

# Physics of Extreme States of Matter

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: **207 610 rubles per semester**

Programme curator: **Boris Y. Sharkov**

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**Basic department:** Physics of Extreme States of Matter (No. 60)

**Head of the program:** Boris Sharkov, Corresponding Member of the Russian Academy of Sciences, Professor, Head of Department, Scientific director of the European Research Center for Antiproton and Ion (FAIR)

The education program "Physics of Extreme States of Matter" is aimed at training specialists in the field of application of accelerated particles to fundamental research and physics of extreme states of matter and radiation technologies.

**Professional activity** of graduates includes research, experimental data acquisition and processing, development of theoretical models, elaboration of new installations/settings for the physics of extreme states of matter, condensed matter physics and materials science, physics of radiation effects, physical experiment technics, material science, research in physics of nonequilibrium processes, development of automatic control of experimental facilities.

The subjects of their work include research into physics of charged particle beams and their interaction with condensed matter, physics of fusion synthesis, phase transitions, radiation chemistry, and advanced methods of ultra-microscopy of matter structure.

Within the master's program graduates gain experience as researchers in using heavy ion beams for physics of extreme states of matter; they get a high level of training in fundamental disciplines, which is necessary for their postgraduate studies and work in Russian and international research centers. Master's students perform research in the Institute for Theoretical and Experimental Physics. Students and graduates have an opportunity to take part in international and Russian megaprojects (CERN, FAIR, "PIC", "Breakthrough").

**The curriculum includes two modules:**

1. General scientific unit is basic training in the humanities and natural sciences and general professional disciplines which aimed at obtaining of general cultural and general professional skills.
2. Professional module consisting of specialized authors on several fronts, deepening knowledge in the field of relevant research and give a wide range of expertise and competence training program: "Methods of ultramicroscopy in solid-state physics," "Nuclear-physical methods for study of condensed matter", "Experimental physics of charged particle interaction with matter", "Data acquisition systems at experiments of high energy density in matter physics", "Phase transitions in condensed matter" and others.
3. Part of the curriculum is also implemented in English.

**Practice:**

1. Research Practice (first and second terms)
2. Scientific research (third term)
3. Pre-diploma practice (lasts 8 weeks at the second year of study).

**Professional activity** of graduates includes experimental data processing, development of theoretical models,

technological aspects, elaboration of new installations/apparatuses for condensed matter physics and materials science, research in physics of nonequilibrium processes and interaction of radiation with matter, development of automatic control of experimental facilities.

The students accomplished education along this program are ready to work in the National Research Centre "Kurchatov Institute", the State Scientific Center of the Russian Federation - Institute for Theoretical and Experimental Physics, research centers of the Russian Academy of Sciences, Rosatom enterprises, innovative and high-tech business companies and international scientific centers.

Graduates obtain advanced training in the field of condensed matter, physics of charged particles and their interaction with matter, nuclear physics, phase transitions, radiation chemistry, advanced techniques for investigation of material fine structure. Educational program also includes courses on modern methods of the data processing, application of scientific software in physics research, simulation of physical processes, programming languages. Students have a possibility to carry out research on unique facilities in ITEP and the National Research Center "Kurchatov Institute".

ITEP (Moscow), NRC "Kurchatov Institute", Bochvar Institute are the institutions where the students proceed and carry out their educational and research activity.

Mega-project FAIR GSI - Darmstadt <http://frrc.itep.ru>; <http://www.fair-center.de>

## **Specializations within this programme**

**Professional activity of graduates** includes experimental data processing, development of theoretical models, technological aspects, elaboration of new installations/apparatuses for condensed matter physics and materials science, research in physics of nonequilibrium processes and interaction of radiation with matter, development of automatic control of experimental facilities.