



St Petersburg  
University



Saint-Petersburg State University in the landscape of  
Russian MEGA science facilities



# St Petersburg University

Saint-Petersburg State University with its  
more than 20 faculties

among them

- ❖ faculty of physics,
- ❖ faculty of mathematics-and-mechanics
- ❖ faculty of applied math and automatization processes
- ❖ faculty of chemistry
- ❖ faculty of biology



was always on the frontier of the Russian (Soviet) mega-science program.



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**Russian (Soviet) Mega-science centers were opened as possibilities for employment of the graduates of SPSU (LSU)**

- ❖ Konstantinov Petersburg Nuclear Physics Institute of NRC (Gatchina).  
50 % of scientists, employs of PNPI, were graduated at SPSU (former LSU)
- ❖ Joint Institute Nuclear Research (Dubna, Moscow region).

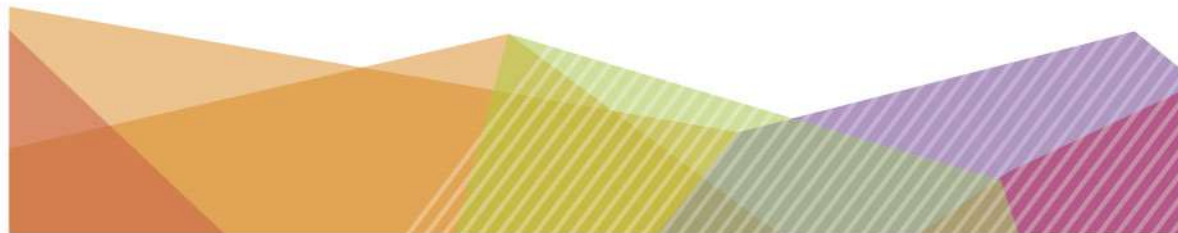




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**SPSU never stops the cooperation SPSU-JINR with particular focus to the high energy physics projects: NICA**

- ❖ The General Agreement between Saint-Petersburg State University and Joint Institute Nuclear Research covering activities in the field of high-energy physics, neutron physics, to support education, practices, joint scientific projects, employment of graduated students .
- ❖ The Chair of Information and Nuclear Technologies has been established in 2017 with the focus to NICA.

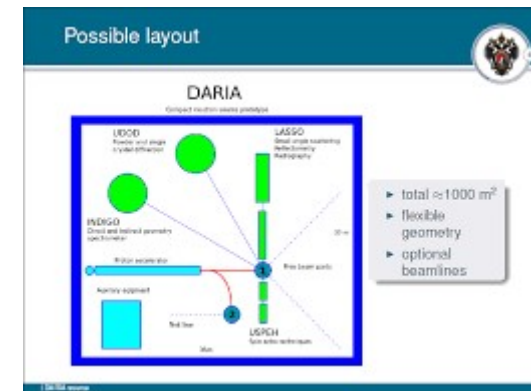




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At present SPSU and JINR organized the consortium on construction of the compact neutron source **DARIA**:  
**Dedicated for Academic Research and Industrial Applications**

- ❖ The Consortium between Saint-Petersburg State University and Joint Institute Nuclear Research, covering activities in the field of neutron physics, support R&D in construction of the **accelerator driven compact neutron source DARIA** has been signed with the focus on education, practices, joint scientific projects, employment of graduated students.





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**At present SPSU follows this tradition and supports cooperation SPSU-PNPI with particular focus to the neutron research facility – reactor PIK**

- ❖ The Agreement between Saint-Petersburg State University and Petersburg Nuclear Physics Institute of NRC KI is signed supporting scientific practices of the bachelor, master and PhD students of SPSU (it includes daily transportation Peterhof-Gatchina, financial support, etc.)
- ❖ The master program “Neutron and Synchrotron Physics” has been established in 2012.

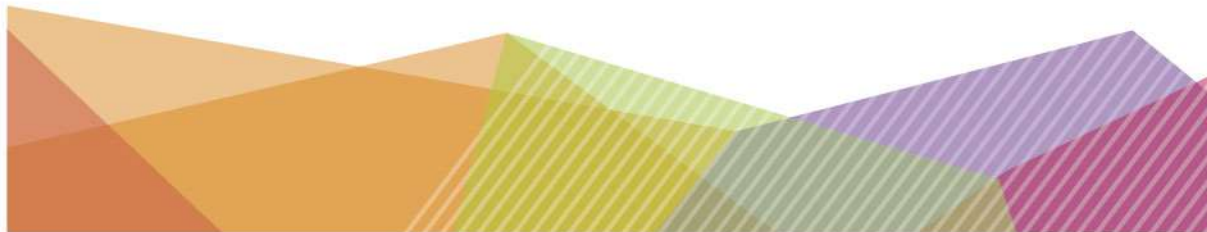




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**SPSU realizes and develops High-school Education establishing new master programs and different forms of practices.**

- ❖ Bachelor, Master and PhD programs “Neutron and Synchrotron Physics” was established at SPSU in Russian since 2012 (in Russian).
- ❖ Converted to the Master program “Condensed Matter Physics at MEGA-science facilities” established since 2018 (in English).





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## Program “Neutron and Synchrotron Physics”

- ❖ The first and the only program in Europe focused on teaching and training students in the field of Neutron and Synchrotron Physics.
- ❖ Bachelor Program – 4-year program (Faculty of Physics)
- ❖ Master Program – 2-year program (Chair of Nuclear Research Methods)
- ❖ PhD program – 4-year program (Chair of Nuclear Research Methods)



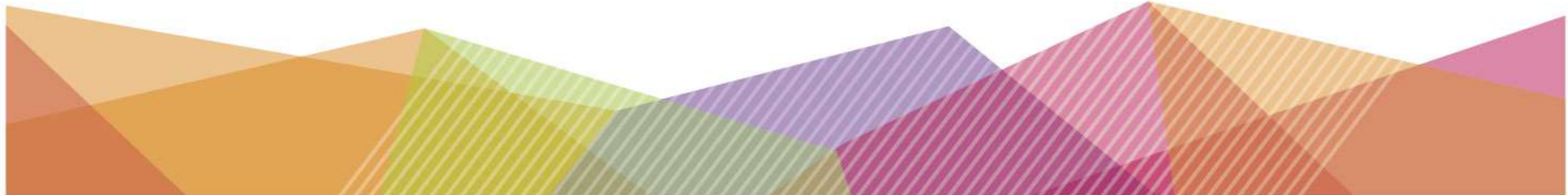




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## Program “Neutron and Synchrotron Physics”: motivation

- ❖ Since 2012 the Master program is aimed at training the scientists in design, construction and operation of instruments and methods at the scientific and experimental facility of the "PIK" reactor in Petersburg Nuclear Physics Institute (PNPI) of NRC "Kurchatov Institute".





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Program “Neutron and Synchrotron  
Physics”: motivation

Since 2012 the Master Program is aimed at training the scientists to use methods of the synchrotron radiation at

- ❖ dedicated synchrotron source at NRC “Kurchatov Institute”
- ❖ European Synchrotron Radiation Facility in Grenoble
- ❖ European X-Ray Free-Electron Laser Facility in Hamburg.





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**90 %** of all experiments at the modern neutron and synchrotron sources are focused on **Solid, Soft and Life Matters** the subject of **Condensed Matter Physics**, Chemistry, Biology, Medicine and **Material Science**.

EDUCATIONAL  
PROGRAM

CONDENSED MATTER PHYSICS  
AT MEGA-SCIENCE FACILITIES

SUBJECT FIELD

03.04.02 PHYSICS

master's degree

in English since 2018



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## main disciplines

- *Theory of interaction of neutrons with matter*
- *Theory of interaction of synchrotron radiation (X-rays) with matter*
- *Basics of detection of neutrons and synchrotron radiation*
- *The sources of neutron and synchrotron radiation*
- *Hands-on neutron-physics training course*

### *Semester II*

- *Atomic structure of matter: diffraction of neutron and synchrotron radiation*
- *Atomic and molecular dynamics: inelastic neutron and X-ray (synchrotron radiation) scattering*
- *Layered structures, polymers, and colloids: small-angle scattering and reflectometry of neutrons and synchrotron radiation*
- *Local structure and X-ray spectroscopy*
- *Basic research with neutrons*
- *Hands-on neutron-physics training course*



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main disciplines

## *Semester III*

- *Physics of magnetism and scattering of polarized and unpolarized neutron*
- *Protein crystallography and synchrotron radiation scattering*
- *Simulation of neutron instruments and neutron scattering processes*
- *Techniques and Methods of Polarized Neutron Scattering*
- *Optics of neutrons and synchrotron radiations*
- *Hands-on neutron-physics training course in JINR (Dubna)*
- *Hands-on training in synchrotron physics in NRC "Kurchatov Institute"*

## *Semester IV*

- *Master's Thesis*
- *Hands-on training at large scale facilities*

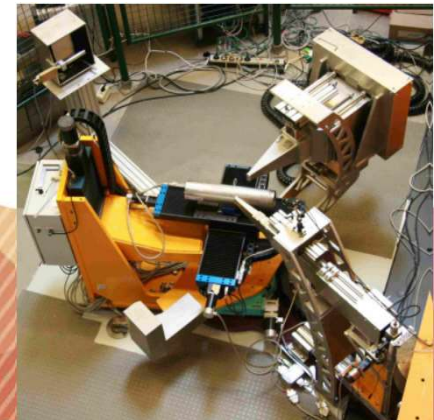


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subject specialism

### Material science

- ❖ Diffraction  $\equiv$  crystal and molecular structure
- ❖ Spectroscopy  $\equiv$  lattice/atom/spin dynamics
- ❖ Small Angle Scattering  $\equiv$  nanosystems/nanostructures
- ❖ Reflectometry  $\equiv$  layered structures and surfaces





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## Companies for employment

- ❖ Konstantinov Petersburg Nuclear Physics Institute of NRC (Gatchina, St. Petersburg, <http://www.pnpi.spb.ru/en>).
- ❖ NRC «Kurchatov Institute» ( Moscow, <http://eng.nrcki.ru>).
- ❖ Joint Institute Nuclear Research (Dubna, Moscow region, <http://www.jinr.ru/main-en>).





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## International companies for employment

- ❖ European Synchrotron Radiation Facility (Grenoble, France)
- ❖ European X-Ray Free-Electron Laser Facility (Hamburg, Germany)
- ❖ Institute Laue-Langevin - international research centre (Grenoble, France)
- ❖ Neutron research source at Heinz Maier- Leibnitz Zentrum (FRM II) (Garching, Germany)
- ❖ Synchrotron Radiation Source at DESY: PETRA III (Hamburg, Germany)
- ❖ European Spallation Source (Lund, Sweden)







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The Master program “Condensed Matter Physics at MEGA-science facilities” is a key element in National State Programme for education and training of specialists in the field of development, design and construction of synchrotron and neutron radiation sources.



## Conclusions

Магистерская программа «Нейтронная и синхротронная физика» является ключевым элементом ФНТП в части подготовки специалистов в области разработки, проектирования и строительства источников синхротронного и нейтронного излучения, а также научных кадров для проведения синхротронных и нейтронных исследований (разработок) в целях получения научных результатов мирового уровня.





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Thank you for attention!



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**SPSU had initiated, constructed and now operates the Russian –German beam line at BESSY with particular focus on the surface investigations**

- ❖ The Agreement between Saint-Petersburg State University and HZB (former BESSY, Berlin) covers activities in the field of synchrotron physics, supporting education, practices, joint scientific projects, employment of graduated students .

