

THEORETICAL CONDENSED MATTER PHYSICS

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/theoretical-condensed-matter-physics/>

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:

[Alexey Sokolik](#)

PhD

Supervisor's research interests:

- Electronic properties of graphene.
- Fast dynamics of electron gas in graphene after laser pump.
- Bose-Einstein condensation and superfluidity.
- Superconductivity in novel materials.
- Quantum virial theorem and its generalizations.
- Magneto plasmons in low-dimensional systems.

Research highlights:

- Quantum-mechanical and quantum fieldtheoretical methods.
- Research of novel materials and nanostructures (graphene, topological insulators, metasurfaces etc.).
- Participation in research grants.

Supervisor's specific requirements:

- Good knowledge of quantum mechanics and solid state physics.
- Knowledge of second quantization and quantum many-body methods.

Main publications:

- Yu.E. Lozovik, A.A. Sokolik, Electron-hole pair condensation in graphene bilayer, JETP Lett. 87, 55 (2008).
- D.K. Efimkin, Yu.E. Lozovik, A.A. Sokolik, Collective excitations on a surface of topological insulator, Nanoscale Res. Lett. 7, 163 (2012).
- D.K. Efimkin, Yu.E. Lozovik, A.A. Sokolik, Electronhole pairing in a topological insulator thin film, Phys. Rev. B

86, 115436 (2012).

- A.A. Sokolik, Yu.E. Lozovik, Many-body filling factor dependent renormalization of Fermi velocity in graphene in strong magnetic field, *Phys. Rev. B* 99, 085423 (2019).
- A.A. Melnikov, A.A. Sokolik, A.V. Frolov, S.V. Chekalin, E.A. Ryabov, Anisotropic ultrafast optical response of terahertz pumped graphene, *Appl. Phys. Lett.* 114, 191107 (2019).
- A.A. Sokolik, A.D. Zabolotskiy, Yu.E. Lozovik, Virial theorem, boundary conditions, and pressure for massless Dirac electrons, *Ann. Phys.* 412, 168001 (2020).

Specializations within this programme