

THEORETICAL PARTICLE PHYSICS AND COSMOLOGY

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-particle-physics-and-cosmology/>

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:

[Dmitry Gorbunov](#)

PhD, DSc

Supervisor's research interests:

Quantum field theory, physics beyond the Standard Model of particle physics (supersymmetry, grand unification, hidden sectors and portals, etc.), neutrino physics, astroparticle physics and cosmology (dark matter models, inflation and reheating, baryogenesis).

Research highlights:

Typically, the group members participate in 2-3 projects supported by Scientific Foundations. There are also special prizes and awards for PhD students from the Institute for Nuclear Research. The group has scientific relations (collaborations, visits, etc) with theory divisions of EPFL (Lausanne), Manchester University, ULB (Brussels), ETH (Zurich), Munich University, Prague University.

Supervisor's specific requirements:

- Quantum field theory (e.g. Peskin & Schroeder).
- Classical Theory of Gauge Fields (e.g. Rubakov).
- Standard Model of particle physics (symmetries, strong and electroweak interactions, Higgs mechanism, etc, e.g, Okun).
- Math: calculus, differential and integral equations, Group Theory, matrix theory.

Main publications:

- Phenomenology of GeV-scale Heavy Neutral Leptons Kyrlo Bondarenko, Alexey Boyarsky (Leiden U.), Dmitry Gorbunov (Moscow, INR & Moscow, MIPT), Oleg Ruchayskiy (Bohr Inst.). May 22, 2018. 54 pp. Published in JHEP 1811 (2018) 032. DOI: 10.1007/JHEP11(2018)032 e-Print: arXiv:1805.08567.
- On sgoldstino interpretation of the diphoton excess S.V. Demidov (Moscow, INR), D.S. Gorbunov (Moscow, MIPT & Moscow, INR). Dec 17, 2015. 4 pp. Published in JETP Lett. 103 (2016) no.4, 219-222, Pisma Zh.Eksp. Teor.Fiz. 103 (2016) no.4, 241-244 INR-TH-2015-036. DOI: 10.1134/S0021364016040044 e-Print: arXiv:1512.05723.

- Relic Gravity Waves and 7 keV Dark Matter from a GeV scale inflaton F. Bezrukov (CERN & Connecticut U. & RIKEN BNL), D. Gorbunov (Moscow, INR & Moscow, MIPT). Mar 18, 2014. 5 pp. Published in Phys. Lett. B736 (2014) 494-498. DOI: 10.1016/j.physletb.2014.07.060 e-Print: arXiv:1403.4638.
- Distinguishing between R2-inflation and Higgsinflation F.L. Bezrukov (Connecticut U. & RIKEN BNL & Munich U., ASC), D.S. Gorbunov (Moscow, INR). Nov 2011. 4 pp. Published in Phys.Lett. B713 (2012) 365-368 LMU-ASC-72-11. DOI: 10.1016/j.physletb.2012.06.040 e-Print: arXiv:1111.4397.
- Sclaron the mighty: producing dark matter and baryon asymmetry at reheating D.S. Gorbunov, A.G. Panin (Moscow, INR). Sep 2010. 6 pp. Published in Phys.Lett. B700 (2011) 157-162. DOI: 10.1016/j.physletb.2011.04.067 e-Print: arXiv:1009.2448.
- Light inflaton Hunter's Guide F. Bezrukov (Heidelberg, Max Planck Inst. & Moscow, INR), D. Gorbunov (Moscow, INR). Dec 2009. 22 pp. Published in JHEP 1005 (2010) 010 DOI: 10.1007/JHEP05(2010)010 e-Print: arXiv:0912.0390.
- On initial conditions for the Hot Big Bang F. Bezrukov (Moscow, INR & ITPP, Lausanne & Heidelberg, Max Planck Inst.), D. Gorbunov (Moscow, INR), M. Shaposhnikov (ITPP, Lausanne). Dec 2008. 22 pp. Published in JCAP 0906 (2009) 029 DOI: 10.1088/1475-7516/2009/06/029 e-Print: arXiv:0812.3622.

Specializations within this programme