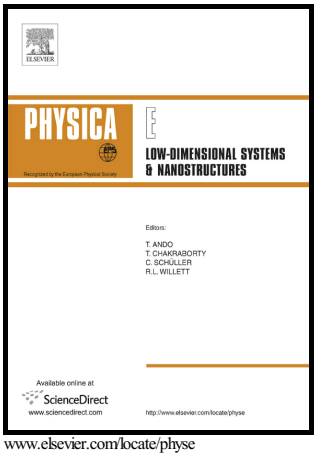
Binding energy and photoionization cross-section of hydrogen-like donor impurity in strongly oblate ellipsoidal quantum dot

D.B. Hayrapetyan, G.L. Ohanyan, D.A. Baghdasaryan, H.A. Sarkisyan, S. Baskoutas, E.M. Kazaryan



www.elsevier.com/locate/physe

PII: S1386-9477(17)31041-X
DOI: http://dx.doi.org/10.1016/j.physe.2017.09.006
Reference: PHYSE12906

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

Received date: 15 July 2017
Revised date: 23 August 2017
Accepted date: 5 September 2017

Cite this article as: D.B. Hayrapetyan, G.L. Ohanyan, D.A. Baghdasaryan, H.A. Sarkisyan, S. Baskoutas and E.M. Kazaryan, Binding energy and photoionization cross-section of hydrogen-like donor impurity in strongly oblate ellipsoidal quantum dot, *Physica E: Low-dimensional Systems and Nanostructures,* http://dx.doi.org/10.1016/j.physe.2017.09.006

Binding energy and photoionization cross-section of hydrogen-like donor impurity in strongly oblate ellipsoidal quantum dot

D.B. Hayrapetyan[11], G.L. Ohanyan[1], D.A. Baghdasaryan[1], H.A. Sarkisyan[1,2,3], S. Baskoutas[4], E.M. Kazaryan[1]

[1]Russian-Armenian University, H. Emin 123, 0051, Yerevan, Armenia

[2]Yerevan State University, A. Manoogian 1, 0025, Yerevan, Armenia

[3]Peter The Great Saint-Petersburg Polytechnical University, Polytechnicheskaya 29, St.Petersburg, 195251, Russia

[4]Department of Materials Science, School of Natural Sciences, University of Patras, GR-26504 Patra, Greece

Abstract

Hydrogen-like donor impurity states in strongly oblate ellipsoidal quantum dot have been studied. The hydrogen-like donor impurity states are investigated within the framework of variational method. The trial wave function constructed on the base of wave functions of the system without impurity. The dependence of the energy and binding energy for the ground and first excited states on the geometrical parameters of the ellipsoidal quantum dot and on the impurity position have been calculated. The behaviour of the oscillator strength for different angles of incident light and geometrical parameters have been revealed. Photoionization cross-section of the electron transitions from the impurity ground state to the size-quantized ground and first excited states have been studied. The effects of impurity position and the geometrical parameters of the ellipsoidal quantum dot on the photoionization cross section dependence on the photon energy have been considered.

Keywords: Hydrogen-like donor impurity, strongly oblate ellipsoidal quantum dot, oscillator strength, photoionization cross section.

1. Introduction

Theoretical and experimental study of the impurity states in quantum semiconductor nanostructures is an actual problem, as the main physical properties these structures depend on the shape and size of the sample, on the shape of the confining potential and on the impurity center position [1-9]. For example, binding energy, oscillator strength, and photoionization cross-section can be manipulated with the help of geometrical parameters of quantum nanostructures [6-8]. Particularly, in [8] the authors investigated the binding energy

[1] Corresponding author at: Russian-Armenian University, 123 Hovsep Emin Str., Yerevan 0051, Armenia. E-mail address: dhayrap82@gmail.com (D.B. Hayrapetyan).