancri γ. South 2° 4′+

#### Face A to the Fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | W | | 47″·325 | +1″·942 | + 2″·277 | −1″·663 | +0″·845 | + 3″·401 | 50″·726 | |
| 5 | E | 60° α | 42·650 | +1·933 | + 2·160 | +0·092 | +2·040 | + 6·225 | 48·875 | 49″·945 |
| 6 | W | | 42·800 | +1·930 | + 2·045 | +3·340 | +0·276 | + 7·591 | 50·391 | |
| 7 | E | | 46·525 | +1·930 | + 1·931 | −2·288 | +1·691 | + 3·264 | 49·789 | |
| 8 | W | | 44·500 | +1·929 | + 1·819 | +2·348 | +1·066 | + 7·162 | 51·662 | |
| 9 | E | 40° α | 49·350 | +1·925 | + 1·708 | −3·571 | −0·809 | − 0·747 | 48·603 | 50·038 |
| 10 | W | | 41·225 | +1·931 | + 1·599 | +4·252 | +2·022 | + 9·804 | 51·029 | |
| 11 | E | | 48·550 | +1·937 | + 1·492 | −4·371 | +1·250 | + 0·308 | 48·858 | |
| 12 | W | | 46·950 | +1·919 | + 1·386 | +1·756 | +0·570 | + 5·631 | 52·581 | |
| 13 | E | 20° α | 45·925 | +1·918 | + 1·282 | −0·408 | −0·092 | + 2·700 | 48·625 | 50·957 |
| 14 | W | | 45·650 | +1·924 | + 1·179 | +1·217 | +3·363 | + 7·683 | 53·333 | |
| 15 | E | | 44·775 | +1·931 | + 1·078 | −1·454 | +2·959 | + 4·514 | 49·289 | |
| 16 | W | | 49·325 | +1·912 | + 0·980 | −0·970 | −0·533 | + 1·389 | 50·714 | |
| 17 | E | 30° α (1) | 44·050 | +1·935 | + 0·884 | +0·788 | +1·415 | + 5·022 | 49·072 | 50·522 |
| 18 | W | | 46·400 | +1·951 | + 0·791 | +0·076 | +2·095 | + 4·913 | 51·313 | |
| 19 | E | | 43·650 | +1·962 | + 0·697 | +0·306 | +4·374 | + 7·339 | 50·989 | |
| 20 | W | | 47·775 | +1·954 | + 0·606 | −1·174 | +2·205 | + 3·591 | 51·366 | |
| 21 | E | 50° α (1) | 42·025 | +1·956 | + 0·515 | +1·218 | +2·077 | + 5·766 | 47·791 | 49·593 |
| 22 | W | | 48·750 | +1·964 | + 0·429 | −0·991 | +0·202 | + 1·604 | 50·354 | |
| 23 | E | | 45·225 | +1·966 | + 0·344 | +0·426 | +0·901 | + 3·637 | 48·862 | |
| 24 | W | | 48·200 | +1·952 | + 0·261 | −0·391 | +3·345 | + 5·167 | 53·367 | |
| 25 | E | 70° α (1) | 43·825 | +1·949 | + 0·181 | −0·231 | +0·974 | + 2·873 | 46·698 | |
| 26 | W | | 49·350 | +1·973 | + 0·100 | −1·171 | +1·911 | + 2·813 | 52·163 | 49·780 |
| 27 | E | | 45·325 | +1·972 | + 0·023 | +0·853 | +0·441 | + 3·289 | 48·614 | |
| 28 | W | | 47·000 | +1·970 | − 0·049 | +0·068 | +1·195 | + 3·184 | 50·184 | |

Mean 2° 4′ 50″·1392

#### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | W | | 50″·600 | +1″·963 | − 0″·120 | −1″·516 | +0″·643 | + 0″·970 | 51″·570 | |
| 30 | E | 20° α | 44·850 | +1·971 | − 0·190 | +1·006 | +1·434 | + 4·221 | 49·071 | 50″·345 |
| 31 | W | | 49·325 | +1·980 | − 0·259 | −1·854 | +1·158 | + 1·025 | 50·350 | |
| Jan. 1 | E | | 41·600 | +1·975 | − 0·302 | +6·471 | +0·643 | + 8·787 | 50·387 | |
| 2 | W | | 46·625 | +1·983 | − 0·365 | +0·601 | +1·819 | + 4·038 | 50·663 | |
| 3 | E | 40° α | 46·575 | +1·980 | − 0·426 | +0·019 | +0·386 | + 1·959 | 48·534 | 49·491 |
| 4 | W | | 49·400 | +1·978 | − 0·485 | −0·853 | +0·643 | + 1·283 | 50·683 | |
| 5 | E | | 46·250 | +1·970 | − 0·542 | −0·145 | +0·551 | + 1·834 | 48·084 | |
| 6 | W | | 51·650 | +1·962 | − 0·597 | −0·436 | 0·000 | + 0·929 | 52·579 | |
| 7 | E | 60° α | 46·700 | +1·969 | − 0·649 | −0·195 | −0·551 | + 0·574 | 47·274 | 50·109 |
| 8 | W | | 51·800 | +1·955 | − 0·699 | −0·436 | −0·074 | + 0·746 | 52·546 | |
| 9 | E | | 46·100 | +1·967 | − 0·746 | −0·554 | +1·268 | + 1·935 | 48·035 | |
| 10 | W | | 45·800 | +1·961 | − 0·792 | +1·135 | +2·665 | + 4·969 | 50·769 | |
| 11 | E | 30° α (1) | 47·450 | +1·944 | − 0·836 | −1·705 | +2·646 | + 2·049 | 49·499 | 50·463 |
| 12 | W | | 47·375 | +1·961 | − 0·877 | +1·336 | +1·893 | + 4·313 | 51·688 | |
| 13 | E | | 55·525 | +1·960 | − 0·915 | −9·246 | +2·573 | − 5·628 | 49·897 | |
| 14 | W | | 49·450 | +1·954 | − 0·951 | −0·224 | +1·489 | + 2·268 | 51·718 | |
| 15 | E | 50° α (1) | 50·825 | +1·933 | − 0·986 | −0·333 | −0·368 | + 0·246 | 51·071 | 50·376 |
| 16 | W | | 49·975 | +1·936 | − 1·016 | −0·183 | −0·717 | + 0·020 | 49·995 | |
| 17 | E | | 49·975 | +1·926 | − 1·048 | +0·108 | −2·242 | − 1·256 | 48·719 | |
| 18 | W | | 49·450 | +1·907 | − 1·075 | +0·254 | −0·827 | + 0·259 | 49·709 | |
| 19 | E | 70° α (1) | 50·275 | +1·920 | − 1·099 | −0·849 | +1·231 | + 1·203 | 51·478 | |
| 20 | W | | 48·000 | +1·912 | − 1·121 | +1·645 | −1·176 | + 1·260 | 49·260 | 50·110 |
| 21 | E | | 52·125 | +1·902 | − 1·142 | −1·203 | −0·184 | − 0·627 | 51·498 | |
| 22 | E | | 50·875 | +1·910 | − 1·160 | −1·291 | −1·103 | − 1·644 | 49·231 | |

Mean 2° 4′ 50″·1490

Mean Result of both Faces..... 2° 4′ 50″·1441

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## G. T. STATION KALIANPUR.

No. 36 (216) 61 CANCRI. North 6° 43′+

### Face A to the fixed Microscopes. A.D. 1839.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 4 | E | | 22″·600 | +6″·303 | + 0″·973 | −1″·663 | −0″·809 | + 4″·804 | 27″·404 | |
| 5 | W | 60° α | 19·425 | +6·273 | + 1·068 | +0·092 | −2·904 | + 4·529 | 23·954 | 25″·451 |
| 6 | E | | 15·550 | +6·265 | + 1·160 | +3·340 | −0·331 | +10·434 | 25·984 | |
| 7 | W | | 20·675 | +6·260 | + 1·250 | −2·288 | −1·434 | + 3·788 | 24·463 | |
| 8 | E | | 16·000 | +6·265 | + 1·338 | +2·348 | −1·084 | + 8·867 | 24·867 | |
| 9 | W | 40° α | 18·850 | +6·250 | + 1·423 | −3·571 | +0·735 | + 4·837 | 23·687 | 24·468 |
| 10 | E | | 15·225 | +6·265 | + 1·507 | +4·252 | −2·885 | + 9·139 | 24·364 | |
| 11 | W | | 22·900 | +6·288 | + 1·587 | −4·371 | −1·452 | + 2·052 | 24·952 | |
| 12 | E | | 17·975 | +6·230 | + 1·665 | +1·756 | −0·496 | + 9·155 | 27·130 | |
| 13 | W | 20° α | 16·400 | +6·227 | + 1·740 | −0·408 | −0·368 | + 7·191 | 23·591 | 24·835 |
| 14 | E | | 19·950 | +6·244 | + 1·814 | +1·217 | −3·878 | + 5·397 | 25·347 | |
| 15 | W | | 19·350 | +6·266 | + 1·885 | −1·454 | −2·775 | + 3·922 | 23·272 | |
| 16 | E | | 17·125 | +6·201 | + 1·952 | −0·970 | +1·029 | + 8·212 | 25·337 | |
| 17 | W | 30° α (i) | 16·975 | +6·281 | + 2·018 | +0·788 | −1·434 | + 7·653 | 24·628 | 25·035 |
| 18 | E | | 21·075 | +6·336 | + 2·078 | +0·076 | −2·040 | + 6·450 | 27·525 | |
| 19 | W | | 17·775 | +6·363 | + 2·139 | +0·306 | −3·933 | + 4·875 | 22·650 | |
| 20 | E | | 22·075 | +6·343 | + 2·196 | −1·174 | −2·996 | + 4·369 | 26·444 | |
| 21 | W | 50° α (i) | 16·400 | +6·344 | + 2·253 | +1·218 | −1·121 | + 8·694 | 25·094 | 25·127 |
| 22 | E | | 19·225 | +6·369 | + 2·304 | −0·991 | −1·066 | + 6·616 | 25·841 | |
| 23 | W | | 14·175 | +6·375 | + 2·353 | +0·426 | −0·202 | + 8·952 | 23·127 | |
| 24 | E | | 22·250 | +6·338 | + 2·400 | −0·391 | −3·657 | + 4·690 | 26·940 | |
| 25 | W | 70° α (i) | 14·525 | +6·326 | + 2·443 | −0·231 | −1·011 | + 7·527 | 22·052 | |
| 26 | E | | 20·850 | +6·409 | + 2·487 | −1·171 | −1·599 | + 6·126 | 26·976 | 24·737 |
| 27 | W | | 15·550 | +6·398 | + 2·525 | +0·853 | −1·323 | + 8·453 | 24·003 | |
| 28 | E | | 18·575 | +6·393 | + 2·558 | +0·068 | −2·169 | + 6·850 | 25·425 | |

Mean 6° 43′ 24″·9422

### Face B to the fixed Microscopes. A.D. 1839-40.

| Date. | Face. | Zero. | Seconds of Observed Zen. dist. | Corrections. Refn. | ✱'s Place. | Collimatn. | Level. | Sum. | Corrected Zenith distance. Each Observ. | Mean at each Zero. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dec. 29 | E | | 18″·300 | +6″·366 | + 2″·590 | −1″·516 | −0″·625 | + 6″·815 | 25″·115 | |
| 30 | W | 20° α | 15·350 | +6·398 | + 2·619 | +1·006 | −2·113 | + 7·910 | 23·260 | 23″·753 |
| 31 | E | | 17·300 | +6·430 | + 2·647 | −1·854 | −1·581 | + 5·642 | 22·942 | |
| Jan. 1 | W | | 10·175 | +6·414 | + 2·546 | +6·471 | −1·911 | +13·520 | 23·695 | |
| 2 | E | | 18·550 | +6·432 | + 2·567 | +0·601 | −1·966 | + 7·634 | 26·184 | |
| 3 | W | 40° α | 15·450 | +6·430 | + 2·585 | +0·019 | −0·919 | + 8·115 | 23·565 | 25·260 |
| 4 | E | | 17·725 | +6·415 | + 2·602 | −0·853 | −0·551 | + 7·613 | 25·338 | |
| 5 | W | | 17·350 | +6·389 | + 2·615 | −0·145 | −0·257 | + 8·602 | 25·952 | |
| 6 | E | | 16·775 | +6·363 | + 2·626 | −0·436 | +1·434 | + 9·987 | 26·762 | |
| 7 | W | 60° α | 11·025 | +6·392 | + 2·633 | −0·195 | +1·066 | + 9·896 | 20·921 | 23·917 |
| 8 | E | | 17·275 | +6·337 | + 2·639 | −0·436 | +0·533 | + 9·073 | 26·348 | |
| 9 | W | | 13·475 | +6·386 | + 2·641 | −0·554 | −0·312 | + 8·161 | 21·636 | |
| 10 | E | | 15·525 | +6·367 | + 2·641 | +1·135 | −2·536 | + 7·607 | 23·132 | |
| 11 | W | 30° α (i) | 18·925 | +6·312 | + 2·639 | −1·705 | −3·253 | + 3·993 | 22·918 | 23·518 |
| 12 | E | | 16·650 | +6·366 | + 2·633 | +1·336 | −1·801 | + 8·534 | 25·184 | |
| 13 | W | | 26·075 | +6·362 | + 2·624 | −9·246 | −2·977 | − 3·237 | 22·838 | |
| 14 | E | | 14·975 | +6·344 | + 2·614 | −0·224 | −0·055 | + 8·679 | 23·654 | |
| 15 | W | 50° α (i) | 14·825 | +6·270 | + 2·601 | −0·333 | +0·404 | + 8·942 | 23·767 | 24·689 |
| 16 | E | | 15·675 | +6·279 | + 2·583 | −0·183 | +1·875 | +10·554 | 26·229 | |
| 17 | W | | 15·950 | +6·244 | + 2·566 | +0·108 | +0·239 | + 9·157 | 25·107 | |
| 18 | E | | 13·200 | +6·192 | + 2·545 | +0·254 | +1·452 | +10·443 | 23·643 | |
| 19 | W | 70° α (i) | 18·925 | +6·226 | + 2·519 | −0·849 | −1·525 | + 6·371 | 25·296 | |
| 20 | E | | 12·925 | +6·206 | + 2·493 | +1·645 | +0·404 | +10·748 | 23·673 | 24·607 |
| 21 | W | | 17·500 | +6·175 | + 2·465 | −1·203 | −0·184 | + 7·253 | 24·753 | |
| 22 | W | | 18·675 | +6·196 | + 2·433 | −1·291 | +0·606 | + 7·944 | 26·619 | |

Mean 6° 43′ 24″·2907

Mean Result of both Faces ..... 6° 43′ 24″·6165

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SYNOPSIS of the Results of the above Observations.

| No. | Position. | Mean Zenith dist. 1st January, 1840. | | Amplitude. | Mean Declination January 1st 1840. | LATITUDES. | |
|---|---|---|---|---|---|---|---|
| | | Kalianpur. | Kaliana. | | | Kalianpur. | Kaliana. |
| 1 | S | 3° 33′ 15″·499 | 8° 56′ 52″·915 | 5° 23′ 37″·416 | 20° 33′ 56″·350 | 24° 7′ 11″·849 | 29° 30′ 49″·265 |
| 2 | S | 1 52 19·207 | 7 15 57·624 | .. 38·417 | 22 14 51·240 | .. 10·447 | .. 48·864 |
| 3 | S | 0 11 50·089 | 5 35 27·678 | .. 37·589 | 23 55 19·760 | .. 9·849 | .. 47·438 |
| 4 | N | 7 39 20·293 | 2 15 43·669 | .. 36·624 | 31 46 33·530 | .. 13·237 | .. 49·861 |
| 5 | S | 0 33 39·710 | 5 57 17·425 | .. 37·715 | 23 33 31·190 | .. 10·900 | .. 48·615 |
| 6 | N | 7 16 56·879 | 1 53 20·163 | .. 36·716 | 31 24 8·960 | .. 12·081 | .. 48·797 |
| 7 | S | 2 28 50·249 | 7 52 27·464 | .. 37·215 | 21 38 19·520 | .. 9·769 | .. 46·984 |
| 8 | S | 3 56 27·357 | 9 20 5·402 | .. 38·045 | 20 10 43·770 | .. 11·127 | .. 49·172 |
| 9 | N | 6 57 5·251 | 1 33 28·700 | .. 36·551 | 31 4 16·960 | .. 11·709 | .. 48·260 |
| 10 | S | 1 28 33·779 | 6 52 11·477 | .. 37·698 | 22 38 37·380 | .. 11·159 | .. 48·857 |
| 11 | N | 8 47 8·566 | 3 23 32·750 | .. 35·816 | 32 54 19·760 | .. 11·194 | .. 47·010 |
| 12 | S | 2 45 53·307 | 8 9 30·606 | .. 37·299 | 21 21 16·900 | .. 10·207 | .. 47·506 |
| 13 | S | 0 4 21·539 | 5 27 59·713 | .. 38·174 | 24 2 49·790 | .. 11·329 | .. 49·503 |
| 14 | N | 8 22 30·766 | 2 58 54·184 | .. 36·582 | 32 29 42·595 | .. 11·829 | .. 48·411 |
| 15 | N | 6 52 1·045 | 1 28 25·021 | .. 36·024 | 30 59 13·440 | .. 12·395 | .. 48·419 |
| 16 | N | 7 56 47·610 | 2 33 10·840 | .. 36·770 | 32 3 59·760 | .. 12·150 | .. 48·920 |
| 17 | N | 6 16 12·850 | 0 52 37·193 | .. 35·657 | 30 23 24·960 | .. 12·110 | .. 47·767 |
| 18 | N | 7 32 59·278 | 2 9 24·007 | .. 35·271 | 31 40 11·300 | .. 12·022 | .. 47·293 |
| 19 | S | 0 51 16·820 | 6 14 54·607 | .. 37·787 | 23 15 53·780 | .. 10·600 | .. 48·387 |
| 20 | S | 0 59 13·617 | 6 22 52·352 | .. 38·735 | 23 7 56·230 | .. 9·847 | .. 48·582 |
| 21 | N | 5 25 47·824 | 0 2 10·778 | .. 37·046 | 29 32 58·970 | .. 11·146 | .. 48·192 |
| 22 | S | 1 31 50·635 | 6 55 28·180 | .. 37·545 | 22 35 19·810 | .. 10·445 | .. 47·990 |
| 23 | N | 6 27 52·671 | 1 4 16·166 | .. 36·505 | 30 35 3·980 | .. 11·309 | .. 47·814 |
| 24 | N | 10 1 36·843 | 4 38 0·813 | .. 36·030 | 34 8 48·310 | .. 11·467 | .. 47·497 |
| 25 | N | 5 28 43·452 | 0 5 6·842 | .. 36·610 | 29 35 53·640 | .. 10·188 | .. 46·798 |
| 26 | N | 6 22 50·816 | 0 59 14·158 | .. 36·658 | 30 30 1·600 | .. 10·784 | .. 47·442 |
| 27 | S | 1 50 57·050 | 7 14 33·906 | .. 36·856 | 22 16 13·740 | .. 10·790 | .. 47·646 |
| 28 | N | 7 58 32·664 | 2 34 56·414 | .. 36·250 | 32 5 44·490 | .. 11·826 | .. 48·076 |
| 29 | N | 8 6 45·165 | 2 43 8·526 | .. 36·639 | 32 13 56·020 | .. 10·855 | .. 47·494 |
| 30 | S | 1 20 57·742 | 6 44 34·836 | .. 37·094 | 22 46 13·180 | .. 10·922 | .. 48·016 |
| 31 | S | 0 35 19·657 | 5 58 58·840 | .. 39·183 | 23 31 50·270 | .. 9·927 | .. 49·110 |
| 32 | S | 1 1 59·037 | 6 25 36·712 | .. 37·675 | 23 5 11·190 | .. 10·227 | .. 47·902 |
| 33 | N | 6 0 37·543 | 0 37 0·564 | .. 36·979 | 30 7 48·340 | .. 10·797 | .. 47·776 |
| 34 | S | 3 8 24·132 | 8 32 1·307 | .. 37·175 | 20 58 46·280 | .. 10·412 | .. 47·587 |
| 35 | S | 2 4 50·144 | 7 28 27·989 | .. 37·845 | 22 2 20·384 | .. 10·528 | .. 48·373 |
| 36 | N | 6 43 24·617 | 1 19 48·709 | .. 35·908 | 30 50 36·510 | .. 11·893 | .. 47·801 |
| Mean Zen. Dist. by North Stars ..... | | | | 5 23 36·3686 | Mean | 24 7 11·0924 | 29 30 48·1507 |
| Do. do. do. by South Stars ..... | | | | 5 23 37·7479 | | | |
| General Mean ..... | | | | 5 23 37·0583 | | | |

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SYNOPSIS shewing the Amplitude of the Celestial Arc as derived from Stars North and South of the Zenith.

5° 23′ 30″+

| South Stars. | | North Stars. | |
|---|---|---|---|
| 7″·416 | | 6″·624 | |
| 8 ·417 | | 6 ·716 | |
| 7 ·589 | | 6 ·551 | |
| 7 ·715 | | 5 ·816 | |
| 7 ·215 | | 6 ·582 | |
| 8 ·045 | | 6 ·024 | |
| 7 ·698 | Maximum Diff. = 2″·327 | 6 ·770 | Maximum Diff. = 1″·775 |
| 7 ·299 | | 5 657 | |
| 8 ·174 | | 5 ·271 | |
| 7 ·787 | | 7 ·046 | |
| 8 ·735 | | 6 ·505 | |
| 7 ·545 | | 6 ·030 | |
| 6 ·856 | | 6 ·610 | |
| 7 ·094 | | 6 ·658 | |
| 9 ·183 | | 6 ·250 | |
| 7 ·675 | | 6 ·639 | |
| 7 ·175 | | 6 ·979 | |
| 7 ·845 | | 5 ·908 | |



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# APPLICATION

OF THE

# RESULTS ABOVE GIVEN

TO THE

# DEDUCTION OF THE FIGURE AND DIMENSIONS

OF

# THE EARTH.

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# RECAPITULATION

OF

## CERTAIN PARTICULARS ADVERTED TO IN THE INTRODUCTORY PAGES.

FROM what has been advanced in pp. clxxiv—v of the Introduction, it will be evident that previous to comparing any Meridional Arc with another Arc it is necessary to know the following results of both.

1st. The latitudes $L$, $l$, of the two limits whence we get their difference $\Delta l$ called the Arc of Amplitude, and their sum $\Sigma l$.

2nd. The whole length $S$, referable to a common standard of feet, fathoms, or other linear dimensions, intercepted between the zeniths of the limits.

Whence for every Arc employed in such comparisons the following constants will be deduced.

3rd. $$m=\frac{3}{4}-\frac{3}{4}\cdot\frac{cos\,\Sigma l\,.\,sin\,\Delta l}{\Delta l}$$

4th. $$n=\frac{3^2.5}{2^6}-\frac{3.5}{2^4}\cdot\frac{cos\,\Sigma l\,.\,sin\,\Delta l}{\Delta l}+\frac{3.5}{2^7}\cdot\frac{cos\,2\,\Sigma l\,.\,sin\,2\,\Delta l}{\Delta l}$$

5th. $$p=\frac{5^2.7}{2^8}-\frac{3.5^2.7}{2^9}\cdot\frac{cos\,\Sigma l\,.\,sin\,\Delta l}{\Delta l}+\frac{3.5.7}{2^9}\cdot\frac{cos\,2\,\Sigma l\,.\,sin\,2\,\Delta l}{\Delta l}-\frac{5.7}{2^9.3}\cdot\frac{cos\,3\,\Sigma l\,.\,sin\,3\,\Delta l}{\Delta l}$$

This being the general form of the data and constants which are functions of them, it is plain that if they be adopted to denote the elements of an Arc near the Equator, the same characters accentuated will apply to any other Arc further from the Equator: from the two sets of constants thus obtained it is then necessary to compute the terms which follows:

6th. $$\alpha=\frac{n-n'}{m-m'}-m';$$

7th. $$\beta=\frac{p-p'}{m-m'}-n'-m'\,\alpha;$$

8th. $$v=\left(\frac{S\,.\,\Delta l'-S'\,.\,\Delta l}{S'\Delta l}\right)$$

And lastly we may proceed to determine all the necessary elements of the ellipsoid of revolution which will satisfy the conditions of the two arcs compared, viz. the major axis $a$ and minor axis $(a-c)$; the square of eccentricity $e^2$ and the compression $\frac{c}{a}$, both in parts of the major axis $a$ considered as unity, all which are as follow:—

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9th. $e^2 = v - \alpha v^2 + (2\alpha^2 - \beta) . v^3$ &c.

10th. $a = \begin{cases} \text{either } \dfrac{S . cosec\ 1''}{\Delta l . \{1 - (1-m) . e^2 - (m-n) . e^4 - (n-p) . e^6 \text{ &c.}} \\ \text{or } \dfrac{S' . cosec\ 1''}{\Delta l' . \{1 - (1-m') . e^2 - (m'-n') . e^4 - (n'-p') . e^6 \text{ &c.}} \end{cases}$

11th. $\dfrac{c}{a} = \dfrac{1}{2} . e^2 + \dfrac{1}{8} . e^4 + \dfrac{1}{16} . e^6$ &c.

In making the selection of Arcs which are most worthy to be employed in these comparisons, it is utterly hopeless to escape the imputation of exercising the judgment arbitrarily, for the plain reason that what pleases one person will rarely satisfy the views of another; if however the elements be all authentically extracted and their functional constants $m$, $n$, $p$, accurately computed, it can be of little moment what selection is made, provided a full exposition be afforded, for these elements and constants will materially facilitate the task of those who give the preference to any other Arcs than those chosen.

The selection which I have made is as follows:

| | | |
|---|---|---|
| 1st. | The Arc Kalianpur to Kaliana ..... | Colonel Everest. |
| 2nd. | „ Damargida to Kalianpur ..... | |
| 3rd. | The whole Arc Damargida to Kaliana..... | |
| 4th. | „ „ Damargida to Punnæ ..... | Colonel Lambton. |
| 5th. | The Arc Punnæ to Kaliana ..... | Colonels Lambton and Everest. |
| 6th. | „ Formentera to Dunkirk ..... | MM. De Lambre, Mechain, D'Arrago, & Biot. |
| 7th. | The whole Arc Jacobstadt to Hochland ..... | Professor Strüve. |
| 8th. | „ „ Tarqui to Cotchesqui ..... | MM. Bouguer & De la Condamine. |
| 9th. | „ „ Dunnose to Clifton ..... | General Mudge. |
| 10th. | „ „ Pahtavara to Mallorn ..... | MM. Ofverbom, Svanberg, Holmquist, & Palander. |
| 11th. | Partial Arc Jacobstadt to Dorpat ..... | Professor Strüve. |
| 12th. | „ Dorpat to Hochland ..... | |

and the arrangement of the various results will doubtless shew the order in which the comparisons have been instituted, without need of further explanation.

As each comparison gives an independent value of $a$ and $c$, there arises a difficulty, similar to that already alluded to, of fixing on the least objectionable method of obtaining the most probable mean result, to which the same observation is applicable, viz. that every geodist is at liberty to use that which seems best to him, provided he gives a full explanation and leaves the data free for others to employ in any manner they may deem preferable.

The method which I have adopted as the simplest may be thus explained:

In either case (whether of $a$ or $c$) the least mean value has been subtracted from all



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the other mean values, and the differences so found arranged in the order of their magnitudes have been designated $d'$, $d''$, $d'''$, &c.; $q$, $q'$, $q''$, $q'''$, &c. are the inverse of the probabilities of error found in the usual way, the first term $q$ appertaining to the lowest mean value, and $q'$, $q''$, $q'''$, &c. to the others in the order of the magnitudes of the quantities from which they have been derived; then by the well-known principle of Cotes the quantity additive to the smallest value will be expressed by

$$\epsilon = \frac{d'.q' + d''.q'' + d'''.q''' + \&c.}{q + q' + q'' + q''' + \&c.}$$

It would be needless to enter into further explanation, and we may now proceed to the results themselves, premising only that the deductions have been made prior to the comparison of the Indian standards with those of the Ordnance Department in England, and consequently that some trifling correction will be eventually needed, but as the computations are so very easy, this need not be a present source of embarrassment, and in truth the errors generated from that source will in all likelihood be trifling when contrasted with those to which some of the earlier Arcs employed in the deductions are liable.

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NUMERICAL VALUES of $S$ and $\Delta l$, together with their derived functions $m$, $n$, $p$, of the several Arcs used in the computations.

No. 1. Arc Kalianpur to Kaliana.

$m = 0 \cdot 30594569$

$S = 326859 \cdot 52$ $n = 0 \cdot 07889875$

$\Delta l = 19417 \cdot 058$ $p = 0 \cdot 01920230$

No. 2. Arc Damargida to Kalianpur.

$m = 0 \cdot 19520887$

$S = 367154 \cdot 37$ $n = 0 \cdot 03254373$

$\Delta l = 21835 \cdot 973$ $p = 0 \cdot 00518221$

No. 3. Arc Kaliana to Damargida.

$m = 0 \cdot 24733065$

$S = 694013 \cdot 89$ $n = 0 \cdot 05436212$

$\Delta l = 41253 \cdot 031$ $p = 0 \cdot 01178113$

No. 4. Arc Damargida to Punnæ.

$m = 0 \cdot 08047354$

$S = 598629 \cdot 84$ $n = 0 \cdot 00630807$

$\Delta l = 35623 \cdot 566$ $p = 0 \cdot 00051465$

No. 5. Arc Punnæ to Kaliana.

$m = 0 \cdot 17001000$

$S = 1292643 \cdot 73$ $n = 0 \cdot 03209294$

$\Delta l = 76876 \cdot 597$ $p = 0 \cdot 00655883$

No. 6. Arc Formentera to Dunkirk.

$m = 0 \cdot 74612262$

$S = 751566 \cdot 44$ $n = 0 \cdot 47113150$

$\Delta l = 44533 \cdot 09$ $p = 0 \cdot 2817814$

No. 7. Arc Jacobstadt to Hochland.

$m = 1 \cdot 08545185$

$S = 218289 \cdot 60$ $n = 0 \cdot 98232687$

$\Delta l = 12905 \cdot 209$ $p = 0 \cdot 83014505$

No. 8. Arc Tarqui to Cotchesqui.

$m = 0 \cdot 00142065$

$S = 188509 \cdot 39$ $n = 0 \cdot 00000343$

$\Delta l = 11223 \cdot 12$ $p = 0 \cdot 00000042$

No. 9. Arc Dunnose to Clifton.

$m = 0 \cdot 93235375$

$S = 172734 \cdot 92$ $n = 0 \cdot 72476392$

$\Delta l = 10223 \cdot 38$ $p = 0 \cdot 52609628$

No. 10. Arc Pahtavara to Mallorn.

$m = 1 \cdot 25828481$

$S = 98879 \cdot 57$ $n = 1 \cdot 31946824$

$\Delta l = 5839 \cdot 565$ $p = 1 \cdot 29145104$

No. 11. Arc Jacobstadt to Dorpat.

$m = 1 \cdot 06549558$

$S = 114336 \cdot 39$ $n = 0 \cdot 94620545$

$\Delta l = 6762 \cdot 718$ $p = 0 \cdot 78436729$

No. 12. Arc Dorpat to Hochland.

$m = 1 \cdot 10742325$

$S = 103953 \cdot 21$ $n = 1 \cdot 02209569$

$\Delta l = 6142 \cdot 491$ $p = 0 \cdot 88054522$

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## No. 1.—ARC KALIANPUR to KALIANA
Compared with

| | Kalianpur to Damargida. | Punnæ to Damargida. | Punnæ to Kaliana. | Formentera to Dunkirk. | Jacobstadt to Hochland. | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|---|---|---|---|---|
| $e^2$ | 0·010410798 | 0·007720363 | 0·008343702 | 0·005777704 | 0·006156903 | 0·007240620 | 0·005896155 | 0·006141773 |
| $\frac{c}{a}$ | 0·005219018 | 0·003867661 | 0·004180589 | 0·002893037 | 0·003083205 | 0·003626887 | 0·002952437 | 0·003075617 |
| | $\frac{1}{191·607}$ | $\frac{1}{258·554}$ | $\frac{1}{239·201}$ | $\frac{1}{345·657}$ | $\frac{1}{324·338}$ | $\frac{1}{275·719}$ | $\frac{1}{338·703}$ | $\frac{1}{325·138}$ |
| $a$ | 3497543·25 | 3490937·91 | 3492465·024 | 3486191·127 | 3487116·192 | 3489763·921 | 3486480·010 | 3487079·270 |
| $c$ | 18253·741 | 13501·764 | 14600·561 | 10085·680 | 10751·494 | 12656·979 | 10293·613 | 10724·920 |
| Mer$^l$ Quad$^t$ | 5479601·02 | 5472953·32 | 5474489·98 | 5468177·81 | 5469108·36 | 5471772·09 | 5468468·40 | 5469071·22 |

## No. 2.—ARC KALIANPUR to DAMARGIDA
Compared with

| | Punnæ to Damargida. | Formentera to Dunkirk. | Jacobstadt to Hochland. | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|---|---|---|
| $e^2$ | 0·005118800 | 0·006707722 | 0·006684614 | 0·005425295 | 0·006573043 | 0·006584961 |
| $\frac{c}{a}$ | 0·002562683 | 0·003359504 | 0·003347911 | 0·002716337 | 0·003291940 | 0·003297919 |
| | $\frac{1}{390·216}$ | $\frac{1}{297·663}$ | $\frac{1}{298·694}$ | $\frac{1}{368·143}$ | $\frac{1}{303·772}$ | $\frac{1}{303·222}$ |
| $a$ | 3482538·659 | 3487026·874 | 3486961·503 | 3483403·287 | 3486645·886 | 3486679·603 |
| $c$ | 8924·643 | 11714·681 | 11674·037 | 9462·096 | 11477·829 | 11498·787 |
| Mer$^l$ Quad$^t$ | 5463351·78 | 5468212·19 | 5468141·40 | 5464288·101 | 5467799·600 | 5467836·12 |

## No. 3.—ARC DAMARGIDA to KALIANA
Compared with

| | Punnæ to Damargida. | Punnæ to Kaliana. | Formentera to Dunkirk. | Jacobstadt to Hochland. | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|---|---|---|---|
| $e^2$ | 0·006774517 | 0·006774398 | 0·006321174 | 0·006453449 | 0·006484086 | 0·006281517 | 0·006388326 |
| $\frac{c}{a}$ | 0·003393015 | 0·003392955 | 0·003165598 | 0·003231948 | 0·003247315 | 0·003145707 | 0·003199280 |
| | $\frac{1}{294·723}$ | $\frac{1}{294·728}$ | $\frac{1}{315·896}$ | $\frac{1}{309·411}$ | $\frac{1}{307·947}$ | $\frac{1}{317·894}$ | $\frac{1}{312·570}$ |
| $a$ | 3487879·107 | 3487878·792 | 3486679·258 | 3487029·235 | 3487110·310 | 3486574·356 | 3486856·920 |
| $c$ | 11834·426 | 11834·216 | 11037·425 | 11269·897 | 11323·746 | 10967·741 | 11155·432 |
| Mer$^l$ Quad$^t$ | 5469456·90 | 5469456·572 | 5468197·63 | 5468564·94 | 5468650·03 | 5468087·54 | 5468384·10 |

## No. 4.—ARC PUNNÆ to DAMARGIDA
Compared with

| | Punnæ to Kaliana. | Formentera to Dunkirk. | Jacobstadt to Hochland. | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|---|---|---|
| $e^2$ | 0·006774618 | 0·006434584 | 0·006506573 | 0·005870364 | 0·006377829 | 0·006442815 |
| $\frac{c}{a}$ | 0·003393065 | 0·003222485 | 0·003258596 | 0·002939503 | 0·003194015 | 0·003226614 |
| | $\frac{1}{294·719}$ | $\frac{1}{310·320}$ | $\frac{1}{306·881}$ | $\frac{1}{340·194}$ | $\frac{1}{313·086}$ | $\frac{1}{309·922}$ |
| $a$ | 3487879·437 | 3486781·219 | 3487013·658 | 3484960·589 | 3486597·991 | 3486807·796 |
| $c$ | 11834·602 | 11236·100 | 11362·769 | 10244·052 | 11136·249 | 11250·583 |
| Mer$^l$ Quad$^t$ | 5469457·28 | 5468201·88 | 5468467·59 | 5466120·59 | 5467992·43 | 5468232·26 |

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**No. 5.—ARC PUNNÆ to KALIANA**
**Compared with**

| | Formentera to Dunkirk. | Jacobstadt to Hochland. | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|---|---|
| $e^2$ | 0·006381831 | 0·006480438 | 0·006350981 | 0·006331337 | 0·006415622 |
| $\frac{c}{a}$ | 0·003196023 | 0·003245485 | 0·003180549 | 0·003170696 | 0·003212973 |
| | $\frac{1}{312\cdot889}$ | $\frac{1}{308\cdot120}$ | $\frac{1}{314\cdot411}$ | $\frac{1}{315\cdot388}$ | $\frac{1}{311\cdot238}$ |
| $a$ | 3486733·792 | 3487021·315 | 3486643·851 | 3486586·582 | 3486832·312 |
| $c$ | 11143·682 | 11317·075 | 11089·444 | 11054·905 | 11203·100 |
| Mer$^{l}$ Quad$^{t}$ | 5468199·91 | 5468515·48 | 5468101·19 | 5468038·34 | 5468308·03 |

**No. 6.—ARC FORMENTERA to DUNKIRK**
**Compared with**

| | Jacobstadt to Hochland. | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|---|
| $e^2$ | 0·006647214 | 0·006374859 | 0·006175552 | 0·006453454 |
| $\frac{c}{a}$ | 0·003329148 | 0·003192526 | 0·003092558 | 0·003231950 |
| | $\frac{1}{300\cdot377}$ | $\frac{1}{313\cdot232}$ | $\frac{1}{323\cdot357}$ | $\frac{1}{309\cdot411}$ |
| $a$ | 3486972·452 | 3486727·522 | 3486548·398 | 3486798·185 |
| $c$ | 11608·648 | 11131·467 | 10782·354 | 11269·157 |
| Mer$^{l}$ Quad$^{t}$ | 5468209·91 | 5468199·64 | 5468192·25 | 5468202·59 |

**No. 7.—ARC JACOBSTADT to HOCHLAND**
**Compared with**

| | Tarqui to Cotchesqui. | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|---|
| $e^2$ | 0·006460376 | 0·007219442 | 0·006073812 |
| $\frac{c}{a}$ | 0·003235422 | 0·003616260 | 0·003041531 |
| | $\frac{1}{309\cdot079}$ | $\frac{1}{276\cdot529}$ | $\frac{1}{328\cdot782}$ |
| $a$ | 3487027·198 | 3486804·942 | 3487140·559 |
| $c$ | 11282·005 | 12609·193 | 10606·246 |
| Mer$^{l}$ Quad$^{t}$ | 5468552·24 | 5467161·64 | 5469260·63 |

**No. 8.—ARC TARQUI to COTCHESQUI**
**Compared with**

| | Dunnose to Clifton. | Pahtavara to Mallorn. |
|---|---|---|
| $e^2$ | 0·006334885 | 0·006406989 |
| $\frac{c}{a}$ | 0·003172475 | 0·003208642 |
| | $\frac{1}{315\cdot211}$ | $\frac{1}{311\cdot658}$ |
| $a$ | 3486587·463 | 3486840·110 |
| $c$ | 11061·110 | 11188·021 |
| Mer$^{l}$ Quad$^{t}$ | 5468034·85 | 5468332·12 |

**No. 9.—DUNNOSE to CLIFTON**
**Compared with**

| | Pahtavara to Mallorn. |
|---|---|
| $e^2$ | 0·006611781 |
| $\frac{c}{a}$ | 0·003311373 |
| | $\frac{1}{301\cdot989}$ |
| $a$ | 3486655·403 |
| $c$ | 11545·618 |
| Mer$^{l}$ Quad$^{t}$ | 5467761·35 |



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DEDUCTION of $a$ and $c$ from the FOREGOING RESULTS.

| Kalianpur to Kaliana | $a$ | $c$ |
|---|---|---|
| Compared with | | |
| Kalianpur to Damargida ..... | 3497543·25 | 18253·741 |
| Damargida to Punnæ..... | 90937·91 | 13501·764 |
| Formentera to Dunkirk ..... | 86191·13 | 10085·680 |
| Jacobstadt to Hochland ..... | 87116·19 | 10751·494 |
| Tarqui to Cotchesqui ..... | 89763·92 | 12656·979 |
| Dunnose to Clifton ..... | 86480·01 | 10293·613 |
| Pahtavara to Mallorn ..... | 87079·27 | 10724·920 |
| Arithmetical Means ..... | 3489301·67 | 12324·027 |
| Values of $p$..... | 1415·42 | 1018·424 |

| Kalianpur to Damargida | $a$ | $c$ |
|---|---|---|
| Compared with | | |
| Kalianpur to Kaliana..... | 3497543·25 | 18253·741 |
| Damargida to Punnæ..... | 82538·66 | 8924·643 |
| Formentera to Dunkirk ..... | 87026·87 | 11714·681 |
| Jacobstadt to Hochland..... | 86961·50 | 11674·037 |
| Tarqui to Cotchesqui..... | 83403·29 | 9462·096 |
| Dunnose to Clifton ..... | 86645·89 | 11477·829 |
| Pahtavara to Mallorn..... | 86679·60 | 11498·787 |
| Arithmetical Means ..... | 3487257·01 | 11857·973 |
| Values of $p$..... | 1712·90 | 1065·013 |

| Damargida to Punnæ | $a$ | $c$ |
|---|---|---|
| Compared with | | |
| Kalianpur to Kaliana..... | 3490937·91 | 13501·764 |
| Kalianpur to Damargida ..... | 82538·66 | 8924·643 |
| Formentera to Dunkirk ..... | 86781·22 | 11236·100 |
| Jacobstadt to Hochland ..... | 87013·66 | 11362·769 |
| Tarqui to Cotchesqui ..... | 84960·59 | 10244·052 |
| Dunnose to Clifton ..... | 86597·99 | 11136·249 |
| Pahtavara to Mallorn ..... | 86807·80 | 11250·583 |
| Arithmetical Means ..... | 3486519·69 | 11093·737 |
| Values of $p$..... | 882·96 | 481·167 |

| Damargida to Kaliana | $a$ | $c$ |
|---|---|---|
| Compared with | | |
| Punnæ to Damargida ..... | 3487879·11 | 11834·426 |
| Formentera to Dunkirk ..... | 86679·26 | 11037·425 |
| Jacobstadt to Hochland ..... | 87029·24 | 11269·897 |
| Tarqui to Cotchesqui..... | 87110·31 | 11323·746 |
| Dunnose to Clifton ..... | 86574·36 | 10967·741 |
| Pahtavara to Mellorn ..... | 86856·92 | 11155·432 |
| Arithmetical Means ..... | 3487021·53 | 11264·778 |
| Values of $p$..... | 173·81 | 115·46 |

| Kaliana to Punnæ | $a$ | $c$ |
|---|---|---|
| Compared with | | |
| Formentera to Dunkirk ..... | 3486733·79 | 11143·682 |
| Jacobstadt to Hochland ..... | 87021·32 | 11317·075 |
| Tarqui to Cotchesqui ..... | 86643·85 | 11089·444 |
| Dunnose to Clifton ..... | 86586·58 | 11054·905 |
| Pahtavara to Mallorn ..... | 86832·31 | 11203·100 |
| Arithmetical Means ..... | 3486763·57 | 11161·641 |
| Values of $p$..... | 68·62 | 41·38 |

| Formentera to Dunkirk | $a$ | $c$ |
|---|---|---|
| Compared with | | |
| Kalianpur to Kaliana ..... | 3486191·13 | 10085·680 |
| Kalianpur to Damargida ..... | 87026·87 | 11714·681 |
| Damargida to Punnæ ..... | 86781·22 | 11236·100 |
| Kaliana to Damargida ..... | 86679·26 | 11037·425 |
| Kaliana to Punnæ ..... | 86733·79 | 11143·682 |
| Jacobstadt to Hochland ..... | 86972·45 | 11608·648 |
| Tarqui to Cotchesqui ..... | 86727·52 | 11131·467 |
| Dunnose to Clifton ..... | 86548·40 | 10782·354 |
| Pahtavara to Mallorn ..... | 86798·19 | 11269·157 |
| Arithmetical Means ..... | 3486717·65 | 11112·133 |
| Values of $p$..... | 76·88 | 149·85 |

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DEDUCTION of $a$ and $c$ from the FOREGOING RESULTS.

| Jacobstadt to Hochland | $a$ | $c$ | Tarqui to Cotchesqui | $a$ | $c$ |
|---|---|---|---|---|---|
| Compared with | | | Compared with | | |
| Kalianpur to Kaliana | 3487116·19 | 10751·494 | Kalianpur to Kaliana | 3489763·92 | 12656·979 |
| Kalianpur to Damargida | 86961·50 | 11674·037 | Kalianpur to Damargida | 83403·29 | 9462·096 |
| Damargida to Punnæ | 87013·66 | 11362·769 | Damargida to Punnæ | 84960·59 | 10244·052 |
| Kaliana to Damargida | 87029·24 | 11269·897 | Kaliana to Damargida | 87110·31 | 11323·746 |
| Kaliana to Punnæ | 87021·32 | 11317·075 | Kaliana to Punnæ | 86643·85 | 11089·444 |
| Formentera to Dunkirk | 86972·45 | 11608·648 | Formentera to Dunkirk | 86727·52 | 11131·467 |
| Tarqui to Cotchesqui | 87027·20 | 11282·005 | Jacobstadt to Hochland | 87027·20 | 11282·005 |
| Dunnose to Clifton | 86804·94 | 12609·193 | Dunnose to Clifton | 86587·46 | 11061·110 |
| Pahtavara to Mallorn | 87140·56 | 10606·246 | Pahtavara to Mallorn | 86840·11 | 11188·021 |
| Arithmetical Means | 3487009·67 | 11386·818 | Arithmetical Means | 3486562·69 | 11048·769 |
| Values of $p$ | 30·42 | 181·52 | Values of $p$ | 537·75 | 270·10 |

| Dunnose to Clifton | $a$ | $c$ | Pahtavara to Mallorn | $a$ | $c$ |
|---|---|---|---|---|---|
| Compared with | | | Compared with | | |
| Kalianpur to Kaliana | 3486480·01 | 10293·613 | Kalianpur to Kaliana | 3487079·27 | 10724·920 |
| Kalianpur to Damargida | 86645·89 | 11477·829 | Kalianpur to Damargida | 86679·60 | 11498·787 |
| Damargida to Punnæ | 86597·99 | 11136·249 | Damargida to Punnæ | 86807·80 | 11250·583 |
| Kaliana to Damargida | 86574·36 | 10967·741 | Kaliana to Damargida | 86856·92 | 11155·432 |
| Kaliana to Punnæ | 86586·58 | 11054·905 | Kaliana to Punnæ | 86832·31 | 11203·100 |
| Formentera to Dunkirk | 86548·40 | 10782·354 | Formentera to Dunkirk | 86798·19 | 11269·157 |
| Jacobstadt to Hochland | 86804·94 | 12609·193 | Jacobstadt to Hochland | 87140·56 | 10606·246 |
| Tarqui to Cotchesqui | 86587·46 | 11061·110 | Tarqui to Cotchesqui | 86840·11 | 11188·021 |
| Pahtavara to Mallorn | 86655·40 | 11545·618 | Dunnose to Clifton | 86655·40 | 11545·618 |
| Arithmetical Means | 3486609·00 | 11214·290 | Arithmetical Means | 3486854·46 | 11160·207 |
| Values of $p$ | 28·22 | 201·08 | Values of $p$ | 50·75 | 98·27 |

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# APPENDIX.

## COMPARISONS OF STANDARDS.

It has been mentioned in page lxxv of the Introduction that the iron Standard bar of 10 feet and brass standard scale of 6 inches, (both marked *B*) of the Great Trigonometrical Survey of India, were sent by me to Southampton in December, 1844, to be compared with the standards used in the Ordnance Survey of Great Britain; having been recently furnished with a copy of the comparisons made on that occasion as well as of those which appear to have been made at my request by Capt. Murphy in 1831, I think it right to give in detail the whole of my own comparisons of the said standards *A* and *B*, made in India in 1834-5, with each other, as also the observed data extracted from the memorandum furnished to me by order of Major General Colby, which I have drawn up on the same principles as those adopted in prior instances of my work.

All these comparisons have been reduced by me by the formula given in page xciv of the Introduction, which rests on the hypothesis that the factor $n$ is common to both standards compared; if that hypothesis be not admitted and the factor of *B* be $n'=n+\delta n$, another term will need to be introduced into the value of $(B-A)$ of the form $-\delta n \,.\, b \,.\, (t'-62^\circ)$: this is a task which I leave to others who deem the values of $n$ and $n'$ sufficiently decided in point of accuracy.

In respect to the 6-inch standard scales, the comparisons instituted at Southampton between *O* and *B* (or as it is there called *I*) will manifestly need no such consideration, as the thermometers do not appear to have been noted in that instance; likewise in reference to those comparisons I have preferred taking a mean of the whole 60 given in General Colby's memorandum; but as the registered values of $O-I$ are all given as positive, there is a doubt relative to the comparisons 13, 14, 15, which have the sign + prefixed, as if they formed exceptions and had a contrary sign to the rest; I have therefore calculated these values in both ways as follows:

1st. Considering the whole values of $O-I$ as positive, the result is

$$\frac{194\cdot1}{60\times20984}=0\cdot00015416 \text{ parts of an inch.}$$

2nd. Considering the values 13, 14, 15 as negative, the result is

$$\frac{190\cdot1}{60\times20984}=0\cdot00015099 \text{ parts of an inch.}$$

This is a point which can be set to rights by a reference to the Superintendent of the Ordnance Survey, but the difference is so trifling as to be utterly insensible, more



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especially as the values $(t-t')$ are not known, the attached thermometers to all appearance not having been noted at the times of observation.

The lengths of the standards employed by me having been determined with relation to others, it must be remembered that every one of my geodetic lines consists of two portions, the one dependent on the 10 feet iron bar, the other on the brass scale of 6 inches, of which the first is to the last as 60 to 3 or 20 to 1: if therefore it be desired to reduce any one of my linear data $\varpi$ to the terms of any other standard, let it be supposed that in terms of that other standard my bar $A$ is $A+i$, and my brass scale in like manner instead of being $A_{(i)}$ is $A_{(i)}+i_{(i)}$, then

$$\varpi \cdot \left\{ \frac{20}{21} \cdot \frac{A+i}{A} + \frac{1}{21} \cdot \frac{A_{(i)}+i_{(i)}}{A_{(i)}} \right\}$$

will be the reduced value, and consequently the correctional term will be additive of the form

$$\varpi \cdot \left\{ \frac{20}{21} \cdot \frac{i}{A} + \frac{1}{21} \cdot \frac{i_{(i)}}{A_{(i)}} \right\}$$

if therefore $A$, $i$, $A_{(i)}$, $i_{(i)}$, be all in the denomination of feet, then as we may safely put $A=10$, $A_{(i)}=\frac{1}{2}$ this value becomes

$$\varpi \cdot \left\{ \frac{20}{21} \cdot \frac{i}{10} + \frac{1}{21} \cdot \frac{i_{(i)}}{\frac{1}{2}} \right\} = \frac{2\varpi}{21} \cdot \left\{ i+i_{(i)} \right\}.$$

Though the terrestrial arc $S$ (vide page clxxv) will need to be altered in like manner, yet it will be remarked that all the other terms $m$, $n$, $p$, &c. of the formula will be unchanged, consequently if the value of $e^2$ be differentiated with respect to $v$ only we may easily obtain the correction due to $e^2$ without going through the necessity of a fresh computation.

It seems to me that it would be premature with data so far from decisive as those we at present possess, to deal very positively with this question, but in the mean time it is manifestly of general benefit to compute those constants which cannot be affected by uncertainty in the standards; in respect to the method employed by myself as detailed in page xcvii for determining the expansion of the iron bar $A$, I have heard it objected that the thermometers cannot truly indicate the temperature of the bar even when their bulbs are thoroughly immersed in cavities filled with fluid quicksilver, because *the mercury would rise to the boiling point under the influence of steam before the bar acquired that temperature*, if there be any force in this objection it would manifestly go to diminish my deduced value of $n$, that factor being directly as the increment of the bar and inversely as that of temperature, whereas if we compare my value in question with those deduced by others the reverse will invariably appear to be the case.

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## No. I.

COMPARISONS of the H. E. I. C.'s 10 feet Iron Standards *A* and *B* made at the Office of the Surveyor General of India, at Dehra Dún, in November, 1834.

| Date, 1834. | Standard *A*. | | Standard *B*. | | Date, 1834. | Standard *A*. | | Standard *B*. | |
|---|---|---|---|---|---|---|---|---|---|
| | Micrometer Readings 20138·2 div. to 1 inch. | Mean of Two Thermometers, Corr$^{n}$ +0·0454. | Micrometer Readings 20138·2 div. to 1 inch. | Mean of Two Thermometers, Corr$^{n}$ −0·2280. | | Micrometer Readings 21038·2 div. to 1 inch. | Mean of Two Thermometers, Corr$^{n}$ +0·0454. | Micrometer Readings 20138·2 div. to 1 inch. | Mean of Two Thermometers, Corr$^{n}$ −0·2280. |
| | R. D. | ° | R. D. | ° | | R. D. | ° | R. D. | ° |
| Nov. 13 | 1 49·9 | 65·300 | 1 78·0 | 67·150 | Nov. 14 | 3 07·7 | 73·400 | 2 94·4 | 72·675 |
| — | 1 76·5 | 67·150 | 1 93·5 | 68·300 | — | 3 18·0 | 73·800 | 3 03·8 | 73·350 |
| — | 2 36·6 | 70·100 | 2 38·5 | 70·475 | — | 3 26·0 | 74·350 | 3 16·9 | 73·750 |
| — | 2 51·5 | 70·950 | 2 48·0 | 71·100 | 15 | 0 76·7 | 57·950 | 0 66·9 | 57·050 |
| — | 2 60·5 | 71·550 | 2 51·8 | 71·550 | — | 0 73·3 | 57·300 | 0 62·1 | 56·675 |
| — | 2 70·5 | 71·850 | 2 67·3 | 72·025 | — | 0 73·0 | 57·250 | 0 67·6 | 56·800 |
| — | 2 76·9 | 72·400 | 2 71·1 | 72·450 | — | 0 79·6 | 57·750 | 0 73·8 | 57·400 |
| — | 2 82·0 | 72·700 | 2 75·0 | 72·700 | — | 0 89·2 | 58·250 | 0 82·0 | 57·850 |
| — | 2 84·6 | 72·900 | 2 75·8 | 72·950 | — | 0 98·4 | 59·000 | 0 90·5 | 58·600 |
| 14 | 0 53·9 | 57·250 | 0 48·5 | 56·650 | — | 1 10·1 | 59·750 | 1 06·4 | 59·500 |
| — | 0 51·6 | 56·900 | 0 45·5 | 56·400 | — | 1 24·4 | 60·750 | 1 17·0 | 60·400 |
| — | 0 47·8 | 56·600 | 0 43·0 | 56·300 | — | 2 15·4 | 66·150 | 2 06·5 | 65·850 |
| — | 0 51·4 | 56·825 | 0 51·1 | 56·650 | — | 2 31·7 | 67·150 | 2 20·0 | 66·600 |
| — | 0 65·5 | 57·550 | 0 61·0 | 57·400 | — | 2 46·4 | 67·850 | 2 34·3 | 67·500 |
| — | 0 80·0 | 58·400 | 0 77·4 | 58·300 | — | 2 64·0 | 68·850 | 2 50·1 | 68·450 |
| — | 1 92·0 | 65·800 | 1 63·0 | 64·300 | — | 2 71·1 | 69·700 | 2 58·9 | 69·150 |
| — | 2 15·5 | 67·225 | 1 83·9 | 65·450 | — | 2 89·1 | 70·675 | 2 76·1 | 70·400 |
| — | 2 32·2 | 68·350 | 2 02·6 | 66·700 | — | 3 00·4 | 71·450 | 2 88·9 | 71·000 |
| — | 2 47·2 | 69·250 | 2 23·0 | 67·825 | — | 3 12·5 | 72·250 | 3 02·0 | 71·650 |
| — | 2 59·0 | 70·325 | 2 39·9 | 69·200 | — | 3 13·0 | 72·650 | 3 06·0 | 72·200 |
| — | 2 76·0 | 71·300 | 2 55·7 | 70·300 | — | 3 25·5 | 72·950 | 3 11·5 | 72·600 |
| — | 2 91·0 | 71·950 | 2 72·4 | 71·250 | — | 3 31·5 | 73·300 | 3 16·1 | 72·850 |
| — | 3 00·5 | 72·600 | 2 81·3 | 72·000 | Mean .. | 2 07·324 | 66·6167 | 1 97·758 | 66·2161 |

By the formula given in page xciv of the Introduction wherein $n = 0{\cdot}000068007$, $b = 120$ these values give

$$n\,b\,(t-t') = 0{\cdot}00055004$$
$$s'-s = -0{\cdot}00047502$$
$$\therefore (B-A) = 0{\cdot}00007502 \text{ parts of an inch.}$$

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## No. II.

COMPARISONS of the H. E. I. C.'s 10 feet Iron Standards *A* and *B* made at the Camp of the Surveyor General of India, at Dehra Dún, in February, 1835.

| Date, 1835. | Standard *A*. Micrometer Readings 20168·7 div. to 1 inch. | Standard *A*. Mean of Two Thermometers, Correction +0·0454. | Standard *B*. Micrometer Readings 20168·7 div. to 1 inch. | Standard *B*. Mean of Two Thermometers, Correction −0·2280. | Date, 1835. | Standard *A*. Micrometer Readings 20168·7 div. to 1 inch. | Standard *A*. Mean of Two Thermometers, Correction +0·0454. | Standard *B*. Micrometer Readings 20168·7 div. to 1 inch. | Standard *B*. Mean of Two Thermometers, Correction −0·2280. |
|---|---|---|---|---|---|---|---|---|---|
| | R. D. | ° | R. D. | ° | | R. D. | ° | R. D. | ° |
| Feb. 11 | −0 82·6 | 41·55 | −0 95·8 | 40·75 | Feb. 12 | +3 51·3 | 71·60 | +3 40·0 | 71·10 |
| — | −0 70·3 | 41·80 | −0 81·8 | 41·30 | — | +3 49·9 | 71·55 | +3 39·3 | 71·00 |
| — | −0 57·8 | 42·75 | −0 63·1 | 42·40 | — | +3 40·1 | 71·15 | +3 31·0 | 70·65 |
| — | −0 26·0 | 44·20 | −0 35·5 | 43·80 | — | +3 32·3 | 70·40 | +3 19·9 | 70·00 |
| — | −0 02·5 | 46·25 | −0 08·5 | 46·25 | 13 | +0 09·0 | 48·70 | −0 16·1 | 47·75 |
| — | +0 33·7 | 48·65 | +0 26·1 | 48·40 | — | +0 09·6 | 48·80 | −0 02·5 | 47·95 |
| — | +0 88·5 | 52·35 | +0 81·2 | 52·00 | — | +0 27·5 | 49·70 | +0 14·3 | 49·15 |
| — | +1 28·0 | 54·85 | +1 19·0 | 54·60 | — | +0 51·0 | 51·20 | +0 42·0 | 50·75 |
| — | +3 30·0 | 68·35 | +3 06·7 | 67·30 | — | +0 82·0 | 53·20 | +0 71·0 | 52·75 |
| — | +3 43·5 | 69·25 | +3 25·5 | 68·35 | — | +1 15·5 | 55·45 | +1 02·6 | 55·10 |
| — | +3 58·8 | 70·40 | +3 41·0 | 69·50 | — | +1 46·0 | 57·60 | +1 37·1 | 57·30 |
| — | +3 68·5 | 71·30 | +3 50·0 | 70·50 | — | +1 75·4 | 59·65 | +1 69·7 | 59·35 |
| — | +3 70·5 | 71·55 | +3 55·9 | 71·00 | — | +3 15·2 | 68·95 | +2 95·0 | 68·05 |
| — | +3 71·6 | 71·65 | +3 57·9 | 71·05 | — | +3 44·5 | 70 90 | +3 26·5 | 70·10 |
| — | +3 56·5 | 70·90 | +3 41·5 | 70·45 | — | +3 74·0 | 72·90 | +3 65·5 | 72·45 |
| — | +3 29·5 | 69·75 | +3 17·5 | 69·45 | — | +4 10·5 | 74·55 | +3 92·2 | 74·00 |
| 12 | −0 10·4 | 48·15 | −0 28·5 | 47·20 | — | +4 17·1 | 75·05 | +3 98·4 | 74·45 |
| — | −0 03·9 | 48·10 | −0 19·2 | 47·35 | — | +4 12·0 | 75·15 | +3 99·0 | 74·50 |
| — | +0 09·6 | 48·80 | −0 02·5 | 48·25 | — | +4 13·0 | 74·80 | +3 93·0 | 74·45 |
| — | +0 28·5 | 49·95 | +0 19·4 | 49·60 | — | +3 98·0 | 74·20 | +3* 84·1 | 73·75 |
| — | +0 58·5 | 51·95 | +0 50·0 | 51·55 | 16 | −1 43·3 | 42·60 | −1 35·2 | 43·35 |
| — | +0 94·0 | 54·05 | +0 86·0 | 53·65 | — | −1 36·3 | 42·85 | −1 30·9 | 43·45 |
| — | +1 27·5 | 56·20 | +1 20·0 | 56·05 | — | −1 22·3 | 43·60 | −1 16·9 | 44·10 |
| — | +1 61·4 | 58·50 | +1 49·5 | 58·10 | — | −1 00·0 | 45·00 | −0 97·0 | 45·50 |
| — | +2 79·3 | 66·85 | +2 61·9 | 66·00 | — | −0 71·2 | 46·65 | −0 68·9 | 47·00 |
| — | +3 08·9 | 68·80 | +2 95·0 | 68·00 | — | −0 40·1 | 48·40 | −0 42·5 | 48·50 |
| — | +3 27·0 | 69·90 | +3 13·4 | 69·20 | — | −0 17·0 | 49·95 | −0 22·0 | 49·95 |
| — | +3 42·8 | 71·05 | +3 31·0 | 70·40 | | | | | |
| — | +3 47·6 | 71·25 | +3 31·4 | 70·80 | Mean .. | 1 67·043 | 59·1723 | 1 55·957 | 58·7446 |

Using the same formula and constants as in the 1st series these values give

$$n\,b\,.\,(t-t') = +0\cdot00057216$$
$$(s'-s) = -0\cdot00054966$$
$$\therefore B-A = +0\cdot00002250 \text{ parts of an inch}$$

Hence..... 45 . $(B-A)$ 1st series ..... $= +0\cdot00337590$
And ..... 56 . $(B-A)$ 2nd series ..... $= +0\cdot00126000$

The sum is 101 . $(B-A)$ ..... $= +0\cdot00463590$

Whence the deduced value of $(B-A)$ ..... $= +0\cdot00004590$ parts of an inch

* In my manuscript copy this is registered as 2 R. 84 D.·1, but it is so manifestly a clerical error that I have not scrupled to correct it as in the text.

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## No. III.

COMPARISONS of the H. E. I. C.'s 6-inch Brass Standard Scales *A* and *B* made at the Office of the G. T. Survey of India at Hatipaon in 1835.

| Date, 1835. | Standard *A.* | | Standard *B.* | | Date, 1835. | Standard *A.* | | Standard *B.* | |
|---|---|---|---|---|---|---|---|---|---|
| | Micrometer Readings 19669·2 div. to 1 inch. | Thermometer Correction +0·037. | Micrometer Readings 19669·2 div. to 1 inch. | Thermometer Correction −0·126. | | Micrometer Readings 19669·2 div. to 1 inch. | Thermometer Correction +0·037. | Micrometer Readings 19669·2 div. to 1 inch. | Thermometer Correction −0·126. |
| | R. D. | ° | R. D. | ° | | R. D. | ° | R. D. | ° |
| June 11 | 0 7·0 | 64·2 | 0 4·3 | 64·7 | June 12 | 0 51·5 | 71·7 | 0 48·4 | 70·1 |
| — | 0 8·3 | 64·5 | 0 5·5 | 64·5 | — | 0 53·5 | 71·5 | 0 49·5 | 70·4 |
| — | 0 8·5 | 65·0 | 0 7·5 | 65·0 | — | 0 50·5 | 71·2 | 0 48·2 | 70·0 |
| — | 0 11·0 | 65·6 | 0 7·0 | 65·6 | — | 0 51·0 | 70·7 | 0 47·4 | 70·0 |
| — | 0 12·5 | 67·0 | 0 9·3 | 67·4 | — | 0 56·5 | 70·7 | 0 52·0 | 70·3 |
| — | 0 11·0 | 68·8 | 0 10·1 | 68·3 | 13 | 0 46·8 | 64·7 | 0 42·3 | 65·2 |
| — | 0 14·5 | 69·5 | 0 10·8 | 69·0 | — | 0 47·2 | 65·7 | 0 45·0 | 66·2 |
| — | 0 15·5 | 70·5 | 0 10·9 | 69·7 | — | 0 47·1 | 67·8 | 0 43·0 | 67·9 |
| — | 0 14·4 | 70·9 | 0 12·0 | 70·4 | — | 0 46·8 | 69·5 | 0 45·8 | 69·3 |
| — | 0 15·2 | 71·7 | 0 13·8 | 70·8 | — | 0 48·2 | 71·4 | 0 45·4 | 70·7 |
| — | 0 16·8 | 70·9 | 0 13·5 | 69·8 | — | 0 46·5 | 72·0 | 0 48·0 | 71·5 |
| — | 0 15·9 | 69·9 | 0 13·1 | 69·4 | — | 0 48·0 | 72·5 | 0 46·4 | 72·4 |
| — | 0 16·0 | 69·8 | 0 14·1 | 69·5 | — | 0 52·1 | 74·2 | 0 49·5 | 73·3 |
| — | 0 18·6 | 71·7 | 0 14·6 | 70·0 | — | 0 55·0 | 75·4 | 0 52·8 | 74·4 |
| 12 | 0 50·3 | 64·3 | 0 45·2 | 64·7 | — | 0 57·2 | 75·5 | 0 53·0 | 74·7 |
| — | 0 47·8 | 64·6 | 0 44·2 | 64·8 | — | 0 57·5 | 75·8 | 0 54·0 | 75·1 |
| — | 0 44·1 | 65·2 | 0 45·2 | 65·2 | — | 0 57·5 | 75·5 | 0 55·0 | 75·0 |
| — | 0 48·2 | 65·8 | 0 45·0 | 65·6 | — | 0 58·0 | 77·2 | 0 58·0 | 75·0 |
| — | 0 45·0 | 66·8 | 0 44·7 | 66·4 | — | 0 63·0 | 77·4 | 0 58·1 | 76·1 |
| — | 0 48·4 | 69·0 | 0 45·3 | 67·7 | — | 0 59·5 | 77·2 | 0 57·5 | 76·7 |
| — | 0 51·1 | 70·3 | 0 45·2 | 68·8 | — | 0 66·5 | 78·3 | 0 62·1 | 77·7 |
| — | 0 50·0 | 70·6 | 0 46·1 | 69·6 | — | 0 66·0 | 79·0 | 0 61·0 | 78·2 |
| — | 0 48·8 | 69·8 | 0 44·3 | 69·3 | — | 0 66·2 | 79·8 | 0 62·5 | 78·5 |
| — | 0 48·8 | 70·4 | 0 46·5 | 69·5 | — | 0 67·3 | 80·0 | 0 64·1 | 78·7 |
| — | 0 50·9 | 72·5 | 0 45·8 | 69·7 | — | 0 68·0 | 80·0 | 0 64·3 | 79·0 |
| | | | | | Mean .. | 0 42·12 | 71·080 | 0 39·146 | 70·436 |

By the formula given in page xciv of the Introduction, wherein $n = 0{\cdot}0000104166$, $b = 6$ inches, these values give

$$n\,b\,.\,(t-t') = +0{\cdot}0000504$$
$$(s'-s) = -0{\cdot}0001512$$
$$\therefore (B-A) = -0{\cdot}0001008 \text{ parts of an inch.}$$



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## No. IV.

COMPARISONS of the H. E. I. C.'s 10-feet Standard *B* with Ordnance Standard $Q_2$ made at the Tower in 1831.

| Date, 1831. | Standard $Q_2$. Micrometer Readings 20520 div. to 1 inch. | Standard $Q_2$. Reduced Temperature. | Standard *B*. Micrometer Readings 20520 div. to 1 inch. | Standard *B*. Reduced Temperature. |
|---|---|---|---|---|
| | | ° | | ° |
| Sept. 29 | 84·75 | 64·76 | 60·57 | 64·67 |
| 30 | 44·50 | 62·45 | 22·00 | 62·08 |
| — | 59·75 | 63·13 | 33·75 | 62·80 |
| — | 62·00 | 63·56 | 31·13 | 63·17 |
| Oct. 6 | 11·25 | 60·25 | 2·63 | 60·55 |
| 7 | 29·25 | 61·24 | 7·00 | 61·28 |
| — | 31·50 | 61·76 | 30·33 | 62·03 |
| 8 | 20·83 | 61·65 | 18·20 | 61·66 |
| 11 | 11·14 | 60·22 | 97·25 | 59·99 |
| — | 9·00 | 60·55 | 88·08 | 60·42 |
| 12 | 72·17 | 60·32 | 57·60 | 60·47 |
| — | 75·65 | 60·62 | 63·13 | 60·90 |
| — | 89·69 | 61·25 | 80·13 | 61·31 |
| 13 | 72·25 | 60·69 | 59·50 | 60·56 |
| — | 93·38 | 61·28 | 71·25 | 61·55 |
| — | 96·25 | 61·99 | 86·58 | 62·05 |
| 14 | 87·38 | 61·32 | 81·00 | 61·48 |
| — | 94·38 | 61·63 | 81·06 | 61·94 |
| — | 1·65 | 62·45 | 87·50 | 62·40 |
| — | 11·75 | 62·88 | 0·08 | 62·72 |
| — | 15·13 | 63·17 | 0·50 | 63·23 |
| 15 | 81·38 | 60·95 | 58·33 | 61·09 |
| — | 85·13 | 61·24 | 73·67 | 61·60 |
| — | 93·83 | 61·89 | 78·50 | 62·12 |
| — | 0·25 | 62·17 | 87·35 | 62·35 |
| Means.. | 53·370 | 61·737 | 54·285 | 61·777 |

Using the same values for $n$, $b$ as those in comparisons 1 and 2 these values give

$$n\,b\,.\,(t-t') = -0\cdot00003264$$
$$(s'-s) = +0\cdot00004459$$
$$\therefore B-Q_2 = 0\cdot00001195 \text{ parts of an inch.}$$

## No. V.

COMPARISONS of the H. E. I. C.'s 10-feet Standard *B* with Ordnance Standard $Q_1$ made at Southampton in 1846 at the Office of the Ordnance Survey.

| Date, 1846. | Standard $Q_1$. Micrometer Readings 20984 div. to 1 inch. | Standard $Q_1$. Reduced Temperature. | Standard *B*. Micrometer Readings 20984 div. to 1 inch. | Standard *B*. Reduced Temperature. |
|---|---|---|---|---|
| | | ° | | ° |
| July 13 | 12·6 | 75·12 | 15·8 | 76·61 |
| — | 14·6 | 75·17 | 18·5 | 76·66 |
| 14 | 24·5 | 69·52 | 14·3 | 70·26 |
| — | 25·4 | 69·57 | 25·0 | 70·86 |
| — | 27·9 | 70·07 | 24·9 | 70·91 |
| — | 29·8 | 70·12 | 31·2 | 71·61 |
| — | 35·6 | 70·57 | 34·3 | 71·66 |
| — | 37·0 | 70·67 | 38·6 | 72·21 |
| — | 39·1 | 71·07 | 39·9 | 72·31 |
| — | 40·0 | 71·17 | 48·7 | 72·91 |
| — | 56·3 | 72·21 | 60·6 | 73·62 |
| — | 57·9 | 72·31 | 69·1 | 74·17 |
| — | 65·2 | 72·76 | 70·1 | 74·27 |
| — | 61·7 | 72·91 | 79·0 | 74·77 |
| — | 70·6 | 73·36 | 81·0 | 74·82 |
| — | 73·3 | 73·41 | 90·3 | 75·47 |
| — | 28·7 | 76·01 | 42·0 | 78·22 |
| — | 30·2 | 76·01 | 43·6 | 78·32 |
| — | 30·0 | 76·31 | 46·0 | 78·37 |
| — | 34·2 | 76·46 | 48·1 | 78·42 |
| Means.. | 39·23 | 72·74 | 46·05 | 74·3225 |

Using the same values for $n$, $b$ as heretofore these results give

$$n\,b\,.\,(t-t') = -0\cdot00129145$$
$$(s'-s) = +0\cdot00032501$$
$$\therefore B-Q_1 = -0\cdot00096644 \text{ parts of an inch.}$$

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Data extracted from the Memorandum furnished by the Superintendent of the Ordnance Survey of Great Britain.

## No. VI.

COMPARISONS of the H. E. I. C.'s 6-inch Standard Scale *B* with the Ordnance 6-inch Scale made at the Office of the Superintendent of the Ordnance Survey of Great Britain at Southampton in 1846.

| Date, 1846. | *O*−*B* Micrometer Reading 20984 div. to 1 inch. | Date, 1846. | *O*−*B* Micrometer Reading 20984 div. to 1 inch. |
|---|---|---|---|
| Feb. 20 | 2·0 | July 29 | 0·6 |
| — | 3·3 | 30 | 0·7 |
| 21 | 4·1 | — | 0·4 |
| — | 1·8 | Aug. 1 | 1 0 |
| 26 | 2·2 | — | 0·8 |
| — | 1·5 | — | 1 7 |
| Mar. 11 | 2·5 | — | 0·7 |
| — | 3·2 | 5 | 3·2 |
| 13 | 0·3 | — | 2·0 |
| — | 2·8 | — | 4 4 |
| July 24 | 0·7 | — | 2·1 |
| 25 | 0·0 | 7 | 3·4 |
| 28 | +0·8 | — | 3·1 |
| — | +0·2 | — | 4·1 |
| 29 | +1·0 | — | 1·6 |
| Sum of 30 readings 1st series..... | | | 56·2 |

## No. VII.

COMPARISONS of the H. E. I. C.'s 6-inch Standard Scale *B* with the Ordnance 6-inch Scale made at the Office of the Superintendent of the Ordnance Survey of Great Britain at Southampton in 1846.

| Date, 1846. | *O*−*B* Micrometer Reading 20984 div. to 1 inch. | Date, 1846. | *O*−*B* Micrometer Reading 20984 div. to 1 inch. |
|---|---|---|---|
| Aug. 12 | 4·2 | Aug. 22 | 4·1 |
| 13 | 3·4 | — | 4·7 |
| 22 | 5·4 | — | 4·2 |
| — | 3·8 | — | 2·7 |
| — | 5·7 | — | 5·2 |
| — | 4·5 | — | 7·2 |
| — | 2·8 | — | 5·4 |
| — | 5·9 | 23 | 5·1 |
| — | 4·1 | — | 4·2 |
| — | 4·0 | — | 4·5 |
| — | 4·0 | — | 4·6 |
| — | 4·8 | — | 4·0 |
| — | 2·5 | — | 6·2 |
| — | 4·2 | — | 5·2 |
| — | 4·8 | — | 6·5 |
| Sum of 30 readings 2nd series..... | | | 137·9 |

The mean of the whole 60 comparisons taken as positive is $\frac{194 \cdot 1}{60} = 3 \cdot 235$ div. whence

$$n b \cdot (t - t') \ldots\ldots = 0 \cdot 00000000$$
$$s' - s \ldots\ldots\ldots\ldots = -0 \cdot 00015416$$
$$\therefore B - O \ldots\ldots\ldots = -0 \cdot 00015416 \text{ parts of an inch.}$$

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# ERRATA.

Page xxxvi, line 8, *for* " 36″5," *read* " 36″·5."
,, xliii, ,, 29, *for* " 1841-2," *read* " 1821-2."
,, liv, ,, 37, *for* " refraction," *read* " refractions."
,, lix, ,, 27, *for* " $\frac{1}{8}\cdot\{\frac{\pi}{2}$," *read* " $\frac{1}{4}\cdot\{\pi$."
,, lxxi, ,, 12, column 3, *for* " 5 44 40·136," *read* " 6 44 40·136."
,, lxxxiii, ,, 15 & 22, *for* " boring," *read* " boning."
,, lxxxiii, ,, 29, *for* " bar," *read* " bars."
,, lxxxvi, ,, 39, *for* " $D$ and $D'$," *read* " $D'$ and $D$."
,, xcv, ,, 17, *for* " inch by," *read* " inch may by."
,, ciii, ,, 4, *for* " denote factor," *read* " denote the factor."
,, cxiv, ,, 10, *for* " axes," *read* " axis."
,, cxv, ,, 30, *for* " render," *read* " rendered."
,, cxxv, ,, 5, 7, 9, 10, 11, 12, *for* " $x$," *read* " $z$."
,, cxxvi, ,, 13, *for* " $x''$," *read* " $z''$."
,, cxxxi, ,, 15, *for* " Rampur," *read* " Ranipur."
,, cxlvi, ,, 11, *for* " $(\alpha)$," *read* " $(C)$."
,, cxlvi, ,, 22, *for* " continued," *read* " constructed."
,, cxlvii, ,, 25, *for* " $(\beta)$," *read* " $(\alpha)$."
,, cxlix, ,, 13, *for* " 0·0000001 to $\bar{1}$·9985600," *read* " 0·0000001 from 0 to $\bar{1}$·9985600."
,, cl, ,, 20, *for* " triangles," *read* " triangle."
,, clii, ,, 38, *for* " be the common," *read* " be common."
,, 89, ,, 17, *for* " The value of 660, &c. &c." *read* " The value of 660 sets of bars and microscopes at 63 feet each is $660 \times 63$."
,, 191, 3rd column, No. 27, *for* " 4 40," *read* " 4 20."

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