



12.2 Niels Bohr

Danish physicist Niels Bohr first proposed the idea that electrons exist in specific orbits around the atom's nucleus. He showed that when an electron falls from a higher orbital to a lower one, it releases energy in the form of visible light.

At home among ideas



Niels Bohr was born October 7, 1885, in Copenhagen, Denmark. His father was a physiology professor at the University of Copenhagen, his mother the daughter of a prominent Jewish politician and businessman. His parents often invited professors to the house for dinners and discussions.

Niels and his sister and brother were invited to join this friendly exchange of ideas. (Niels and his brother also shared a passion for soccer, which they both played, and for which Harald, later a world-famous mathematician, was to win an Olympic silver medal.)

Bohr entered the University of Copenhagen in 1903 to study physics. Because the university had no physics laboratory, Bohr conducted experiments in his father's physiology lab. He graduated with a doctorate in 1911.

Meeting of great minds

In 1912, Bohr went to Manchester, England, to study under Ernest Rutherford, who became a lifelong friend. Rutherford had recently published his new planetary model of the atom, which explained that an atom contains a tiny dense core surrounded by orbiting electrons.

Bohr began researching the orbiting electrons, hoping to describe their behavior in greater detail.

Electrons and the atom's chemistry

Bohr studied the quantum ideas of Max Planck and Albert Einstein as he attempted to describe the electrons' orbits. In 1913 he published his results. He proposed that electrons traveled only in specific orbits. The orbits were like rungs on a ladder— electrons could move up and down orbits, but did not exist in between the orbital paths.

He explained that outer orbits could hold more electrons than inner orbits, and that many chemical properties of the atom were determined by the number of electrons in the outer orbit.

Bohr also described how atoms emit light. He explained that an electron needs to absorb energy to jump from an inner orbit to an outer one. When the electron falls back to the inner orbit, it releases that energy in the form of visible light.

An institute, then a Nobel Prize

In 1916, Bohr accepted a position as professor of physics at the University of Copenhagen. The University created the Institute of Theoretical Physics that Bohr directed for the rest of his life. In 1922, he was awarded the Nobel Prize in physics for his work in atomic structure and radiation.

In 1940, World War II spread across Europe and Germany occupied Denmark. Though he had been baptized a Christian, Bohr's family history and his own anti-Nazi sentiments made life difficult.

In 1943, he escaped in a fishing boat to Sweden, where he convinced the king to offer sanctuary to all Jewish refugees from Denmark. The British offered him a position in England to work with researchers on the atomic bomb. A few months later, the team went to Los Alamos, New Mexico, to continue their work.

A warrior for peace

Although Bohr believed the creation of the atomic bomb was necessary in the face of the Nazi threat, he was deeply concerned about its future implications.

Bohr promoted disarmament efforts through the United Nations and won the first U.S. Atoms for Peace Award in 1957, the same year his son Aage shared the Nobel Prize in physics. He died in 1962 in Copenhagen.



Reading reflection

1. How did Niels Bohr's model of the atom compare with Ernest Rutherford's?
2. Name two specific contributions Bohr made to our understanding of atomic structure.
3. Make a drawing of Bohr's model of the atom.
4. In your own words describe how atoms emit light.
5. Why do you think Bohr was concerned with the future implications of his work on atomic bombs?