

# 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**

Tel.: **+7 (498) 713 91 70**

E-mail: [interadmission@phystech.edu](mailto:interadmission@phystech.edu)

## **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  $\mathbb{R}^n$ , 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**