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Investigation of Dynamical Parameters of Exciton Confined in CdS Spherical Quantum Dots with a B-Spline Technique

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Abstract: Exciton energies as a function of radii of quantum dots in the range of 5～35 Å are calculated based on effective mass approximation model with the B-spline technique and compared with experimental and other theoretical data for the CdS dots. This method leads to accurate and fast convergent exciton energy, which are in good agreement with experimental data in the whole confinement regime. The effect of penetration of wave function from the inside to the outside of the dots and the effect of dielectric constants are taken into account. The magnitudes of dynamical parameters are discussed. It is found that the different materials surrounding the CdS quantum dot affect not only the potential energy and Coulomb interaction energy of the system, but also the effective masses. The comparison shows that the effective mass approximation model can describe very well the quantum size effects observed experimentally on the exciton ground state energy.

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