

## Owen Willans Richardson

Owen Willans Richardson was awarded the Nobel Prize in Physics in 1928. He was awarded it because of his work on the thermionic phenomenon, which even had a law named after him.

Richardson was born in Dewsbury, Yorkshire on April 26, 1879. His parents were Joshua Henry and Charlotte Maria Richardson. In his childhood, Richardson attended Batley Grammar School. He entered Cambridge in 1897 with the help of a scholarship called an Entrance Major Scholarship at Trinity College. While attending Cambridge, Richardson was awarded First Class Honors in Natural Science, with distinction in Physics and Chemistry. He obtained this at the Universities of Cambridge and London. He graduated Cambridge in 1900.

After graduation, Richardson researched the emission of electricity from hot bodies. He did his work at the Cavendish Laboratory. He announced the discovery of a law on November 25<sup>th</sup>, 1901. The paper which announced this law was read before the Cambridge Philosophical Society. Richardson was elected a Fellow of Trinity College, Cambridge, in 1902.

Richardson continued to study this principle until 1906, when he came to America to be Professor of Physics at Princeton University. While at Princeton, he worked on thermionic emission, photoelectric action, and the gyromagnetic effect. He was elected to join the American Philosophical Society in 1911 and in 1913 became a Fellow of the Royal Society.

Because of this new membership, Richardson left Princeton and returned to England, where he became Wheatstone Professor of Physics at King's College in the University of London.

Richardson's non professional life consisted of a wife named Lilian Maud Wilson, whom he married in 1906. Lilian was the sister of H.A. Wilson, who is a well-known physicist. Lilian was also a student with Richardson at Cambridge. Richardson had two sons and a daughter with Lilian, but Lilian died in 1945. After her death, Richardson married the fellow physicist Henriette Rupp in 1948. Richardson died in 1959.

Richardson's legacy is far reaching. He attained many awards and titles, such as the Hughes Medal by the Royal Society, Section A President of the British Association, President of the Physical Society of London, Yarrow Research Professor of the Royal Society of London, and the Nobel Prize. Richardson was even knighted in 1939. He received honorary degrees from the University of St. Andrews, University of Leeds, and the University of London.

Richardson mostly worked on thermionics, photoelectric effects, magnetism, the emission of electrons by chemical action, the theory of electrons, the quantum theory, the fine structure of Ha and Da, soft-rays, and the spectrum of molecular hydrogen.

The law which he discovered states "If then the negative radiation is due to the corpuscles coming out of the metal, the saturation current  $s$  should obey the law  $s = AT^{1/2}e^{-b/T}$ ." This form is similar to the Arrhenius equation and was discovered when Richardson the exponential dependency of a heated wire's current to the temperature of the wire. Thermionic emission is the flow of charge carriers from a surface or over a potential energy barrier. It is induced by heat. This is due to the thermal energy given to

the carrier that overcomes the binding potential. This is also known as the work function of metal. Charge carriers are electrons or ions, and they used to be referred to as Thermions. When these ions are emitted, a charge is left behind in the emitting region that is the same magnitude but the opposite sign to the total charge emitted. If the emitter is connected to a battery, however, then the emitter will be in the same state as it was before the emission. Richardson's law depends on the sea of electrons, whose electrons have velocities which follow a distribution. The minimum amount of energy an electron needs to leave a surface is the work function, and the work function is characteristic of the material.

Richardson discovered a law which paved the way for thermionic emission, and his ideas were later developed by Schottky and Ryudberg.

## Sources:

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[http://nobelprize.org/nobel\\_prizes/physics/laureates/1928/](http://nobelprize.org/nobel_prizes/physics/laureates/1928/)

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