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ETHER-DRIFT EXPERIMENTS AT MOUNT WILSON[1]

AFTER the wave theory of light was established, it became necessary to assume the existence of an all-pervading medium in which the waves could be developed and transmitted; this hypothetical medium was called the "ether." It was endowed with such properties as were necessary for the explanation of observed phenomena. Several physicists sought to prove the existence of the ether by direct experiment. The most fundamental of such proposals was that of Professor A. A. Michelson, made in 1881, based upon the idea that the ether as a whole is at rest and that light waves are propagated in the free ether in any direction and always with the same velocity with respect to the ether. It was also assumed that the earth in its orbital motion around the sun passes freely through this ether as though the latter were absolutely stationary in space. The experiment proposed to detect a relative motion between the earth and the ether, and it is this relative motion which is often referred to as "ether-drift." The experiment is based upon the argument that the *apparent* velocity of light would vary according to whether the observer is carried by the earth in the line in which the light is traveling, or at right angles to this line. The velocity of light is 300,000 kilometers per second, while the velocity of the earth in its orbit is 1/10,000th part of this, 30 kilometers per second. If the earth's orbital velocity were directly effective, the two apparent velocities should differ by 30 kilometers per second or by one part in 10,000. However, there is no known method of measuring the velocities under such simple conditions. All methods require the ray of light to travel to a distant station and back again to the starting point, and a positive effect of the earth's motion on the ray going outward would be neutralized by a negative effect on the returning ray. But for a moving observer, it was shown that the neutralization would not be quite complete; the apparent velocity of the ray going and coming in the line of the earth's motion would differ from the apparent velocity of the ray going and coming at right angles, in the ratio of the square of the velocity of the earth to the velocity of light, that is, by an amount equal to one part in $(10,000)^2$ or to one part in 100,000,000.

[1] Read before the National Academy of Sciences, Washington, April 28, 1925.