

**INTERNATIONAL RESEARCH  
AND PRACTICE CONFERENCE  
“NANOTECHNOLOGY  
AND NANOMATERIALS”**

The NANO-2023 Conference is dedicated  
to the brave men and women serving in the Armed Forces  
of Ukraine, who safeguard freedom and peace in Ukraine

**16-19 of August 2023**

**Bukovel, UKRAINE**

**Abstract book**

**УДК 536:669**

**The International research and practice conference “Nanotechnology and nanomaterials” (NANO-2023).** Abstract Book of participants of the International research and practice conference, 16–19 August 2023, Bukovel. Edited by Dr. Olena Fesenko. – Kyiv: LLC APF POLYGRAPH SERVICE, 2023. – P. 640.

This book contains the abstracts of contributions presented at the International research and practice conference “Nanotechnology and Nanomaterials” (NANO-2023).

The NANO-2023 Conference was organized by the Institute of Physics of NAS of Ukraine with the participation of the University of Tartu (Estonia), the Lviv Polytechnic National University, University of Turin (Italy) and Pierre and Marie Curie University – Paris 6 (France).

NANO-2023 was the 11th conference in the series of NANO-conferences initiated by the Institute of Physics of NAS of Ukraine in 2012 in the framework of FP7 Nanotwinning project. From year to year, they attract more attention and participants. In 2012, the first meeting was held in the format of International Summer School for young scientists «Nanotechnology: from fundamental research to innovations». The 2013 and 2014 conferences were organized in conjunction with the International Summer Schools for young scientists under the same title. In 2013, this event was attended by more than 300 scientists, in 2014-2017, 450 scientists took part and in 2018 it gathered above 650 participants. In 2021 conference was attended by more than 700 scientists from Ukraine, Poland, Italy, Estonia, France, Austria, Germany, Greece, Turkey, USA, Romania, Moldova, Czech Republic, Taiwan, Lithuania, Egypt, Iran, India, Algeria, Indonesia and other countries. In 2021 and 2022 the Organizer Committee has received more than 500 application forms from about 25 countries of the world each years.

The NANO-2023 conference brought together leading scientists and young researchers from many countries of the world. This year its topics were as follows: Nanobiotechnology for health-care; Nanochemistry and biotechnology; Nanocomposites and nanomaterials; Nanoobjects microscopy; Nanooptics and photonics; Nanoplasmonics and surface enhanced spectroscopy; Nanoscale physics; Nanostructured surfaces; Physico-chemical nanomaterials science.

Website of the NANO-2023 conference: <http://nano-conference.iop.kiev.ua>

ISBN: 978-617-8092-32-0

© International Science and Innovation cooperation, Technology transfer Department of Institute of Physics of NAS of Ukraine, 2023

## Electric field effect on the absorption coefficient of hemispherical quantum dots

*Holovatsky V. A.<sup>1</sup>, Holovatskyi I. V.<sup>1</sup>, Duque C. A.<sup>2</sup>*

<sup>1</sup> *Institute of Physical, Technical and Computer Sciences, Chernivtsi National University after Yuriy Fed'kovych, Kotsiubynsky str, 2, Chernivtsi-58002, Ukraine*

<sup>2</sup> *Grupo de Materia Condensada-UdeA, Facultad de Ciencias Exactas y Naturales, Instituto de Física, Universidad de Antioquia, Medellín AA 1226, Colombia*  
*E-mail: v.holovatsky@chnu.edu.ua*

The increased interest in hemispherical quantum dots [1-2] is caused by the outstanding properties and potential applications of such nanostructures in optoelectronic devices such as photodetectors, solar cells, and others.

This study presents a simple model within the effective mass approximation to describe the effect of an external electric field on the energy structure and wave functions of electrons and holes in type II hemispherical quantum dots. The case of a uniform electric field perpendicular to the surface on which a hemispherical quantum dot is grown is considered.

The solutions of the Schrödinger equation were obtained by the matrix method on the orthogonal basis of the exact wave functions of quasiparticles in this nanostructure without the influence of an electric field.

It is shown that the shift of the energy levels of the electron localized in the core of the nanostructure depends linearly on the electric field. And the shift of energy levels of the hole is non-linear.

The values of the wave functions expansion coefficients show that new states of quasiparticles are formed from several old neighboring states, the number of which increases with increasing electric field intensity.

At the same time, the basic state, which makes the greatest contribution to the formation of a new state, can change. Such a change in the symmetry of the quasiparticle state occurs in the case of energy levels anticrossing. As a result, the oscillators strength of quantum transitions, which are forbidden in the absence of an electric field, increase significantly.

The optical transition energies and the absorption coefficient dependences on external electric field are investigated.

---

1. Wu, S., Song, Y., Han, S., Yang, Y., Guo, F., & Li, S. *Chinese Physics B*, 2021, 30, 053201.

2. Mohammadi, S. A., Khordad, R., & Rezaei, G. *Physica E: Low-Dimensional Systems and Nanostructures*, 2016, 76, 203–208.

Наукове видання

**The International research and practice conference**  
**"Nanotechnology and nanomaterials"**  
**(NANO-2023)**

**Book of abstracts is published in authors' edition without  
modifying by the Organizing Committee**

Head of Organizing Committee:

*Dr. Olena Fesenko*, Institute of Physics of the NAS of Ukraine

Design and layout: *Volodymyr Havlo*

Technical support of the International conference (NANO-2023): Junior Researchers of the Institute of Physics of the NAS of Ukraine: A. D. Yaremkevych (media assistance), Y. S. Kifiuk (sound equipment and photo report), O. P. Budnyk (registration of participants and general questions), V.O. Hryn (general questions) and P.V. Golub (technical support), Leading Engineers of the Institute of Physics of the NAS of Ukraine: M. V. Rallev (information and transportation support), S. Starinets (registration support) and V. S. Tkachenko (poster session support).

Здано в набір 24.07.2023. Підписано до друку 11.08.2023.  
Формат 60x90/16. Папір офсетний. Умовн. друк. арк. 34,5. Зам. № 262.

ТзОВ "Галицька видавнича спілка"  
вул. Тугана-Барановського, 24, м. Львів, 79005,  
тел.: (032) 276-37-99  
Свідоцтво суб'єкта видавничої справи ДК № 7408 від 27.07.2021 р.

Друк: ТзОВ "РВФ "Поліграф-сервіс"  
вул. Грабовського 11/13, м. Львів, 79008  
тел.: (067) 673-85-75  
Свідоцтво про внесення суб'єкта видавничої справи до державного  
реєстру видавців, виготовників і розповсюджувачів видавничої  
продукції серія ДК № 3900 від 14.10.2010