ABSTRACT BOOK

International research and practice conference:

NANOTECHNOLOGY AND NANOMATERIALS (NANO-2022)

25-27 August 2022
Lviv, Ukraine

INTERNATIONAL RESEARCH AND PRACTICE CONFERENCE "NANOTECHNOLOGY AND NANOMATERIALS"

(The NANO-2022 Conference is dedicated to the International Year of Basic Sciences for Sustainable Development)

25-27 of August 2022

Lviv, UKRAINE

Abstract book

УДК 536:669

The International research and practice conference "Nanotechnology and nanomaterials" (NANO-2022). Abstract Book of participants of the International research and practice conference, 25–27 August 2022, Lviv. Edited by Dr. Olena Fesenko. – Kyiv: LLC APF POLYGRAPH SERVICE, 2022. – P. 542.

This book contains the abstracts of contributions presented at the International research and practice conference "Nanotechnology and Nanomaterials" (NANO-2022).

The NANO-2022 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-2021 was the ninth conference in the series of NANO-conferences initiated by the Institute of Physics of NAS of Ukraine in 2012 in the framework of FP7 Nanotwining 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 the Organizer Committee has received more than 800 application forms from about 25 countries of the world.

The NANO-2022 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-2022 conference: http://nano-conference.iop.kiev.ua

In order to support the formation of the communications between the scientific and innovation communities the EEN-Ukraine consortium together with EEN partners in Germany organized STARTUP2022 competition for selection 10 the best Ukrainian startups for participation in the Start-up BW Summit, Germany.

ISBN: 978-617-8092-32-0

Welcome to International Conference «NANOTECHNOLOGY AND NANOMATERIALS»!

It gives me a great pleasure to welcome you all at the International Conference "Nanotechnology and nanomaterials" (NANO-2022) that will be held in Lviv from August 25 to 27, 2022. Its aim is to promote scientific contacts and discussions between researchers representing various fields.

Previous NANO Conferences, held in Ukraine in 2013-2021, allowed the participants, including young scientists, to familiarize with current research and application problems in this area and thus forward implementation of nanotechnologies into innovations meeting public needs. The events also gave the opportunity to young and early-career researchers to attend lectures of internationally recognized experts and roundtable discussions on the emerging fields in nanosciences and nanotechnologies.

Our previous International Conferences and Summer Schools received positive feedback from international experts and from the media. Now we are holding the 10th such meeting, for which we are deeply grateful to its indefatigable initiator and organizer, Dr. Olena Fesenko and all her assistants, as well as to the universities and institutes that hospitably welcome the participants.

This year above 600 registration forms have been received from scientists representing more than 30 countries. We especially appreciate the participation in the conference of our foreign colleagues, both those who attend here and those who communicate their works remotely.

The fruitful cooperation of scientists is highly important not only to science itself. It helps us to overcome political and war conflicts and misunderstandings and to find our just peaceful future, which is now vitally important not only to Ukraine but also to other countries.

I wish the participants of the Conference to successfully share and broaden their knowledge in nanoscience and nanotechnologies, to advance the networking and launch new contacts between academia and research players in this area and thus to create a good basis for further practical contributions.

May good health serve us and promote creative success in our research!

Academician of NAS of Ukraine,
Professor **Anton G. Naumovets**

Magnetic field effect on the optical properties core-shell type II quantum dot

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This study presents a simple model within the effective mass approximation to describe the magnetic field impact on the energy structure and interband optical quantum transitions in type-II ZnTe/CdSe spherical quantum dots. The dependencies energy spectra and wave functions of an electron and hole on the magnetic field are calculated by the diagonalization method for spherical quantum dots different sizes.

It is shown that the magnetic field violates the spherical symmetry of the system and takes off the degeneration of energy spectrum with respect to the magnetic quantum number. The energy of the electron in the states with $m \geq 0$ increases when magnetic field enhances; for the states with $m<0$ these dependences are non-monotonous (decreasing at first and then increasing). Moreover, the ground state of electron, which localized in the spherical shell CdSe, is formed alternately by the lowest states m=0, -1, -2, … with increasing the induction of magnetic field [1-2] (Aharonov Bohm effect). The hole is localized in the core and it ground state m=0 at all range magnetic field value.

The absorption coefficient and oscillator strength of the quantum transitions are calculated as function of the magnetic field induction [3].

*1. Holovatsky V., Voitsekhivska O., Bernik I. Effect of magnetic field on electron spectrum in spherical nano-structures// Condens. Matter Phys.-2014.- **17**, N 1, P.13702.*

*2. Holovatsky V., Bernik I., Yakhnevych M. Effect of magnetic field on electron spectrum and probabilities of intraband quantum transitions in spherical quantum-dot-quantum-well// Phys. E Low-Dimensional Syst. Nanostructures.-2016.**-83**, P.256-262.*

*3. Al E. B., Kasapoglu E., Sakiroglu S., Sari H., Sökmen I., Duque C. A. Binding energies and optical absorption of donor impurities in spherical quantum dot under applied magnetic field// Phys. E Low-Dimensional Syst. Nanostructures.-2020.-**119**, 114011.*

Optical absorption in core-shell quantum antidot with donor impurity under applied co-directed electric and magnetic fields

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The dependence of the energy spectrum on the size of nanoparticles, the effect of external fields, and impurity presence in nanoparticles give great potential for the practical application of quantum dots in optoelectronic systems such as light-emitting diodes and flat light-emitting panels, lasers, photodetectors, cells of solar panels and photoelectric converters.

Theoretical studies of the co-directed electric and magnetic fields influence on an electron energy spectrum and wave functions are fulfilled in the multilayer spherical quantum dot (MSQD) $Al_{0.3}Ga_{0.7}As/GaAs/Al_{0.3}Ga_{0.7}As$ with off-center donor impurity. The calculations were done within the effective mass approximation and the nanosystem rectangular potential profile by the matrix method using the exact electron wave functions in the nanosystem without the external fields and impurity effects [1]. In this paper it was investigated external fields combined effect and core size on the electron energy spectrum, binding energies of an off-center hydrogenic donor impurity and optical absorption coefficients.

For the electron energy spectrum, the ground state shifts to a lower energy region as the electric field strength increases. The magnetic field shifts all energy levels to a higher energy region. The magnetic field effect is stronger for larger nanostructures.

The linear $\alpha^{(1)}(\omega)$, third-order nonlinear $\alpha^{(3)}(I,\omega)$ and total optical absorption coefficients are defined by taking into account quantum transitions from ground to several excited states. The results show that external fields and impurity presence effects cause significant changes on the optical absorption coefficient. For nanosystems with a bigger core, the external fields effect is stronger. The absorption coefficients maximums shift to the region of higher energies with the increase of the magnetic field induction.

*1. Holovatsky V., Chubrey M., Voitsekhivska O. Effect of electric field on photoionisation cross-section of impurity in multilayered quantum dot// Superlattices and Microstructures. -2020.- **145**.-P.106642.*

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The **Enterprise Europe Network** is a service that provides support for Small and Medium-sized Enterprises (SMEs) with international ambitions. Co-funded by the European Union's COSME and Horizon 2020 programmes, the Network's aim is to help businesses innovate and grow internationally.

The Enterprise Europe Network was launched on 7 February 2008 by former EU Commissioner Günter Verheugen. The Enterprise Europe Network combines the previous Euro Info Centres and the Innovation Relay Centres. From 2008 to 2014, the Network was co-financed by the EU's Competitiveness and Innovation Framework Programme (CIP), in cooperation with institutions at national and regional levels. From 2015-2020, the Network is co-financed under the European Union's programme for the competitiveness of SMEs [6] (COSME) and Horizon 2020[7].

Under the responsibility of the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, the Enterprise Europe Network is managed by the Executive Agency for Small and Medium-sized Enterprises (EASME).

The Network is active in more than 60 countries worldwide. It brings together 3,000 experts from more than 600 member organisations, including:

- chambers of commerce and industry
- technology poles
- innovation support organisations
- universities and research institutes
- regional development organisations

Enterprise Europe Network advisory services support businesses seeking to expand into international markets. The services cover a wide range of regulatory areas and market intelligence:

- Compliance with EU regulations and standards (e.g. CE marking)
- Access to international markets – market intelligence and capacity building
- International public contracts –access to cross-border procurement and EU tender opportunities
- National and regional finance and funding – identification of sources of finance and investor-readiness training
- EU funding schemes and application support
- Intellectual property rights (IPR) – patents and IPR applications and exploitation strategies
- Energy and resource efficiency – identification of technologies and finance opportunities
- Management improvement – capacity building

Enterprise Europe Network innovation support services[4] are available based on an assessment of the needs and development phase of the business.

At an entry level, Network services include:

• information on innovation-related policies, legislation and support programmes

• links with local innovation stakeholders

• information about access to local sources of funding/support

Network experts can provide one-to-one services to support innovation capacity building. Services include innovation audits, advice on intellectual property, marketing and access to finance.

Finally, the Network provides key account management services to businesses benefitting from the Horizon 2020 SME instrument programme[5], part of the European Innovation Council (EIC) pilot.

In 2017, Ukraine joined the European Enterprise Entrepreneurship Network (EEN) within the framework of the COSME program, which promotes the competitiveness and innovative development of small and medium-sized enterprises, innovation organizations and institutes / universities. For this purpose in Ukraine was created a Consortium EEN-Ukraine , which included representatives of business and government agencies, as well as scientific organizations

To contact EEN-Ukraine please follow the website

http://www.iop.kiev.ua/~een/index-en.html or page of Facebook

https://www.facebook.com/EnterpriseEuropeNetworkEU.

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The International research and practice conference "Nanotechnology and nanomaterials" (NANO-2022)

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 in the course of the International conference (NANO-2022). Junior Researchers of the Institute of Physics of the NAS of Ukraine A.D. Yaremkevych (media assistance) and Y.S. Kifiuk (sound equipment and photo report), Leading Engineers of the Institute of Physics of the NAS of Ukraine Maksym Rallev (informational and transportation support), O.P. Budnyk (registration of participants and excursions), Pavlo Golub (registration of participants and general questions), Vitaliy Tkachenko (registration support), A.V. Klochek (registration of participants and general question), T.V. Tsebrienko (registration support).

Підписано до друку 04.05.2022. Формат 60x84/$_{16}$.
Папір офсетний. Друк офсетний. Умовн. друк. арк. 3,48.
Наклад 300 прим.Зам. № 46190.

ТзОВ "Галицька видавнича спілка"
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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

STARTUP2022 event – in order to support the formation of the communications between the scientific and innovation communities the EEN-Ukraine consortium together with EEN-Germany partners organized STARTUP2022 competition for selection 10 the best Ukrainian startups for participation in the Start-up BW Summit, Germany.

Our publications

Abstracts Book of the 1st International Summer School (2012)
Abstracts Book of the 1st International Summer School and International Conference NANO-2013
Abstracts Book of the 2-nd International Summer School and International Conference NANO-2014
Abstracts Book of the 3-rd International Conference NANO-2015
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O. Fesenko, L. Yatsenko (eds.), Nanocomposites, Nanophotonics, Nanobiotechnology, and Applications, Springer Proceedings in Physics 156, DOI: 10.1007/978-3-319-0661-0, ©Springer International Publishing, Switzerland 2014

O. Fesenko, L. Yatsenko, Nanoplasmonics, Nano-Optics, Nanocomposites, and Surface Studies 167, DOI: 10.1007/978-3-319-18543-9, ©Springer International Publishing, Switzerland 2015

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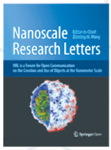

Participants of International Summer Schools and International NANO Conferences – published their articles in Special Issue of Springer Open Journal "Nanoscale Research Letters" (in 2013, 2014 and 2015) dedicated to NANO Conferences. Impact Factor of Journal – 2.779.

www.springer.com/materials/nanotechnology/journal/11671

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