

PLASMA ASTROPHYSICS, COMPARATIVE PLAN-ETARY ATMOSPHERES

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:

[Arakel Petrosyan](#)

PhD, DSc

Supervisor's research interests:

Theoretical and numerical studies of turbulence and waves in rotating astrophysical plasma flows and in planetary atmospheres. Development of multiscale solar activity models involving Rossby waves activity. Kinetics of rotating plasma, energy cascades in turbulence in rotating plasma flows in kinetic description. Development of advanced numerical tools in rotating plasma kinetics. Particulate flows in plasma astrophysics and applications to planets originations. Computational physics and extremal computations.

Research highlights:

Our group is conducting studies on theoretical aspects of astrophysical and planetary fluid dynamics, and using supercomputer technologies in solving problems of plasma astrophysics and planetary physics. The work involves close collaboration with scientists from Hugh Altitude Observatory in National Center of Atmospheric Research (Boulder, Colorado), Max Planck Institute for Solar System Research (Göttingen, Germany), Max Planck Institute for Astronomy (Heidelberg, Germany).

Supervisor's specific requirements:

- Basic knowledge of plasma physics or fluid dynamics.
- Basic knowledge of partial differential equations.
- Basic knowledge of numerical methods for differential equations.
- Basic programming skills in C++.

Supervisor's main publications:

- A. Chernyshov, K.V. Karelsky, A.S. Petrosyan, Three-dimensional modeling of compressible magnetohydrodynamic turbulence in the local interstellar medium, *Astrophysical Journal*, Vol. 686, pp.1137 (2008).
- A. Petrosyan et al., Turbulence in the Solar Atmosphere and Solar Wind, *Space Sci. Rev.*, 156: 135-238 (2010).
- A. Petrosyan et al., The Martian Atmospheric Boundary Layer, *Reviews of Geophysics*, 49, RG3005/2011.

- A.A. Chernyshov, K.V. Karelsky, A.S. Petrosyan, Subgrid-scale modeling for the study of compressible magnetohydrodynamic turbulence in space plasmas, *Phys. Usp.*, 57, 421–452 (2014).
- Miesch, M., Petrosyan, A. et al., Large-Eddy Simulations of Magnetohydrodynamic Turbulence in Heliophysics and Astrophysics, *Space Sci. Rev.* 194: 97 (2015).
- Klimachkov D.A., Petrosyan A.S., Parametric Instabilities in Shallow Water Magnetohydrodynamics of Astrophysical Plasma in External Magnetic Field, *Phys. Lett. A*, 381, p.106 (2017).
- Petrosyan A. et al., Shallow Water Magnetohydrodynamics in Plasma Astrophysics. Waves, Turbulence, and Zonal Flows, *Atmosphere* 11(4), 314 (2020).

Specializations within this programme