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New Analysis of the Interferometer Observations of Dayton C. Miller

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For nearly thirty years the results of the Michelson-Morley experiment obtained by Dayton C. Miller on Mount Wilson have stood as evidence with all other kinds of observations, in favor of Einstein's special theory of relativity. In the present time, however, the original observations are available in the original volume. It has seemed surprising that the observations be subjected to a new analysis. It is now shown that the small periodic fringe displacements found by Miller are due to an optical disturbance in the mounting of the interferometer. It is a very difficult experiment. The mounting necessarily affects an optical system which requires new conditions. There was much loss of coherence at Mount Wilson due to the atmosphere. In the present analysis, including Miller himself in his work done at Case in Cleveland, the comparison in the present study, Miller's previous Mount Wilson data made no effect on the final position of the author theory and, while the correction required by local disturbances, are entirely consistent with a null result at all speeds during a year.

INTRODUCTION

THE null result obtained in the Michelson-Morley experiment at Cleveland in 1887 was the culmination of the long nineteenth-century search for an ether and proved to be a major impetus for the theoretical developments made by Lorentz, Poincaré, Einstein, Planck, and especially Einstein. The crucial significance of the Michelson-Morley result stimulated many experiments of this experiment during the next fifty years, especially in the investigation of the theory of relativity. All trials of this experiment except the one carried out at Mount Wilson by Dayton C. Miller failed to null result within the accuracy of the observation. Miller's observed fringe displacements also were very small, being on the average only about 1/10 of those predicted by the author theory for the 30 km/sec velocity of the earth in its orbit. However, as these small effects have remained as adequate explanation, and they cannot be done has continued, it has seemed desirable to make a rather detailed analysis of the experimental results.¹

Michelson and Morley had originally planned to repeat their experiment at intervals of about three months throughout a year and then to allow for any possibility

that the earth's orbital velocity at one epoch might fortuitously coincide with the motion of the entire solar system through space and give a small residual velocity in their apparatus. However, after completing the July, 1887 observations, they did not return to this problem, and the completion of the author's first experiment for all epochs was finally carried out by Miller during the years from 1910 through 1916 in Cleveland and at Mount Wilson. Miller's Mount Wilson experiment² was conducted at intervals from April, 1910, through February, 1916, being interrupted with and followed by numerous trials at Cleveland.

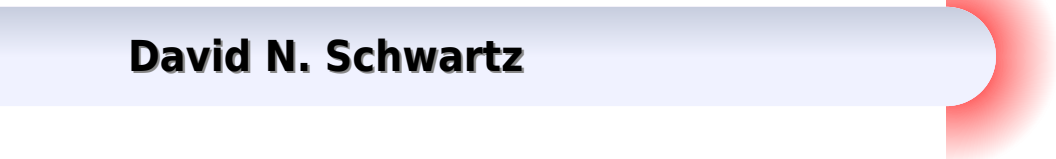
In February, 1911, the interferometer was set up at Mount Wilson, and Miller made numerous observations during the period April 6-26, 1911. These data indicated a possible small periodic effect, with an average residual harmonic amplitude of about 400 fringes, but Miller suspected that temperature effects or expansion of the in the steel base of the interferometer as it rotated in the earth's magnetic field might be the cause. Accordingly he had designed a concrete base for the interferometer, which was cast at Mount Wilson in October of 1911. Unfortunately the greatest incentive to continue the experiments came from Professor Albert Einstein who visited Miller at Case on May 25, 1913, and urged that

¹ R. S. Barnard and R. W. McCombs, *Rev. Mod. Phys.* 27, 107 (1955).
² The author's complete report on the early experiments has been in the *Journal of the Optical Society of America*, Vol. 1, No. 1, published by the A. C. Miller, from Mount Wilson, N. J., 1911.

³ F. C. Lewis, *Sci. News*, Sept. 2nd, Vol. 35, No. 1000; *Sci. News*, Vol. 35, No. 1001; *Sci. News*, Vol. 35, No. 1002; *Sci. News*, Vol. 35, No. 1003; *Sci. News*, Vol. 35, No. 1004; *Sci. News*, Vol. 35, No. 1005; *Sci. News*, Vol. 35, No. 1006; *Sci. News*, Vol. 35, No. 1007; *Sci. News*, Vol. 35, No. 1008; *Sci. News*, Vol. 35, No. 1009; *Sci. News*, Vol. 35, No. 1010; *Sci. News*, Vol. 35, No. 1011; *Sci. News*, Vol. 35, No. 1012; *Sci. News*, Vol. 35, No. 1013; *Sci. News*, Vol. 35, No. 1014; *Sci. News*, Vol. 35, No. 1015; *Sci. News*, Vol. 35, No. 1016; *Sci. News*, Vol. 35, No. 1017; *Sci. News*, Vol. 35, No. 1018; *Sci. News*, Vol. 35, No. 1019; *Sci. News*, Vol. 35, No. 1020; *Sci. News*, Vol. 35, No. 1021; *Sci. News*, Vol. 35, No. 1022; *Sci. News*, Vol. 35, No. 1023; *Sci. News*, Vol. 35, No. 1024; *Sci. News*, Vol. 35, No. 1025; *Sci. News*, Vol. 35, No. 1026; *Sci. News*, Vol. 35, No. 1027; *Sci. News*, Vol. 35, No. 1028; *Sci. News*, Vol. 35, No. 1029; *Sci. 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Modern Physics 1955

David N. Schwartz



Modern Physics 1955:

The Last Man Who Knew Everything David N. Schwartz, 2017-12-05 The definitive biography of the brilliant charismatic and very human physicist and innovator Enrico Fermi In 1942 a team at the University of Chicago achieved what no one had before a nuclear chain reaction At the forefront of this breakthrough stood Enrico Fermi Straddling the ages of classical physics and quantum mechanics equally at ease with theory and experiment Fermi truly was the last man who knew everything at least about physics But he was also a complex figure who was a part of both the Italian Fascist Party and the Manhattan Project and a less than ideal father and husband who nevertheless remained one of history's greatest mentors Based on new archival material and exclusive interviews *The Last Man Who Knew Everything* lays bare the enigmatic life of a colossus of twentieth century physics Catalog of Books and Reports in the Bureau of Mines Technical Library, Pittsburgh, Pa United States. Bureau of Mines. Technical Library, Pittsburgh, 1968 Enrico Fermi Giuseppe Bruzzaniti, 2016-03-21 This biography explores the life and career of the Italian physicist Enrico Fermi which is also the story of thirty years that transformed physics and forever changed our understanding of matter and the universe nuclear physics and elementary particle physics were born nuclear fission was discovered the Manhattan Project was developed the atomic bombs were dropped and the era of big science began It would be impossible to capture the full essence of this revolutionary period without first understanding Fermi without whom it would not have been possible Enrico Fermi The Obedient Genius attempts to shed light on all aspects of Fermi's life his work motivation influences achievements and personal thoughts beginning with the publication of his first paper in 1921 through his death in 1954 During this time Fermi demonstrated that he was indeed following in the footsteps of Galileo excelling in his work both theoretically and experimentally by deepening our understanding of the Pauli exclusion principle winning the Nobel Prize for his discovery of the fundamental properties of slow neutrons developing the theory of beta decay building the first nuclear reactor and playing a central role in the development of the atomic bomb Interwoven with this fascinating story the book details the major developments in physics and provides the necessary background material to fully appreciate the dramatic changes that were taking place Also included are appendices that provide a timeline of Fermi's life several primary source documents from the period and an extensive bibliography This book will enlighten anyone interested in Fermi's work or the scientific events that led to the physics revolution of the first half of the twentieth century *Electrons, Neutrons and Protons in Engineering* J. R. Eaton, 2013-10-22 *Electrons Neutrons and Protons in Engineering* focuses on the engineering significance of electrons neutrons and protons The emphasis is on engineering materials and processes whose characteristics may be explained by considering the behavior of small particles when grouped into systems such as nuclei atoms gases and crystals This volume is comprised of 25 chapters and begins with an overview of the relation between science and engineering followed by a discussion on the microscopic and macroscopic domains of matter The next chapter presents the basic relations involving

mechanics electricity and magnetism light heat and related subjects which are most significant in the study of modern physical science Subsequent chapters explore the nucleus and structure of an atom the concept of binding forces and binding energy the configuration of the system of the electrons surrounding the atomic nucleus physical and chemical properties of atoms and the structure of gases and solids The energy levels of groups of particles are also considered along with the Schrödinger equation and electrical conduction through gases and solids The remaining chapters are devoted to nuclear fission nuclear reactors and radiation This book will appeal to physicists engineers and mathematicians as well as students and researchers in those fields

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Theory, Evidence, Data: Themes from George E. Smith Marius Stan, Christopher Smeenk, 2023-11-27 This book builds on the path breaking work of George E Smith and further explores the notions of evidence and confirmation in the exact sciences from two perspectives conceptual and historical Contributions in this volume investigate the philosophical presuppositions explanatory scope and historical precursors of evidence in mathematical physics and related disciplines The papers are written by and of interest to philosophers and historians of science

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