Heike Kamerlingh Onnes

1853-1926

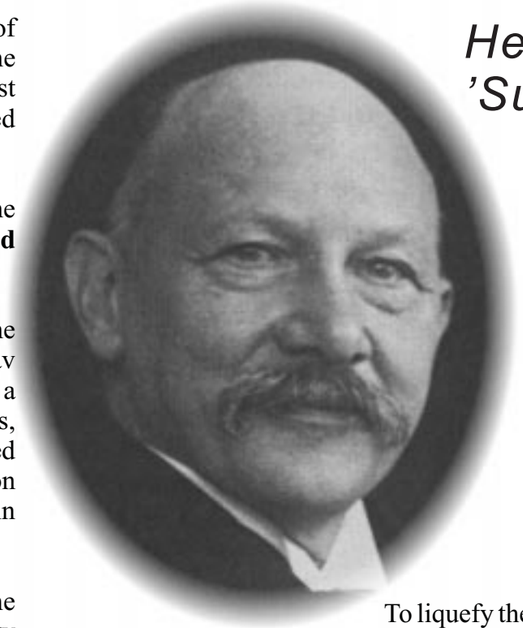
Awarded the Nobel Prize for Physics in 1913

In the history of refrigeration and low temperature physics, Heike Kamerlingh Onnes is one of the main founders. He achieved in 1908 the liquefaction of helium, thus making accessible the study of the properties of matter at really very low temperatures. Three years later he had the first glimpse of the strange new world of superfluidity, when at the age of 58 he discovered superconductivity in mercury. In 1913 he received the Nobel Prize for Physics.

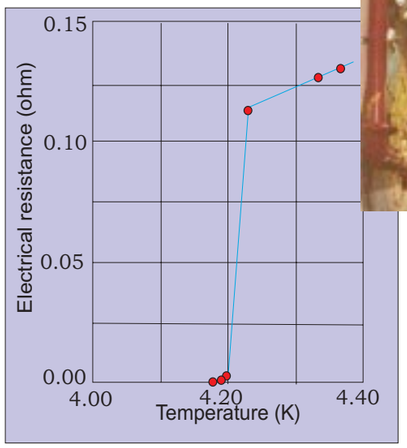
Heike Kamerlingh Onnes was born in 1853 in Groningen in the Netherlands. His father was the owner of a tile factory, and his mother, a clever woman, **taught her children diligence and persuaded them to read and discuss matters.**

He started his studies in physics in 1870 at the University of Groningen, the following year he worked at the University of Heidelberg with the German physicists Robert Bunsen and Gustav Kirchhoff. In 1873 he went back to the University of Groningen where he was awarded a doctorate in 1879. During this time he became acquainted with Johannes Diderik Van der Waals, who was then professor of Physics in Amsterdam. Kamerlingh Onnes was very much influenced by his work on the equation of state and by his law of corresponding states, a single equation accounting for the behaviour of all real gases. In 1882 he was appointed professor in experimental physics at Leiden University.

His first goal was to give experimental support to the theory of Van der Waals by exploring the behaviour of real gases of simple molecules at low condensation temperatures. To reach very low temperature one must remove heat from the specimen; this could be done by immersing the specimen in a liquefied gas which remove heat as it boils.

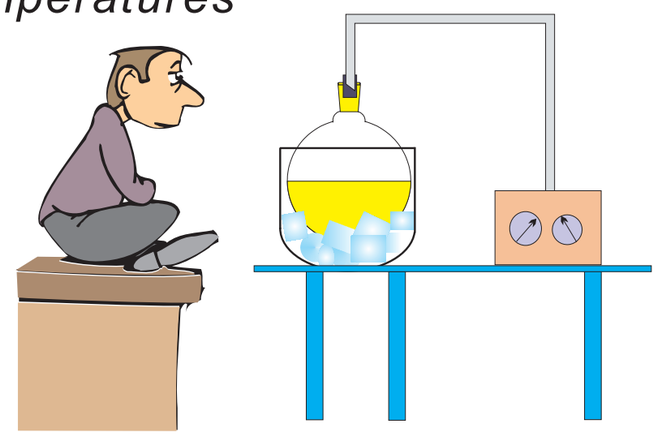


He discovered 'Superconductivity'



which is used in particle accelerators

He studied liquefied gas at very low temperatures



which is used as a rocket fuel

To liquefy the gas, one compresses it and cools it below the inversion temperature. If now the gas is allowed to expand, further cooling occurs, resulting in the liquefaction of some of the gas. For this purpose in Leiden he built a cryogenic laboratory. In 1892 his apparatus for the liquefaction of air in large quantities was ready. Subsequently he built a large hydrogen liquefier in 1906 and succeeded with the liquefaction of helium, using evaporating liquid hydrogen, on the 10th of July in 1908.

He tells us that it was a wonderful moment when the liquid was seen for the first time and he was overjoyed when he could show liquid helium to his friend van der Waals, whose theory guided him in the liquefaction up to the very end.

Leiden Laboratory has carried his name since 1932. His laboratory motto was : ***'Door meten tot weten'*** (to comprehend through measurement).

Kamerlingh Onnes was interested in investigating the electrical properties of pure metals with no impurities in this newly available region of low temperatures. The question was: will the resistance increase, or decrease or remain constant when cooling the samples? He decided to work with mercury which can be repeatedly distilled at room temperature in order to obtain a pure sample. What happened was completely unpredictable: Onnes found (1911) that when cooling the pure mercury tubes to a temperature of 4.2 K the resistance suddenly dropped to zero. He showed similar results in some other metals, for instance in tin and lead and in 1914 he established a permanent current, or what he called a "persistent supercurrent", in a superconducting coil of lead. It was 46 years before John Bardeen, Leon N. Cooper and J. Robert Schrieffer established the theoretical foundations that best explained superconductivity.

R.deB.O.