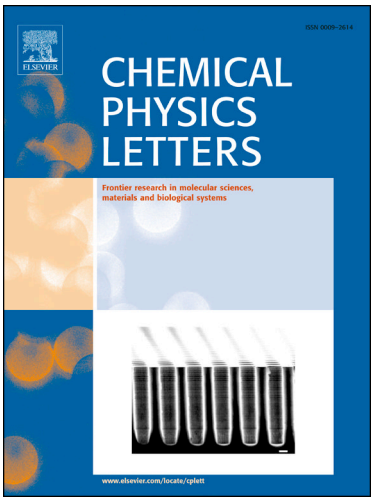

Research paper

Hydrogen-like donor in a core-shell nanowire under electric and magnetic fields

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Hydrogen-like donor in a core-shell nanowire under electric and magnetic fields

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Abstract

The electric and magnetic field effects on the energy spectrum, the charge distribution and the electric dipole moment induced by the electron released from an off-axis donor confined inside the thin shell layer is studied by using the double Fourier series expansion method. The density of states exhibits strongly marked Aharonov-Bohm oscillations induced by the magnetic field, while the electric field modifies the charge distribution. The average electron-donor distance increases slowly as the electric field increases from zero, but then it rises sharply as the electric field exceeds a threshold value forming a giant permanent dipole moment.

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Keywords: Cylindrical quantum core/shell, Hydrogenic donor impurity, Aharonov-Bohm effect, Electric dipole moment.

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1. Introduction

Lately, there has been a great deal of attention to the study of quasi-one-dimensional nanostructures such as wires, rods, tubes, owing to their possible applications in fabrication of nanoscale devices with reduced dimensionality [1-4]. Another type of quasi-one-dimensional system so-called nanohelices was recently reported [5]. The presence of a single conducting channel in these structures, parallel to the nanowire axis, enables the