STRANGE HYPERON PRODUCTION AND SEARCH FOR NUCLEAR MATTER WITH STRANGENESS IN PROTON-PROTON AND HEAVY ION COLLISIONS WITH ALICE AT THE LARGE HADRON COLLIDER

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/strange-hyperon-production-and-search-for-nuclear-matter-with-strangeness-in-proton-proton-and-heavy/

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:
Alexander Borissov
PhD

Supervisor's research interests:
Investigations in high energy heavy ion physics on the base of the data taking and analysis of ALICE experiment at the LHC at CERN.

Research highlights:
ALICE (A Large Ion Collider Experiment) is a heavyion detector on the Large Hadron Collider (LHC) at CERN. It is designed to study the physics of strongly interacting matter at extreme energy densities in proton-proton and heavy ion collisions, where a phase of matter referred to as a quark-gluon plasma is formed. The first observation of $\Sigma 0$ and anti- $\Sigma 0$ hyperons in proton-proton collisions at LHC with ALICE allows one its detailed analysis and simulations in proton-proton and lead-lead collisions on the base of ALICE data accumulated in 2010-2018. Another topic is connected with the search and investigations of hyper-nuclei, i.e. nuclei with nonzero strangeness, produced at the LHC energies, service work and participation in data taking in the ALICE experiment in the next running period. Research is based on analysis of huge amount of data recorded by the ALICE experiment from protonproton, proton-lead and lead-lead collisions at LHC. During my work in the ALICE experiment at CERN since 2010, I supervised several master and Ph.D. students from Germany, Russia, South Korea and USA. The results of my research have been published in several ALICE papers.

Supervisor's specific requirements:

- Base knowledge of nuclear and particle physics and kinematics of particle production on the collider

experiments.
- Base knowledge of the particle detectors used in high energy physics.
- Knowledge of Linux system, C++ language and ROOT package.
- Interest for the statistical analysis of big amount of data.
- Interest for the work in the international collaboration with the travels to CERN near Geneva.

Main publications:

- J. Adam et al. (ALICE Collaboration), Enhanced production of multi-strange hadrons in highmultiplicity proton-proton collisions, Nature Physics 13 (2017) 535-539, arXiv:1606.07424v2.
- J. Adam et al. (ALICE Collaboration), Production of \Sigma(1385) and \Xi(1530) in p-Pb collisions at \ sqrt{NN} = 5.02 TeV, Eur. Phys. J. C 77 (2017) 389, arXiv:1701.07797 [nucl-ex].
- S. Acharya et al. (ALICE Collaboration), Investigation of the p–Σ0 interaction via femtoscopy in pp collisions, Phys. Let. B, 805, 2020, 135419, axXiv:1910.14407.

Specializations within this programme