The Ether-Drift Experiment

The Michelson Era in American Science, 1870–1930. STANLEY GOLDBERG and ROGER H. STUEWER, Eds. American Institute of Physics, New York, 1988. x, 300 pp., illus. $54. AIP Conference Proceedings, vol. 179. Based on a conference, Cleveland, OH, Oct. 1987.

The Michelson-Morley experiment of 1887, in which light was found to have the same velocity whether moving in the direction of the earth's rotation or perpendicular to it, is still occasionally cited as having both disproved the existence of a luminiferous ether and inspired Einstein to formulate his theory of special relativity. Historians have long been skeptical of such claims. Many leading physicists, Albert Michelson included, continued to believe in the ether decades after the famous experiment was performed. Einstein, most evidence suggests, gave the experiment little serious consideration before publishing his theory of special relativity. And when Michelson, in 1907, became the first American to win a Nobel Prize, the award committee chose to ignore the ether-drift experiment and instead celebrated the accuracy of his interferometer and its value in metrological investigations. Their judgment of Michelson's achievement, it more and more seems, accurately reflected contemporary opinion.

If the history of science were only about landmarks in theory, there would be little purpose in commemorating the Michelson-Morley experiment with the lavish centennial jubilee that led to the volume under review (and to a companion collection of lectures by prominent physicists: *Modern Physics in America*, Fickinger and L. Kowalski, Eds., also published by the American Institute of Physics). Other than stimulating H. A. Lorentz to suggest that matter may contract in the direction of its motion just enough to conceal the ether drift sought by Michelson and Morley, the 1887 experiment had few direct effects on theoretical physics.

But science is much more than theory, and when understood in a broader sense the Michelson-Morley experiment does offer historians opportunities to illuminate important aspects of the culture of *fin de siècle* science. The experiment was, among other things, a triumph of precision measurement in an age when exactitude had been elevated to a religion among scientists. It depended upon an exquisitely tooled instrument at a time when science more and more was becoming dependent upon technology, and it, in turn, led to new interferometer-based tools at a time when technology more and more was becoming dependent on science. The experiment also offers testimony to the growing competence of American scientists in a world in which Europe still enjoyed a scientific preeminence as secure as its political and economic power.

In all these ways the Michelson-Morley experiment exemplifies an era, and this volume, to the credit of its editors and 23 contributors, enlarges our understanding of each of these facets of its subject. Scientific instruments, too often taken for granted by historians, receive their due in the opening contributions by Chris J. Evans and Deborah Jean Warner, Darwin H. Stapleton, and Edwin T. Layton, Jr. Their papers not only provide us with a much fuller understanding of the genesis of the famous Michelson interferometer but also explore its large and important effects on engineering disciplines in the 20th century, where, in modified form, it became an indispensable tool for the exact measurement of lengths, the calibration of micrometric standards, and the study of variations in the index of refraction in gases and liquids.

Michelson's career in science, which spanned the decades during which America moved toward a rough parity with European scientific powers, is ably discussed in several papers—most notably by Kathryn Olesko, who expertly analyzes the relevance of Michelson's pedagogical duties at the Naval Academy to his development as a physicist, by Albert Moyer, who adds much to our knowledge of Michelson's life during the year of the experiment itself, and by John L. Michel, who offers fresh insights into the relationship between Michelson and his junior colleague at the University of Chicago, Robert A. Millikan. Jed Buchwald and Nancy Nersessian explore the place of Michelson's work in the physics of the late 19th century and debate its role in the thought of Lorentz. Robert Marc Friedman, in a contribution based upon the recently opened Nobel archives, shows us that Michelson's award, and those of other laureates, depended far more upon the internal politics of the Swedish scientific community than historians have hitherto supposed.

This is a heterogeneous collection of essays, but it is one that mirrors the diversity and richness of Michelson's life, associations, and science. He would be pleased.

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Erwin Schrödinger

Schrödinger. Life and Thought. WALTER MOORE. Cambridge University Press, New York, 1989. xii, 513 pp., illus. $39.50.

It is 22 years since the publication of William T. Scott's slim "Introduction" to Erwin Schrödinger's writings. That was very useful but deliberately restricted in its scope. Schrödinger had a many-sided life. Walter Moore paints on an altogether broader canvas, as is possible in some ways because the lapse of time has blunted sensibilities, and so comes somewhere near to capturing the whole of a modern Renaissance man. What everyone knows about Schrödinger is the invention of wave mechanics in 1925–26, and this gets full treatment. Moore gives careful descriptions of the discovery and of Schrödinger's correspondence at the time, and these descriptions can be read with profit by those with only an elementary knowledge of physics. But the correspondence shows also Schrödinger's thoughts about the difficult aspects of the theory that he was not able to resolve clearly; these are particularly apposite today when it has been more fully realized that we know only how to operate quantum mechanics, not how to understand it. Many of us are aware of one other branch of physics where Schrödinger was outstanding—we know his beautiful *Space-Time Structure*, written when he was in Dublin toward the end of his life. This gets the same treatment, and so again background to the finished book is provided, with a description suitable for nonspecialists.

What is more surprising is the number of other branches of physics that Schrödinger was interested in and in how many he made important progress. Color vision, statistical mechanics, and nonlinear electrodynamics were only a few. But Moore does not leave it at that. Schrödinger had many intellectual interests, worked hard at philosophy (though in an unfashionable way, leaning heavily to Indian philosophy), wrote some passable poetry in both German and English, and, indeed, had only one blind spot—he hated music. Without going into too much detail, Moore makes clear just how wide his interests were. But, as Schrödinger himself said, his life story cannot be anything like complete without including the many women who crossed his path. His views on women have a distinctly unmodern ring; they are seen as the help to the creative genius. Moore chronicles the various affairs with care and relates the lady in the ascendant at each time to the scientific work going on at that time; for it was only at times of great erotic excitement that Schrödinger was correspondingly productive in