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Planetary model of the hydrogen atom and hydrogen-like structures

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Abstract

The planetary model of Rutherford-Bohr of the hydrogen atom and hydrogen-like structures are discussed in the paper. The equation of electron motion in the central field of nucleus and its solution are given within the frameworks of the Kepler's problem. The substantiation of this problem is given on the basis of the energy conservation law and the angular momentum.

Phenomenon of stability atom and hydrogen-like cations is analyzed here. Their stability is provided due to the balance of forces of Coulomb attraction of the electron from the nucleus and the forces of centrifugal repulsion due to the rotational motion of the electron. Mechanism of the hydrogen atom stability is revealed on the basis of analysis extreme character of potential function of the hydrogen atom. The answer to the question 'why electron does not fall on the atomic nucleus while rotating' is suggested in the paper.

The nature of discreteness of optical spectrum and the mechanism of its formation are revealed. The idea of periodicity of rotating electron on the circular orbits, which are precisely given by its radius of orbit and the orbital speed, lies on the basis of understanding discreteness of energy levels of the hydrogen atom and single-electron cations of the hydrogen. In this case, not the angular momentum is quantized as it is said in the Bohr's theory but the radius of the hydrogen atom.

The mechanism of electron capture by the atomic nucleus as a result of forming of the circular orbit of the electron is suggested. On the one hand, this orbit owes its forming to the attraction forces by the nucleus charge and on the other hand, to forces of centrifugal repulsion. Forces of centrifugal repulsion occur in the central field of the nucleus due to the splitting of speed of electron motion to radial and azimuthal components.

The program for computer modeling is created to study dynamic problems. The planetary model of the hydrogen atom lies on the basis of the computer program. As an example, some of realized models are presented. These models are intended for studying special aspects of electron motion in the hydrogen atom and hydrogen-like cations such as electron capture, phenomenon of atom stability, processes of perturbation and forming of the atom.

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