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(*b*. Manchester, England, 29 May 1882; *d*. Pasadena, California, 21 January 1946)

mathematics, mathematical physics.

The son of Marnie Elizabeth Bond and Samuel Bateman, a druggist and commercial traveler, Bateman became interested in mathematics while at Manchester Grammar School. He attended Trinity College, Cambridge, where he received a B.A. in 1903 and an M.A. in 1906. After a tour of Europe in 1905–1906 he taught for several years, first at Liverpool University and then at Manchester. In 1910 he emigrated to the United States, where he taught for two years at Bryn Mawr College, then held a three-year research fellowship and lectured at Johns Hopkins from 1912 to 1917, taking his Ph.D. there in 1913. Although by this time he had an international reputation as a mathematician, he worked part-time on meteorology at the Bureau of Standards. In 1917 Bateman was appointed professor of mathematics, theoretical physics, and aeronautics at Throop College (which later became California Institute of Technology) in Pasadena, California, where he taught until his death. He was made a fellow of the Royal Society in 1928 and a member of the U.S. National Academy of Sciences in 1930, was elected vice-president of the American Mathematical Society in 1935, and delivered the Society's Gibbs lecture in 1943.

General theories had little attraction for Bateman; he was a master of the special instance. Much of his work consisted of finding special functions to solve partial differential equations. After some geometrical studies, he used definite integrals to extend E. T. Whittaker's solutions of the potential and wave equations to more general partial differential equations (1904). These and later results he applied to the theory of electricity and, with Ehrenfest, to electromagnetic fields (1924).

While in Göttingen in 1906, Bateman became familiar with the work of D. Hilbert and his students on integral equations. He applied integral equations to the problem of the propagation of earthquake waves, determining, from the time of contact at various surface points, the velocity of the motion at interior points. In 1910 he published a comprehensive report on research concerning integral equations.

Bateman's most significant single contribution to mathematical physics was a paper (1909) in which, following the work of Lorentz and Einstein on the invariance of the equations of electromagnetism under change of coordinates of constant velocity and constant acceleration, he showed that the most general group of transformations which preserve the electromagnetic equations and total charge of the system and are independent of the electromagnetic field is the group of conformal maps of four-dimensional space.

Bateman was one of the first to apply Laplace transform methods to integral equations (1906), but he felt that he never received recognition for this. In 1910 he solved the system of ordinary differential equations arising from Rutherford's description of radioactive decay. From 1915 to 1926 Bateman worked on problems of electromagnetism and classical atomic models that were solved by the quantum theory (1926). His interests shifted to hydrodynamics and aerodynamics; in 1934 he completed a monumental 634-page report on hydrodynamics for the National Academy of Sciences.

In 1930 Bateman set out to find complete systems of fundamental solutions to the most important equations of mathematical physics, and he wrote a text describing many of the methods of solving these equations (1932). Much of the remainder of his life was dedicated to completing the task of collecting special functions and integrals that solve partial differential equations. He developed many of these, such as Bateman's expansion and Bateman's function. Bateman kept references to the various functions and integrals on index cards stored in shoe boxes—later in his life these began to crowd him out of his office. His memory for special facts was phenomenal. Mathematicians both telephoned and wrote to him, asking about particular integrals; and after consulting his files, Bateman supplied the questioner with formulas and extensive references. After his death the Office of Naval Research assembled a team of mathematicians headed by Arthur Erdelyi to organize and publish Bateman's manuscripts. Only parts of the resulting volumes on trascendental functions and integral transforms made extensive use of Bateman's files.

BIBLIOGRAPHY

For bibliographies of Bateman's books and papers and biographical material, see Arthur Erdelyi, "Harry Bateman 1882–1946," in *Obituary Notices of Fellows of the Royal Society*, **5** (London, 1948), 591–618; and F. D. Murnaghan, "Harry Bateman," in *Bulletin of the American Mathematical Society*, **54** (1948), 88–103. The volumes resulting from the Bateman

Manuscript Project are Arthur Erdelyi, ed., *Higher Transcendenal Functions*, **3,** vols. (New York, 1953–1955), and *Tables of Integral Transforms*, 2 vols, (New York, 1954).

C. S. Fisher