JOHANNES DIDERIK VAN DER WAALS
1837-1923

Van der Waals was born on 23 November 1837 in Leiden, the son of a carpenter. He attended primary and a simple form of secondary school in Leiden and then obtained various teaching licenses through independent study. In 1864 he became teacher of mathematics and science at the HBS in Deventer, and in 1865 he married Anna Magdalena Smit. In 1866 Van der Waals transferred to an HBS in The Hague, where he went on to become principal. During this period he also studied mathematics and physics at the University of Leiden, but because he had not had a classical secondary education he was not allowed to take examinations. Only after receiving a dispensation from this requirement, in 1871, could he take his doctoral examination. He took his doctorate in physics in 1873 with the dissertation *Over de continuiteit van den gas- en vloeistoftoestand* (On the continuity of the gaseous and liquid state). By considering the gaseous and liquid states as being continuous with each other—although in the liquid state the sizes of the molecules could not be ignored as in the gaseous state—Van der Waals was able to explain several phenomena that had recently been discovered, and especially the fact that for each gas there is a 'critical temperature' above which the gas cannot be made liquid no matter how high the pressure. Quantifying the weak attractive forces among molecules, Van der Waals was able to correct the ideal gas law to apply to condensed gases and liquids as well: $(p + a/v^2)(v-b) = RT$, now called the Van der Waals equation of state. The following year, James Clerk Maxwell wrote a laudatory review of Van der Waals's dissertation in *Nature*, saying 'This at once puts his name among the foremost in science'. The dissertation was translated into German in 1881, English in 1890, and French in 1894. In 1875 Van der Waals was elected to the Royal Academy of Arts and Sciences, and in 1877 he was appointed to the chair of physics at the recently founded University of Amsterdam.

In his work, Van der Waals started from the supposition that atoms and molecules were real, a proposition which, in 1873, was still controversial. But his purely theoretical derivations from this assumptions were sufficiently fruitful to allow him to derive the mass of the hydrogen atom. By 1880, he had eliminated the constants a and b from his equation of state by expressing pressure, temperature, and volume in terms of multiples or fractions of their critical values.

His equation was now the same for all substances. The simplified relationship became known as the law of corresponding states. Van der Waals went on to broaden the law of corresponding states to include binary mixtures.

The cryogenic experiments of Dewar in England and Kamerlingh Onnes at Leiden were predicated on Van der Waals's theories. Although his own work was exclusively theoretical, he obtained a well-equipped physics laboratory at the University of Amsterdam, in 1881, where experiments were carried out under his supervision. Van der Waals was active in the Mathematics and Physics division of the Royal Academy, serving as its secretary from 1896 to 1912, changing the format of its publication in 1892 and making them available in English (*Proceedings*), beginning in 1898, thus ensuring that Dutch scientific research would henceforth be better known in other countries. He retired in 1907 and was succeeded by his son, Johannes Diderik, Jr. In 1910 he received the Nobel Prize for physics.

By temperament, Van der Waals was an individualist, often seen by others as domineering and remote. He was a devout Christian who never went to church, and he eschewed politics and social obligations. He died in Amsterdam on 8 March 1923.

Primary works

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Secondary sources

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[A.v.H.]