Bohr's theory of hydrogen atom

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1 Introduction

In this research paper, I'm going to focus on examining and analyzing the definition as well as the structure of Bohr's hydrogen atom.

2 What is Borh's hydrogen atom ?

Neils Bohr introduced the atomic hydrogen model in 1913. It's described as a positively charged nucleus, comprised of protons and neutrons, surrounded by a negatively charged electron cloud. In the model, electrons orbit the nucleus in atomic shells. The atom is held together by electrostatic forces between the positive nucleus and negative surrounding.

3 Bohr's theory of hydrogen atom under perception of Physics

Quantized Energy Stats: The electrons in free atoms can be found in only certain discrete energy states. These sharp energy states are associated with the orbits or shells of electrons in an atom (which is a hydrogen atom). The Bohr Model successfully predicted the energies for the hydrogen atom, but had significant failures that were connected by solving the Schrodinger equation for the hydrogen atom.

Angular Momentum Quantization: In the Bohr model, the wavelength associated with the electron is given by the DeBroglie relationship:

$$\lambda = \frac{h}{mv}$$

The standing wave condition that circumference= whole number of wavelength. In the hydrogenic case, the number n is the principal quantum number.

$$2\pi r = n\lambda_n$$

Those can be combined to get an expression for the angular momentum of the electron in orbit.

$$L = mvr = \frac{hr}{\lambda} = \frac{nh}{2\pi}$$

Bohr Orbit: Combining the energy of the classical electron orbit with the quantization of angular momentum, the Bohr approach yields expressions for the electrons orbit radio and energies.

$$\frac{mv^2}{2} = \frac{(mvr)^2}{2mr^2} = \frac{n^2h^2}{8\pi^2}$$

4 Hydrogen Spectrum

The movement of electrons between these energy levels produces a spectrum. The Balmer equation is used to describe the four different wavelengths of Hydrogen which are present in the visible light spectrum. These wavelengths are at 656, 486, 434, and 410nm. These correspond to the emission of photons as an electron in an excited state transitions down to energy level n=2. The Rydberg formula, below, generalizes the Balmer series for all energy level transitions.

The Lyman series is a hydrogen spectral series of transitions and resulting ultraviolet emission lines of the hydrogen atom as an electron goes from n 2 to n = 1 (where n is the principal quantum number) the lowest energy level of the electron. You can't see this light.

Paschen series are the series of lines in the spectrum of the hydrogen atom which corresponds to transitions between the state with principal quantum number n = 3 and successive higher states. You can't see this light.