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Few-particle intraband dipole transitions in strongly oblate asymmetric ellipsoid QD

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The investigation methods of photon and ion channeling can give important information about the zone structure and the confinement potential character of the investigated quantum dots (QD). [1,2]. In particular, it is essential at the description of the physical processes in QDs with complicated geometry when the problem of quantum confinement of the particles is fundamentally important for the construction of a realistic Hamiltonian of the one-particle or many-particle system localized in QD. In the above-mentioned article [1] based on ion channeling methods through InAs QD there was an investigation of mechanical strain character. The possibility of the strain effect definition in QDs is discussed in the work [3]. It has been shown that in InGaAs/GaAs QDs the barrel-shaped lateral confinement leads to a larger spacing between higher excited states. As the shape of the lateral confinement is similar to the rectangular one for low-level states we can consider the model of QDs confinement potential in the frame of infinitely high QW approximation. The above-mentioned results allow us to consider the electron gas behavior in the ellipsoidal or lens-shape QDs in the scope of the infinite height rectangular quantum confinement potential model. While it can be shown that in the case of the strongly oblate ellipsoidal or lens-shape QDs with the circular cross-section, the in-plane motion in the perpendicular axial direction is confined with the two-dimensional circular oscillator potential [4]. In the proposed work the electron gas behavior in the strongly oblate ellipsoidal QD is discussed in the case when the cross-section is not circular but elliptic. The strong oblation condition of the QD, in that case, will imply that semiaxes a (along OX) and b (along OY) are much greater than semiaxis c (along the axial direction OZ).In the frame of the adiabatic approximation, it is shown that the electron gas is localized in the two-dimensional asymmetric oscillator well in the cross-section of QD. In the frame of the exact solvable Moshinsky model [5], there is given the analytical description of the electron gas behavior in the mentioned system and there is shown the possibility of the realization of the generalized Kohn theorem [6,7,8] in the considered system. The resonance frequencies of the long-wave radiation do not depend on the number of particles.

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