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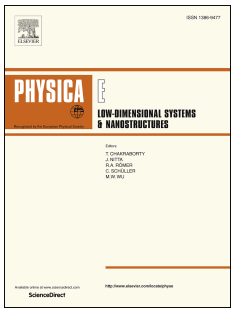

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Recombination energy for negatively charged excitons inside type-II core/shell spherical quantum dots

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Abstract

The recombination energy of isolated neutral exciton and that of isolated negatively charged exciton inside a type-II core/shell spherical quantum dot are studied. Our investigation considers the charge-carriers effective mass discontinuity at the surface contact between the core and shell materials. Although our model omits the effect of the surface polarization, the dielectric-constant mismatch at the nanodot boundaries was taken into account. In order to achieve the exciton and negative trion energies, we proceed by a variational calculation in the framework of the envelope approximation. Our results reveal a strong correlation between the nanodot morphology and the energy spectrum of the neutral and negatively charged exciton.

Keywords: Exciton, Trion, Recombination energy, Core/shell materials, Nanostructures, Quantum dots

1. Introduction

As is well known, the degree of freedom of charge carriers is the ultimate way to distinguish nanosized semiconductor materials. According to the restriction of charge carriers motion in one, two or three spatial directions we can, respectively, talk about quantum wells, quantum wires or quantum dots. Based on this analysis, one can accurately manage the optical, photophysical, photochemical and even catalytic properties of nanomaterials, which is of vital importance in order to invent new electronic and optoelectronic devices and to develop those currently commercialized.

Given that the relevance of optoelectronic and electronic devices is usually related to the degree of knowledge of the physical and the chemical properties of materials of which they are made. Various theoretical works were published in order to contribute to demystify the behavior of some useful properties of materials at nanoscals. For instance,

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