

Biographical Encyclopedia of Astronomers

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Rydberg, Johannes [Janeé] Robert

Born Halmstad, Sweden, 8 November 1854

Died Lund, Sweden, 28 December 1919

Swedish physicist Johannes Rydberg calculated the amount of energy required to unbind the single electron of hydrogen, and this amount (13.6 eV) is often given his name as the Rydberg constant (alternatively 109.678 cm^{-3}). More recently, the phrase Rydberg matter has been used to describe neutral gas in which the electrons are located in states of very high excitation far from their nuclei

Rydberg was the son of Maria Beata Andersson and Sven R. Rydberg, a local tradesman and boatyard operator, who died when his son was four. He married Lydia E. M. Carlsson in 1886, and they had a son and two daughters.

Rydberg studied and worked all his life at Lund University. He first went there in 1873 after completing his gymnasium studies in Halmstad; he was awarded the Ph.D. degree in mathematics in 1879, becoming a *docent* in mathematics the following year. His interests progressively turned toward mathematical physics, and in 1882 Rydberg was made a lecturer in physics until he was appointed in 1901 to an extraordinary professorship in physics as well as to the directorship of Lund's physics department. From 1876 to 1897, he was also an assistant at the university's Physics Institute. When in 1908 a new law eliminated the rank of extraordinary professor, Rydberg automatically became an ordinary professor, a position he retained until his death, although from 1914 he was ill and often absent from the university. Rydberg was a member of the Royal Society of London (1919) and a leading figure of the Physics Society of Lund

While contemporary Swedish spectropists of renown, Anders Ångström, Robert Thalen, and Barnhard Hasselberg, carried out mainly experimental programs of charting the spectra of different elements found in the sun, Rydberg largely relied on other scientists' measurements to study the structure of spectra, in particular to find arithmetic formulas describing the wavelengths of lines and to compare them with the physical and chemical properties of elements. A mathematician by training, Rydberg carried over a mathematical approach to spectroscopy. He most notably concerned himself with the numerical analysis of regularities in spectra, producing what became known as Rydberg's formula. From the 1860s, spectropists had searched for patterns or regularities in the positions of spectral lines, often hoping to find harmonic ratios. Johann Balmer notably put forward a formula accounting for the hydrogen spectrum in 1885. In 1889, Rydberg proposed a more general formula describing all series of all atomic line spectra, which contributed to organizing the mass of available spectroscopic measurements, but which failed to lead him to his stated goal: the understanding of the nature and properties of the atom. This work,

Together with contemporary research into spectral regularities by Walther Ritz, as well as Heinrich Kayser and Carl Runge, it subsequently proved central in the elaboration of atomic theories from the 1910s onward. Niels Bohr's theory of atomic structure (1913), combining Ernest Rutherford's nucleus with Max Planck's quantum, gave for the first time an interpretation of Rydberg's formula and confirmed Rydberg's belief that spectral characteristics were useful in the investigation of atomic structure and properties. The numerical value of the Rydberg constant depends upon the charge and mass of the electron (not yet discovered when he put forward his formula) and Planck's constant. Though to Rydberg it was an empirical result from laboratory experiment, the constant can be derived using Bohr's theory of atomic structure.

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