Institute of Applied Physics of Academy of Sciences of Moldova

PROMOTION CATALOGUE

www.h2020-holo.com

The HOLO project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 687328
Welcome to the promotion guide of the Institute for Applied Physics of Academy of Sciences of Moldova (IAP-ASM).

The main objectives of the Institute are: carrying out research in fundamental and applied physics and introducing the results obtained into the national economy.

This catalogue presents descriptions of the scientific divisions of IAP-ASM, the research and innovation activities of the institute, as well as their ongoing achievements. It has been produced within the framework of the HOLO project, funded by the European Commission’s Horizon 2020 Research and Innovation Programme (Grant Agreement No. 687328)
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Welcome to the Institute of Applied Physics of the Academy of Sciences of Moldova!

The main research areas of the Institute are:

✓ Fundamental and applied research into physics and the physico-chemistry of condensed matter: crystalline, noncrystalline and nanostructured materials, atoms and nuclei; electronics and quantum optics, design of high technologies and multifunctional electronic, and optoelectronic and photonic devices;

✓ Fundamental and experimental research into using electricity as a catalyst in heat and mass transfer, in cavitation, in electro-floatation and electro-plasmolysis; modification of surfaces of materials by electro-physical and electrochemical methods; development of high technologies and up-to-date techniques.

In addition to being known among the international scientific community for its fundamental investigations, several scientific schools have also been founded since its establishment, including schools of: Crystallography (acad. T. Malinowski), Electrochemistry (acad. Yu. Petrov), Physics of Semiconducting Materials (acad. S. Radautsan), and Kinetical Physics (acad. V. Kowarski).

Moreover, each laboratory is also actively involved in a number of ongoing national and European projects. At present, the Laboratory of Materials for Photovoltaics and Photonics is leading an EU Horizon2020 Twinning project in boosting the scientific excellence and innovation capacity in digital holographic microscopy of the institute, working towards demonstrating achievements and increased potential on a wider platform with the support of European academic partners. Overall, this promotion guide serves to highlight the accomplishments and continued research of this laboratory as well as the rest of the scientific divisions at the institute.

I hope you continue to follow the scientific developments, collaborations and advancements at the Institute of Applied Physics of the Academy of Sciences of Moldova.

Mihai Macovei, Dr.Sci.
Head of the Institute
phone: + (373) 22 723252, fax: + (373) 22 738149
e-mail: macovei@phys.asm.md
About the Institute: Overview

The Institute of Applied Physics was inaugurated in 1964, resulting from merging the physical laboratories of the Institute of Physics and Mathematics and technical laboratories of the Institute for Electrophysical Problems. In the 1990s, certain departments of the Institute decided to jointly form two independent research centres, namely: the International Laboratory of Superconductivity and Solid State Electronics of ASM; the Centre of Optoelectronics of ASM, together with IAP (with its Materials Science Centre, the Electrophysical Studies Centre and the Theoretical Physics Centre) and also the Specialized Bureau of Design and Technology in Solid-State Electronics represented physical-technical profile of the ASM.

In the 2006, the Centre of Optoelectronics, the International Laboratory of Superconductivity and Solid State Electronics joined the Institute of Applied Physics again. Within more than 40 years of its existence, the Institute of Applied Physics, as the only scientific physical institution in the Republic of Moldova, has made a major input in not only the advancement of science but in the development of various aspects of the republican economy.

The Institute is known to the abroad/worldwide scientific community not only for its fundamental and applied investigations. Several scientific schools have been founded since its establishment, e. g. of Crystallography (acad. T. Malinowski), of Electrochemistry (acad. Yu. Petrov), of Physics of Semiconducting Materials (acad. S. Radautsan), of Kinetical Physics (acad. V. Kowarski), Physics of Noncrystalline Materials (acad. A. Andriesh). Today, the Institute is proud to have acad. S. Moskalenko and acad. V. Moskalenko as the heads of the schools of Solid State Theory and of Nuclear Physics; and acad. M. Bologa as the head of the school of Intensification of Heat- and Mass-Transfer.

Today, the Institute of Applied Physics at the Academy of Sciences of Moldova is comprised of 10 laboratories highly-skilled and technologically advanced across their respective domains.
Currently the Institute employs 245 persons, among them - 167 researchers, 26 doctors-habilitate and professors, 92 Ph.D., 6 ASM Academicians, 1 ASM Corresponding Member, 39 young scientists (under 35).
Fig. Dynamic of scientific publications of the last 6 years

IAP_ASM has been steadily producing scientific publications during the past few years while also illustrating an increased impact factor (IF) during their body of work. Each research laboratory within the institute has produced a range of local and international writing collaborations demonstrating important findings and research within their respective fields. References of some of these recent publications are available in the following section outlining each research laboratory in greater detail.
“Elektronnaya obrabotka materialov”

The journal Elektronnaya obrabotka materialov was founded by the Academy of Sciences Moldova and the Institute of Applied Physics in Chisinau, Republic of Moldova. It was created in 1965 under the initiative of academician B. R. Lazarenko, an outstanding expert in electrical discharge machining.

As a non-profit and non-commercial journal, this peer-reviewed scientific source publishes both original and review papers on topical theoretical themes and practical areas of application of electroerosion and electrochemical methods of materials processing; on physical and chemical methods of obtaining macro- micro- and nano-scale materials and investigations of their properties; on electrical processes in technology, chemistry, in the process of treatment of biological products and foodstuffs; on electromagnetic fields in biological systems.

The English version of the journal, titled, Surface Engineering and Applied Electrochemistry is distributed by Springer and widely available online.

**Thematic scope of papers:**
- Investigations of macro- micro- and nano-scale materials: Physical and chemical methods of their fabrication;
- Surface treatment by electro-erosion and electrochemical methods;
- Engineering: electrical processes in chemistry and technology;
- Electrical methods of processing biological products and foodstuffs; electromagnetic fields in biological systems
- Devices and equipment.

**Scientific Electronic Library**

**National Bibliometric Instrument** stores, classifies and measures public data regarding scientific publications of researchers from the Republic of Moldova. This refers specifically to scientific articles published in national scientific journals of A, B and C categories (especially those found in electronic format), evaluated and accredited according to the requirements approved by the Supreme Council for Science and Technological Development (SCSTD) and the National Council for Accreditation and Attestation (CNAA). The repository is being progressively updated with new articles and in time aims to become an important database of periodicals, that provides relevant data for evaluation of research results, researchers personal merits and for decision support systems.


**Publication of papers in either Russian or English and free-of-charge.**

**Contacts:**
Elektronnaya Obrabotka Materialov
5 Academiei str., MD-2028
Chisinau, Rep. of Moldova
phone: + (373 22) 73 80 49
fax: + (373 22) 73 81 49
[eom@phys.asm.md](mailto:eom@phys.asm.md)
The laboratories of the scientific divisions within the Institute of Applied Physics are well-equipped to support and engage the research of its staff and students. These are some of the main scientific equipment available for use within the institute.

Digital holographic microscope

Closed cycle cryogenic installation

Terrestrial station for monitoring atmospheric parameters

Xcalibur E X-ray Diffraction System from Rigaku Oxford Diffraction

Optical microscope XLC-101

Nanotester PMT-NI-02

Scanning electron microscope TESLA B-300
International Collaboration

The Institute of Applied Physics of the Academy of Sciences of Moldova prioritises their research and development activities on an international level, regularly collaborating with a number of well-known and highly-respected academic institutions worldwide. They have been involved in numerous bi-lateral and multilateral projects, reviewing scientific papers, working on joint research and participating in conferences and seminars.
Central and Eastern European Conference on Thermal Analysis and Calorimetry (CEEC-TAC, www.ceec-tac.org) has become a forum where researchers can meet, present their work, explain their results and discuss the encountered scientific and technical problems of theoretical & applied thermal sciences. Every two years, CEEC-TAC aims to gather scientists from Central and Eastern Europe and invites researchers, in the field of Thermal Analysis and Calorimetry from all over the world, to share experience and knowledge with those working in complementary fields or just using thermo-analytical techniques. Besides the regular conference, we organize working sessions where in a relaxed and informal environment the participants can discuss about their plans and needs, thus fostering new contacts and further collaborations.

The 4th Central and Eastern European Conference on Thermal Analysis and Calorimetry (CEEC-TAC4) is jointly organized with the 26th Symposium on Thermal Analysis and Calorimetry-Eugen Segal of the Commission for TA&C of the Romanian Academy (CATCAR26), and 1st Symposium on Thermal Analysis and Calorimetry in Moldova (MoldTAC1).
The purpose of this workshop is to take advantage of the multidisciplinarity in the modern science and to bring together scientists from various research disciplines and countries (i.e., Moldova and Germany as well as neighbouring countries) in order to discuss the latest developments in the research fields situated at the border of multiple scientific areas. Younger and well–known researchers will have the possibility to meet and talk as well as initiating scientific projects for further application for funding to Alexander von Humboldt Foundation or other German or EU programs.

The workshop will include plenary talks by well-known researchers in various multidisciplinary areas as well as invited and contributed talks on specific border research topics. A poster section will be organized as well. More concretely, the Humboldt-Kolleg will mainly focus on multidisciplinarities involving the following research topics:

• Nanotechnologies: present and feature,
• Quantum dynamics and quantum technologies,
• New materials and applications.

Some laboratory discoveries make a long way to reach their primary beneficiaries – the society and thus to be applied in our everyday life. The game changes when it comes to progress in photonics, as the field of light applications is rapidly developing and strongly correlated with the achievements in the experimental research.

Following the series of LIGHTtalks events that took place in different European countries, the Institute of Applied Physics organized on March 3, 2016 the workshop “Light in life”. It was a LIGHTtalk: “Power of Photonics” event in the framework of LIGHT2015 project founded to mark the International Year of Light ”. Here, the scientific community and industry engineers gather to bring forward and discuss various applications of photonics, their significance and impact to our everyday life. The workshop aimed to highlight innovative, pioneering and efficient technological applications present in Moldavian research and industry of photonics. More information can be found here.
MSCMP 2016 is a biennial international gathering for academics and research-oriented practitioners in the areas of physics and electrochemistry. It is an interdisciplinary conference which aims at creating a forum for further discussions on recent developments and future perspectives and collaboration in the integrated areas of physics and electrochemistry.

“Optical and Digital Holography: Materials and Methods”

This international satellite summer school included course material covering the following topics: Development and application of optical and digital holography methods, computational image data processing, digital holographic microscopy, 3D surface morphology, interferometry and diffractive optics, the industrial application of advanced optical technologies and biomedical optics. The lectures will be delivered by experienced researchers and aimed at about 20 young researchers: MSc, PhD. and Post-docs.

Young Scientist Tutorial will be organized in the frame of the event aimed for young researchers, undergraduate masters, and PhD students, as well as for all those interested in the theme. Topics of discussion include: 1. "XRD - Advanced applications for material science“; 2. "XRF - Standardless analysis of various sample types“.
International Projects

Control of the quantum dynamics of a collection of artificial atoms.

Type: Bilateral project SCSTD (ASM) - Federal Ministry of Education and Research (BMBF, Germany) # 13.820.05.07/GF
Duration: 2013-2015
Division: Lab of Quantum optics and Kinetic processes

This project deals with various new realizations in the field, based on artificial atoms, investigated with a focus on their role in developing novel sources of light as well as on manipulation of the quantum dissipation in these systems.

A rigorous treatment of light interaction with a few-particle quantum-dot sample and a corresponding manipulation, and adequate description of entanglement creation in these systems was performed. This project was funded by Supreme Council for Science and Technological Development (Academy of Sciences of Moldova) and Federal Ministry of Education and Research (BMBF, FRG). Project team was divided into two local teams headed by Mihai Macovei, Dr. Sci. (Institute of Applied Physics, Chisinau, Rep. of Moldova) and Prof. Christoph Keitel (Max Planck Institute for Nuclear Physics, Heidelberg, Germany).

TeraHertz sensors for health protection

Type: International Project, Program ERA.Net Rus Plus Ru ID: 149, Acronym: TERASENS
Duration: 2016-2017
Division: Laboratory of Physics of Semiconductor Compounds Sergiu Radautsan
Laboratory of Materials for Photovoltaics and Photonics.

The main task attributed to IAP-MD in the project will be the fabrication of nanosheets of MoS$_2$ on SiO$_2$/Si, glass and GaN substrates and investigation of the optical properties of these 2D systems. In order to establish the optimal conditions of preparation and achieve the best results regarding their physical properties the fabrication of MoS$_2$ layers on GaN substrate will be done by different methods. To reach the objective from many methods of fabrication, we have chosen atomic layer deposition (ALD) and chemical vapour deposition (CVD) that consist of a controllable set of fabrication parameters for better results on reproducibility and characteristics of samples. IAP-MD completely masters both methods and possesses all necessary equipment.
Spin-liquid and Spin-ice States in Frustrated Rare Earth and Transition Metal Spinels

Type: International project, SCOPES # IZ73Z0_152734  
Duration: 2014-2017  
Division: Laboratory of Physics of Semiconductor Compounds Sergiu Radautsan

The project is aimed at investigation of magnetic frustration effects in transition-metal (TM) and rare-earth (RE) spinels. The TM AB₂X₄ (A=Fe, Mn; B=Sc, Y; X=S, Se) family is interesting due to realization of spiral spin- and spin-orbital liquids. We plan to extend available experimental findings on polycrystalline samples by growing and investigating single crystals. The potential of the RE AB₂X₄ (A=Cd, Zn; B=Er, Yb; X=S, Se) compounds is at the beginning of its exploration. The first experiments performed on polycrystalline CdEr₂Se₄ suggest it is the first spin ice outside the rare-earth pyrochlore series. We will grow single crystals of several members of the RE family and investigate them using advanced local-probe and scattering techniques.

Training and collaboration on material development and process improvements in oil and sugar production

Type: International project, FP7-PEOPLE-2011-IRSES # 295202, acronym - OIL&SUGAR  
Duration: 2012-2016  
Division: Laboratory of Electrophysical and Electrochemical Material Treatment Methods

Material degradation can result in contamination during food production. There is a need for modern corrosion-resistant and cost-effective machinery for industrial processing. The EU-funded OIL&SUGAR (Training and collaboration on material developments and process improvements in oil and sugar production) initiative aimed to improve science and technology research key to oil and sugar production. The researchers undertook multidisciplinary work to tackle the limitations of current production technologies. OIL&SUGAR focused on novel techniques for the surface modification of materials, cutting-edge extraction technology and innovative biocompatible materials. The researchers looked in particular at material degradation during oil and sugar processing. Researchers examined the physical properties of olive oil and showed that wear was a leading cause of corrosion in the production of olive oil. They developed a system to provide a more accurate assessment of wear issues when olive oil is being extracted. OIL&SUGAR came up with a list for the most pressing fields for further investigation and training to support the oil and sugar industries. The new processing technologies and methods proposed by OIL&SUGAR promise to enhance the features of materials, as well as to lower production costs and increase yields in the oil and sugar industries.
Energy - efficient decontamination by UV & cold plasma using metamaterials

Type: International project, NATO # EAP.SFPP 984890
Duration: 2015—2018
Division: Laboratory of Quantum Optics and Kinetic Processes

The main purpose of this Project is decontamination of polluted/infected surfaces and/or liquid ((waters) by interaction with metamaterials, thin films produced by pulsed laser technologies and cold (non-equilibrium) plasma.

The main goal of this project is the design of low-cost and energy efficient environmental monitoring systems for sustainable healthy environment. Combinatorial pulsed laser deposition (C-PLD) and combinatorial matrix-assisted pulsed laser evaporation (C-MAPLE) are simple technologies for transferring and depositing thin, uniform and adherent inorganic and organic nanoparticle films with high versatility and deposition rates. The fabrication of combined multi-oxides, biological sensitive molecules (multi-antibody microarray) with variable composition in miniaturized structures will be achieved by the 2 technologies. The synthesized structures will be used for the detection of NO, SO, CO, chlorine, pesticides, or biological warfare agents. The detection mechanisms and model descriptions of the nano-sensors for the toxic molecules and viruses (comparing their optical absorption) will be proposed.

Aerosol Robotic Network

Type: International project, Aerosol Robotic Network (AERONET) NASA/GFSC (USA) code 618
Duration: 2010-2020
Division: Laboratory of Materials for Photovoltaics and Photonics

The AERONET program (AErosol RObotic NETwork) is a federation of ground-based remote sensing aerosol networks established by NASA and LOA-PHOTONS (CNRS) and is greatly expanded by collaborators from national agencies, institutes, universities, individual scientists, and partners. The program provides a long-term, continuous and readily accessible public domain database of aerosol optical, microphysical and radiative properties for aerosol research and characterization, validation of satellite retrievals, and synergism with other databases. The network imposes standardization of instruments, calibration, processing and distribution. More information at AERONET.
Boosting the scientific excellence and innovation capacity in digital holographic microscopy of the Institute of Applied Physics of the Academy of Sciences of Moldova

Type: International project, H2020-TWINN-2015, # 687328, acronym – HOLO
Duration: 2016-2018
Division: Laboratory of Materials for Photovoltaics and Photonics

The overall aim of the HOLO project is to boost the scientific excellence and innovation capacity in digital holographic microscopy of the Institute of Applied Physics of the Academy of Sciences of Moldova (IAP-ASM) by creating a network with the high-quality Twinning partners: Universität Stuttgart (USTUTT), Tampere University of Technology (TUT) and Intelligentsia Consultants (Intelligentsia). To achieve this aim, the 3 year project will build upon the existing strong research and innovation base of IAP-ASM and its Twinning partners. To boost their scientific excellence and innovation capacity in digital holographic microscopy, the partners will implement a science and innovation strategy focused on two sub-topics:
1. Design and optimization of diffractive optical elements (DOE) to improve digital holographic microscopy (DHM),
2. Development of advanced image processing algorithms for digital holographic microscopy (DHM) using diffractive optical elements (DOE).

Reinforcing cooperation with Eastern Partnership countries on bridging the gap between research and innovation for inclusive and secure societies.

Type: International project, FP7-INCO-2013-9 # 609534, acronym - SECURE-R2I
Duration: 2013-2016
Division: Laboratory of Materials for Photovoltaics and Photonics

The overall aim of the SECURE-R2I project is to reinforce cooperation with Eastern Partnership Countries (EPC) on bridging the gap between research and innovation for Horizon 2020 Societal Challenge 7 “Secure Societies”. The research domains encompassed by “Secure Societies” are broad and include ICT; Security; Nanosciences, Nanotechnologies, Materials (NMP); and Social Sciences and Humanities (SSH). These research domains also form the basis of important economic sectors in the EPC, with many potential benefits for the EU, but which also need European support to increase their exploitation. Addressing this issue, the SECURE-R2I project will assist R&D and innovation (RDI) organisations in EPC via a range of knowledge and technology transfer activities with the support of European specialists. More information at www.secure-r2i.eu
Synthesis, Experimental and Theoretical Study of Bistable Magnetic Materials Based on 3d and 3d-4f Exchange Coupled Clusters: Prospects for Practical Applications

Type: International project, SCOPES # IZ73Z0_152404
Duration: 2014-2017
Division: Laboratory of Physical Methods of Solid State Investigation “Tadeusz Malinowski”; Laboratory of Physics of Semiconductor Compounds “Sergiu Radautsan”

The project is aimed at the synthesis, experimental study and theoretical modeling of new transition metal clusters, mixed transition metal-lanthanoid clusters and 1D, 2D and 3D coordination polymers (CPs) which include these clusters as repeat units. We will focus on systems exhibiting properties promising for practical applications such as single molecule magnet (SMM) and single chain magnet (SCM) behavior, 2D and 3D magnetic ordering, thermally driven spin-crossover (SCO) and light-induced excited spin state trapping (LIESST) effect. The main objective is to reveal the key mechanisms governing those properties of the named compounds which are useful for nanotechnological applications. The research will be conducted by a consortium comprised of the Institute of Applied Physics and Institute of Chemistry (Moldova) and the University of Berne (Switzerland).

The electrophysical processing of whey for obtaining healthy and environmental products: technology and installation

Type: International project, STCU # 6011
Duration: 2015-2017
Division: Laboratory of Thermo- and Hydrodynamic Processes

The framework of the project aims:
• to develop wasteless technologies of electrophysical processing so as to permit the fractionation of whey, having as the main objective the desired isolation of whey proteins and of amino acids in concentrates, in a special combination with minerals, which will make it possible to manufacture a specific range of very healthy food additives and dietetic supplements;
• to determine qualitatively and quantitatively major protein fractions and to analyze amino acids, first, in whey and in protein mineral concentrates obtained during the electrophysical processing of whey;
• to design an installation that will work non-stop, producing no waste, which will allow for fractionation of whey and energy savings.
Digital holographic microscope for biological tissues Research with LabVIEW program

Type: Bilateral project SCSTD (ASM) - Federal Ministry of Education and Research (BMBF, Germany) # 13.823.15.10/GA
Duration: 2013-2015
Division: Laboratory of Materials for Photovoltaics and Photonics

The project objective was to develop a system based on digital holographic microscopy for investigating of biological samples by light scattering. Changing directions of illumination and observation allowed high resolution 3D image reconstruction. The specific aim of the project was to use this system to identify the stages of pre-attachment and haustorial development of biological tissues. Partnered with the Institute of Applied, Optics, University of Stuttgart, Germany.

European Innovation Ecosystem as a gate for supporting FoF Research and Experimentation

Type: International project, FP7-2013-NMP-ICT-FOF # 608899, acronym - I4MS-GATE
Duration: 2013-2015
Division: Laboratory of Materials for Photovoltaics and Photonics

The project objective is reinforcing such leadership European manufacturing industry, and in particular SMEs, demand specific actions to (a) bring new cutting edge ICT technology closer to manufacturing to allow assessment and take up, (b) make visible the impact of the solutions and (c) multiply the competitiveness of European industry as a result. I4MS-Gate is an FP7 CSA that aims at multiplying the innovation impact of more than 160 European ICT for Manufacturing Experiments planned in the I4MS Programme. It aims at amplifying the findings of two European R&D ICT road-mapping activities (Road2Fame and PathFinder). Collaborating with major European stakeholders, I4MS-Gate will deliver the reference European portal on ICT Innovation for Manufacturing SMEs (www.i4ms.eu).
Scientific Divisions

Scientific research at the Institute of Applied Physics of the Academy of Sciences in Moldova is carried out within its laboratories, made for long periods of time, and within research groups or temporary teams including, sometimes, researchers from different IFA laboratories or researchers and/or engineers from other institutions. This section illustrates the 10 high-specialised laboratories of IFA, outlining their expertise, ongoing research and accomplishments.

❖ Laboratory of Quantum Photonics
❖ Laboratory of Physics of Semiconductor Compounds "Sergiu Raduțan“
❖ Laboratory of Theoretical Physics
❖ Laboratory of Electrophysical and Electrochemical Treatment of Materials Boris Lazarenko
❖ Laboratory of Materials for Photovoltaics and Photonics
❖ Laboratory of Physical Methods of Solid State Investigation “Tadeusz Malinowski”
❖ Laboratory of Optoelectronics "Andrei Andriesh“
❖ Laboratory of Quantum Optics and Kinetic Processes
❖ Laboratory of Mechanical Properties of Materials "Iulia Boiarskaia“
❖ Laboratory of Thermo- and Hydrodynamic Processes
Laboratory of Quantum Photonics

Quantum Photonics Laboratory (former Quantum Coherences and Quantum Nano-Photonics Group) is a new, recently formed (2015) division of the Institute of Applied Physics, with the aim to carry out studies and theoretical modelings of the phenomena of quantum coherence and nanophotonics. The research areas of the laboratory include: Quantum coherence; quantum interference; photonics; photonics; nonmaterial quantum cooling; accelerated decay.

The activities of the laboratory focus on the following quantum technologies:

- Quantum optomechanic / nanomechanic nano-resonator systems interacting with electric / magnetic / electromagnetic fields,
- Systems of artificial atoms (quantum dots, quantum wells, quantum circuits etc.) interacting with acoustic and/or electromagnetic fields and/or phonons; interactions, coherences or interference of these particles etc.;
- Quantum dissipation and their manipulation; photon-photon, phonon-phonon, photon-phonon and/or qubit-photon-phonon-mechanical-nanoresonator quantum correlations and entanglement states;
- Photonic crystals, crystals made of photons; photon condensation and manipulation of excitations in quantum atomic lattices, biomaterials and optical / optomechanical / nanomechanical micro-cavities.

Head of laboratory:
Ph.D. Corneliu Gherman
phone : + (373) 22 739805
fax : + (373) 22 738149
email : cornel/at/phys.asm.md
Laboratory of Quantum Photonics: National research projects

Quantum Coherences and Nano-Photonics

**Type:** Institutional project, SCSTD code 14.02.093F, acronym – QUANO  
**Duration:** 2015 - 2018

The aim of this project is the study and theoretical modeling of the phenomena of quantum coherence and nanophotonics. The project goal is to develop theories describing and predicting new effects in various nano-and micro-systerm interacting with intense (non-) coherent radiation, able to form the basis of various practical applications. Proposed studies include the development of new theoretical models and computer simulations elucidative for understanding 4 types of photon / phonon / optomechanical nano-systems.

Effects of quantum optics and kinetics in nanostructures for informatics and advanced biophotonics

**Type:** Institutional project, SCSTD code 15.817.02.07F, acronym – OPTICACUANTICA  
**Duration:** 2015-2018

The control and detecting of the quantum states of the correlated radiator assembly (quantum dots, impurities, atoms, nuclei, etc.) in absorption and emission can be used in the processing of information and optical transmission in the optical integrated circuits and Bioinformatics. The quantum processing based on the phenomenon of corpuscular-wave proprieties of collective modes of interaction oscillations (atom-photon, electron-phonon, optical and magnetic resonance, plazmoni, etc.) will result in hybridization of these subsytems and their further use in various optical equipment extensive applications in telecommunication, information security and Bioinformatics. Cooperative effects of optics and condensed matter physics according of our opinion may lie on the bases of the transmission and processing of information by the cellular tissue through the intracellular space.. Development of nonlinear models of superradiance, ferromagnetism and superconductivity opens the new possiblities in the diagnosis of the new collective processes of coheretization between the cells under influence of external factors in the form of pulses transmitted through neurons of the peripheral nervous system.
Laboratory of Quantum Photonics: National research projects


The Laboratory of Physics of Semiconductor Compounds was founded in 2013 and is named after one of the most famous academicians in Moldova, Dr. Sergiu Radautsan, well-known for his significant role in semiconductor physics. Along with his disciples and colleagues, he developed a technology of obtaining many various ternary semiconducting compounds, that have a wide range of optical, electrical and radiative properties, important for both theoretical and practical purposes.

The activities of the laboratory focus on the following research fields:

➢ Elaboration of the technology of obtaining of ternary and multiterinary compounds. Experimental and theoretical studies of the physics and physical chemistry of the obtained compounds as well as of the magnetic, optical and luminescent properties;

➢ Elaboration of switches with special functional properties on the basis of obtained new materials;

➢ Experimental and theoretical studies in the field of obtaining thin semiconductor films, elaboration of multifunctional electronic, optoelectronic and photonic devices on their basis, elaboration of advanced technologies.
Local research projects

Multifunctional oxycarbogenide and metalloorganic materials with advanced magnetic, absorptive and luminescent characteristics: synthesis, experimental study, modeling and applications

Type: Institutional project, SCSTD code 15.817.02.06F, acronym - MULTIMAGSPEC
Duration: 2015 - 2018

The project is focused on preparation and investigation of spinel compounds based on transition and rare-earth metals, bulk and two-dimensional lamellar crystals of transition-metal dichalcogenides, metalloorganic materials, coordination polymers, and nanoclusters, single-molecule magnets, manifesting advanced magnetic, luminescent and absorptive properties promising for application in spintronics and optoelectronics devices. In collaboration with Laboratory of Physical Methods of Solid State Investigation “Tadeusz Malinowski”

Semiconductor magnetic materials and technologies for applications in spintronic

Type: Project for young scientists, SCSTD code 16.80012.02.03F
Duration: 2016-2017

The project is focused on growth of single crystals of the magnetic semiconductor compounds with spinel structure MnCr$_2$S$_4$ and CoCr$_2$S$_4$. The research aims at determination of correlations between the magnetic ordering and structural and electronic properties as well as at characterization of their magnetic ground state. The study is directed towards elucidating of the origin of multiferroic behavior, of the mechanism of spin ordering in materials with different degree of frustration caused by disorder and peculiarities of their crystal structure.

Investigation of electrical and optical properties of Cu$_2$ZnSi(Se,Te)$_4$ as new materials for energy production from renewable sources

Type: Project for young scientists, SCSTD code 14.819.02.17F
Duration: 2014-2015

Project objectives include: the crystal growth of the Cu$_2$ZnSiSe$_4$ and Cu$_2$ZnSiTe$_4$ by chemical transport reactions and Bridgman method; determination of the chemical composition of the obtained compounds; and the study of the dependence of the optical and electrical properties of crystals of the temperature and/or other experimental conditions of measurements.
Laboratory of Physics of Semiconductor Compounds:
Publications


Laboratory of Physics of Semiconductor Compounds: Patents

chiileov, V.; Parşutin, V.; Paramonov, A.; Bologa, M.; Covali, A. Procedeu de identificare a obiectului electroconductiv si dispozitivul pentru realizarea acesteia. Brevet de Invenţie nr. MD921 din 31-01-2016.


Laboratory of Theoretical Physics

Fields of activity:

- Bose-Einstein Condensation of excitons and atoms in nano- and micro-structures under the influence of the electro-magnetic fields.
- Quantum statistical and kinetic methods for the investigations of the many-body systems, including the applications to the condensed and nuclear matter.

Head of laboratory:
acad. ASM, prof., Dr.Sci. Sveatoslav Moskalenko
phone: + (373) 22 738084
fax: + (373) 22 738149
email: exciton@phys.asm.md
Condensarea Bose-Einstein a excitonilor și atomilor în nano și microstructuri sub influența câmpurilor electromagnetice.

Type: Institutional project, SCSTD code 15.817.02.05F, acronym – CBECEM
Duration: 2015-2018

The main goal of the project concerns the investigations of the phenomenon of the Bose-Einstein condensation (BEC) in a mixt matter-light system formed by the two-dimensional (2D) magnetoexcitons and by the photons accumulated into the microresonator what leads to the formation of the new mixed quasipaticles named as polaritons. The BEC of 2D polaritons on the lower branch of the dispersion law in the point of the in-plane wave vector $k_{||}=0$ will be investigated. In such conditions new quantum states as, for example, the coherent superposition of the acoustical plasmon magnetoexciton and photon states of the plasmoriton-type appear. The BEC of atoms and molecules in the traps in the presence of the two-photon Raman quantum transitions will be studied taking into account the tunneling of the particles between the potential wells of the traps.

CSSDT 15.817.02.08F (2015 - 2018) Qua nlum, statistical and kinetic methods to study of the many particles systems. Applications to condensed and nuclear matters.

Type: Institutional project, SCSTD code 15.817.02.08F, acronym - MECUSTCI
Duration: 2015-2018

In this project new theoretical methods will be developed to investigate the properties of impurity electronic systems strongly correlated. We shall discuss Generalized Wick Theorem (GWT) proposed in 1990 by one of our authors and published in TMF. It contains new element as Kubo cumulants, irreducible Green's functions and correlation functions. Analogous generalization has been proposed by Metzner one year late in PRB. By using this new conception the main theoretical models as Hubbard, Anderson and Holstein have been investigated and in next period of time this study will be continued. The simplest irreducible Green's function will be used and its properties determined. The program of calculations will be generalized to take into account new effect of nuclear matter produced by collision of heavy ions at density and temperature extremal.
Laboratory of Theoretical Physics: Publications


5. MOSKALENKO, S.A.; PODLESY, I.V.; DUMANOV, E.V.; LIBERMAN, M.A. Two-dimensional cavity polaritons under the influence of the perpendicular strong magnetic and electric fields. The gyrotropy effects. Solid State Commun. 2015, 222, 58—64. ISSN0038-1098. doi 10.1016/j.ssc.2015.08.027 (IF: 1,897).


Laboratory of Electrophysical and Electrochemical Treatment of Materials

*Boris Lazarenko*

The Laboratory of Electrophysical and Electrochemical Treatment of Materials *Boris Lazarenko* was created in 2013 as a result of the merge of the Laboratory of Electrochemical Treatment of Materials and the Laboratory of Electroerrosive Methods of material Treatment and Antocorrosion Protection.

Fundamentals of innovative research into the field of electrochemical treatment of materials at the Institute of Applied Physics are connected with the name of its first director, a renowned scientist, academician Boris Lazarenko (1910 – 1979). Those activities were followed and further developed by academician Yuri Petrov (1921-1990), the founder of the first-in-Moldova school of electrochemical technologies for materials treatment. The initial research and elaborations were connected with developing methods based on electrochemical dimensional treatment of metals and obtaining of wear-resistant galvanic coatings, mainly on the basis of iron group metals.

**Head of laboratory:**

cor. memb. ASM, prof., Dr.Sci. Alexandr Dikusar

phone : + (373) 22 738178
fax : + (373) 22 738149
email : dikusar@phys.asm.md
Laboratory of Electrophysical and Electrochemical Treatment of Materials: National Research Projects

Growth of bulk FeCr$_2$S$_4$ single crystals with spinel structure. Characterization of their physical properties.

Type: Project for young scientists, SCSTD code 16.80012.02.25F, acronym – BAMS
Duration: 2017-2018

The main goal of this fundamental research project is growth of high quality bulk single crystals of the ferimagnetic spinel FeCr$_2$S$_4$. The research aims to elucidate the influence of the type and amount of transport agent on the magnetic properties, orbital ordering, structural and electronic properties of obtained single crystals. The estimated fundamental results will be important for physical systems with strong electronic correlations, and for applications due to application potential of spinel materials to design spintronic and magneto-optical devices. In collaboration with Laboratory of Materials for Photovoltaics and Photonics

Physico-chemical methods and engineering aspects of new materials and surfaces obtaining for multiscale technologies

Type: Institutional project, SCSTD code 15.817.02.05A, acronym - MULTI-TECH
Duration: 2015-2018

In this project will be carried out theoretical and experimental research on metal surfaces in order to give them high physico-mechanical and operational properties. Based on this research will be developed new processes and technologies based on metal surfaces modified by electro-physico-chemical methods of processing, in particular, the electro-alloying methods, accelerated thermochemical processing of aqueous electrolytes and electrochemical formation of coatings will be applied for various functional usages and development of equipment for technologies based on new principles. Development of new methods for conducting fine electro-physico-chemical processes that will allow the formation of superficial layers on metal surfaces with specified properties it is envisaged. Obtaining on metal surfaces of surface layers with metastable structures will create prerequisites for a considerable increase of operating characteristics of the working areas of machine. Based on the scientific results obtained will be created technological bases of the processes and will be developed recommendations on technology implementation for hardening of metal surfaces in various fields of the economy.
Laboratory of Electrophysical and Electrochemical Treatment of Materials: Publications


Laboratory of Materials for Photovoltaics and Photonics

The research profile of the Photonics group is "Physics and engineering of non-crystalline materials, photonic and optoelectronic devices". The team carries out the study of optoelectronics and optical sensors, holography, holographic interferometry, new phenomena concerning photo-induced absorption and light amplification in chalcogenide glasses and polymers, as well as elaboration of registration media and holographic information technologies. Traditional developing branch of optics is variety interferometry techniques which are applied as for research as industrial purposes.
This laboratory is the consortium leader for the EU H2020 HOLO project. For more information, please see www.h2020-holo.com/

Their expertise in research areas include:

- Experimental and theoretic investigations of physical and physico-chemical properties of semiconductor crystalline and non-crystalline materials, as well as compounds from environmental friendly and abundant chemical elements.
- Development of advanced and low-cost technologies for obtaining of the mentioned materials and multifunctional photovoltaic and photonic devices on their bases.
- Involvement in national program for valorization of renewable energy sources by studying the solar irradiation and optical properties of variability of atmospheric aerosols in an urban environment (mun. Chisinau), as well as by designing of new simple and efficient technologies for obtaining functional photovoltaic elements.
- Design of new technologies for obtaining of multilayered nanostructures of chalcogenide glasses with different composition and azopolymer structures as well as investigation of their optical properties. Research of new carbazol and non-carbazol layers of azopolymers with possibility of direct recording of optical diffraction elements.
Laboratory of Materials for Photovoltaics and Photonics: National Research Projects

Growth of bulk FeCr$_2$S$_4$ single crystals with spinel structure. Characterization of their physical properties.

*Type:* Project for young scientists, SCSTD code 16.80012.02.25F, acronym – BAMS
*Duration:* 2017-2018

The main goal of this fundamental research project is growth of high quality bulk single crystals of the ferimagnetic spinel FeCr2S4. The research aims to elucidate the influence of the type and amount of transport agent on the magnetic properties, orbital ordering, structural and electronic properties of obtained single crystals. The estimated fundamental results will be important for physical systems with strong electronic correlations, and for applications due to application potential of spinel materials to design spintronic and magneto-optical devices. In collaboration with [Laboratory of Electrophysical and Electrochemical Material Treatment Methods](#).

Investigation of physical properties of off-stoichiometric Cu$_2$ZnSn(S,Se)$_4$ powder samples with different range of structural disorder

*Type:* Project for young scientists, SCSTD code 16.80012.02.24F, acronym – KESTPOWDERS
*Duration:* 2017-2018

The project aims to obtain and research complex physical properties of CZTSSe powder samples to establish a correlation between the stoichiometry and degree of structural disorder and optical and electrical parameters. The obtained fundamental results will be of interest for physics and material science of the kesterite compounds and will be useful for the development of new generation electronic devices.
Synthesis and characterization of new multicomponent chalcogenide semiconductor materials for applications in photovoltaic and photonic

Type: Institutional project, SCSTD code 15.817.02.04A, acronym – FOTOVOLTAICAFOTONICA
Duration: 2015-2018

The main objectives of the projects are: i) Investigation of the properties of absorbing materials from the series Cu₂Zn(Sn, Si, Ge)(S, Se)₄ and of other chalcogenide materials, perspective for thin film solar cells, with cheap, earth abundant and non-toxic materials, which will influence positive to the alternative energy production; ii) Elaboration of the advanced multifunctional structures for the optoelectronic application, investigation and development of optical diffraction elements (ODE) on the nanoscale multilayer structures from chalcogenide glasses (CG) and layers of azopolymers (AZP), extension of the existing registration methods with laser/electron beam, development of the ODE design on the basis of systematic study of CG and AZP structures.
Laboratory of Materials for Photovoltaics and Photonics: Publications


Laboratory of Physical Methods of Solid State Investigation

Tadeusz Malinowski

Laboratory of Physical Methods of Solid State Investigation was founded in 1957 and is named after a famous physicist Tadeusz Malinowski. Their fields of activity include:

➢ X-ray single crystal and powder diffraction structural study of the crystalline materials originated from organic, metal-organic, and inorganic compounds, including semiconductors, superconductors, semimetals, materials with NLO, luminescence, thermoelectric, and photocatalytic properties, galvanic coatings, bentonite adsorbents, metals and alloys; studies of fundamental peculiarities of those structures and investigation of their electronic properties by quantum chemical and molecular dynamics calculations;

➢ Development of the crystal engineering principles for design of coordination polymers, porous materials, nanosized polynuclear systems, cluster based polymers, new magnetic materials, multi-component pharmaceutical compounds and their structural investigation;

➢ Crystallography of supramolecular compounds and the study of non-bonded interactions;

➢ Study of structures of biologically active compounds and structure- properties relationship for psychotropic, antiviral, antimicrobial, antymycotic, antitumor active pharmaceutical ingredients.

Head of laboratory:
assoc. prof., Ph.D. Victor Kravtsov
phone : + (373) 22 738154
fax : + (373) 22 738149
email : kravtsov@phys.asm.md
New non-toxic aromatic carboxylate derivatives with role in plant growth regulation: from synthesis and structural investigations to biological tests (CAREPLANT)

Type: Bilateral project SCSTD (ASM)- Romanian National Authority for Scientific Research # 16.80013.5007.04/Ro
Duration: 2016-2018

The project CarePlant aims to obtain non-toxic compounds with role in plant growth regulation, in order to improve vegetable production, a priority not only in both countries, but worldwide. The objectives of the project are obtain, characterize and biological testing new aromatic carboxylate derivatives with low toxicity and high biodegradability, as well as plant growth regulators. The new compounds will be characterized by physicochemical (FTIR-ATR, RMN, MS), thermal (TGA/DSC) and structural (X-ray single-crystal and powder diffractions) methods essentials for establishing the structure, determining intermolecular interactions and the existence of polymorphic forms. Beside experimental investigations, quantum chemical calculation will be used to obtain more complete and reliable information about the molecular system. The effect of compounds on rooting vegetable seedlings, seeds germination capacity and plant growth regulation in correlation with photosynthesis and cellular respiration will be studied.
Laboratory of Physical Methods of Solid State Investigation

Tadeusz Malinowski: National research projects

Crystal engineering approach for design and tuning the architecture of functional metal-organic materials

Type: Project under state programme "Design-ul substanțelor chimice și dirijarea arhitecturii materialelor pentru diverse aplicații", SCSTD (ASM) # 16.00353.50.05A
Duration: 2016-2017

The objective is to develop the rational protocols for the directed fabrication of perspective MOMs with combination of useful properties, inclusion/luminescence/catalysis; inclusion/magnetism; inclusion/biologic activity.

• To produce MOMs by connecting rod-or square-like organic moieties with inorganic ions or clusters. Tuning crystal structure by single-crystal-to-single-crystal transformations. Tailoring of material's properties would be realized by appropriate choice of starting components.
• To implement the single crystal X-ray structural study of fabricated materials.
• To study the structure – properties relationship with attraction of arsenal of available investigation techniques.
• To make efforts for preparation of Horizon 2020 project.

Design, preparation and study of metal-organic mixed-ligand materials with useful properties based on transition metals and polydentate ligands

Type: Project for young scientists, SCSTD code 16.80012.02.05F, acronym – DESMMOLIGMIXT
Duration: 2017-2018

The project is aimed on directed design, and synthesis of new MOMs with predicted composition, architectural topology and specific properties. The objectives of the project are: 1. Design of perspective MOMs with the combination of useful properties - absorption, luminescence, catalysis, magnetism, biological activity [3-5]. 2. Use of polydentate ligands with two or more donor atoms and transition metals in developing of the design. 3. Implementation of the single crystal X-ray structural study and spectroscopic characterization of the fabricated materials, and analysis of homogeneity of obtained materials using the facilities of powder diffractions. 4. Study of the structure – properties relationship for new coordination compounds with the attraction of arsenal of the available in the team disposal investigation techniques.


Laboratory of Optoelectronics

Andrei Andriesh

The scientific activity of the LO is focused on the investigations of the electrical, optical, photoelectrical and luminescent characteristics of different binary and ternary vitreous chalcogenide semiconductor systems, also called chalcogenide glasses. In the center of attention are the following issues: obtaining of photosensitive thin films from chalcogenide glasses; elaboration of registration media of optical and holographic information; development of different fiber optic sensors for the IR spectrum, of photonic and optoelectronic devices.

Research areas include:

➢ Production technology and optical spectroscopy of chalcogenide glasses, optical fibers, amorphous layers including metallic impurities doped with rare earth elements, polymer nanocomposite materials coordinated with lanthanides.

➢ Study of electrical, optical, photoelectrical, luminescence and photoinduced phenomena in non-crystalline semiconductors and optical fibers.

➢ Theoretical study of the electronic and vibrational dynamics in quantum small systems (nanostructures) and quantum molecular systems under the action of external fields (electric, magnetic, high-intensity laser radiation).

➢ Elaboration of photonic and optoelectronic devices (photocells; recording media; gas, microdeformation, temperature, ir and ionizing radiation detectors).
Laboratory of Optoelectronics *Andrei Andriesh*: National research projects

Elaboration of new nanostructured optical materials from composites based on polymers-inorganic semiconductors with practical applications.

Type: Institutional project, SCSTD code 15.817.02.03A, acronym - MONPSA-MMXV
Duration: 2015-2018

The nanocomposite materials from chalcogenide glasses and organic polymers-inorganic semiconductors are attractive for different practical applications due to their low-cost, simple processing, mechanical hardness, variation of the chemical composition using the commercial chemical elements. The main objective of the project is the elaboration of new nanostructured optical materials from chalcogenide glasses and nanocomposites on the base of polymers-inorganic semiconductors with high refractive index (n≥1.8) for fabrication of diffractive elements for practical applications in photonics and optoelectronics. The project also will include theoretical calculations and analysis of spectral characteristics of nanostructures and nanocomposite materials.

Optical diffractive elements for protection products of national economy

Type: Project for young scientists, SCSTD code 16.80012.50.22A, acronym – PROTECTODUS
Duration: 2017-2018

The main goal of the Project is elaboration of optical diffractive elements and complex diffraction structures based on chalcogenide glasses, characterization and optimization of parameters of obtained elements and structures to selecting the best system one. In collaboration with Laboratory of Materials for Photovoltaics and Photonics


Laboratory of Quantum Optics and Kinetic Processes

Research focuses on quantum and nonlinear optics and their applications, such as laser spectroscopy, ion trapping and low density systems, quantum cryptography and communication, as well as physics of multi-phonon and multi-photon processes in the solid state and molecular systems in the external fields. However, other subjects of non-crystalline solids and soft matter physics, i.e. nucleation theories, computer simulation of stochastic multi-agent herding models, are also investigated.

Fields of activity:

➢ Developing multi-quantum nonlinear processes in the environments of the multiple radiators (quantum dots impurutăți atoms, etc.) in which the phenomenon of cooperative directing and transmission of information to be revealed by studying the statistics of field.

➢ Studying cooperative phenomena of quantum optics and of quantum biophotonics in order to manage and to transmit the information in nanostructures, molecular systems and neural systems.

➢ Quantum information processing using the concept as quantum separability and inseparability, quantum discord between two or more subsystems in case of their cooperative interaction.
Quantum simulations and information with trapped ultracold atoms

Type: Bilateral project SCSTD (ASM) - the National Research Council (CNR, Italy)
# 15.820.18.02.04/It
Duration: 2015-2016

The aim of this project was the description of new nonlinear collective phenomena like entangled and disentangled effects between more large atomic systems, which appear in the muti-quantum processes of interaction of ultra-cold atoms with cavity electromagnetic field for further applications in quantum processing of information. The progress in manipulating and controlling of the trapped neutral atoms in optical lattices by quantum optical exchanges between them open novel applications of atomic collective phenomena like Bose-Einstein condensation scattering super-radiance with applications in quantum information processing, atomic interferometer, and molecular and biological physics.

Effects of quantum optics and kinetics in nanostructures for informatics and advanced biophotonics

Type: Institutional project, SCSTD code 15.817.02.07F, acronym - OPTICACUANTICA
Duration: 2015-2018

The control and detecting of the quantum states of the correlated radiator assembly (quantum dots, impurities, atoms, nuclei, etc.) in absorption and emission can be used in the processing of information and optical transmission in the optical integrated circuits and Bioinformatics. Based on existing effects in some physical or biological systems will be developed as a new method of highlighting the probabilities of quantum events (needed in computer science), the study of distribution functions, entropy, and quantum competition. Based on these studies will be focused on the notion of measure and standard of polarization correlations or the number of particles (or phase) to quantify the transmission and routing information with a high degree of safety in integrated optical circuit devices.
Laboratory of Quantum Optics and Kinetic Processes: Publications


Laboratory of Mechanical Properties of Materials  "Iulia Boiarskaia"

Within the period of its activity (since 1963) LPMM became a scientific center, unique in Moldova Republic, where all-round investigations of the problems of strength and plasticity, defect structure and mechanical properties especially by means of local deformation (micro- and nanoindentation) of a wide range of materials (crystalline and composite ones, glasses, polymers, coated systems, fibers, etc.) are carried out.

Fields of activity:

➢ Study of the mechanical properties (hardness, Young’s modulus, fracture toughness, yield limit, hardening, etc.) of a wide range of materials (crystalline, polycrystalline, amorphous, polymeric, composite, ceramic, etc.), both bulk and size-limited, under micro-/nano-indentation, micro-/nano-scratching and uniaxial extention-compression; correlation of the mechanical properties with other physical ones;

➢ Investigations of the processes and mechanisms of deformation, which take place under micro-/nano-indentation and scratching: dislocation sliding, twinning, rotation, densification, phase transition, etc. and application of this knowledge for the study of different physical parameters and phenomena: anizotropy of hardness and fracture, dislocation mobility, scale effect, etc;

➢ Influence of different factors, intern (structure, dopants, defects) and extern (load, deformation rate, cyclic deformation, temperature, radiation), on the deformation processes and mechanical behavior of materials in macro-, micro- and nano-volumes;

➢ Using the micro-/nano-indentation and micro-/nano-scratching methods for the obtaining of local modified structural, mechanical, electrical and optical properties in the main matrix of material

Head of laboratory:
assoc. prof., Ph.D. Olga Shikimaka
phone : + (373) 22 738038
fax : + (373) 22 738149
email : olshi@phys.asm.md
Laboratory of Mechanical Properties of Materials: National Research Project

Nanoindentation deformation for mechanical characterization and creation of new local structures in vitreous, polimeric and crystalline materials.

Type: Institutional project, SCSTD code 15.817.02.06A, acronym – NANOINMEC

Duration: 2015-2018

The project is aimed to the study by means of the dynamic nanoindentation method of the micro- and nanomechanical properties of advanced materials with a view of their application in optoelectronics, magneto-optics, medicine. These are the bulk (3D) materials and film/substrate structures, borophosphate and aluminophosphate glasses doped with rare earth (Dy, Tb), transition (Mn, Fe) and post-transition (Bi, Pb) elements, glassy copolymers of styrene and methyl acid, coated films/substrate structures (ITO SiO2/Si structures, Cu coating on the Si, MgO and LiF substrates). A new and less studied area is the elucidation of the basic mechanisms of the deformation of vitreous materials and polymers in micro- and nanovolumes depending on the structure, composition and deformation regimes, which are of interest from both the fundamental point of view, particularly, in terms of the study of deformation peculiarities of amorphous materials, and practical one, because this knowledge will open up new possibilities for creating materials with desired mechanical properties that will contribute to obtain the safe and sustainable systems and devices based on them.

Also in this project the nanoindentation method will be used in a new aspect, for the creation of special local structures in the glassy matrix with modified optical, mechanical, electrical properties at the micro- and nanoscale under high local pressures (about 5-12 GPa) arising during indentation. As well, the effect of the local crystallization of amorphous structure will be used trough the laser processing, which find his application as an effective method for producing regular micro/nanostructures (systems of dots, lines, gratings). Different indentation regimes, thermal and laser surface treatment, either in combination or separately, will be applied to find the best ways for micro- and nanostructuring of surfaces, which will contribute to the development of new effective nanotechnologies for integrated systems in the field of micro-optoelectronics.


Laboratory of Thermo- and Hydrodynamic Processes

Experimental and theoretical investigations are performed in the laboratory, in respect to technological and technical solutions in the priority areas related to the interaction of thermal, electrophysical, ultrasonic, cavitational and hydrodynamic fields with homogeneous media and heterogeneous systems.

Study objectives include: intensification of charge, heat and mass transfer under thermoelectrophysical influence; investigation of regularities of ultrasonic and cavitational processes for enhancement of plant materials treatment; obtaining and investigation of nanocomposites based on diatomite for solving environmental problems and catalysis.

Fields of activity:

➢ Research of heat and mass transfer processes conditioned by the action of electric fields and development of advanced technologies and techniques for hydrodynamic and thermal processes.
➢ Study of polyphasic media, cavitation and interphase phenomena, unsteady fluid flows in order to steer processes and enhancing mass transfer and heat.
➢ Development of electrophysical processes, cavitation and adsorption in the food, pharmaceutical, textile, chemical industry.

Head of laboratory:
acad. ASM, dr. hab., prof., Mircea Bologa
tel.: +(373) 22 738184
e-mail: mbologa@phys.asm.md
Laboratory of Thermo- and Hydrodynamic processes: National Research Project

Charge, heat and mass transfer under thermoelectrophysical and cavitation influences; technological and technical elaborations

Type: Institutional project, SCSTD code 15.817.02.07A, acronym - TSCM
Duration: 2015-2018

The project will provide experimental and theoretical investigations, technological and technical solutions in the priority areas related to the interaction of thermal, electrophysical, ultrasonic, cavitation and hydrodynamic fields with homogeneous media and heterogeneous systems.

Objectives: intensification of charge, heat and mass transfer under thermoelectrophysical influence; investigation of regularities of ultrasonic and cavitation processes for enhancement of plant materials treatment; obtaining and investigation of nanocomposites based on diatomite for solving environmental problems and catalysis. The optimal modes of transfer processes will be found and technological and technical recommendations for their implementation will be presented.
Laboratory of Thermo- and Hydrodynamic processes: Publications

3. ZELENTSOV, V.; DATSKO, T. Breakthrough analysis of fluorine removal in fixed bed adsorption column using modified diatomite. Termotehnica. 2016, 10(1S), 9—12. ISSN 1222-4057.
Contact information

Project Coordinator:
Dr. Elena ACHIMOVA (IAP-ASM)
Email: achimova@phys.asm.md

Address:
Institute of Applied Physics
5 Academiei str.
Chisinau, MD-2028
MOLDOVA (Rep. of)
phone: +(373) 22 738150
fax: +(373) 22 738149
email: director@phys.asm.md

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