

PAUL EHRENFEST
1880-1933

Ehrenfest was born on 18 January 1880 in Vienna. His father had a grocery store in a working-class district of the Austrian capital. Although his parents had given up the orthodox Jewish faith, Paul Ehrenfest always was very conscious of his Jewish descent. He attended the Akademisches Gymnasium, where he excelled in mathematics. He studied at the Technological University and at the University, where he was fascinated by Ludwig Boltzmann's lectures on thermodynamics. By these lectures Ehrenfest was won over to theoretical physics. In 1902 he went to Göttingen to study mathematics and in 1903 visited Leiden, where he met Lorentz. In June 1904 he received his doctorate with an unpublished and not very important dissertation *Die Bewegung starrer Körper in Flüssigkeiten und die Mechanik von Hertz*, on the extension of Hertz's mechanics to problems in hydrodynamics. Ludwig Boltzmann was his supervisor.

In December 1904 Ehrenfest married Tatyana Alexeyevna Afanassjewa, a Russian student of mathematics, whom he had met during his stay in Göttingen. Paul and Tatyana Ehrenfest became close collaborators and on the invitation of Felix Klein they wrote a monograph on the foundations of statistical mechanics for the prestigious *Encyklopaedie der mathematischen Wissenschaften* (published in 1911). From 1904 to 1907 the couple lived in Vienna and Göttingen, but in 1907 they moved to the Russian capital St. Petersburg. They did not have any regular employment, but were able to live from small inheritances. While Paul Ehrenfest was working in the field of statistical mechanics, Tatyana Ehrenfest developed some new ideas concerning the teaching of mathematics. In 1911 Ehrenfest decided to look for an official position and for this reason traveled and lectured extensively in Germany. During a stay in Prague he met Albert Einstein. Quite unexpectedly in 1912 Ehrenfest was then asked to succeed Lorentz as professor of theoretical physics in Leiden. In October 1912 the Ehrenfests moved to Leiden and in December Paul Ehrenfest gave his inaugural lecture *Zur Krise der Lichtaether-Hypothese*.

As a professor of physics, Ehrenfest differed greatly from Lorentz, with whom he nevertheless established close ties. While Lorentz had been gentle, but reserved and formal, Ehrenfest was very much concerned with his students and very informal. He organized a weekly Wednesday evening colloquium, established a reading room (the

Bosscha reading room, for which Göttingen had been the model) and maintained close contacts with his students. Prominent Dutch physicists like J.M. Burgers, H.B.G. Casimir, S.A. Goudsmit, G.E. Uhlenbeck and J. Tinbergen drew their inspiration from his lectures, which even according to Einstein were 'peerless'. But his critical abilities, which had led him to a clarification of Boltzmann's theorems, were much better developed than his creative power or his calculating skill. Even his greatest contribution to physics, the adiabatic principle, testifies to this. In essence, this principle is mainly the result of a critical analysis of fundamental ideas put forward by Planck and Wien. Ehrenfest had worked on these problems in quantum theory before his call to Leiden and he continued this line of research afterwards. In the late 1920's and the early 1930's Ehrenfest worked on the new quantum mechanics and its relationship to classical physics. He also wrote some articles posing some very fundamental questions on the physical and mathematical aspects of quantum mechanics. But in his publications Ehrenfest seldom breaks new ground; he clarifies what has been said by others, he re-formulates a theory, he poses questions nobody had asked before, but a real breakthrough is not to be found in his work.

Ehrenfest was widely respected as a physicist. He traveled all over the world to give lectures, Einstein and Bohr belonged to his closest friends and his house in Leiden was a vital centre of mathematical and physical discussion. Nevertheless, he had always suffered from feelings of inferiority and insufficiency and during the 1920s and early 1930s these feelings intensified. Depressed by the Nazis' coming to power in Germany and confronted with a number of personal problems, Ehrenfest took his own life. He died in Amsterdam on 25 September 1933.

Primary works

Poggendorff, vol. 5, 324-325; vol. 6, 644; vol. 7B, 1212. *Collected Scientific Papers*, ed. by M.J. Klein, intr. by H.B.G. Casimir (Amsterdam, 1959); *The conceptual foundations of the statistical approach in mechanics*, trans. M.J. Moravcsik (Ithaca, 1959); archival material in Museum Boerhaave, Leiden.

Secondary sources

H.A. Kramers, in: *Physica* 13 (1933) 273-276 and *Nature* 132 (1933) 667; W. Pauli, in: *Naturwissenschaften* 21 (1933) 841-843; H.A. Kramers, 'Physiker als Stilisten', *Naturwissenschaften* 23 (1935) 297-301; A. Einstein, 'Paul Ehrenfest in memoriam', reprinted in: *idem, Out of my later years* (New York, 1950) 214-217; G.E. Uhlenbeck, 'Reminiscences of Professor Paul Ehrenfest', *American Journal of Physics* 24 (1956) 431-433; M.J. Klein, *Paul Ehrenfest. I: The making of a theoretical physicist* (Amsterdam, 1970) (the second volume of this biography is as yet unpublished).
H.B.G. Casimir, in: *BWN*, vol. 1, 168-170; M.J. Klein, in: *DSB*, vol. 4, 292-294.

[K.v.B.]