De Broglie Relation Encyclopedia Article

De Broglie Relation

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De Broglie Relation

Our current understanding of atomic and **molecular structure** is based on the theory of quantum mechanics (also known as wave mechanics). The first major break with the classical mechanics of English physicist Isaac Newton (1642-1727) came with the proposal in 1900 by German physicist **Max Planck** (1858-1947) that **energy** is absorbed or given off by **matter** in small packets called quanta. Subsequent work by **Albert Einstein** (1879-1955) supported and extended Planck's quantum ideas. It was not until the revolutionary proposal by French physicist Louis de Broglie (1892- 1987) in 1923, however, that the pieces came together which resulted in the development of wave mechanics. De Broglie proposed that minute moving particles such as electrons, atoms, and molecules might possess certain properties commonly associated with waves, including a wavelength. The de Broglie relation that predicted the wave length (l) of a particle of **mass** (m) traveling at a **velocity** (v) is l = h/mv, where h is a universal constant known as **Planck's constant** (6.63 x 10^{-27} erg-sec).

De Broglie's proposal was confirmed by Clinton Davisson (1881-1958), Lester H. Germer (1896-1971) and George P. Thomson (1892-1975) who observed that a stream of electrons is diffracted as it passes through a crystal which acts as a diffraction grating. This would be expected behavior for a wave but not for a particle unless it possesses wave properties.

In 1926 Austrian physicist **Erwin Schrödinger** (1887- 1961) combined the developing ideas of quantized systems and the wave nature of particles into a set of postulates which form the basis of wave mechanics, a theory that has led to a new understanding of the world of atoms and molecules.