



The Ethereal Aether: A History of the Michelson-Morley-Miller Aether-drift Experiments, 1880-1930

Lloyd S. Swenson Jr.

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The Ethereal Aether is a historical narrative of one of the great experiments in modern physical science. The fame of the 1887 Michelson-Morley aether-drift test on the relative motion of the earth and the luminiferous aether derives largely from the role it is popularly supposed to have played in the origins, and later in the justification, of Albert Einstein's first theory of relativity; its importance is its own.

As a case history of the intermittent performance of an experiment in physical optics from 1880 to 1930 and of the men whose work it was, this study describes chronologically the conception, experimental design, first trials, repetitions, influence on physical theory, and eventual climax of the optical experiment. Michelson, Morley, and their colleague Miller were the prime actors in this half-century drama of confrontation between experimental and theoretical physics.

The issue concerned the relative motion of "Spaceship Earth" and the Universe, as measured against the background of a luminiferous medium supposedly filling all interstellar space. At stake, it seemed, were the phenomena of astronomical aberration, the wave theory of light, and the Newtonian concepts of absolute space and time.

James Clerk Maxwell's suggestion for a test of his electromagnetic theory was translated by Michelson into an experimental design in 1881, redesigned and reaffirmed as a null result with Morley in 1887, thereafter modified and partially repeated by Morley and Miller, finally completed in 1926 by Miller alone, then by Michelson's team again in the late 1920s.

Meanwhile Helmholtz, Kelvin, Rayleigh, FitzGerald, Lodge, Larmor, Lorentz, and Poincaré—most of the great names in theoretical physics at the turn of the twentieth century—had wrestled with the anomaly presented by Michelson's experiment. As the relativity and quantum theories matured, wave-particle duality was accepted by a new generation of physicists. The aether-drift tests disproved the old and verified the new theories of light and electromagnetism. By 1930 they seemed to explain Einstein, relativity, and space-time. But in historical fact, the aether died only with its believers.

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