



Institute of Nuclear Physics and Engineering

National Research Nuclear University MEPhI

Student Research Opportunities

2019 Edition

Laboratory of Engineering Computer Modeling

Head of laboratory

Georgy V. Tikhomirov
Dr. Sci. (Phys.–Math.), Professor

Scientific team engaged in modeling in the field of reactor physics, and development of new and improvement of existing calculation test problems. The laboratory is aiming to train highly qualified specialists in the field of reactor physics and technology.



Research fields

The central research themes at present at ECM Lab include:

- High-fidelity neutron-physical calculations of fast liquid metal reactors
- Thermal-hydraulics analysis of water, sodium, lead and gas cooled reactors
- Coupled neutronics and thermal-hydraulics modeling
- Codes verification and validation methodology

Possible researches within the internship

- Fast reactors neutronics and fuel cycle modeling with Serpent Monte Carlo code
- Use of the Serpent Monte Carlo code for few-group cross section generation
- Multi-physics transients modeling with diffusion code and system code coupling

Laboratory of Simulators and Automated Process Control Systems for Nuclear Power Plants

Head of laboratory

Andrei A. Semenov
PhD, Senior Research

Research fields

- NPP computer simulators for Education and Training
- NPP core dynamic
- Transients optimization
- Diagnostics, analysis of uncertainty and reliability of nuclear reactor



Possible researches within the internship

- Calculations uncertainty and reliability of NPP core
- Influence of the neutron spectrum changes to neutron microsection library

Laboratory of Thermal Hydraulics and Boiling Physics

Head of laboratory

Kirill V. Kutsenko
PhD, Associate Professor



International scientific team, which is engaged in experimental and theoretical research in the field of thermal hydraulic processes and boiling physics of various liquids.

Research fields

- Experimental investigation of thermal and hydraulic processes;
- Development of methods for diagnosing changes in heat transfer regimes;
- Investigation of nanofluid boiling for solar energy applications;
- Unsteady processes of boiling in various liquids;
- Study of critical heat flux phenomena.

Possible researches within the internship

- Experimental investigation and numerical simulation of processes of nanofluid boiling in solar power plants
- Experimental and numerical investigation of heat transfer processes in thermo-hydraulic systems

Laboratory of Simulation of the Nuclear Reactor Cores by Real-time Models

Head of laboratory

Vyacheslav G. Zimin
PhD, Dr. of Eng., Research Associate



Research fields

- Development of numerical methods for neutron diffusion calculations
- Neutron kinetics code SKETCH-N for XYZ and Hex-Z geometry
- Generation of neutron cross section libraries for WWER-1000 calculations
- Coupling of the neutronics codes and thermal-hydraulics codes;
- Verification and validation of reactor core models using benchmarks and experimental data

Possible researches within the internship

- Benchmark calculations of the fast breeder reactors
- Approximation of the multi-dimensional data by the regression analysis tools

Laboratory of Innovative and Research Nuclear Reactors

Head of laboratory

Anatoly N. Shmelev

Doctor of Technical Sciences, Professor



Research fields

- Neutronics codes validation against experimental data
- Prospective nuclear fuel cycles: high burn-up and non-proliferation
- Nuclear reactor neutronics simulation using Monte Carlo and deterministic codes
- Multiphysics simulation of new generation nuclear reactors
- Research reactor safety analysis
- Quantitative evaluation of proliferation protection for fissionable materials
- Radioactive waste management

Possible researches within the internship

- Peculiarities of the fast reactor with reflector from lead-208
- Radical increase of LWR fuel burn-up and proliferation protection of fissile materials by introducing hybrid thermonuclear reactors into nuclear fuel cycle
- Research reactor neutronics simulation using Monte Carlo and diffusion codes
- High-temperature nuclear reactor for hydrogen productions - a step towards future green energy

Laboratory of Virtual Reality and Reverse Engineering

Head of laboratory

Ivan S. Saldikov

PhD, Assistant Professor

Scientific team engaged in development in the field of virtual (VR) and augmented reality (AR). The laboratory is aiming to combine modeling with VR and AR technologies



Research fields

- Creation of the virtual analogs and digital twins of the real experiments/objects
- Visualization in VR and AR
- Simulation of various processes in virtual reality

Possible researches within the internship

- Creating objects for virtual analogs
- Visualization of neutron flux distributions in MEPHI sub-critical facility in VR
- Creating models of detectors to measure the radiation dose rates
- Visualization of background radiation in the room with radiation sources in VR

Laboratory of Advanced Technologies for Creating New Materials

Head of laboratory

Dmitri P. Shornikov
PhD, Senior Research

Research fields

- Investigation of the patterns of compacting structural ceramics based on carbides, nitrides, oxides (boron and silicon carbide, silicon nitrides, titanium, zirconium, SiAlON, AlON, etc.)
- Methods of compacting organometallic composites for medicine
- Study of compaction of structural materials based on corrosion-resistant steels and high-nickel alloys
- Investigation of the structural-phase state of powder compacts obtained with the help of electromagnetic fields



Possible researches within the internship

- Obtaining of products from boron carbides and silicon by the method of spark-plasma sintering
- Obtaining of products from nitride ceramics by the method of high-voltage electropulse compaction
- Study of the influence of magneto-pulsed pressing on the structure and properties of ceramic compacts

Laboratory of Rapidly-Quenched Amorphous and Nanocrystalline Alloys

Head of laboratory

Oleg N. Sevryukov
PhD, Associate Professor

Research fields

- Development of amorphous and nanocrystalline filler metals for high temperature brazing
- Investigations of brazed joints of similar and dissimilar materials

Possible researches within the internship

- Experimental investigation of diverter and first wall joints, obtained by rapidly-quenched alloys, for DEMO reactor



Laboratory of X-Ray Texture

Head of laboratory

Yuriy A. Perlovich
Dr. Sci. (Phys.–Math.), Professor



Research fields

- X-ray analysis of structure and texture formation in alloys based on zirconium, titanium, austenitic and ferritic-martensitic steels, low-carbon and dispersed-hardened steels, superconductors, etc
- Study of regularities in the formation of nitride, oxide and other coatings on the surface of crystalline materials
- Studying the regularities of crystallization of amorphous materials
- Investigation of mechanisms of superelasticity and shape memory using X-ray data and measurement of mechanical properties
- Modeling of structure and texture formation using DAMASK software
- Modeling plastic deformation of products using ANSYS software
- Calculation of the anisotropy of material properties taking into account the crystallographic texture and indentation results

Possible researches within the internship

- Effect of the structural-phase state of superelastic alloys and crystallographic texture on the anisotropy of properties

Laboratory of Numerical Methods of Radiation Transport

Head of laboratory

Mikhail P. Panin
PhD, Associate Professor



Research fields

- Monte Carlo method in radiation transport problems
- Simulation of radionuclide distribution in the environment

Possible researches within the internship

- Modeling of accident irradiation on the basis of voxel phantoms

Head of laboratory

Valeriy V. Dmitrenko
Dr. Sci. (Phys.–Math.), Professor



Research fields

Development and creation of gamma-ray spectrometers with high energy resolution and its application for:

- Characterization of radioactive waste during the decommissioning of nuclear and radiation-hazardous facilities (D NRHF)
- Sorting of radioactive waste in process of radioactive contamination cleaning on the territories contaminated with technogenic origin (violations in the process of RW utilization, catastrophes at the facilities of the nuclear power complexes, etc.)
- Installations on unmanned aerial vehicles for routine environmental monitoring and obtain information in the case of technogenic catastrophes
- Use in pedestrian and transport portals monitors (airports, railway, river and marine stations, etc.) to detect and identify of radioactive and fissile materials
- Studies of the gamma-ray radiation of the Sun and cosmic gamma-ray bursts in the range 0.05 - 5 MeV on space vehicles (Experiment "SIGNAL", International project "Intergeliozond")
- Detection and identification of radioactive objects in near-Earth space (Experiment "NUKLID", International project "Universiade-Socrates")
- Measurements of tumor irradiation dose in the treatment of cancer by neutron capture therapy

Development and creation of high-efficiency multilayer film screens to protect the photomultipliers from residual magnetic fields in the SHiP experiment at CERN

Possible researches within the internship

- Participation in the preparation and testing of prototypes of gamma-ray spectrometers for experiments "SIGNAL" and "NUKLID"
- Simulation of the gamma-ray spectrometer "SIGNAL" response to solar flares of various classes
- Participation in the study of the screening properties of multilayer film screens to protect the photomultipliers from residual magnetic fields in the SHiP experiment at CERN

Scientific & Educational Centre NEVOD

Head of laboratory

Anatoly A. Petrukhin
Dr. Sci. (Phys.–Math.), Professor



Research fields

- Fundamental research in the field of particle physics above accelerator energies to study the processes of generation and interaction of cosmic rays with energies 10^{15} - 10^{19} eV, as well as a search for new states of matter in TeV mass region.
- Applied research in the field of nuclear-physical monitoring of the Earth's atmosphere and near-Earth space using the methods of the muon diagnostics for early detection of potentially dangerous events.
- Development of nuclear-physical instrumentation and research techniques for various areas of nuclear science and technology

Possible researches within the internship

- Study of energy deposit of EAS cores in the Cherenkov water calorimeter NEVOD.
- Investigation of lateral distribution function for events in the NEVOD-EAS array.
- Study of response of muon hodoscope URAGAN to disturbances in Heliosphere.
- Investigation of coronal mass ejections with muon hodoscope URAGAN.
- Investigation of properties of scintillation detectors.
- Investigation of properties of photomultiplier tubes.
- Investigation of properties of drift chambers.
- Study of the response of optical modules to Cherenkov light of muons and cascades.

Questions or Problems

Please do not hesitate to contact any faculty staff of your research interest.
For general information, e.g., regarding admission, please contact this office:
Anton D. Smirnov, Engineer
E-mail: ADSmirnov@mephi.ru

National Research Nuclear University MEPHI
115409, Russia, Moscow, Kashirskoe shosse, 31
TEL: +7 495 788-5699