PECULIARITIES OF ELECTRON-PHONON INTERACTION IN QUANTUM WIRE EMBEDDED INTO SEMICONDUCTOR MEDIUM (HgS/CdS)

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In this paper there is investigated the shift of qround electron band as a function of radius of quantum wire (QW) embedded into semiconductor medium due to the interaction between an electron and confined, interface phonons. The same problem have been already studied by different authors [1-2] who have been used the various physical models and mathematical approximation to describe the dependences of quasiparticle spectral characteristics on QW sizes. Namely, these approximations on QW sizes. Namely, these approximations were: i) introduction of the average effective mass for the electron moving in heterosystem, where its real effective masses are different in different media; ii) considering of the infinite barrier in the media interface.

In the proposed paper the electron spectrum and wave functions are obtained within the model exactly taking into account the skips of the potential energies and effective masses in the interface between the QW and the medium. As a result, the complicated dependence of the electron energy on the longitudinal quasimomentum is obtained. The total orthonormalized set of the electron wave function is established. In the framework of dielectric continuum model the spectra of L- and I-phonons are found. The Hamiltonian of electron-phonon system is obtained in the representation of occupational numbers over the all variables of the system.

Using the method of quantum-mechanical Green functions, the renormalization of electron ground band due to the interaction with L- and I-phonons is investigated for the HgS QW embedded into CdS semiconductor medium. There is analysed the influence of confined and interface phonons, discrete and continuous part of the spectra on the formation of ground band shift and its dependence on QW sizes. It is shown that the main features of spectral characteristics in quasi one-dimensional system are qualitatively similar to the same of quasi two-dimensional one [3].

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