

MATERIAL SCIENCE OF QUANTUM MATERIALS

Moscow Institute of Physics and Technology (National Research University)

Degree or qualification is awarded: **PhD (Candidate of Science)**

Language of study: **English**

Mode of study: **full-time**

Duration: **4 years**

Availability of free education: **yes**

Price: **375 000 RUB**

Programme webpage at the university website:

<https://eng.mipt.ru/programs/material-science-of-quantum-materials/>

Programme curator: **Denis Ustyuzhaninov**

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Entry requirements:

- Master's degree / equivalent in a related field
- B2 level of English
- Good track record of publications related to the topic of the intended research
- Strong research proposal 1,500 - 3,500 words

Research supervisor:

[Kirill Pervakov](#)

PhD

Supervisor's research interests:

The main research interest is Material Science of Superconductors and Non-trivial Topological Matter. The area of expertise includes phase diagrams, crystal structure design, synthesis and crystal growth, mechanical alloying, X-ray diffractometry, electronic microscopy and its application (EDS, EBSD, Auger spectroscopy). Concerning the materials, we deal with ironbased superconductors (IBS) and its application, superconductors with magnetic atoms, new bismuthbased materials, transition metal dichalcogenides, tin arsenide-based materials and other new quantum materials.

Research highlights:

The research will be done in Ginzburg Center for High-Temperature Superconductivity and Quantum Materials of Lebedev Physical Institute that seven Nobel prize winners worked in. It equipped well with modern experimental equipment and has full-cycle investigation from synthesis to low-temperature experiment. The equipment used in the Center allows one to investigate a wide variety of materials include air-sensitive materials that became more and more actual in scientific research.

The Center has successful collaborations with many foreign institutions. Among them are IFW (Germany), PSI (Switzerland), DLS (UK), St. Andrew's University (UK).

Supervisor's specific requirements:

The applicant should be familiar with experimental methods of solid-state investigation (no experience is required) and confident in condensed matter physics and/or chemistry, especially with such topics as:

- Superconductivity or Topological matter.
- Electronic band structure.
- Crystallography.
- Quantum physics.
- Electrophysics.

Coding (LabView, Python etc.) is not mandatory but is an advantage.

Main publications:

- Electronic structure and superconductivity of the non-centrosymmetric Sn₄As₃, New J. Phys. in press <https://doi.org/10.1088/1367-2630/ab890a> (2020).
- Synthesis of electron- and hole-doped bulk BaFe₂As₂ superconductors by mechanical alloying, Ceramics International 46 (7), pp. 8625-8630 (2020).
- Electronic band structure and superconducting properties of SnAs, Phys. Rev. B 100, 184514 (2019).
- Critical Current and Microstructure of FeSe Wires and Tapes Prepared by PIT Method, IEEE Transactions on Appl. Supercond. 29 (3), pp. 1-5 (2019).
- Superconducting properties of Ba(Fe_{1-x}Ni_x)₂As₂ thin films in high magnetic fields, Appl. Phys. Lett. 110, 022601 (2017).

Specializations within this programme