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(*b*. Birkdale, Lancashire, England, 24 October 1873; *d*. Edinburgh, Scotland, 24 March 1956)

mathematics, physics, philosophy.

Whittaker was educated at Manchester Grammar School and Trinity College, Cambridge. He was bracketed second wrangler in the mathematical tripos of 1895, was elected a fellow of Trinity College the following year, and was first Smith's prizeman in 1897. In 1905 he was elected a fellow of the Royal Society, and was awarded the Sylvester and Copley medals of the society in 1931 and 1954 respectively. In 1906 he became astronomer royal for Ireland and from 1912 until his retirement in 1946 was professor of mathematics at the University of Edinburgh. from 1039 to 1944 Whittaker was president of the Royal Society of Edinburgh, and was an honorary member of several learned societies. In 1935 Pope Pius XI conferred on him the cross *pro ecclesia et pontifice* and a year later appointed him to the Pontifical Academy of Sciences. In 1945 Whittaker was knighted and in 1949 became an honorary fellow of Trinity College, Cambridge.

In 1901 Whittaker married Mary Boyd, daughter of the Reverend Thomas Boyd of Cambridge; they had three sons and two daughters. The second son, J. M. Whittaker, became a mathematician and was vice-chancellor of the University of Sheffield. Whittaker's daughter married the mathematician E, T, Copson.

Whittaker's deepest interest was in fundamental mathematical physics, and consequently much of his earlier work was concerned with the theory of differential equations. Perhaps his most significant paper in this field was the one published in 1902 in which he obtained the most general solution of Laplace's equation in three dimensions, which is analytic about the origin, in the form

and the corresponding solution of the wave equation in the form

The discovery of the general integral representation of any harmonic function brought a new unity into potential theory; the integral representations of Legendre and Bessel functions, for example, were immediate consequences. Moreover, entirely new fields of research in the theory of Mathieu and Lamé functions were opened up. Whittaker also made a detailed study of the differential equation obtained from the hypergeometric equation by a confluence of two singularities, and he introduced the functions $W_{k,m}(z)$, which now bear his name. Another lifelong interest of Whittaker's was the theory of automorphic functions and the standard English book on the subject by L. R. Ford owes much to Whittaker. He also wrote a few papers on special problems in algebra and on numerical analysis.

Whittaker had an intense interest in the theory of relativity and from 1921 onward wrote ten papers on the subject. In one of the papers he gave a definition of spatial distance in curved space-time, which is both mathematically elegant and practical. In other papers he extended well-known formulas in electromagnetism to general relativity, gave a relativistic formulation of Gauss's theorem, and dealt with the relation between tensor calculus and spinor calculus.

Whittaker will long be read, since his textbooks on several diverse branches of mathematics have become classics. *Modern Analysis* (1902) was the first book in English to present the theory of functions of a complex variable at a level suitable for undergraduate and beginning graduate students. Forsyth's *Theory of Functions* had appeared in 1893, but its contents had not penetrated to the general body of mathematicians. *Modern Analysis* was extensively revised and enlarged in 1915 in collaboration with G. N. Watson, whose name was then added to the title page. Whittaker's *Analytical Dynamics*, which was published in 1904, was the first book to give a systematic account in English of the superbly beautiful theory that springs from Hamilton's equations; and it was of fundamental importance in the development of the quantum theory. Then, in 1910 there appeared *The History of the Theories of Aether and Electricity*. In 1951 a revised version of the book was published and constituted the first volume of a new treatise with the same title; it deals with the history up to the end of the nineteenth century. The second volume, which appeared in 1953, describes the developments made between 1900 and 1926 and is concerned mainly with relativity and quantum theory. The two volumes together form Whittaker's *magnum opus*. A contemplated third volume dealing with later theories was never completed.

Notwithstanding the excellence of *Aether and Electricity*, the chapter in the second volume dealing with the special theory of relativity has been criticized for the emphasis it places on the work of Lorentz and Poincaré, and for the consequent impression it gives that the work of Einstein was of minor importance. The consensus is that Whittaker made an error of judgment. As early as 1899 Poincaré had thought it possible that there might not be such a thing as absolute space, and in 1904 he had discussed without mathematics the possibility of a new mechanics in which mass would depend on velocity and in which the velocity of light would be an upper limit to all physically possible velocities. Also, Lorentz had derived the transformation that

now bears his name before Einstein published his paper in 1905, but Lorentz interpreted it in terms of absolute space and time, concepts that, according to Born, he was still clinging to a few years before his death in 1928. Likewise, Poincaré seemed to regard the Lorentz transformation (which he discussed in a mathematically impressive paper in 1906) as physically important only because Maxwell's equations are invariant under it. It was Einstein (who had doubts about the ultimate validity of Maxwell' equations) who derived the transformation law from more fundamental physical principles.

Soon after his arrival at the University of Edinburgh, Whittaker instituted a mathematical laboratory and lectured on numerical analysis. His book *The Calculus of Observations*, written with G. Robinson, grew out of these lectures and was published in 1924. At that time very little of its content was to be found in any other book in English.

Although Whittaker expended a tremendous effort on advanced study and research, he regarded his undergraduate teaching as of paramount importance and, in addition to lecturing to the honors classes, he lectured once a week to the first-year class on the history and development of mathematics. He was an outstanding lecturer and by his dignified bearing, his great command of language, his eloquent delivery, and his obvious mastery of his subject, he made a tremendous impression upon young students. They knew at once that they were in the presence of a scholar and teacher of the first rank and in all his prelections they saw at work a mind of astonishing accuracy and force, ranging at will over the whole field of ancient and modern mathematics and presenting with insight and great persuasive power the profundities there disclosed.

Whittaker was a deeply religious man all through his life and, after having belonged to several branches of the Protestant faith – including the Church of Scotland, of which he was an elder – he was received into the Roman Catholic Church in 1930. After retiring from his chair at Edinburgh, Whittaker spent much of his time studying the philosophical aspects of modern physics and the repercussions that recent developments might have on theology. He expounded his views in *The Beginning and End of the World* (1942), *Space and Spirit* (1947), *From Euclid to Eddington* (1949), and in a large number of papers. He wrote from an orthodox Roman Catholic point of view with great emphasis on natural theology and the work of Thomas Aquinas. He deplored that in modern life "the sense of creatureliness and dependence has passed away, and God is left out of account." He was undoubtedly one of the few men of his time who could speak with authority on both physics and theology.

BIBLIOGRAPHY

An extensive account of Whittaker's life and work is in the Whittaker Memorial Number of *Proceedings of the Edinburgh Mathematical Society*. **11** , pt.**1** (1958), 1–70, which includes a general biographical notice and articles by five contributors on different aspects of Whit–taker's work. See also biographical notices by G. F. J. Temple, in *Biographical Memoirs of Fellows of the Royal Society*, **2** (1956), 299–325; and by W. H. McCrea, in *Journal of the London Mathematical Society*, **32** (1957), 234–256.

The question concerning the origin of the special theory of relativity is discussed by G. Holton, in *American Journal of Physics*, **28** (1960), 627–636; and M. Born, *The Born-Einstein Letters* (New York, 1971), 197– 199.

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