

OPEN QUANTUM SYSTEMS

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 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:

[Alexander Teretenkov](#)

PhD

Supervisor's research interests:

I study a wide range of problems in the theory of open quantum systems. But there are several topics which I am especially interested in:

- Exactly solvable Gorini-Kossakowski-Sudarshan-Lindblad equations, especially the generalizations of the equations with generators which are quadratic in creation and annihilation operators.
- Exactly solvable models of non-Markovian quantum evolutions, especially by pseudo mode method generalizations.
- Perturbative derivation of master equations both by projective and stochastic limit methods, especially in the case when it could be done for all the orders of perturbation theory.

Research highlights:

- The theory of open quantum systems is a theoretical basis of modern spectroscopy, quantum optics, quantum measurement theory, quantum thermodynamics and has a wide range of physical applications. It belongs to the intersection of cutting edges of physics and mathematics. There is a very wide and active community providing a great number of conferences, seminars and grant possibilities.
- Supervisor's specific requirements:
- Basic knowledge of theory of open quantum systems (circa Chapters 2-3 in H.P. Breuer and F.P. Petruccione's book "Theory of open quantum systems").
- Basic but solid skills in usual mathematical subjects: linear algebra, ordinary and partial differential equations, probability theory, stochastic processes, and in usual physical subjects: electrodynamics, quantum mechanics, statistical physics.

Main publications:

- A. E. Teretenkov, "Irreversible quantum evolution with quadratic generator: Review", *Infin. Dimens. Anal. Quantum Probab. Relat. Top.*, 22:4 (2019), 19300019.
- A. E. Teretenkov, "Dynamics of Moments for Quadratic GKSL Generators", *Math. Notes*, 106:1 (2019), 151-155.
- A. E. Teretenkov, "Non-Markovian evolution of multilevel system interacting with several reservoirs. Exact and

approximate”, Lobachevskii J. Math., 40:10 (2019), 1587–1605.

- S. V. Kozyrev, A. A. Mironov, A. E. Teretenkov, I. V. Volovich, “Flows in nonequilibrium quantum systems and quantum photosynthesis”, Infin. Dimens. Anal. Quantum Probab. Relat. Top., 20:4 (2017), 1750021.
- A. M. Chebotarev, A. E. Teretenkov, “Singular value decomposition for the Takagi factorization of symmetric matrices”, Appl. Math. Comput., 234 (2014), 380–384. Web cite:
http://www.mathnet.ru/php/person.phtml?option_lang=rus&personid=76513

Specializations within this programme