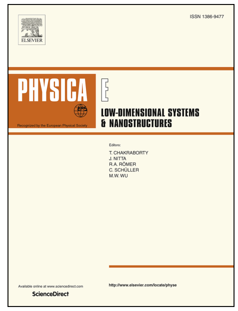
# Accepted Manuscript




Stark shift and photoionization cross section of on-center and off-center donor impurity in a core/shell ellipsoidal quantum dot

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PII: S1386-9477(17)31655-7

DOI: 10.1016/j.physe.2017.12.034

Reference: PHYSE 13005

To appear in: *Physica E: Low-dimensional Systems and Nanostructures*

Received Date: 28 October 2017

Revised Date: 22 November 2017

Accepted Date: 25 December 2017

# Stark shift and photoionization cross section of on-center and off-center donor impurity in a core/shell ellipsoidal quantum dot

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**Abstract**

Within the framework of the effective-mass approximation and by using a variational method, the Stark shift of on-center and off-center donor impurity binding energies and photoionization cross section under a *z*-direction electric field in a prolate (oblate) core/shell ellipsoidal quantum dot has been studied. We have calculated the Stark shift as a function of the core and shell sizes and shapes, electric field, and impurity position. We also discuss the photoionization cross section as a function of photon energy with different core and shell sizes and shapes, electric field strengths, and impurity positions. The results show that the Stark shift depends strongly on the impurity position, it could be positive or negative. The core and shell sizes and shapes also have a pronounce influence on the Stark shift, and the Stark shift changes with them is non-monotonic, especially when the impurity is located at the –*z*-axis, the situation will become complicated. In addition, the core and shell sizes and shapes, impurity position, and electric field also have an important influence on the photoionization cross section. In particular, the photoionization cross section will vanish when the impurity is located at center of spherical core with spherical or prolate shell case at zero field.

**Keywords:** Core/shell ellipsoidal quantum dot; Stark shift; photoionization cross section; Off-center impurity

## 1. Introduction

The low dimensional semiconductor structures such as quantum wells, quantum wires and quantum dots (QDs) have been around for some time, but it still attracts the attention of researchers. Compared with other quantum structures, QDs have the so-called "zero-dimension" structure, which the electron is confined in all three spatial dimensions, therefore the quantum effect is more pronounced. For example, larger binding energy of electronic state, more pronounced quantization of density states and energy levels. Therefore, it has more potential in optical and electronic devices, even in memory storage and quantum computing [1-3].

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