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Numerical modeling InAs/GaAs quantum ring capacitance spectroscopy using non-parabolic approximation. IGOR FILIKHIN, VLADIMIR SUSLOV, BRANISLAV VLAHOVIC, North Carolina Central University — Direct observation for discrete energy spectra of InAs/GaAs quantum dots (QD) and rings (QR) is possible by capacitance-voltage (CV) end far infrared (FIR) spectroscopy [1]. Existing theoretical explanations of experimental data are limited by the parabolic potential model [1,2] and infinite confinement, which they are using. In present work a single subband model for InAs/GaAs QD(QR) is used. The finite confinement band-gap potential is estimated by the band gap difference of InAs quantum object and GaAs substrate [3]. The non-parabolic approximation is defined by electron effective mass dependence on the confinement energy according to the Kane formula. The 3D confined energy problem is solved numerically by the finite element method. Obtained results for single electron levels are in good agreement with the CV spectroscopy. The calculations also reproduce experimental value for the energy-gate-voltage conversion coefficient equal to 7. Our estimation for the magnitude of the electron effective mass agrees with experimental data. The results are compared with the parabolic potential model calculations.
[1] A. Lorke, et al., PRL **84** 2223 (2000).
[2] A. Emperador, et al., PR B. **62** 4573 (2000).
[3] I. Filikhin et al., Modelling Simul. Mater. Sci. Eng. **12** 1121 (2004).

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