

Difference Between Bohr and Rutherford Model

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Key Difference – Bohr vs Rutherford Model

The concept of [atoms](#) and their structure was first introduced by John Dalton in 1808. He explained the laws of the chemical combination by considering atoms as invisible particles without a structure. Then in 1911, the New Zealand physicist Ernest Rutherford proposed that atoms consist of two components: a positively charged nucleus in the center of the atom and negatively charged [electrons](#) in the extranuclear part of the atom. Certain theories such as electromagnetic theory presented by Maxwell could not be explained with Rutherford's model. Because of such limitations in Rutherford's model, the Danish physicist Niels Bohr proposed a new model in 1913 based on the quantum theory of radiations. Bohr's model was largely accepted and he was awarded the Nobel Prize for his work. Even though it was largely accepted, it still carries certain drawbacks and limitations. The main difference between Bohr model and Rutherford model is that **in Rutherford model, electrons can revolve in any [orbit](#) around the nucleus, whereas in Bohr model, electrons can revolve in a definite shell.**

What is Bohr Model?

Bohr's model was proposed by Niels Bohr in 1922 to explain the structure of the atom. In this model, Bohr mentioned that the most of the [atomic mass](#) lies in the central nucleus that contains [protons](#) and electrons are arranged in definite energy levels and revolve around the nucleus. The model also proposed electronic configuration, which explains the arrangement of electrons in circular orbits designated as K, L, M, N, etc. Atoms with complete electron configurations are not active. Electron configuration determines the reactivity of the atom.

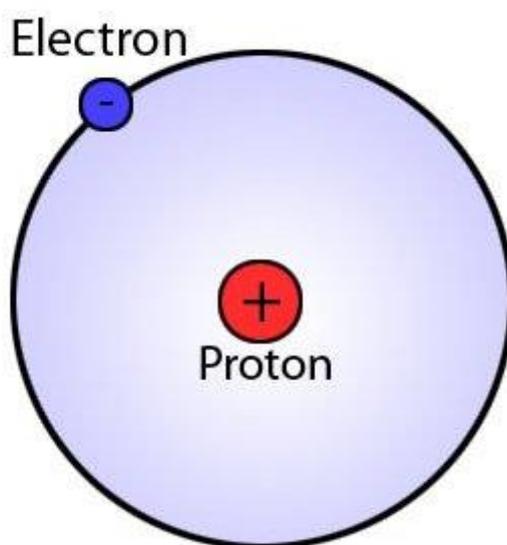


Figure 01: Bohr Model

Bohr's model is able to explain the spectrum of the [hydrogen atom](#), but it cannot fully explain the reactivity of multielectron atoms. Moreover, it does not explain the Zeeman Effect, where each spectral line split up into more lines in the presence of an external magnetic field. In this model, an electron is considered only as a particle. However, a French physicist, de Broglie discovered that electrons have both wave and particle properties. Later on, a physicist put forth another principle called Heisenberg's uncertainty principle, which explains the impossibility of the simultaneous determination of exact position and momentum of small moving particles such as electrons. With this invention, Bohr's model faced a serious setback.

What is Rutherford Model?

In 1911, Ernest Rutherford proposed Rutherford's model. It states that the atom (the volume) consists mainly of space and the mass of the atom is centered in the nucleus, which is the core of the atom. The nucleus is positively charged and the electron orbit around the nucleus. The orbits have no definite paths. Moreover, since atoms are neutral, they have equal positive (in the nucleus) and negative charges (electrons). Rutherford's model failed to explain the electromagnetic theory, the stability of atom and the existence of definite lines in the hydrogen spectrum. The model is commonly known as the "plum pudding" model.

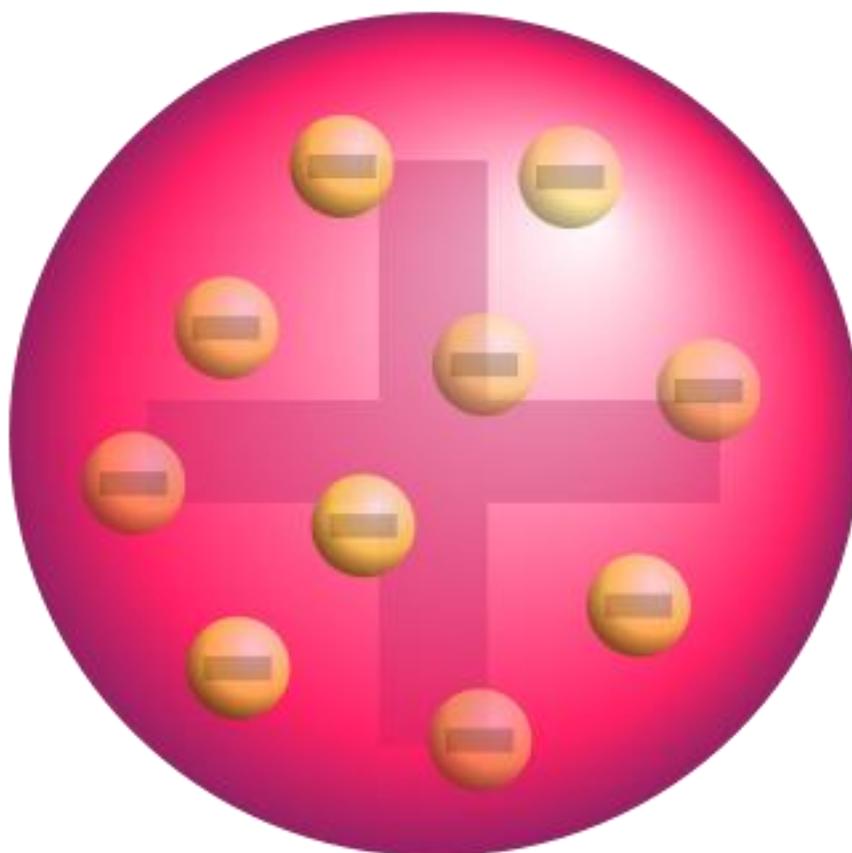


Figure 02: Rutherford Model

What is the difference between Bohr and Rutherford Model?

Bohr vs Rutherford Model	
Bohr model was proposed by Niels Bohr in 1922.	Rutherford model was proposed by Ernest Rutherford in 1911.
Theory	
Most of the atomic mass lies in the central nucleus, which contains protons, and the electrons are arranged in definite energy levels or shells.	Most of the atom consists of empty space. The center of the atom contains a positively charged nucleus and its negatively charged electrons are present in the space surrounding the nucleus.
Emission of Radiation of Electrons	
Electrons only emit waves of definite frequencies.	Electrons emit waves of all frequencies.
Electron Emission Spectrum	
Electron emission spectrum is a line spectrum.	Electron emission spectrum is a continuous spectrum.

Summary – Bohr vs Rutherford Model

Both Bohr and Rutherford models are planetary models that explain the atomic structure up to a certain extent. These models have limitations and do not explain some modern principles of physics. However, these models greatly contribute towards modern advanced models that explain the atomic structure. Bohr model states that most of the atomic mass is in the central nucleus, which contains protons and, that electrons are arranged in definite energy levels or shells, resulting in electron line spectrum. Rutherford's model states that most of the atom consists of an empty space and the center of the atom contains a positively charged nucleus surrounded by negatively charged electrons, resulting in continuous electron spectrum. This is the difference between Bohr and Rutherford Model.

References:

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2. Warren, D. Chemists in a social and historical context: chemists are real people, living in the real world. Royal Society of Chemistry, 2001. Print.

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APA: Difference Between Bohr and Rutherford Model. (2017, August 11). Retrieved (date), from <http://www.differencebetween.com/difference-between-bohr-and-vs-rutherford-model/>

MLA: "Difference Between Bohr and Rutherford Model" Difference Between.Com. 11 August 2017. Web.

Chicago: "Difference Between Bohr and Rutherford Model." Difference Between.Com. <http://www.differencebetween.com/difference-between-bohr-and-vs-rutherford-model/> (accessed [date]).



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