XXXII. *On the Principles to be applied in explaining the Aberration of Light. By the* Rev. J. Challis, *M.A., Plumian Professor of Astronomy in the University of Cambridge**.

THE aberration of light having been brought before the notice of the readers of this Journal by several recent communications, I am unwilling to let the subject drop without saying a few more words respecting the principles to be applied in the explanation of the phænomenon, which possibly may appear, after all that has been said, to be involved in uncertainty. I propose to answer the question, Is the aberration of light to be attributed to known causes, or must we, to explain it, have recourse to hypothesis?

The first attempts to explain aberration referred it to the combined effect of the motion of the earth and the temporaneous transmission of light, and accordingly proceeded on the principle of attributing it to known causes. It must, however, be admitted that every attempt to show *how* the observed effect resulted from these causes, what was the particular *modus operandi*, was unsatisfactory. Some idea appropriate to the subject was still wanting. This idea I consider that I have succeeded in supplying. I have argued, as had not been argued before, that because the direction of a celestial object is necessarily referred to the direction of a terrestrial object, light from the one as well as light from the other must be taken account of in considering the question of aberration. It is self-evident, that if at any instant two objects appear in the same direction, whatever course the light from the more distant may have taken before it reaches the nearer, it subsequently pursues a common course with light from the latter, and the two portions of light enter the eye at the given instant simultaneously. The direction in which the light comes is therefore judged to be the same as the direction at that instant of the nearer object from the eye. But during the interval the light takes to pass from the nearer or terrestrial object to the eye, this object is carried by the earth's motion away from the direction of the progression of light, and the two directions, at the time they are judged to be coincident, are in reality separated by a certain angle. This angle is aberration. I may refer to my communication in the February Number for a proof, which I venture to say is as cogent as any proof in the elements of geometry, that according to the principles just stated, an astronomical instrument employed to measure the *earth's way*, as it is called, would measure a smaller angle.

* Communicated by the Author.

The difference, or aberration, is readily calculated from knowing by observations of the eclipses of Jupiter's satellites, the ratio of the earth's velocity to the velocity of light. Being so calculated the amount is found to be the same as the amount of aberration independently determined by astronomical observation. It follows from this accordance, not only that the aberration of light is entirely accounted for on these principles, but also, as a corollary, that the direction of the progression of light from a star, as it enters the eye, is the true direction of the star. Whether it be the star, or the terrestrial object to which it is referred, that is *seen* in its true place, is a curious question, not readily answered, and not in the least degree necessary to be answered in the present inquiry.

Sufficient reasons have now, I think, been adduced for coming to the conclusion, that the question I proposed to consider must receive the following categorical answer:—The aberration of light is entirely due to known causes, viz. the motion of the earth and the temporaneous transmission of light, and does not require for its explanation any hypothesis whatever.

What then becomes of the theories which have been framed to account for aberration on the hypothesis of certain motions of the æthereal medium? As explanations of aberration they can be of no value, it being an acknowledged principle in philosophy, that an hypothesis is not to be sought for to explain what may be explained by known causes. All that is left for the theorist to do, supposing, as it appears necessary to suppose, that the æther is in some way put in motion by the motion of the earth, is to show that *no* aberration results from such motion, the whole being attributable to the earth's motion. This problem I have considered in my two former communications, not because it was necessary to do so to complete the explanation of aberration, but with the view of removing an objection that might be raised against the undulatory theory of light. By taking account both of the light from the star and the light from the terrestrial object to which the star's direction is referred, I found that no aberration would result from the motion of the æther, provided it satisfied certain not improbable analytical conditions. A different conclusion would be arrived at by the same reasoning, if the light from the star, as is commonly done in treating of aberration, were alone considered.

With these remarks I dismiss the subject of aberration, having attained the object I had in view in taking it up, if I have succeeded in extricating the explanation of the phænomenon from hypothesis and conjecture, and placing it on its true basis.

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