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The dumbbell model of the helium atom

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Abstract

The purpose of this article is to discuss the problems of the electronic structure of a helium atom. Given the evolution of ideas about the structure of the helium atom. The first physically reasonable model of the helium atom was the atom shell model, proposed N. Bohr. Changing this to closure shell model came quantum-mechanical s^2-spherical model of the electron cloud. In the quest to improve shell Bohr's model the author proposes a model with two elliptical orbits with common focus on the nucleus of the atom. This article proposes for discussion a revised model of the dumbbell structure of the helium atom. In this model, the charge of the cation He^+ acts as the center of attraction of valence electrons and carries out the capture of an electron on elliptical orbit and the education two-elliptical shell. The shell of the atom is a system of two coupled elliptic orbits formed mirror symmetrical relative to the core electrons. In this configuration, the elliptical orbits of the atom are relatively independent. A distinctive feature of this two- elliptical of the model is that when calculating the eccentricity of elliptical orbits was used the energy of the circular orbit, which was determined based on finding the minimum of the potential function, ε_m = 27.5 eV. The main parameters of a helium atom: the semi-major axis $a \approx 0.415$ Å, while the semi-minor axis at $b \approx 0.37$ Å, eccentricity э = 0.32, the minimum $r_1 = 0.28$ Å and maximum $r_2 = 0.55$ Å, corresponding to the distance of the apogee ha and the effective radius a_{eff}, so $r_2 = r_A = a_{eff}$. For comparison, according to the literature, the radius of a helium atom is in the range $a \approx 1.2$-1.4 Å. An indirect confirmation of the proposed model can serve as: the fact of the crystallization of helium, the doublet nature of the optical spectrum of a helium atom. In the framework of the dipole shell model dumbbell model of a helium atom became the basis for the understanding of the mechanism of formation of multi-electron atoms. The helium atom can serve as next example of rightness the classical approach in atomic physics.

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