Thematic Section: Theoretical and Computer Chemistry. **Full Paper**
Subsection: Theory of the Structure of Substances. *Registration Code of Publication:* 11-25-5-1
Publication is available for discussion in the Internet as a material of "All-Russian Working Chemical Conference "*Butlerov's Heritage-2011*". http://butlerov.com/bh-2011/
Contributed to editorial board: April 11, 2011.

Trajectory-wave approach to electron dynamics in hydrogen atom

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Keywords: *variation principle, wave function, wave equation, wave motion, trajectory motion, hydrogen-like atom.*

Abstract

In this work we propose a new approach to the explanation of the nature of electron based on the corpuscular-wave monism using the further development of the optical-mechanical analogy to describe the physical reality. In this theory the motion of an electron is considered to occur along a trajectory the presence of which is a reflection of the existence of a particle, as well as it is assumed that any motion is defined by a wave V(x,t). It is assumed that there is an explicit relationship between the trajectory and wave equations of the electron, which are established on the basis of the local variational principle. In this approach, an electron wave propagating in free space takes along the electron trajectory. We used this theory to describe the electron motion in a hydrogen-like atom and found its stationary states. The energies of these states coincide with the known quantum mechanics solutions for the energy of the hydrogen-like atom, however, in our approach the spatial trajectories of the electron have the form of the surfaces, which are formed in the region of nodes of the standing electron wave. These surfaces have the form of spheres for the spherical symmetrical electron states and the radii of these spheres coincide with the radii of the Bohr orbits of these states. Thus, in this approach the trajectory and wave measurements of the electron get a consistent spatial description that is inherent to the picture of the corpuscular-wave monism.