

«... Students have the opportunity to master: modern methods of insurance and financial mathematics, stochastic analysis, probability theory, mathematical statistics, advanced methods of computer simulation of physical processes; methods and means of scientific experiment; basics of methods of computational physics, synergetics and catastrophe theory; theory of self-organization of complex systems and the basics of dynamic chaos; theory of nonlinear phenomena ...»



INFORMATION PACKAGE

FACULTY OF PHYSICS AND MATHEMATICS

Kyiv, 2016

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*** *The information is current as for 2016/2017 academic year. In the next academic year, there may be minor changes in the list of training directions, specialties, and specializations.*



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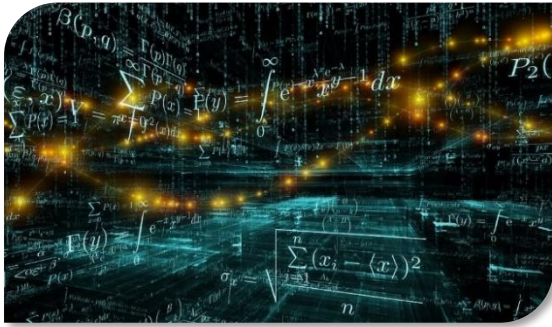
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1. COMMON DESCRIPTION AND THE STRUCTURE OF FACULTY



Training of specialists at the **Faculty of Physics and Mathematics (FPM)** is carried out on fundamental and applied problems in various branches of modern mathematics and physics – from the theory of numbers and theory of functions to cryptography and computer data analysis with the use of mathematical statistics; from aerodynamics

and hydrodynamics to nuclear physics and elementary particles with the use of methods of mathematical and computer simulation.

Students have the opportunity to master: modern methods of insurance and financial mathematics, stochastic analysis, probability theory, mathematical statistics, advanced methods of computer simulation of physical processes; methods and means of scientific experiment; basics of methods of computational physics, synergetics and catastrophe theory; theory of self-organization of complex systems and the basics of dynamic chaos; theory of nonlinear phenomena.

Structure

Faculty consists of 7 departments:

- **Mathematical Analysis and Probability Theory;**
- **General and Solid State Physics;**
- **Descriptive Geometry, Engineering and Computer Graphics;**
- **Differential Equations;**
- **Mathematical Physics Department;**
- **General and Theoretical Physics;**
- **General and Experimental Physics, and Research Laboratory "DIDACTIC"**

1. Department of Mathematical Analysis and Probability Theory

trains experts in fundamental and applied aspects of the probabilistic analysis of complex stochastic systems. The department trains professionals with a degree in Mathematics (specialization "Insurance and Financial Mathematics").

Knowledge acquired by students during training can be used for constructing of mathematical models in the face of uncertainty and risks, and also for evaluation of structural characteristics of the models for the

purpose of prediction and identification.

Graduates work in higher educational institutions, research institutes, schools, insurance companies, banks, analytical units of investment funds and consulting firms, high-tech departments of firms for development of software, etc.



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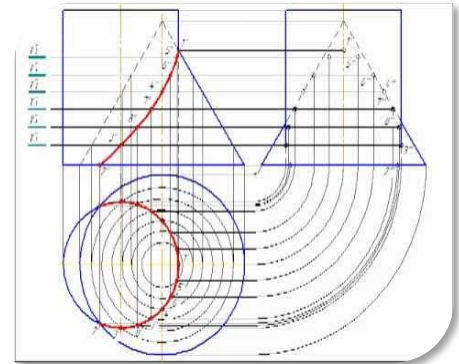
2. Department of General and Solid State Physics is one of the basic departments of the Igor Sikorsky KPI. Department trains professionals with a degree in "Physics and Astronomy" (specialization "Computer Simulation of Physical Processes").

Added to this, teachers of the department read the general course of physics at ten faculties and institutes of the university. The department leads specialized courses at the FPM and supervises the graduate students and undergraduates.

3. Department of Descriptive Geometry, Engineering and Computer Graphics

The main objective of the department is teaching of engineering graphics disciplines, fostering the skills of students in:

- geometric modeling of technical objects and their parameterization;
- the design of typical elements of technical objects.



4. Department of Differential Equations provides teaching of mathematical disciplines at the Faculty of Physics and Mathematics and the engineering faculties.

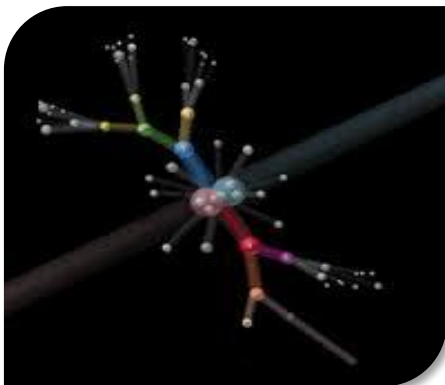
5. Mathematical Physics Department provides teaching of mathematical disciplines in nine faculties and two institutes of the Igor Sikorsky KPI in order to ensure high quality of the educational process of preparation of bachelors, specialists, and masters of engineering and mathematical disciplines.

6. Department of General and Theoretical Physics

Teachers of the department (professors and associated professors) are specialists in various fields of general and theoretical physics, and they help the students to master the difficult but wonderful world of physics by use of their inspiration and creative attitude to work.

7. Department of General and Experimental Physics

The main task of the department is the training of students in the field of physics.



Teachers of the department conduct training in general and theoretical physics at the Faculty of Physics and Mathematics, Welding Faculty, Heat & Power Engineering Faculty, Faculty of Electric Power Engineering and Automation, as well as at the Institute of Energy Saving and Energy Management.

Research Laboratory "DIDACTIC" is engaged in the development, manufacturing and



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introduction in the educational process of modern visual teaching aids based on microprocessor technology, computer-based training programs, distance learning tools.

2. EDUCATIONAL PROGRAMS

Levels of higher education. Training of students at the FPM is carried out at three levels of higher education.

At the first level (Bachelor's, I – IV academic years) students acquire fundamental knowledge in physics, mathematics, mechanics, computer engineering, and special disciplines. During the IV year, they defend bachelor course work and receive qualification degree Bachelor.

At the second level (Magistracy, V – VI academic years) training is carried out according to the Master program. Students are trained and acquire relevant skills including laboratory practice.

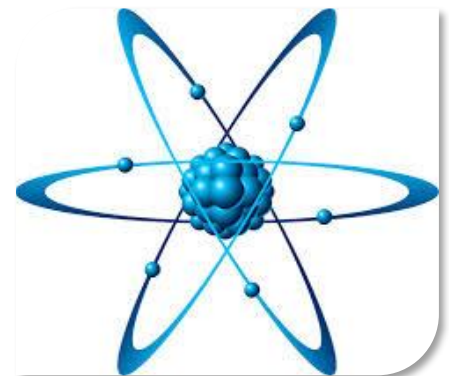
At the third science-educational level Department of Mathematical Analysis and Probability trains Doctors of Philosophy (Ph.D.). The Higher doctoral program is also available at the Department for the training of highly qualified scientific personnel.

Terms of specialists training: Bachelor (b) – 4 years; Master (m) – 2 years (standard terms of training at Bachelor course and Magistracy), Doctor of Philosophy – 4 years.

Training of specialists is carried out on the full-time and correspondence forms of education.

Faculty of Physics and Mathematics trains specialists on the fundamental and applied problems in various branches of modern mathematics and physics – from the theory of numbers and theory of functions to cryptography and computer data analysis with the use of mathematical statistics; from aerodynamics and hydrodynamics to nuclear and elementary particles physics with the use of methods of mathematical and computer simulation.

Graduates of the **Faculty of Physics and Mathematics** work as the specialists in the field of insurance and financial mathematics, stochastic analysis of complex dynamical systems, statistical analysis of empirical data; nanotechnology, solid state physics, chaos theory and nonlinear phenomena, astrophysics, information technologies in physics, software developers of biomedical processes description, the developers of the methods of quantum chemistry,



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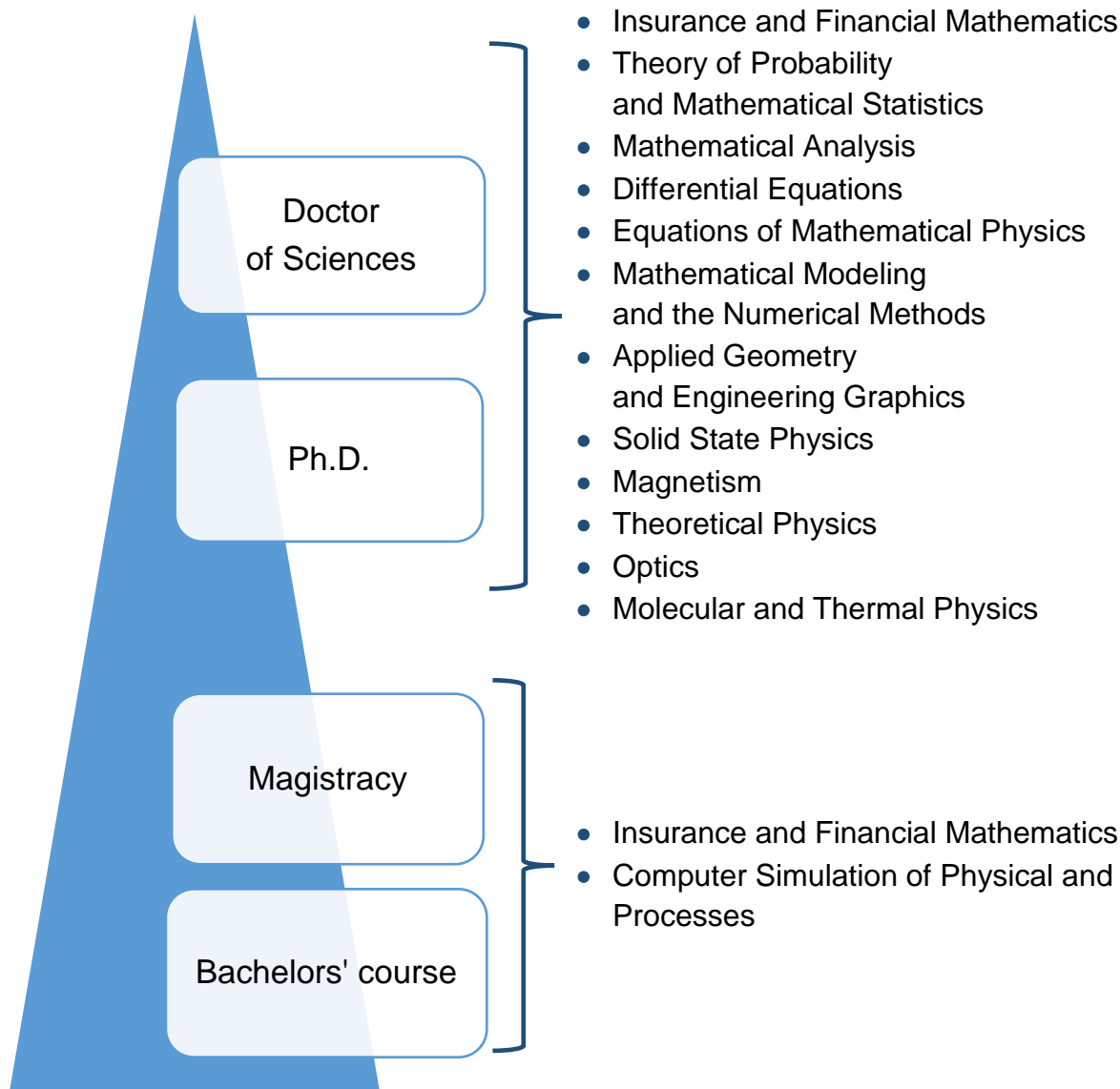
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researchers, teachers at higher education institutions, systems analysts in state and commercial institutions.

Specialties of training:



A graduate-bachelor of FPM has the prospects:

1) of further employment in Ukrainian banks and insurance companies, research institutes, analytical units of investment funds and consulting firms, secondary schools in areas of "Mathematics" and "Physics";



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2) to continue studying to get a Master's degree at the FPM, other Ukrainian universities or abroad (for example at the universities of France).

3. TRAINING AND LABORATORY BASE

Premises and classrooms of the FPM are used for training sessions.

Training is carried out with the use of modern equipment of the university and the National Academy of Sciences of Ukraine.

4. RESEARCH ACTIVITY

The scientific work is carried out at the **Faculty of Physics and Mathematics** in the following directions:

- Development of mathematical methods for the study of stochastic systems and boundary value problems of mathematical physics;
- Study of asymptotic properties of random point processes;
- Analysis of real objects in the generalized renewal processes;
- Geometrical modeling of objects, processes, and phenomena;
- Nanotechnology;
- Solid state physics;
- Chaos theory, nonlinear phenomena;
- Differential and integral equations;
- Physics of magnetic phenomena;
- Theoretical physics.

Department of Mathematical Analysis and Probability Theory

The main focus of research is the study and development of new mathematical methods for analysis of linear and nonlinear stochastic systems, statistical procedures, further development of the theory of special functions and its application to problems of mathematical physics.

Methods for research of empirical full convergence are developed jointly by the scientists from University of Ulm (Germany), investigations are funded by the Foundation for Basic Research of Ukraine and the DFG (Germany). Joint work with university experts from Cergy-Pontoise (France) on the statistical dependence is funded by the Ministry of Education and Science of Ukraine and CNRF (France).

The department also conducts joint research with the specialists from:



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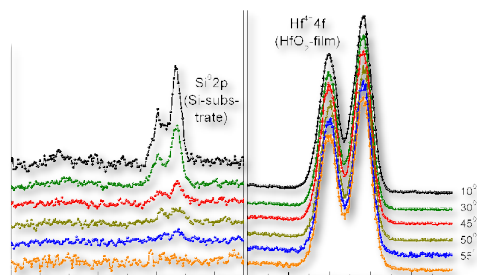


- University of Bern (Switzerland) on the multi-dimensional random point processes in the framework of the program, which is funded by the SNCF (Switzerland);
- University of Cologne (Germany) on the analysis of dual objects, which are funded the DFG (Germany).

Department of General and Solid State Physics

The main directions of research at the department:

- Quantum chemistry methods to calculate the dynamics of complex molecules;
- Numerical methods for determining optimal regimes controlled synthesis of nanoparticles and surfaces with the desired morphology;
- Methods of signal stabilization in optical communications in a turbulent zone;
- Spectroscopy of films and nanoscale composites based on silicon-organic polymers.
- Theoretical and experimental studies of optical, electro-physical properties and surface phenomena of semiconductor materials, modeling of self-organization processes of nanoparticles;
- Development of theoretical fundamentals and create a series of optoelectronic devices based on semiconductor materials;
- The latest technology of training, distance learning.



Department of Descriptive Geometry, Engineering and Computer Graphics

The main focus of research of the department are:

- Geometric modeling of product surfaces design, processes and equipment in the aircraft industry and mechanical engineering;
- Geometric modeling of multicriteria problems of science and technology;
- Simulation of agricultural production processes in order to optimize the construction of agricultural tools and equipment;
- The latest technologies of learning, distance learning.

Department of Differential Equations

The main focus of research of the department are:

- Differential equalizations and their applications;
- Application of differential equalizations is in mechanics and thermodynamics;
- Differential equalizations are with stochastic coefficients;
- Problems of theory of functional rows;



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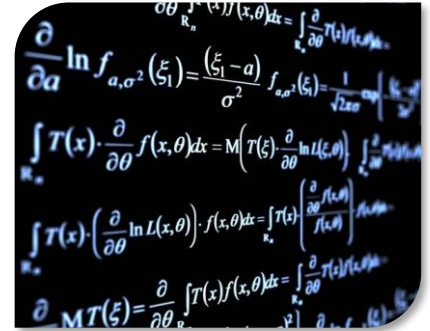


- Problems of functional analysis.

Mathematical Physics Department

The scientific work of the department covers the fundamental scientific research in the following areas:

- Development of analytical methods for studies of the theory of parabolic equations;
- Theoretical study of deterministic chaos in dynamic systems;
- Development of theory of decision operators and the theory of optimal mathematical models;
- Development of the theory of nonlinear dynamics of magnetization distributions in crystals of the external variables fields;
- Implementation of international projects on computer modeling of basic physical and mechanical processes in materials science.



Department of General and Theoretical Physics



The main directions of scientific work of the department:

- Physics of superconductivity; physics of magnetic phenomena;
- Physics of imperfect crystals;
- Physics of composite media;
- The theory of complex systems;
- Development of diagnostic sensors for aircraft systems.

Department of General and Experimental Physics

The main directions of scientific work of the department:

- Magnetic properties of ferromagnets and antiferromagnets;
- Electrochemical and hydrodynamic processes in a magnetic field;
- Study of the behavior of domain structures in an external magnetic field;
- Thermomagnetic phenomena in ferromagnetic bodies;
- The study of the propagation of spin waves in a magnetic medium;



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- The study of surface properties of solids by means of scanning electron microscopy and tunneling and atomic force microscopy.

5. INTERNATIONAL PROJECTS AND COLLABORATION

In recent years, mathematicians of FPM carry out joint projects with colleagues from Bern (Switzerland) and Paderborn (Germany) in order to analyze the asymptotic properties of the point random processes and limit theorems of probability theory. Within the frameworks of cooperation, joint conferences were held in Kyiv, as well as in Germany, France, and Sweden.

Physicists of the FPM carry out the joint work with the colleagues from the Los Alamos National Laboratory, USA (LANL). The LANL was founded in 1943 for the implementation of the Manhattan Project to build atomic weapons. Now at the base of LANL, the fundamental investigations are conducted in many areas of physics involving scientists from all around the world.



During the past three years, the active cooperation is carried out with the Center for Advanced Material Processing (Clarkson University, NY), which is supported by the joint agreement.

Department of Mathematical Analysis and Probability Theory has the agreements with the Ulm University (Germany) and the Cergy-Pontoise University (France) on joint activities in the training of bachelors, masters, and Ph.D. Under these agreements, masters and post-graduate students are trained in Ulm and Paris.

Joint work is carried out with the colleagues from the University of Oslo (Norway), Cardiff University (UK), University of Debrecen (Hungary), Lublin University of Technology (Poland), University of Florida Gainesville, and Lakehead University (Canada).

Department of General and Solid State Physics:

- Clarkson University, NY. Centre of Advance Material Processing - Development of highly active catalysts based on platinum nanopillars and sintering problems in nanosystems, in accordance with the agreement on cooperation between the Igor Sikorsky KPI and the Clarkson University, which operates from March 1, 2012, until February 29, 2016



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- Los Alamos National Laboratory USA, NM – development of methods of calculation of the dynamics of nanosystems with an account for no-daibatics, research in the field of optical communications in a turbulent atmosphere.
- Imperial College London – development of theoretical fundamentals of creation of metamaterials in acoustics.

Department of General and Experimental Physics collaborates in the field of the physics of magnetic phenomena with the:

- Adam Mickiewicz University in Poznań (Poland);
- University of Exeter (Exeter, United Kingdom);
- University of the Basque Country (Spain);
- Royal Institute of Technology (Stockholm, Sweden).



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