

HYPOTHESES ON LUMINOUS ETHER AND ON AN EXPERIMENT THAT APPEARS TO DEMONSTRATE THAT THE MOTION OF BODIES CHANGES THE VELOCITY WITH WHICH LIGHT PROPAGATES IN THEIR INTERIOR

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$$\Delta = 4L \frac{u}{v} m^2$$

M. H. Fizeau

ABSTRACT. The author discusses Fresnel's hypothesis to explain light aberration and light waves. An experiment to determine the possible changes in the speed of light traveling through transparent bodies is discussed, as well as the apparatus used for such experiments. The author presents calculations and discusses results and possible sources of error.***An excerpt from the beginning: Several theories on wave systems have been proposed to attempt to explain the aberration of light. First, Fresnel and, more recently, Doppler, Stokes, Challis and several others have published papers on this subject, but it does not seem that any of the theories so far proposed have been able to completely satisfy the physicists. Because of a lack of definite knowledge about the properties of the luminous ether and its relationship to ponderable matter, it has been necessary to introduce hypotheses, among which are those which are more or less probable, but none that can be considered as proven. These can be reduced to three main hypotheses, all of which refer to the state in which the ether inside a transparent body should be considered: The ether adheres, or is fixed, to the molecules of the body, and, consequently, shares in the motion that may be imposed on the body; Or, the ether is free and independent, and is not carried along by the body in its motion; Or, finally, a third hypothesis which borrows from each of the two above, in which only a portion of the ether would be free, while the other portion would be fixed to the molecules of the body and would solely share in its motion. This last hypothesis, postulated by Fresnel, was conceived in order to satisfy at the same time the phenomenon of aberration, and a famous experiment by Arago, in which he had shown that the motion of the Earth did not have any effect upon the refraction value of starlight in a prism. These two phenomena

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could be explained through Fresnel's hypothesis with admirable precision. However, Fresnel's hypothesis is not regarded today as absolute truth, and the relationships between ether and ponderable matter are still generally considered as uncertain and hard to understand. This is because Fresnel's mechanical conception seems too unusual to be accepted without direct proof, or perhaps because it seemed equally possible to satisfy the observed phenomena with either of the two other hypotheses. Perhaps, finally, as other physicists have thought, certain results from this theory seemed contrary to experience. The following considerations have led me to try an experiment, the results of which, I believe, should clarify this matter. It is possible in the three hypotheses enumerated above that, if the body is in motion, the velocity at which light will go through it will be different from that observed if the body were at rest. For each of these hypotheses, the motion of the body would have a different effect upon the light velocity. Thus, if ether is supposed to be fixed to the body during the latter's motion, the velocity of light will be augmented by that of the body, if the direction of the light ray and of the motion are the same. If the ether is supposed to be free, the velocity of light will not change. Finally, if only part of the ether is attached to the body, the velocity of light will be augmented only by a fraction of the velocity of the body, and not by the total amount as in the first hypothesis. This result is not as evident as in the first two hypotheses, but Fresnel has made it clear that it may be upheld by very credible mechanical considerations. It is supposed that the speed of light in a body at rest or in motion may be determined exactly. If the body is in motion, and if the speed of light corresponding to the state of rest increases by the total speed of motion of the body, this will conform with the first hypothesis. If the speed of light is the same in both cases (body at rest or in motion), the second hypothesis will be...

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