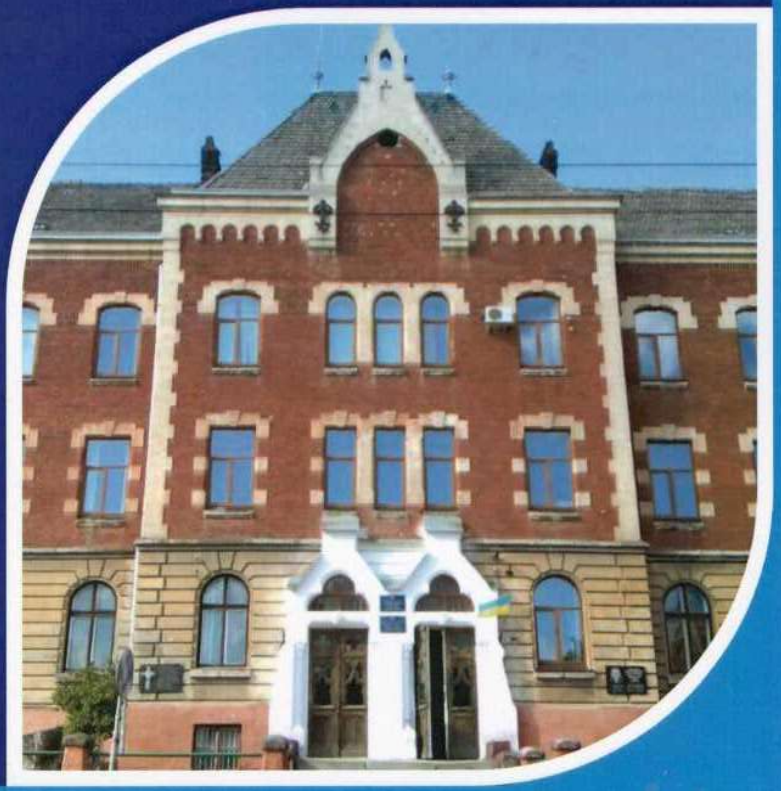
XI-th International Conference

Topical Problems of Semiconductor Physics



MATERIALs of Conference

Drohobych, UKRAINE

May 27-31, 2024

Ministry of Education and Science of Ukraine

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V.E. Lashkaryov Institute of Semiconductor Physics NAS of Ukraine

Scientific Council "Semiconductor and Dielectric Physics" at Physics and Astronomy Department of NASU

Drohobych Ivan Franko State Pedagogical University

XI-th International Conference

TOPICAL PROBLEMS OF SEMICONDUCTOR PHYSICS

Prykarpattya,

Drohobych, UKRAINE

MAY 27-31, 2024

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Actual problems and important achievements of modern semiconductors physics are presented in the Proceedings of the XI-th International Conference “Topical Problems of Semiconductors Physics”. The abstracts are grouped into 7 sections, according to the Conference Thematic: “Section A. New frontiers in semiconductors and their based structures for electronics, optoelectronics, spintronic and sensing”, “Section B. Semiconductor low-dimensional structures: advances in synthesis, characterization, theoretical modeling and applications”, “Section C. The semiconductors for LEDs, solar and related energy technologies and sensor materials”, “Section D. Synthesis, processing and characterization of multifunctional oxide materials”, “Section E. Advanced strategies for smart functional and multifunctional bionanomaterials and biointerfaces”, “Section F. Laser material processing: from fundamental interactions to innovative applications”, “Section G. Modern computational methods and their applications in materials science: Synergy of theory and experiment”. The Proceedings were prepared for publication by the Conference Program Committee and presented in the author’s edition.

Recommended for publication by the Academic Council of Drohobych Ivan Franko State Pedagogical University.

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TABLE OF CONTENTS

Modelling the electric field effect on the optical characteristics of lens-shaped quantum dots

Holovatsky V.A., Holovatsky I.V., Makhanets O.M.

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Molecular beam epitaxy and colloidal chemistry are the main methods for quantum dots creating. Each of these methods does not exclude the other, but only complements the variety of nanostructures that are used in modern nanoelectronics. Epitaxial quantum dots are a large class of a wide range of semiconductor nanostructures grown on a crystal surface by various technological methods [1]. Depending on the semiconductor materials and growing methods, quantum dots of various sizes and shapes are obtained, which affects their optical characteristics, and therefore significantly complicates theoretical research. For modelling, the finite element method is most often used within the integrated platform for numerical simulation COMSOL Multiphysics. In this work, the energy spectrum and wave functions of an electron in a lens-shaped quantum dot were calculated, based on which the influence of the electric field on the oscillator strength of quantum transitions was investigated.

Two models of a lens-shaped quantum dot are considered: a spherical segment and half of an oblate ellipsoid Fig1. For the second model, there are exact solutions of the Schrödinger equation in the form of spheroidal functions of the first kind that make up the orthonormal basis [1-2], which allows to study the effect of the electric field on the energies and wave functions of the electron in the nanostructure by the matrix method. In this study, calculations absorption coefficient for both models were performed using the finite element method in COMSOL Multiphysics. Research results obtained by various methods coincide with high accuracy.

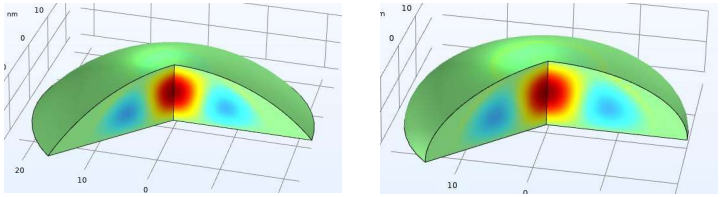

Fig. 1. Models a lens shaped QD: a) spherical segment, b) oblate hemispheroid.

1. Wu S. Anisotropic exciton Stark shift in hemispherical quantum dots. *Chinese Phys B*. 2021. V.30, No 5. P.053201.
2. Baghdasaryan D.A., Hayrapetyan D.B., Kazaryan E.M. Oblate spheroidal quantum dot: electronic states, direct interband light absorption and pressure dependence. *Eur Phys J B*. 2015, V.88, No 9. P. 1-6.

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