

Abernethy, 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.

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 yet,

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 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 the 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.

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 inclination 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;

the ..

Aberration the one arises from the figure of the lens or speculum, the other from the unequal refrangibility of the rays of light. This last species is sometimes called the Newtonian, from the name of its discoverer. See OPTICS.

||
Abgar.

ABERRATION of the Planets, is equal to the geocentric motion of the planet, the space it appears to move as seen from the earth, during the time that light employs in passing from the planet to the earth. Thus, in the sun, the aberration in longitude is constantly 26", that being the space moved by the sun, or, which is the same thing, by the earth, in the time of 8' 7", which is the time in which light passes from the sun to the earth. In like manner, knowing the distance of any planet from the earth, by proportion it will be, as the distance of the sun is to the distance of the planet, so is 8' 7" to the time of light passing 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 ascension, or declination. (*Hutton's Math. Dict.*)

ABERYSTWITH, a market-town of Cardiganshire, in Wales, seated on the Ridal, near its confluence with the Iſwith, where it falls into the sea. It is a populous, rich town, and has a great trade in lead, and a considerable fishery of whiting, cod, and herrings. It was formerly surrounded with walls, and fortified with a castle; but both are now in ruins. Its distance 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 sacred books of the Persian magi, which they ascribe to their great founder Zoroaster. The Avesta is a commentary on two others of their religious books called *Zend* and *Pozend*; the three together including the whole system of the Ignicolæ or worshippers of fire.

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

ABEX, a country of Higher Ethiopia, in Africa, bordering on the Red sea, by which it is bounded on the east. It has Nubia or Sennar on the north; Sennar and Abyssinia on the west; and Abyssinia on the south. Its principal towns are Suaquem and Arkeko. It is subject to the Turks, and has the name of the beglerbeglik of Habeleth. It is about five hundred miles in length and one hundred in breadth; is a mountainous country, sandy, barren, and unhealthy, much infested with wild beasts; and the forests abound with ebony trees.

ABEYANCE, in *Law*, the expectancy of an estate. Thus if lands be leased to one person for life, with reversion to another for years, the remainder for years is in abeyance till the death of the lessee.

ABGAR, or **ABGARUS**, a name given to several of the kings of Edessa in Syria. The most celebrated of them was one who, it is said, was cotemporary with Jesus Christ; and who having a distemper in his feet, and hearing of Jesus's miraculous cures, requested him by letter to come and cure him. Eusebius*, who believed that this letter was genuine, and also an answer

our Saviour is said to have returned to it, has translated them both from the Syriac, and asserts that they were taken out of the archives of the city of Edessa. The first is as follows: "Abgarus, prince of Edessa, "to Jesus the holy Saviour, who hath appeared in the "flesh in the confines of Jerusalem, greeting. I have "heard of thee, and of the cures thou hast wrought "without medicines or herbs. For it is reported thou "makest the blind to see, the lame to walk, lepers to "be clean, devils and unclean spirits to be expelled, "such as have been long diseased to be healed, and "the dead to be raised; all which when I heard concerning thee, I concluded with myself, That either "thou wast a God come down from heaven, or the "Son of God sent to do these things. I have therefore written to thee, beseeching thee to vouchsafe to "come unto me, and cure my disease. For I have "also heard that the Jews use thee ill, and lay snares "to destroy thee. I have here a little city, pleasantly "situated, and sufficient for us both. **ABGARUS.**" To this letter, Jesus, it is said, returned an answer by Annanias, Abgarus's courier; which was as follows: "Blessed art thou, O Abgarus! who hast believed in "me whom thou hast not seen; for the Scriptures say "of me, They who have seen me have not believed in "me, that they who have not seen, may, by believing, "have life. But whereas thou writest to have me "come to thee, it is of necessity that I fulfil all things "here for which I am sent; and having finished them, "to return to him that sent me: but when I am returned to him, I will then send one of my disciples "to thee, who shall cure thy malady, and give life to "thee and thine. **JESUS.**" After Jesus's ascension, Judas, who is also named Thomas, sent Thaddeus, one of the seventy, to Abgarus; who preached the gospel to him and his people, cured him of his disorder, and wrought many other miracles: which was done, says Eusebius, A. D. 43.—Though the above letters are acknowledged to be spurious by the candid writers of the church of Rome; several Protestant authors, as Dr Parker, Dr Cave, and Dr Grabe, have maintained that they are genuine, and ought not to be rejected.

ABGILLUS, **JOHN**, surnamed *Prefter John*, was son to a king of the Friscii; and, from the austerity of his life, obtained the name of *Prefter*, or Priest. He attended Charlemagne in his expedition to the Holy Land; but instead of returning with that monarch to Europe, it is pretended that he gained mighty conquests, and founded the empire of the Abyssines, called, from his name, the empire of *Prefter John*. He is said to have written the history 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 some authors) of Scythia. They had no fixed habitations; they led a wandering life. Their houses were waggons, which carried all their possessions. They lived on the flesh of their herds and flocks, on milk and cheese, chiefly on that of mare's milk. They were unacquainted with commerce. They only exchanged commodities with their neighbours. They possessed lands, but they did not cultivate them. They assigned their agriculture to any who would undertake it, reserving only to themselves

Abgar
||
Abians.

* Eccl.
Hist lib. i.
cap. 13.