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The Atomic Theory and Quantum Physical Models of the Atom

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Opinion Article

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ABOUT THE STUDY

Atomic theory is the scientific notion that matter is made up of tiny components known as atoms. The theory that matter is made up of distinct particles is an ancient one, but it acquired scientific traction in the 18th and 19th centuries when scientists discovered it could explain the behaviour of gases and how chemical components behaved with one another. By the end of the nineteenth century, atomic theory had acquired universal support among scientists. The word "atom" is derived from the Greek word atoms, which meaning "*uncuttable*". Under the incorrect notion that chemical atoms are the fundamental particles in existence, John Dalton used the word to the basic units of mass of the chemical elements, it took another century for scientists to realise that Dalton's so called atoms had their own underlying structure. The term "elementary particles" currently refers to particles that are actually indivisible.

Quantum physical models of the atom

Louis de Broglie postulated in 1924 that all moving particles, particularly subatomic particles like electrons, show wave like behaviour. Fascinated by this thought, Erwin Schrödinger investigated if the movement of an electron in an atom might be better characterised as a wave rather than a particle. Schrödinger's equation, which was published in 1926, defines an electron as a wave function rather than a point particle. Many of the spectrum phenomena that Bohr's model failed to explain were elegantly anticipated by this technique. Although this approach was numerically advantageous, it was difficult to visualise and receive significant opposition. Max Born, one of its detractors, claimed alternatively that Schrödinger's wave function did not indicate the physical extent of an electron like a charge distribution in classical electromagnetism, but rather the likelihood that an electron would be discovered at a specific position when measured. This reconciled the concepts of wave-like and particle like electrons, the behaviour of an electron or any other subatomic entity, has both wave-like and particle like features and whether one is more obvious depends on the context.

Because electrons are described as waveforms, it is technically impossible to calculate an electron's location and momentum at the same time. The Heisenberg uncertainty principle was named after theoretical physicist Werner Heisenberg, who published a version of it in 1927. Heisenberg investigated a thought experiment in which one attempts to determine an electron's location and momentum at the same time. Heisenberg, on the other hand, did not provide clear mathematical descriptions of what "uncertainty" in these measures meant. Earle Hesse Kennard, Wolfgang Pauli, and Hermann Weyl are responsible for the accurate mathematical description of the position-momentum uncertainty principle. This rendered Bohr's model, with its clean, clearly defined circular orbits, invalid. The contemporary atomic model depicts electron locations in an atom in terms of probability. An electron can potentially be found at any distance from the nucleus, but it exists more frequently in some locations surrounding the nucleus than others, depending on its energy level and angular momentum, this pattern is known as its atomic orbital. The orbitals can be spheres, dumbbells, toruses and so on, with the nucleus at the centre. Solving the Schrödinger equation yields the morphologies of atomic orbitals; nevertheless, analytic solutions of the Schrödinger equation are known for just a few very basic model Hamiltonians, including the hydrogen atom and the dihydrogen cation. Even the helium atom, which has just two electrons, has excluded all attempts to completely analyse it.