SPECIAL ARTICLES

THE ABSOLUTE MOTION OF THE SOLAR SYSTEM AND THE ORBITAL MOTION OF THE EARTH DETERMINED BY THE ETHER-DRIFT EXPERIMENT[1]

THE ether-drift experiment, first suggested by Maxwell in 1876 and made possible by Michelson's invention of the interferometer in 1881, though capable of being applied to the detection of the general absolute motion in space of the earth, was actually arranged for detecting only the known orbital component of the earth's motion. For the first time, in 1925 and 1926, at Mount Wilson, the writer made observations of such extent and completeness that they were sufficient

[1] Read before the National Academy of Sciences, Washington, D. C., April, 1933.

for the determination of the absolute motion of the earth. These observations involved the making of about 200,000 single readings of the position of the interference fringes, and lead to more than 25,000 single values of both the right ascension and declination of the apex of the motion.

The ether-drift effect in the interferometer, as is well known, is a second order effect, and the observations correctly define the line in which the absolute motion takes place, but they do not determine whether the motion in this line is positive or negative.

At the Kansas City meeting in December, 1925, before the completion of the Mount Wilson observations, a report was made showing that the experiment gives evidence of a cosmic motion of the solar system, but which failed to identify the effects of the orbital motion, though it seemed that the observations should have been quite sufficient for this purpose.[2]

In the autumn of 1932, a reanalysis of the problem was made, based upon the alternative possibility that the motion of the solar system is in the cosmic line previously determined, but is in the opposite direction, being directed southward. This gives wholly consistent results, leading for the first time to a definite quantitative determination of the absolute motion of the solar system, and to a positive detection of the effect of the motion of the earth in its orbit.

The apex of the cosmic motion of the solar system is located in the right ascension of 4 h., 56 m., and in declination 70° 30′ south, diametrically opposite the apex previously announced. The velocity of the cosmic motion is determined by comparison with the known velocity, 30 kilometers per second, of the earth's orbital motion, and has the value of 208 kilometers per second. For some unexplained reason the observed displacement of the interference fringes in the interferometer corresponds to about one twentieth of the full velocity. This might be accounted for by an incomplete Lorentz contraction, or by Stokes's theory of a dragged ether.

The location of this apex is in the southern constellation Dorado, the Sword-Fish, and is about 20° south of the star, Canopus, the second brightest star in the heavens. It is in the midst of the famous Great Magellanic Cloud of stars. The apex is only about 6° from the pole of the ecliptic; thus the indicated motion of the solar system is almost perpendicular to the plane of the ecliptic. This suggests that the solar system might be thought of as a dynamic disk which is being pulled through a resisting medium, and which therefore sets itself perpendicular to the line of motion.

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[2] SCIENCE, 63: 433–443, 1926.