GEOMETRIC GROUP THEORY, GEOMETRIC TOPOLOGY, HYPERBOLIC GEOMETRY, DISCRETE SUBGROUPS OF LIE GROUPS, ARITHMETIC GROUPS, REFLECTION GROUPS, COXETER POLYTOPES

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:
Nikolay Bogachev
PhD

Supervisor's research interests:
I study geometric actions of groups on Riemannian manifolds and the corresponding quotient manifolds and orbifolds. Sometimes, if a group H acts on a metric space X properly discontinuously, then the quotient X/H is an orbifold or manifold with some nice geometric and combinatorial properties. Various examples of such actions are provided by the theory of hyperbolic reflection groups developed by Vinberg in 1967. A natural fundamental domain of a discrete group generated by reflections with respect to hyperplanes is a Coxeter polytope, which can be described in the sense of Coxeter diagrams/graphs. The modern research of discrete groups combines algebraic, geometric, topological, combinatorial, dynamical, and number theoretical approaches. Sometimes, computer experiments are very helpful.

Research highlights:

- In the framework of my research I collaborate with mathematicians from Switzerland, USA, Italy, Brazil, Germany, France, and Russia.
- My work was awarded by the Simons Foundation Prize for PhD students (2017, 2018), and also supported by grants of RSF, RFBR, Basis.

Supervisor's specific requirements:

- Algebra: groups, rings, modules, number fields.
- Linear algebra: vector spaces, linear maps and operators, bilinear and quadratic forms.
- Topology: topology of R^n, topological spaces and manifolds.
- Geometry: convex polyhedra, smooth manifolds, Riemannian manifolds.
- Python knowledge would be a benefit.

Main publications:

- N. Bogachev, From geometry to arithmeticity of compact hyperbolic Coxeter polytopes, 2020, arXiv:2003.11944.
- N. Bogachev, A. Kolpakov, On faces of quasiarithmetic Coxeter polytopes, 2020, arXiv:2002.11445, to appear in Int.Math.Res.Notices.
- N. Bogachev, Classification of (1,2)-reflective anisotropic hyperbolic lattices of rank 4, Izvestiya Math, 2019, vol. 83:1, pp. 1-19.
- N. Bogachev, A. Perepechko, Vinberg's algorithm for integral hyperbolic lattices, Math. Notes, 2019.

Specializations within this programme