MACHINE LEARNING APPLICATIONS IN ASTRO-PARTICLE PHYSICS

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

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:
Oleg Kalashev
PhD, DSc

Supervisor's research interests:
Machine learning applications for search for the sources of ultra-high energy cosmic rays, determination of their composition, determination of blazars' redshifts from multi-wavelength photometry, search for a unified model of different gamma-ray pulsar populations.using multimessenger approach to constrain dark matter models and scenarios of ultra-high-energy cosmic ray and neutrino origin.

Research highlights:
You will join the international group of scientists working on the most challenging problems in modern astrophysics. Our group is a member of the Telescope Array collaboration.

Supervisor's specific requirements:

- Deep knowledge of probability theory and statistics.
- Good python and C++ programming skills.
- Base knowledge of astroparticle physics and cosmology.
- Base knowledge in supervised and unsupervised machine learning.

Main publications:

- "Using Deep Learning in Ultra-High Energy Cosmic Ray Experiments" Conf Ser 1525 (ACAT 2019).
- Prospects of detecting a large-scale anisotropy of ultra-high-energy cosmic rays from a nearby source with the K-EUSO orbital telescope, Oleg Kalashev, Maxim Pshirkov, Mikhail Zotov, JCAP 09 (2019) 034.
- Identifying nearby sources of ultra-high-energy cosmic rays with deep learning, Oleg Kalashev, Maxim Pshirkov, Mikhail Zotov e-Print: 1912.00625, JCAP 2020.
- Dark matter component decaying after recombination: constraints from diffuse gammaray and neutrino flux measurements, Oleg E. Kalashev, Mikhail Yu. Kuznetsov, Yana V. Zhezher, JCAP 10 (2019).
- Cosmic infrared background excess from axionlike particles and implications for multimessenger observations

of blazars, Oleg E. Kalashev, Alexander Kusenko, Edoardo Vitagliano, Phys.Rev.D 99 (2019) 2.

Specializations within this programme