Femtosecond Laser Physics and Technology

National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)

Degree or qualification is awarded: **Master degree**

Language of study: **Russian**
Mode of study: **full-time**
Duration: **2 years**
Availability of free education: **yes**
Price: **196 820 rubles per semester**

Programme webpage at the university website:
http://eis.mephi.ru/AccGateway/index.aspx?report_url=/Accreditation/program_annotation&report_param_pid=104

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Field of study: "Nuclear Physics and Technologies".

Duration of training: 2 years, 120 credits.

Course delivery language: russian & english.

Basic department: Laser micro and nanotechnology (No. 87).

Program goal: the program prepares students for the fields associated with the interaction of radiation with matter, materials science, laser technology, micro and nano-processing of materials, created on the basis of these new technologies and photonics, electronics and medicine, radiation technologies.

The curriculum of masters consists of two modules of training: the basic module and the professional one. The basic module includes:

- special chapters of higher mathematics;
- nuclear physics;
- foreign language (English);
- fundamentals of information security of critical technologies;
- the methodology of scientific knowledge;
- management and marketing;
- preparation of scientific texts in the package LATEX;
- computer technology;
- fundamentals of nuclear technology;
- the foundations of the nuclear non-proliferation and safe management of nuclear materials;
- the interaction of radiation with matter;
- the professional module includes unique special courses that correspond to the most modern state of science: surface physics and nanostructures, computer modeling, calculation and design of nanosystems, interaction of radiation with condensed media, laser micro and nanotechnology, methods of diagnostics and analysis of materials and nanostructures, fundamentals of biology and medical photonics;
- introduction to the physics of the surface;
- physics of nanostructures;
- computer modeling, calculation and design of nanosystems;
- fundamentals of nanobiology;
- laser micro – and nanotechnologies;
- photonics;
- experimental physics of condensed matter;
- optical methods of information processing;

- fiber-optic communication lines;
- physical basis of surface processing technology;
- selected chapters of General physics;
- the application of optical spectroscopy for the investigation of nanostructures;
- selected chapters of theoretical physics;
- methods of diagnosis and analysis of micro – and nanosystems;
- medical nanophotonics;
- plasma-chemical synthesis of thin-film structures;
- coherent Photonics;
- the Biophotonics;
- photonics (additional chapters);
- the graduates carry out dissertation work using modern unique analytical research equipment.

Part of the curriculum is also implemented in English.

The following research facilities are available:

- variety of modern pulse-periodic lasers with femto, pico, nano and microsecond pulses duration with frequency up to 1-100 MHz and an average power up to 50 watts, generating in the IR, visible and the UV wavelengths;
- equipment and technologies for plasma-chemical synthesis of various carbon materials, preparation of samples for experiments;
- a wide range of optical microscopes, including unique and combined with laser systems for in situ monitoring of laser irradiation;
- electron and scanning probe microscopes;
- equipment for spectral-luminescent and Raman optical characterization;
- unique instalations for pump-probe laser studies of fast processes with high spatial resolution and highest sensitivity.

High qualification of graduates is provided by: the global level of researches of the department, the involvement in educational process of leading and activity working scientists from the department. Students have internships in reputable foreign laboratories of the universities of Arizona and Nebraska (USA), the cities of Marseille and Nancy (France), Stuttgart, Ulm and Bochum (Germany), Rome (Italy), Beijing technology (China) and several others, which the basic scientific partners of the department.

During studying the students have the opportunity to realize themselves in the implementation of their results in the creation of new elements, devices, and equipment through a network of small innovative enterprises related to the department and headed by leading its employees.

The graduates are in demand for large, medium and small high-tech companies, both Russian and foreign. They also can use their knowledge and skills in the laboratories of universities, academic and industrial research institutes.

Specializations within this programme

Nuclear Physics and Technologies

Sphere and objects of professional activity: The main field of research are non equilibrium processes stimulated by intense ultra-short laser pulses on the surface and in the bulk of materials, and developing on the basis the received data technologies for fabrications of micro-and nanostructures. As the object of laser irradiation are coatings, materials (metals, semiconductors, dielectrics, composites, and organic matter). Special emphasis is made on novel carbon materials (CVD mono, poly and nanocrystalline diamond, nanotubes, graphene).