Abernethy || Aberration.

liged to attend ſome public affairs in London; and his mother, to ſhelter herſelf from the mad fury of the Iriſh rebels, retiring to Derry, a relation who had him under his care, having no opportunity of conveying him to her, carried him to Scotland; and thus he eſcaped the hardſhips and dangers of the ſiege of Derry, in which Mrs Abernethy loſt all her other children. He afterwards ſtudied at the univerſity of Glaſgow, where he remained till he took the degree of maſter of arts; and, in 1708, he was choſen miniſter of a diſſenting congregation at Antrim, in which ſituation he continued above 20 years. About the time of the Bangorian controverſy (for which ſee HOADLEY), a diſſenſion aroſe among his brethren in the miniſtry at Belfaſt, on the ſubject of ſubſcription to the Weſtminſter confeſſion of faith. In this controverſy he became a leader on the negative ſide, and incurred the cenſure of a general ſynod. The agitation of parties began to be alſo felt among the members of his congregation. Many of them deſerted him; which induced him to accept of an invitation to ſettle in Dublin, where his preaching was much admired. Here he continued for ten years, reſpected and eſteemed. But his labours were terminated by a ſudden attack of the gout in the head, to which he had been ſubject; and he died in December 1740, in the 60th year of his age. His writings, as was his character, are diſtinguiſhed for candour, liberality, and manly ſentiment. He publiſhed a volume of ſermons on the Divine Attributes; after his death a ſecond volume was publiſhed by his friends; and theſe were ſucceeded by four other volumes on different ſubjects: all of which have been greatly admired.

ABERNETHY, a ſmall town in Strathern, a diſtrict of Perthſhire in Scotland, ſituated on the river Tay, a little above the mouth of the Erne. It is ſaid to have been the ſeat of the Pictiſh kings; and was afterwards the ſee of an archbiſhop, which was afterwards transferred to St Andrew's. In the churchyard of Abernethy, there is a tower of ſingular conſtruction. It is of a circular form, is 74 feet in height, and 48 feet in circumference. The tower at Brechin is the only one of a ſimilar ſtructure in Scotland. The reſearches of the antiquarian have hitherto failed in diſcovering the uſes of theſe inſulated buildings. Conjecture, therefore, has ſupplied the place of certainty, by ſuppoſing that they are of Pictiſh origin, and that they were intended as places of confinement for religious devotees in performing penance, and hence they have been denominated towers of repentance.

ABERRATION, in *Aſtronomy*, an apparent motion of the celeſtial bodies, produced by the progreſſive motion of light, and the earth's annual motion in her orbit.

This effect may be explained and familiarized by the motion of a line parallel to itſelf, much after the manner that the compoſition and reſolution of forces are explained.

M. de Maupertuis, in his "Elements of Geography," gives a familiar and ingenious idea of the aberration, in this manner: "It is thus," ſays he, "concerning the direction in which a gun muſt be pointed to ſtrike a bird in its flight; inſtead of pointing it ſtraight to the bird, the fowler will point a little before it, in the path of its flight, and that ſo much the more as the flight of the bird is more rapid, with reſpect to the flight of the ſhot." In this way of conſidering the matter, the flight of the bird repreſents the motion of the earth, and the flight of the ſhot repreſents the motion of the ray of light. Aberration

Mr Clairaut too, in the Mem. de l' Acad. des Sciences for the year 1746, illuſtrates this effect in a familiar way, by ſuppoſing drops of rain to fall rapidly and quickly after each other from a cloud, under which a perſon moves with a very narrow tube; in which caſe it is evident that the tube muſt have a certain inclination, in order that a drop which enters at the top, may fall freely through the axis of the tube, without touching the ſides of it; which inclination muſt be more or leſs according to the velocity of the drops in reſpect to that of the tube; then the angle made by the direction of the tube and of the falling drops, is the aberration ariſing from the combination of thoſe two motions.

This diſcovery, which is one of the brighteſt that have been made in the preſent age, we owe to the accuracy and ingenuity of the late Dr Bradley, aſtronomer royal; to which he was occaſionally led by the reſult of ſome obſervations which he had made with a view to determine the annual parallax of the fixed ſtars, or that which ariſes from the motion of the earth in its annual orbit about the ſun.

The annual motion of the earth about the ſun had been much doubted, and warmly conteſted. The defenders of that motion, among other proofs of the reality of it, conceived the idea of adducing an inconteſtable one from the annual parallax of the fixed ſtars, if the ſtars ſhould be within ſuch a diſtance, or if inſtruments and obſervations could be made with ſuch accuracy, as to render that parallax ſenſible. And with this view various attempts have been made. Before the obſervations of M. Picard, made in 1672, it was the general opinion, that the ſtars did not change their poſition during the courſe of a year. Tycho Brahe and Ricciolus fancied that they had aſſured themſelves of it from their obſervations; and from hence they concluded that the earth did not move round the ſun, and that there was no annual parallax in the fixed ſtars. M. Picard, in the account of his *Voyage d' Uranibourg*, made in 1672, ſays that the pole ſtar, at different times of the year, has certain variations, which he had obſerved for about 10 years, and which amounted to about 40″ a year: from whence ſome, who favoured the annual motion of the earth, were led to conclude that theſe variations were the effect of the parallax of the earth's orbit. But it was impoſſible to explain it by that parallax; becauſe this motion was in a manner contrary to what ought to follow only from the motion of the earth in her orbit.

In 1674 Dr Hook publiſhed an account of obſervations which he ſaid he had made in 1669, and by which he had found that the ſtar γ Draconis was 23″ more northerly in July than in October: obſervations which, for the preſent, ſeemed to favour the opinion of the earth's motion, although it be now known that there could not be any truth or accuracy in them.

Flamſteed having obſerved the pole ſtar with his mural quadrant, in 1680 and the following years, found that its declination was 40″ leſs in July than in December; which obſervations, although very juſt, were

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Aberration. yet, however, improper for proving the annual parallax; and he recommended the making of an inſtrument of 15 or 20 feet radius, to be firmly fixed on a ſtrong foundation, for deciding a doubt which was otherwiſe not ſoon likely to be brought to a concluſion.

In this ſtate of uncertainty and doubt, then, Dr Bradley, in conjunction with Mr Samuel Molineux, in the year 1725, formed the project of verifying, by a ſeries of new obſervations, thoſe which Dr Hook had communicated to the public almoſt 50 years before. And as it was his attempt that chiefly gave riſe to this, ſo it was his method in making the obſervations, in ſome meaſure, that they followed; for they made choice of the ſame ſtar, and their inſtrument was conſtructed upon nearly the ſame principles: but had it not greatly exceeded the former in exactneſs, they might ſtill have continued in great uncertainty as to the parallax of the fixed ſtars. For this, and many other convenient and uſeful aſtronomical inſtruments, philoſophers are indebted to the ingenuity and accuracy of Mr Graham.

The ſucceſs of the experiment evidently depending ſo much on the accuracy of the inſtrument, this became a leading object of conſideration. Mr Molineux's apparatus then having been completed, and fitted for obſerving, about the end of November 1725, on the third day of December following, the bright ſtar in the head of Draco, marked γ by Bayer, was for the firſt time obſerved, as it paſſed near the zenith, and its ſituation carefully taken with the inſtrument. The like obſervations were made on the fifth, eleventh, and twelfth days of the ſame month; and there appearing no material difference in the place of the ſtar, a farther repetition of them, at that ſeaſon, ſeemed needleſs, it being a time of the year in which no ſenſible alteration of parallax, in this ſtar, could ſoon be expected. It was therefore curioſity that chiefly urged Dr Bradley, who was then at Kew, where the inſtrument was fixed, to prepare for obſerving the ſtar again on the 17th of the ſame month; when, having adjuſted the inſtrument as uſual, he perceived that it paſſed a little more ſoutherly this day than it had done before. Not ſuſpecting any other cauſe of this appearance, it was aſcribed to the uncertainty of the obſervations, and that either this, or the foregoing, was not ſo exact as had been ſuppoſed. For which reaſon they propoſed to repeat the obſervation again, to determine from what cauſe this difference might proceed: and upon doing it, on the 20th of December, the doctor found that the ſtar paſſed ſtill more ſoutherly than at the preceding obſervation. This ſenſible alteration ſurpriſed them the more, as it was the contrary way from what it would have been, had it proceeded from an annual parallax of the ſtar. But being now pretty well ſatisfied, that it could not be entirely owing to the want of accuracy in the obſervations, and having no notion of any thing elſe that could cauſe ſuch an apparent motion as this in the ſtar; they began to ſuſpect that ſome change in the materials or fabric of the inſtrument itſelf, might have occaſioned it. Under theſe uncertainties they remained for ſome time; but being at length fully convinced, by ſeveral trials, of the great exactneſs of the inſtrument; and finding, by the gradual increaſe of the ſtar's diſtance from the pole, that there muſt be ſome regular cauſe that produced it; they took care to examine very nicely, at the time of each obſervation, how much the variation was; till Aberration. about the beginning of March 1726, the ſtar was found to be 20″ more ſoutherly than at the time of the firſt obſervation: it now indeed ſeemed to have arrived at its utmoſt limit ſouthward, as in ſeveral trials, made about this time, no ſenſible difference was obſerved in its ſituation. By the middle of April it appeared to be returning back again towards the north; and about the beginning of June, it paſſed at the ſame diſtance from the zenith, as it had done in December, when it was firſt obſerved.

From the quick alteration in the declination of the ſtar at this time, increaſing about one ſecond in three days, it was conjectured that it would now proceed northward, as it had before gone ſouthward, of its preſent ſituation; and it happened accordingly; for the ſtar continued to move northward till September following, when it again became ſtationary; being then near 20″ more northerly than in June, and upwards of 39″ more northerly than it had been in March. From September the ſtar again returned towards the ſouth, till, in December, it arrived at the ſame ſituation in which it had been obſerved twelve months before, allowing for the difference of declination on account of the preceſſion of the equinox.

This was a ſufficient proof that the inſtrument had not been the cauſe of this apparent motion of the ſtar; and yet it ſeemed difficult to deviſe one that ſhould be adequate to ſuch an unuſual effect. A nutation of the earth's axis was one of the firſt things that offered itſelf on this occaſion; but it was ſoon found to be inſufficient; for though it might have accounted for the change of declination in γ Draconis, yet it would not at the ſame time accord with the phenomena obſerved in the other ſtars, particularly in a ſmall one almoſt oppoſite in right aſcenſion to γ Draconis, and at about the ſame diſtance from the north pole of the equator: for though this ſtar ſeemed to move the ſame way, as a nutation of the earth's axis would have made it; yet changing its declination but about half as much as γ Draconis in the ſame time, as appeared on comparing the obſervations of both made on the ſame days, at different ſeaſons of the year, this plainly proved that the apparent motion of the ſtar was not occaſioned by a real nutation; for had this been the caſe, the alteration in both ſtars would have been nearly equal.

The great regularity of the obſervations left no room to doubt, but that there was ſome uniform cauſe by which this unexpected motion was produced, and which did not depend on the uncertainty or variety of the ſeaſons of the year. Upon comparing the obſervations with each other, it was diſcovered that, in both the ſtars above mentioned, the apparent difference of declination from the *maxima*, was always nearly proportional to the verſed ſine of the ſun's diſtance from the equinoctial points. This was an inducement to think that the cauſe, whatever it was, had ſome relation to the ſun's ſituation with reſpect to thoſe points. But not being able to frame any hypotheſis, ſufficient to account for all the phenomena, and being very deſirous to ſearch a little farther into this matter, Dr Bradley began to think of erecting an inſtrument for himſelf at Wanſtead; that, having it always at hand, he might with the more eaſe and certainty inquire into the laws of this new motion. The conſideration likewiſe of being

Aberration. being able, by another inſtrument, to confirm the truth of the obſervations hitherto made with that of Mr Molineux, was no ſmall inducement to the undertaking; but the chief of all was, the opportunity he ſhould thereby have of trying in what manner other ſtars ſhould be affected by the ſame cauſe, whatever it might be. For Mr Molineux's inſtrument being originally deſigned for obſerving γ Draconis, to try whether it had any ſenſible parallax, it was ſo contrived, as to be capable of but little alteration in its direction; not above ſeven or eight minutes of a degree: and there being but few ſtars, within half that diſtance from the zenith of Kew, bright enough to be well obſerved, he could not, with his inſtrument, thoroughly examine how this cauſe affected ſtars that were differently ſituated, with reſpect to the equinoctial and ſolſtitial points of the ecliptic.

Theſe conſiderations determined him; and by the contrivance and direction of the ſame ingenious perſon, Mr Graham, his inſtrument was fixed up the 19th of Auguſt 1727. As he had no convenient place where he could make uſe of ſo long a teleſcope as Mr Molineux's, he contented himſelf with one of but little more than half the length, namely of 12 feet and a half, the other being 24 feet and a half long, judging from the experience he had already had, that this radius would be long enough to adjuſt the inſtrument to a ſufficient degree of exactneſs: and he had no reaſon afterwards to change his opinion; for by all his trials he was very well ſatisfied, that when it was carefully rectified, its ſituation might be ſecurely depended on to half a ſecond. As the place where his inſtrument was hung, in ſome meaſure determined its radius; ſo did it alſo the length of the arc or limb, on which the diviſions were made, to adjuſt it: for the arc could not conveniently be extended farther, than to reach to about $6\frac{1}{4}$ degrees on each ſide of his zenith. This however was ſufficient, as it gave him an opportunity of making choice of ſeveral ſtars, very different both in magnitude and ſituation; there being more than two hundred, inſerted in the Britiſh Catalogue, that might be obſerved with it. He needed not indeed to have extended the limb ſo far, but that he was willing to take in *Capella*, the only ſtar of the firſt magnitude that came ſo near his zenith.

His inſtrument being fixed, he immediately began to obſerve ſuch ſtars as he judged moſt proper to give him any light into the cauſe of the motion already mentioned. There was a ſufficient variety of ſmall ones, and not leſs than twelve that he could obſerve through all ſeaſons of the year, as they were bright enough to be ſeen in the day time, when neareſt the ſun. He had not been long obſerving, before he perceived that the notion they had before entertained, that the ſtars were fartheſt north and ſouth when the ſun was near the equinoxes, was only true of thoſe ſtars which are near the ſolſtitial colure. And after continuing his obſervations a few months, he diſcovered what he then apprehended to be a general law obſerved by all the ſtars, namely, that each of them became ſtationary, or was fartheſt north or ſouth, when it paſſed over his zenith at ſix of the clock, either in the evening or morning. He perceived alſo that whatever ſituation the ſtars were in, with reſpect to the cardinal points of the ecliptic, the apparent motion of every one of them tended the ſame way, when they paſſed his inſtrument about the ſame hour of the day or night; for they all moved ſouthward when they paſſed in the day, and northward when in the night; ſo that each of them was fartheſt north when it came in the evening about ſix of the clock, and fartheſt ſouth when it came about ſix in the morning. Aberration.

Though he afterwards diſcovered that the maxima, in moſt of theſe ſtars, do not happen exactly when they paſs at thoſe hours; yet, not being able at that time to prove the contrary, and ſuppoſing that they did, he endeavoured to find out what proportion the greateſt alterations of declination, in different ſtars, bore to each other; it being very evident that they did not all change their declination equally. It has been before noticed, that it appeared from Mr Molineux's obſervations, that γ *Draconis* changed its declination above twice as much as the before-mentioned ſmall ſtar that was nearly oppoſite to it; but examining the matter more nicely, he found that the greateſt change in the declination of theſe ſtars, was as the ſine of the latitude of each ſtar reſpectively. This led him to ſuſpect that there might be the like proportion between the *maxima* of other ſtars; but finding that the obſervations of ſome of them would not perfectly correſpond with ſuch an hypotheſis, and not knowing whether the ſmall difference he met with might not be owing to the uncertainty and error of the obſervations, he deferred the farther examination into the truth of this hypotheſis, till he ſhould be furniſhed with a ſeries of obſervations made in all parts of the year; which would enable him not only to determine what errors the obſervations might be liable to, or how far they might ſafely be depended on; but alſo to judge, whether there had been any ſenſible change in the parts of the inſtrument itſelf.

When the year was completed, he began to examine and compare his obſervations; and having ſatisfied himſelf as to the general laws of the phenomena, he then endeavoured to find out the cauſe of them. He was already convinced that the apparent motion of the ſtars was not owing to a nutation of the earth's axis. The next that occurred to him, was an alteration in the direction of the plumb-line, by which the inſtrument was conſtantly adjuſted; but this, upon trial, proved inſufficient. Then he conſidered what refraction might do; but here alſo he met with no ſatisfaction. At laſt, through an amazing ſagacity, he conjectured that all the phenomena hitherto mentioned, proceeded from the progreſſive motion of light, and the earth's annual motion in her orbit: for he perceived, that if light were propagated in time, the apparent place of a fixed object would not be the ſame when the eye is at reſt, as when it is moving in any other direction but that of the line paſſing through the object and the eye; and that when the eye is moving in different directions, the apparent place of the object would be different. (*Hutton's Math. Dict.*)

Aberration, in *Optics*, the deviation or diſperſion of the rays of light, when reflected by a ſpeculum, or refracted by a lens, which prevents them from meeting or uniting in the ſame point, called the geometrical focus, but are ſpread over a ſmall ſpace, and produce a confuſion of images. There are two ſpecies of aberration diſtinguiſhed by their different cauſes; tha

Aberration ‖ Abgar.

the one arifes from the figure of the lens or fpeculum, the other from the unequal refrangibility of the rays of light. This laft fpecies is fometimes called the Newtonian, from the name of its difcoverer. See OPTICS.

ABERRATION of the Planets, is equal to the geocentric motion of the planet, the fpace it appears to move as feen from the earth, during the time that light employs in paffing from the planet to the earth. Thus, in the fun, the aberration in longitude is conftantly 20″, that being the fpace moved by the fun, or, which is the fame thing, by the earth, in the time of 8′ 7″, which is the time in which light paffes from the fun to the earth. In like manner, knowing the diftance of any planet from the earth, by proportion it will be, as the diftance of the fun is to the diftance of the planet, fo is 8′ 7″ to the time of light paffing from the planet to the earth: then computing the planet's geocentric motion in this time, that will be the aberration of the planet, whether it be in longitude, latitude, right afcenfion, or declination. (*Hutton's Math. Dict.*)

ABERYSTWITH, a market-town of Cardiganfhire, in Wales, feated on the Ridal, near its confluence with the Iftwith, where it falls into the fea. It is a populous, rich town, and has a great trade in lead, and a confiderable fifhery of whiting, cod, and herrings. It was formerly furrounded with walls, and fortified with a caftle; but both are now in ruins. Its diftance from London is 203 miles W. N. W. W. Long. 4. 15. N. Lat. 52. 30.

ABESTA, or AVESTA, the name of one of the facred books of the Perfian magi, which they afcribe to their great founder Zoroafter. The Abefta is a commentary on two others of their religious books called *Zend* and *Pazend*; the three together including the whole fyftem of the Ignicolæ or worfhippers of fire.

ABETTOR, a law term, implying one who encourages another to the performance of fome criminal action, or who is art and part in the performance itfelf. Treafon is the only crime in which abettors are excluded by law, every individual concerned being confidered as a principal. It is the fame with *art-and-part* in the Scots law.

ABEX, a country of Higher Ethiopia, in Africa, bordering on the Red fea, by which it is bounded on the eaft. It has Nubia or Sennar on the north; Sennar and Abyffinia on the weft; and Abyffinia on the fouth. Its principal towns are Suaquem and Arkeko. It is fubject to the Turks, and has the name of the Beglerbeglik of Habelefh. It is about five hundred miles in length and one hundred in breadth, is a mountainous country, fandy, barren, and unhealthy, much infefted with wild beafts; and the foreffs abound with ebony trees.

ABEYANCE, in *Law*, the expectancy of an eftate. Thus if lands be leafed to one perfon for life, with reverfion to another for years, the remainder for years is in abeyance till the death of the leffee.

ABGAR, or ABGARUS, a name given to feveral of the kings of Edeffa in Syria. The moft celebrated of them was one who, it is faid, was cotemporary with Jefus Chrift; and who having a diftemper in his feet, and hearing of Jefus's miraculous cures, requefted him by letter to come and cure him. Eufebius *, who believed that this letter was genuine, and alfo an anfwer our Saviour is faid to have returned to it, has tranflated them both from the Syriac, and afferts that they were taken out of the archives of the city of Edeffa. The firft is as follows: "Abgarus, prince of Edeffa, "to Jefus the holy Saviour, who hath appeared in the "flefh in the confines of Jerufalem, greeting. I have "heard of thee, and of the cures thou haft wrought "without medicines or herbs. For it is reported thou "makeft the blind to fee, the lame to walk, lepers to "be clean, devils and unclean fpirits to be expelled, "fuch as have been long diffeafed to be healed, and "the dead to be raifed; all which when I heard con"cerning thee, I concluded with myfelf, That either "thou waft a God come down from heaven, or the "Son of God fent to do thefe things. I have there"fore written to thee, befeeching thee to vouchfafe to "come unto me, and cure my diffeafe. For I have "alfo heard that the Jews ufe thee ill, and lay fnares "to deftroy thee. I have here a little city, pleafantly "fituated, and fufficient for us both. ABGARUS." To this letter, Jefus, it is faid, returned an anfwer by Annanias, Abgarus's courier; which was as follows: "Bleffed art thou, O Abgarus! who haft believed in "me whom thou haft not feen; for the Scriptures fay "of me, They who have feen me have not believed in "me, that they who have not feen, may, by believing, "have life. But whereas thou writeft to have me "come to thee, it is of neceffity that I fulfil all things "here for which I am fent; and having finifhed them, "to return to him that fent me: but when I am re"turned to him, I will then fend one of my difciples "to thee, who fhall cure thy malady, and give life to "thee and thine. JESUS." After Jefus's afcenfion, Judas, who is alfo named Thomas, fent Thaddeus, one of the feventy, to Abgarus; who preached the gofpel to him and his people, cured him of his diforder, and wrought many other miracles: which was done, fays Eufebius, A. D. 43.—Though the above letters are acknowledged to be fpurious by the candid writers of the church of Rome; feveral Proteftant authors, as Dr Parker, Dr Cave, and Dr Grabe, have maintained that they are genuine, and ought not to be rejected.

Abgarus, Abians.

ABGILLUS, JOHN, furnamed Preffter John, was fon to a king of the Friffii; and, from the aufterity of his life, obtained the name of *Preffter*, or Prieft. He attended Charlemagne in his expedition to the Holy Land; but inftead of returning with that monarch to Europe, it is pretended that he gained mighty conquefts, and founded the empire of the Abyffines, called, from his name, the empire of Preffter John. He is faid to have written the hiftory of Charlemagne's journey into the Holy Land, and his own into the Indies; but they are more probably trifling romances, written in the ages of ignorance.

ABIANS, anciently a people of Thrace, or (according to fome authors) of Scythia. They had no fixed habitations; they led a wandering life. Their houfes were waggons, which carried all their poffeffions. They lived on the flefh of their herds and flocks, on milk and cheefe, chiefly on that of mare's milk. They were unacquainted with commerce. They only exchanged commodities with their neighbours. They poffeffed lands, but they did not cultivate them. They affigned their agriculture to any who would undertake it, referving only to themfelves

* *Eccl. Hift.* lib. i. cap. 13.