

HEIKE KAMERLINGH ONNES  
1853-1926

Kamerlingh Onnes was born in Groningen on 21 September 1853, the son of Harm Kamerlingh Onnes, owner of a manufactory of roofing tiles, and Anna Gerdina Coers. His parents valued high culture and the arts. One of his brothers was an artist and father of the well-known painter Harm Kamerlingh Onnes; his sister was married to an artist. After finishing secondary school (HBS) in Groningen, and taking a special course in Greek and Latin in order to qualify for university admission, Kamerlingh Onnes enrolled at the University of Groningen in 1870. He took an active part in the student protests against the government proposal to close the university and served as president (rector) of the student body in 1876. But he also shone as a student, winning a gold medal in a prize competition held by the University of Utrecht in 1871 and a silver medal for a competition held by his own university in 1872.

As a student, Kamerlingh Onnes also spent three semesters at the University of Heidelberg, where he studied first under Robert Bunsen and then Gustav Kirchhoff, in whose famous seminar he excelled, winning an assistantship in Kirchhoff's laboratory. Kirchhoff suggested that he should investigate the pendulum experiment of Foucault, and it was on this subject that Kamerlingh Onnes wrote his dissertation at Groningen: *Nieuwe bewijzen voor de aswenteling der aarde* (New Proofs of the Earth's Axial Rotation, 1879).

From 1878 to 1882, he was employed by the Polytechnic School in Delft, as assistant to its director, Johannes Bosscha, teaching the courses of Bosscha and J.A. Snijder. It was during this period that he developed close contacts with J.D. van der Waals at the University of Amsterdam and became familiar with the scientific problems posed by the molecular theory of matter. At the age of 29, in 1882, Kamerlingh Onnes was already recognized as one of the rising stars in the scientific community of the Netherlands, and when the physicist P. L. Rijke retired from his chair at the University of Leiden, Lorentz, who occupied the chair of theoretical physics, argued that Rijke's chair should become a chair of experimental physics and that Kamerlingh Onnes should be appointed to it. Kamerlingh Onnes accepted the appointment and began his career at Leiden with an inaugural lecture echoing Kirchhoff: *De beteekenis van het quantitatief onderzoek in de natuurkunde* (The Importance of Quantitative Research in Physics).

Above the door to every physics laboratory he would like to have the inscription *Door meten tot weten*, or 'through measuring to knowing'. In 1887 Kamerlingh Onnes married Maria Adriana Wilhelmina Elisabeth Bijleveld. The couple had one son.

Kamerlingh Onnes's career at Leiden spanned four decades. His central work was the measurement of properties of matter at very low temperatures. Researchers in other countries had recently succeeded in liquefying air (78.6 °K), and Kamerlingh Onnes set out to follow them. It was not until 1892 that his apparatus for liquefying air and oxygen (using the cascade method with liquid methyl chloride and ethylene) was ready. With this apparatus, which produced large quantities of liquid air and oxygen, Kamerlingh Onnes pursued research lines following Van der Waals (molecular properties) and Lorentz (electromagnetic properties). In both areas he made crucial contributions. But to reach yet lower temperatures necessary to investigate the simplest substances, hydrogen and helium, a different apparatus was needed. James Dewar had liquefied hydrogen in 1898, and Kamerlingh Onnes needed a new apparatus in order to compete. Because the new method used compressed gases, the safety concerns of the city government had to be addressed, and the first apparatus was not ready until 1905. By the following year, with an improved apparatus, Kamerlingh Onnes was able to produce large quantities of liquid hydrogen (20.4 °K), and in 1908 he succeeded in liquefying helium (4.2 °K). For this achievement he received the Nobel Prize in 1913. Until 1923 Kamerlingh Onnes's laboratory (named after him in 1932) was the only place in the world where helium could be liquefied.

With this apparatus, Kamerlingh Onnes was able to reach temperatures as low as 1 °K, and eventually 0.83 °K. In his investigations of the electrical properties of substances at low temperatures he expected electrical resistance to decrease to a certain point and then increase without bounds. To his surprise, however, he found, in 1911, that it decreased to zero, and that it did so discontinuously when a metal reached a certain transition temperature. The phenomenon of superconductivity remained unexplained until the 1950s.

Kamerlingh Onnes was active in international scientific circles. In 1908 he was the chairman of the first international conference on cryogenic technology and then served on the council of the Institut International du Froid until his death. In the Netherlands, he was instrumental in the foundation of the Nederlandsche Vereeniging

voor Koeltechniek in 1908. More importantly, in 1901 Kamerlingh Onnes founded the Vereeniging tot Bevordering van de Opleiding tot Instrumentmaker, a society for the promotion of the training of instrument makers. As part of this effort, Kamerlingh Onnes founded a school for instrument making in the workshops of his laboratory. The practical training, along with the theoretical examinations in this school served as an important model for practical technical education in the Netherlands.

Throughout his life, Kamerlingh Onnes was of delicate health yet highly energetic. At Leiden, his assistant G.J. Flim was crucial to the vast amount of research done in the laboratory. Kamerlingh Onnes retired in 1924 and died in Leiden on 21 February 1926.

#### *Primary works*

*Poggendorff*, vol. 3, 707; vol. 4, 724-725; vol. 5, 607-609; vol. 6, 1273-1274. Most of his scientific papers appeared in *Proceedings of the Royal Academy of Arts and Sciences* and *Verslagen* of the meetings of the scientific division. These are reprinted in *Communications from the Physical Laboratory at the University of Leiden*. See also the *Reports and Communications* submitted to the first congresses of the International Institute of Refrigeration, and K. Gavroglu and Y. Goudaroulis, eds, *Through measurement to knowledge: The selected papers of Heike Kamerlingh Onnes, 1853-1926* (Boston studies in the philosophy of science 124; Dordrecht: Kluwer Academic, 1991). Kamerlingh Onnes's papers and the apparatus with which he first liquefied helium are in the Museum Boerhaave at Leiden.

#### *Secondary sources*

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[A.v.H.]