Abstract

The Peculiarities of Hydrogen-Type Systems in Thin Semiconductor Films (QWS) in Presence of Transverse Magnetic Field

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Received: Mon, 25 Feb 2002 02:50:54

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At present time the uniqueness of the properties of hydrogen-type systems (excitons, small impurity centers) in thin semiconductor films is widely recognized [1]. Firstly this uniqueness is due to the fact, that in definite conditions the nature of the center's internal interaction between the particles becomes two-dimensional Columbic [2]. Under these conditions the conventional approximate approach in the theory of diamagnetic excitons (see e.g., [3]) becomes inapplicable while studying hydrogen-type systems in QWS structures in the case when a strong external magnetic field is perpendicular to the film's plane. The peculiarity of the current problem is in the fact that as the Columbic internal interaction as well as the interaction with the external magnetic field takes place in the film's plane and at the direction of the size quantization only the film's potential acts.

In the present work the hydrogen-type system is studied by means of variation technique without any limiting restrictions on the value of the magnetic field.

By means of two variation parameters the wave function and the energy of the ground state are obtained. The evolution of wave-function is studied in a wide range of magnetic field's changeover. It is shown, that in the case of extreme strong fields the system is described by means of Landau states, while in the case of extreme weak fields — by means of the states of a hydrogen-type center. In the case of moderate fields the state of system is considered to be a peculiar symbiosis of the two extreme cases.

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