

**ELECTRON SPECTRUM RENORMALIZED DUE TO
INTERACTION WITH L- AND I-PHONONS IN QUANTUM DOT EMBEDDED
INTO SEMICONDUCTOR MEDIUM
(GaAs/Al_xGa_{1-x}As)**

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For the last years the quasiparticles spectra and their interaction have been intensively studied in low-dimensional nanoheterosystem (quantum dots, wires and wells) [1]. Herein the different models (dielectric continuum, hydrodynamic continuum, Huang-Zhu model) have been used for the description of phonons; the effective mass approximation or Klein model - for the electrons, holes and excitons.

The interaction of quasiparticles is usually studied within the perturbation theory or different variational methods. The quantum-mechanical Green functions method is used very rare, through it together with the Kubo method, is a universal opportunity to study the problem of quasiparticles interaction and their physical properties in low-dimensional nanoheterosystem.

In this paper, on the base of the general theory developed in [2], the Hamiltonian of the electron-phonon system is obtained in the representation of occupational numbers over the all variables for the QD in semiconductor medium. The Green functions method is modified in order to take into account the configurational interaction in the electron-phonon system.

On the example of GaAs QD embedded into Al_xGa_{1-x}As medium the renormalization of the down part of the electron spectrum is studied due to the interaction with L- and I-phonons. There is analysed the dependence of the renormalized spectrum on the QD size and on the Al concentration (x) in Al_xGa_{1-x}As medium in the frames of direct band. The partial contributions of L- and I-phonons into the shifts of energy levels are obtained. It is shown that the interaction with confined phonons of QD is a basic one. The half-space L-phonons of the medium essentially influence on the renormalization of the spectrum only for the very small QDs (≤10 nm). The same is concerned to the I-phonons. For the big QDs the interaction between electron and I-phonons weakly influence the electron spectrum. The bigger is the QD size, the bigger becomes the role of discrete states of the spectrum in the formation of shifts of electron levels. The states of continuous spectrum make the contribution an order smaller than the states of the discrete spectrum for the QD of arbitrary sizes.

It is shown that only for the very small QDs the shifts of energy levels depend on the QD radius. For the big QDs the magnitudes of the shifts are close to those ones of the three-dimensional crystal (GaAs).

1. Tkach M., Fiz.tv.tela. (rus), V.39, № 6, P.1109 (1997).
2. Cruz R.M., Teitsworth S.W., Stroschio M.A., Phys.Rev. B, V.52, №3, P.1489 (1995).