



# JOINT INSTITUTE FOR NUCLEAR RESEARCH

Science brings  
nations together

DUBNA | 2023

[WWW.JINR.INT](http://WWW.JINR.INT)



## THE JOINT INSTITUTE FOR NUCLEAR RESEARCH

is an international intergovernmental organization, a world-famous scientific centre that integrates fundamental theoretical and experimental research with the development and application of advanced technology and university education.

The megascience project on the construction of the superconducting heavy ion collider NICA is being implemented at the Joint Institute.

JINR plays a significant role in the implementation of the megascience project on the construction of the Baikal-GVD deep-underwater neutrino telescope.

10 new elements have been discovered at JINR. JINR has a unique neutron pulsed reactor IBR-2 for research in neutron nuclear physics and condensed matter physics.



JINR is one of the organizers of the **International Year of Basic Sciences for Sustainable Development**

### RESEARCH DIRECTIONS

**Theoretical Physics**

**Relativistic Heavy Ion Physics**

**Spin Physics**

**Particle Physics**

**Low Energy Nuclear Physics**

**Nuclear Neutron Physics**

**Condensed Matter Physics**

**Neutrino & Astroparticle Physics**

Life sciences:

**Radiobiology**

**Biomedicine**

**Structural Biology**

**Astrobiology**

**Ecology**

**IT & High-performance computing**

**Outreach & Education**

**7 JINR Laboratories,  
each being comparable  
with a large research institute  
in the scale of investigations  
performed**



Veksler and Baldin Laboratory  
of High Energy Physics



[lhep.jinr.ru](http://lhep.jinr.ru)



Dzhelepov Laboratory  
of Nuclear Problems



[dlnp.jinr.ru](http://dlnp.jinr.ru)



Bogoliubov Laboratory  
of Theoretical Physics



[theor.jinr.ru](http://theor.jinr.ru)



Frank Laboratory  
of Neutron Physics



[flnph.jinr.ru](http://flnph.jinr.ru)



Flerov Laboratory  
of Nuclear Reactions



[flerovlab.jinr.ru](http://flerovlab.jinr.ru)



Meshcheryakov Laboratory  
of Information Technologies



[lit.jinr.ru](http://lit.jinr.ru)



Laboratory  
of Radiation Biology



[lrb.jinr.ru](http://lrb.jinr.ru)



### Dear colleagues and friends,

The Joint Institute for Nuclear Research in Dubna is an integral part of a global family of unique international research centres. Our mission is to provide the highest quality of the scientific agenda for cutting edge research and discoveries aimed to understand the fundamental properties of matter.

The JINR Long-Term Development Strategy up to 2030 and beyond is designed to strengthen our common international scientific family. The core research fields at JINR are Low-Energy Nuclear Physics, Relativistic Heavy Ion and Spin Physics, Particle Physics, Neutrino and Astroparticle Physics, Condensed Matter and Neutron Nuclear Physics, Radiobiology and Nuclear Medicine, Theoretical Physics, Information Technologies & High-Performance Computing. The foundation of the Institute is its world recognised scientific schools. The idea of neutrino oscillations, 10 new superheavy elements discovered, ultracold neutrons, superfluidity of the nuclear matter, postradiation recovery of cells, quantum field theory, harmonical superdimension in supersymmetry, a new generation of neutron pulsed reactors, and hyper convergent heterogeneous computing cluster — these are only some of visible scientific subjects associated with modern JINR.

Our Institute and its laboratories are also setting the agenda at the forefront innovations. To name just a few of these frontiers: novel materials and energetics, biomedicine, quantum technologies, data science, etc.

JINR is of course about basic science. No doubt that the quality of our scientific product is mainstaying on essential issues reinforcing us as a modern dynamic international intergovernmental scientific organization: worldwide scientific cooperation, science diplomacy, friendly social environment, digitalisation, innovation policy.

Our international team is diverse but united through the passion for research and sharing the value of international cooperation. The JINR Sofia Declaration signed in November 2021 highlights the value of international scientific and technological integration in solving the tasks of strengthening peace, mutual understanding, and socio-economic progress of all the countries.

JINR is open for attracting new partners and even entire regional clusters: science brings nations together. We feel obligated to use our scientific and integrating potential to promote peaceful scientific and technological progress in different parts of our planet.

Please, enjoy this brochure and become our missionary. On behalf of the JINR team I wish you pleasant acquaintance with our International Research Centre.

Grigory Trubnikov  
Director of JINR



**Seven-Year  
Plan for JINR  
Development  
(PDF)**



**JINR  
Strategy  
(PDF)**



## ORGANIZATION

The Committee of Plenipotentiaries of the Governments of the JINR Member States (CP), which is the supreme governing body of JINR, takes main decisions on the Institute's activities. The JINR Member States share the financing of the JINR activities and have equal rights in controlling the Institute. The Member States make contributions in the amount established by the Committee of Plenipotentiary Representatives. The Finance Committee and the Scientific Council operate under the CP JINR.

The research policy of JINR is determined by the Scientific Council. It consists of eminent scientists from world-leading scientific organizations and universities.

The Programme Advisory Committees (PACs) are advisory bodies to the JINR Directorate and to the JINR Scientific Council in three scientific fields: Particle Physics, Nuclear Physics, Condensed Matter Physics. The Programme Advisory Committees evaluate experimental projects proposed by scientific collaborations, institutes, JINR laboratories, and individual scientists.

The Science and Technology Council of the Institute is an advisory body to the Directorate of the Institute. It aims to ensure the participation of the scientific staff of the Institute in organizing its research activities. The immediate control over the JINR activity is exercised by the Directorate.



## MISSION AND GOALS

The Institute was established with the aim of uniting the efforts, scientific and material potential of its Member States for investigations of the fundamental properties of matter. Over 65 years JINR has accomplished a wide range of research and trained scientific staff of the highest quality for the Member States.

The concept of further development of JINR as a multidisciplinary international centre for fundamental research in nuclear physics

and related fields of science and technology implies efficient use of theoretical and experimental results, as well as methods and applied research at JINR in the field of high technology through their application in industrial, medical, and other kinds of technical development. The Institute's development strategy is detailed in the Seven-Year Plan for the Development of JINR.



On 1 February 1957, JINR was registered by the United Nations.

On 24 September 1997, UNESCO and JINR signed an Agreement on Cooperation in Paris. Based on the agreement, the Institute became one of the international intergovernmental organizations associated with UNESCO.

## INTERNATIONAL DIALOGUE FOR SCIENTIFIC INTEGRATION AND SCIENCE DIPLOMACY

### SOFIA DECLARATION

A Declaration highlights the value of international scientific and technological integration in solving the tasks of strengthening peace, mutual understanding, and socio-economic progress of all the countries. The document was adopted on 22 November 2021, at the session of the Committee of Plenipotentiary Representatives of the Governments of the JINR Member States held in Bulgaria.



Full text

## JINR'S RANK in the worldwide rating of International Intergovernmental Research Organizations

The list of the Intergovernmental Research Organizations is received from the open database of the Yearbook of International Organizations. Information on budget and staff is taken from the annual reports of the organizations.

2 PERSONNEL

5 BUDGET natural science only

8 BUDGET



## NICA NUCLOTRON-BASED ION COLLIDER FACILITY

### SEARCH FOR NEW STATES OF NUCLEAR MATTER

Megascience project for research into the critical states of nuclear matter under extreme conditions, which occurred after the Big Bang at early stages of the Universe evolution using high-intensity heavy ion beams.

NICA covers an energy range where most important and interesting physics appears to take place — transition from hadronic to partonic effect dominance, possible appearance of first order phase transition in QCD phase diagram, transition from baryon to meson dominance in particle production.

### NICA PARAMETERS

**Range of nuclei:**  
from hydrogen to bismuth, including gold

**Energy of extracted beams:**  
up to **4.5 GeV/N**

**Intensity (per second):**  
Heavy ions —  **$5 \cdot 10^8$**   
Protons —  **$10^{10}$**

**Designed luminosity:**  
Heavy ions —  **$10^{27} \text{ cm}^{-2}/\text{s}^{-1}$**

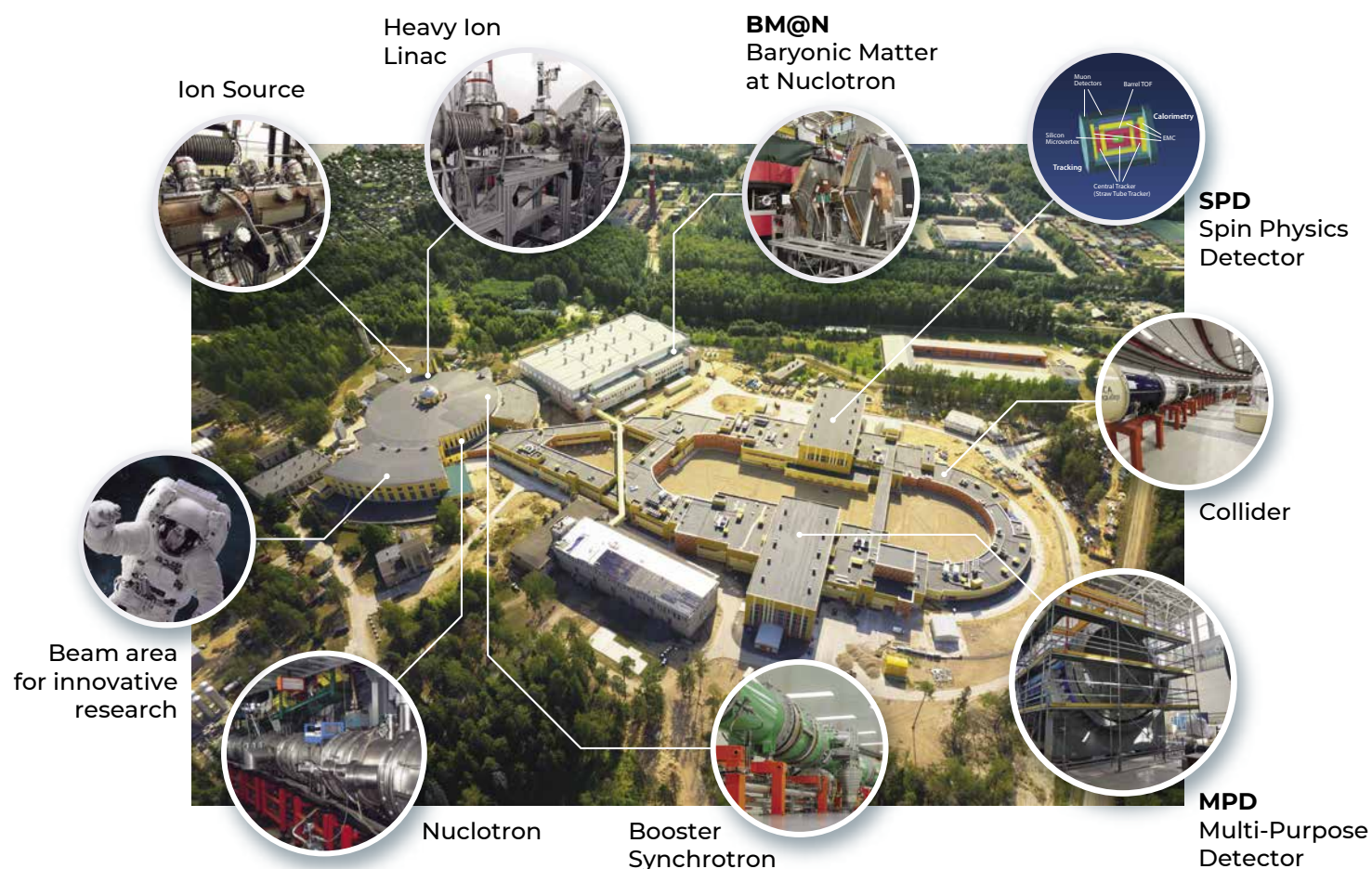
Light nuclei and polarised protons and deuterons —  **$10^{32} \text{ cm}^{-2}/\text{s}^{-1}$**



[nica.jinr.ru](http://nica.jinr.ru)

$\sqrt{s} = 4-11$   
GeV/N  
Energy

Collider ring circumference  
**503m**



### JINR IN EXTERNAL EXPERIMENTS ON PARTICLE PHYSICS

Involvement in external experiments — for mutual benefit from the exchange of new scientific information and technological know-how with the emphasis on the tasks initiated or supported by JINR groups.

In LHC experiments at CERN, JINR physicists participate in analyses of data obtained and in the detectors upgrades.

Search for beyond Standard Model phenomena: CMS, ATLAS, COMET

Spin and orbital momentum composition of the proton: COMPASS/AMBER

Spectroscopy of charmed particles production in electron-positron annihilations: BES-III

Also @ CERN: ALICE, SPS, NA62, NA64

RHIC@BNL — beam energy scan made by the STAR collaboration is one of the key components of the NICA physics programme and STAR members engagement is above rubies. FAIR/GSI projects are also beneficial for NICA:

- silicon tracker technology in CBM will be implemented in BM@N and SPD experiments
- high speed electronics with PASTRECK chip from HADES will be used for straw-tracker of SPD
- superconducting dipole magnet CBM, R&D for track gas detectors, and scintillation detectors with SiPM readout are very helpful in preparation of NICA experiments



APPLIED RESEARCH INFRASTRUCTURE FOR ADVANCE DEVELOPMENT AT NICA FACILITY

Channels for transporting charged particle beams and irradiation stations are being developed at NICA. They are designed for research in the fields of life sciences, radiation materials science and radiation resistance of electronics, development of advanced technologies for nuclear power problems.

# 100%

## of dipole and quadrupole magnets

manufactured and tested for the project

# 95%

## capital construction

# 87%

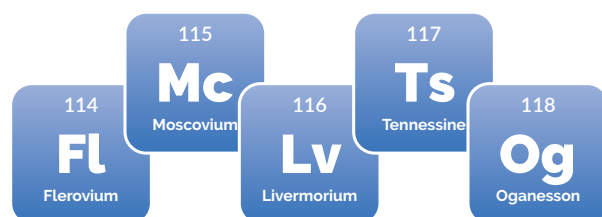
## overall project progress



## LOW ENERGY NUCLEAR PHYSICS

In this field, JINR conducts advanced experiments on the synthesis of new superheavy elements.

The scientific programme includes experiments on the study of nuclear and chemical properties of new superheavy elements, reactions of fission, fusion, and multinucleon transfer in heavy-ion collisions.



**5** NEW superheavy elements have been discovered at JINR that conclude period 7 of the Periodic Table for the past **25** years

One of the results of global importance achieved by JINR scientists is the experimental proof of the existence of the “island of stability” of superheavy elements centred near  $Z=114$  and  $N=184$ .

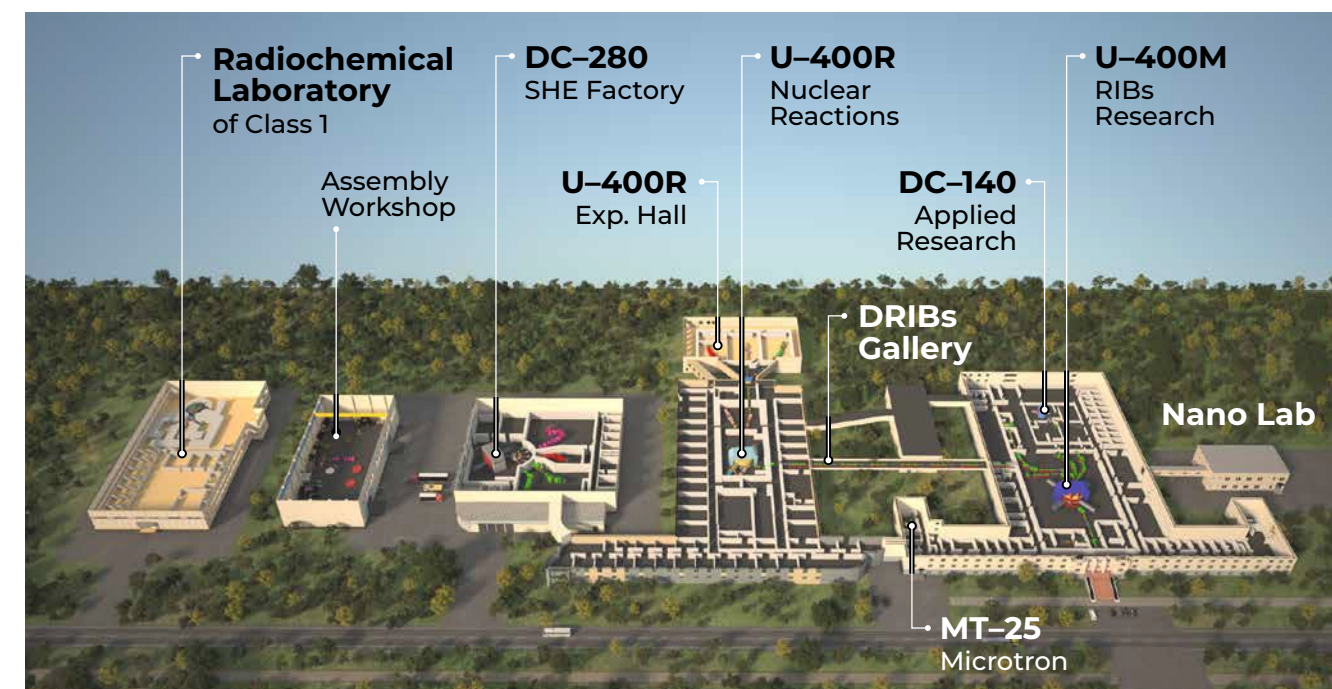
In November 2021, FLNR JINR Scientific Leader **Yuri OGANESSIAN**, who had new element 118 named after him for his pioneering contributions to transactinoid elements research, was awarded the UNESCO–Russia Mendeleev International Prize in the Basic Sciences “to acknowledge his breakthrough discoveries extending the Periodic Table and for his promotion of the basic sciences for development at the global scale.”

### AT PRESENT

The development of works in the fields of synthesis and property study of superheavy elements is associated with the creation of a new accelerator complex called the Superheavy Element Factory (SHE Factory) based on the DC-280 specialised cyclotron. The key task of the complex is to synthesise new chemical elements with atomic numbers 119, 120, and further, as well as to study in detail nuclear and chemical properties of the earlier synthesised superheavy elements.

Record parameters of accelerated heavy ion beams have been achieved at the Superheavy Element Factory accelerator complex. The  $^{48}\text{Ca}$  beam intensity exceeds 7 puA. The  $^{40}\text{Ar}$  beam at the SHE Factory has reached its designed intensity of 10 puA.

The scientific infrastructure of the SHE Factory is gradually improving: accelerators U-400 and U-400M are developing, a new facility DC-140 is under construction for applied research in the fields of track membranes and materials sciences.



BASIC FACILITY — DRIBS-III ACCELERATOR COMPLEX

## SUPERHEAVY ELEMENT Factory

SUMMARY OF EXPERIMENTS: 2020–2023

### Strategic Research Directions:

- Heavy and superheavy nuclei
- Light exotic nuclei
- Radiation effects and nanotechnologies
- Accelerator technologies

**240** new events of synthesis of superheavy nuclides

**VS.**

~100 events at all the facilities in the world, including in Dubna, since 1999

**36** isotopes decays were studied

### 6 new isotopes were discovered:

$^{286}\text{Mc}$ ,  $^{276}\text{Ds}$ ,  $^{275}\text{Ds}$ ,  $^{272}\text{Hs}$ ,  $^{268}\text{Sg}$ ,  $^{264}\text{Lr}$

### New decay modes:

$^{268}\text{Db}$  (alpha-decay)  
 $^{279}\text{Rg}$  (spontaneous fission)

Test of target stability up to 7 puA  $^{48}\text{Ca}$





## NEUTRINO PHYSICS AND ASTROPHYSICS

Research programme in the fields of neutrino physics and astrophysics includes a number of projects, among which **Baikal-GVD** is the main infrastructure and research facility.

The neutrino telescope is located in Lake Baikal 3.6 km away from the shore, at a depth of about 1,300 m. Baikal-GVD is the largest in the Northern Hemisphere and the second in size in the world.

Baikal-GVD: Identification of astrophysical sources of ultra-high energy (exceeding tens of TeV) neutrinos.

Topicality: their sources are still unknown. The identification of sources will help to elucidate the mechanisms of galaxies creation and evolution. This unique scientific facility is an important tool of multi-messenger astronomy, a new powerful method to investigate the Universe.

Baikal-GVD is one of the three neutrino telescopes across the world and, along with IceCube at the South Pole and KM3NeT (former ANTARES) in the Mediterranean Sea, is part of the Global Neutrino Network (**GNN**).

The Baikal-GVD Neutrino Telescope is being constructed by the international collaboration with a leading role of the RAS Institute for Nuclear Research (Moscow) and the Joint Institute for Nuclear Research.



### JINR PARTICIPATION IN NEUTRINO OSCILLATION EXPERIMENTS

- Determination of CP-violating phase: DUNE
- Determination of neutrino mass ordering: NOvA, JUNO
- Precise determination of elements of the lepton mixing matrix: JUNO, DUNE

### Physical properties of neutrino

- Determine if a neutrino is a Majorana particle: SuperNEMO, GERDA-LEGEND
- Coherent elastic neutrino-nucleus scattering process at nuclear reactors: nuGEN (GEMMA)
- Sterile neutrino oscillation: DANSS

### Dark Matter discovery

- Existence of the dark matter particles: DarkSide, EDELWEISS
- Sources of high-energy (exceeding tens of TeV) gammas: TAIGA
- Determination of nuclear matrix elements via muon capture: MONUMENT

more than  
**60**  
& scientists  
& engineers

from  
**9**  
international  
research  
centres

Together,  
**Baikal-GVD**  
and **TAIGA**  
can provide a unique  
**multi-messenger observation**  
of the Universe integrated  
into the global astroparticle  
network.

The discovery of  
**gravitational waves**  
is one of the most remarkable discoveries ever.

**VIRGO**  
The VIRGO experiment aims to search for gravitational waves. JINR scientists installed Institute's brand new laser inclinometers at the VIRGO Interferometric Gravitational-Wave Antenna to improve its sensitivity.

## CONDENSED MATTER AND NUCLEAR NEUTRON PHYSICS

This scientific programme is implemented mainly, but not exclusively, at two basic facilities: the **IBR-2** pulsed reactor of periodic action and the **IREN** resonant neutron source based on a linear electron accelerator.

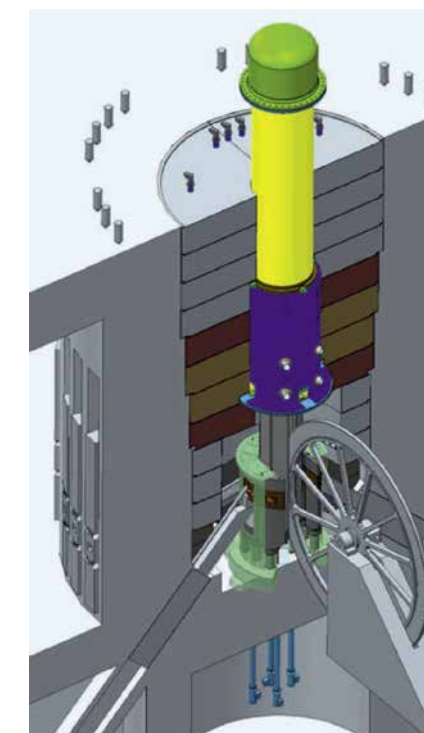
[ibr-2.jinr.ru](http://ibr-2.jinr.ru)



The **IBR-2** reactor is among top-5 "brightest" neutron sources in the world, and an international user programme is being implemented at its instruments to fulfil a wide range of tasks in physics, chemistry, biology, geology, materials science, ecology, etc. A suite of 13 high-performance instruments is available for conducting experiments, at which more than 200 experiments are carried out annually by scientists from all around the world.

Research at **IREN** focuses on nuclear data, issues related to fundamental symmetries of nuclear interactions, elementary analysis by the method of neutron resonances and applied research for the study of cultural heritage objects.

JINR is considering the possibility of creating a new neutron source of the 4th generation — the **NEPTUNE** pulsed reactor of periodic action with a power up to 15 MW and fuel based on neptunium nitride. In combination with a modern complex of bispectral moderators, sample environment systems, and spectrometers, such a source promises to become the best in the world and open unprecedented possibilities for scientists from the JINR Member States and the entire neutron community.



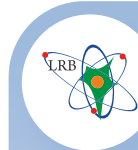
Schematic view of the  
4th generation pulsed reactor

## LIFE SCIENCES



### Dzhelepov Laboratory of Nuclear Problems

- Proton therapy of cancer
- Molecular genetics
- Detectors and tomography



### Laboratory of Radiation Biology

- Fundamental Radiobiology
- Radiation Neuroscience
- Clinical Radiobiology
- Mathematical Modelling
- Radiation Protection
- Astrobiology

Infrastructure for molecular, cellular and animal research

## RADIOBIOLOGY, BIOMEDICINE, STRUCTURAL BIOLOGY, ASTROBIOLOGY, ECOLOGY



### Flerov Laboratory of Nuclear Reactions

- Ion beams for cellular research
- Radionuclides synthesis for radiation medicine



### Frank Laboratory of Neutron Physics

- Beamlines for neutron scattering
- Structural Biology
- Ecology



### Meshcheryakov Laboratory of Information Technologies

- High performance computing
- System for biological data storage and processing
- Bioinformatics, Machine Learning



### Veksler and Baldin Laboratory of HEP

- Heavy ion beamlines for space radiobiology, technologies for beam therapy

## LIFE SCIENCES

Scientific research in general and life sciences in particular have always benefited from the development of large-scale scientific infrastructures.

### JINR ADVANTAGES

- Multiple radiation sources with applied channels (protons, neutrons, heavy ions, radionuclides)
- Variety of complementary instruments for structural biology studies
- Infrastructure for large-scale animal research, including on primates
- Member of International Biophysics Collaboration

### PROTON THERAPY AT JINR Expertise since 1968.

**BASIC FACILITY — PHASOTRON,  
A CYCLIC ACCELERATOR OF HEAVY  
CHARGED PARTICLES**

Ten beam channels at the Phasotron have been used for experiments with pi-mesons, muons, neutrons, and protons. Secondary beams are intended for medical research, mainly, for medical treatment of oncological diseases.

- A fundamentally new method to enhance the biological effectiveness of medical proton beams and gamma-ray units has been developed and patented by LRB JINR.
- Worldwide unique experiments were carried out to study the effect of high-energy heavy charged particles on the brain and behaviour of primates.
- Computational studies of molecular and genetic mechanisms of severe brain diseases, including Alzheimer disease and epilepsy, are in progress at LRB, FLNP, and MLIT.
- DLNP JINR conducts genetic research, in particular the determination of the longevity gene and the determination of the propensity to various allergic reactions.
- Owing to the research at IBR-2 neutron beamlines, there is a better understanding of origins of the relevant mechanisms for health protection and even its recovery.
- The method of neutron activation analysis is used at FLNP to help in assessing the safety of seafood, quality of wastewater treatment, environmental pollution.

### TREATMENT APPROACHES DEVELOPED FOR:

meningiomas, chordomas, chondrosarcomas, gliomas acoustic neuromas, astrocytomas, aragangliomas, pituitary adenomas, AVMs, brain and other metastases; other neck and head tumours, melanomas, skin diseases, lung carcinoma metastases, breast cancer.

- The TANGRA collaboration on the platform of FLNP JINR is developing a mobile setup based on the tagged neutron method for determining soil organic carbon (SOC) content.



- JINR in cooperation with the Space Research Institute of the Russian Academy of Sciences participates in the development and creation of neutron, gamma-ray, and charged particle detectors for spacecraft. Thus, the HEND and LEND high-energy neutron detectors work on board NASA orbiters; the DAN device on board the Curiosity rover is part of the Mars Science Laboratory.
- LRB JINR has developed and patented a novel accelerator-based technique of modelling radiation fields with continuous particle energy spectra generated by the Galactic cosmic rays inside a spacecraft in deep space.
- In 2021, JINR issued a monograph about unique findings in the well-studied carbonaceous chondrite, which fell in 1864 in France near the village of Orgueil. Most of the fossilised microorganisms (microfossils) included in the Atlas were found by LRB JINR scientists. The monograph also considers some aspects of the transfer of life in space (the theory of panspermia).
- For the first time the synthesis of prebiotic compounds has been observed after irradiation of formamide and meteorite matter with high energy hadron beams.
- LRB and MLIT, jointly with the University of Belgrade, conduct research on the development and implementation of algorithms for automation of radiobiological research
- JINR has further plans to develop vibrational spectroscopy & microscopy: Raman and FT-I, as well as Micro-spectroscopic study of programmed cell death — NETosis and Apoptosis.



## ADVANCED INSTRUMENTS

### SARRP

(Small Animal Radiation Research Platform) X-ray irradiation facility designed for radiobiological studies on small laboratory animals. This is the only SARRP system installed in the territory of Russia and Eastern Europe.



### MULTIFUNCTIONAL “CARS” MICROSCOPE

(CARS — Coherent Anti-Stokes Raman Scattering)

#### Tasks:

- Raman, SERS, SECARS, and CARS spectroscopy and microscopy of biological objects;
- Exploration of structural and spectral characteristics of phosphors activated with various rare-earth elements;
- Plasmon-enhanced photo- and upconversion luminescence studies.



### XEUS 3.0

X-ray scattering station by XENOX company provides study of the structure of materials and nanomaterials from atomic to nanoscale in real time with SAXS, WAXS, and USAXS methods.

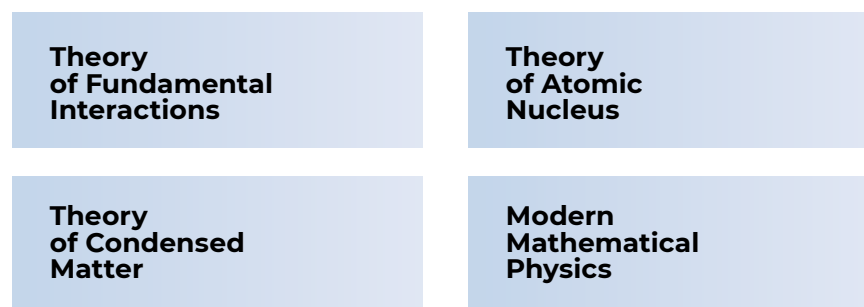






Research in the field of theoretical physics at JINR is carried out by the Bogoliubov Laboratory of Theoretical Physics (BLTP) as well as by theoretical groups in the experimental laboratories. As one of the largest centres, BLTP acts as a “generator” of interdisciplinary studies and international cooperation, thus determining the global scientific agenda of both theoretical and experimental research.

The research topics in theoretical physics are related to fundamental problems of modern physics and those specified by the JINR basic facilities, primarily, the NICA project, as well as physics programmes of international collaborations (LHC, RHIC, FAIR, K2K, etc.). The Laboratory hosts the world’s leading experts in quantum field theory and particle physics, modern nuclear physics, condensed matter physics, and mathematical physics. Pioneering results of the studies of Dubna theoreticians gained worldwide acknowledgement.



**33%**  
of JINR  
publications

**230**  
scientists

**>500**  
scientific  
papers  
published  
per year

**~15**  
annual  
scientific  
meetings

## BASIC INSTRUMENT — MULTIFUNCTIONAL INFORMATION AND COMPUTING COMPLEX AT JINR

**Development of information technologies and mathematical methods based on them, Data Processing & Storage, Experimental Data Analysis, Big Data, Quantum Computing, Machine & Deep Learning.**

Network infrastructure with a bandwidth of up to 4x100 Gbit/s, distributed computing and data storage systems based on grid technologies and cloud computing, hyper-convergent high-performance computing infrastructure with liquid cooling for supercomputer applications.

### Telecommunication Channels:

- JINR–Moscow 3x100 Gbit/s,
- JINR–CERN (100 Gbit/s) and JINR–Amsterdam (100 Gbit/s), providing connection between Tier-0 (CERN) and Tier-1 (JINR),
- Local area network 2x100 Gbit/s,
- Distributed multisite cluster network between MLIT and LHEP 4x100 Gbit/s.

### JINR GRID INFRASTRUCTURE

- Tier-1 for CMS @ LHC
- Tier-2 for ALICE, ATLAS, CMS, LHCb, BES, BIOMED, MPD, NOvA, ILC, etc.

**HybriLIT Platform** consists of the “Govorun” supercomputer and the “HybriLIT” education and testing polygon.

### JINR CLOUD INFRASTRUCTURE

Neutrino experiments of JUNO, NOvA, Baikal–GVD

Included in DICE — Distributed Information and Computing Environment (JINR & Member States)

The free resources of the JINR DICE were involved in the research of the SARS–CoV–2 virus at the Folding@Home platform

A heterogeneous computing environment, based on the DIRAC platform, was created for processing and storing data.

## GOVORUN SUPERCOMPUTER

Hyper-converged software-defined system

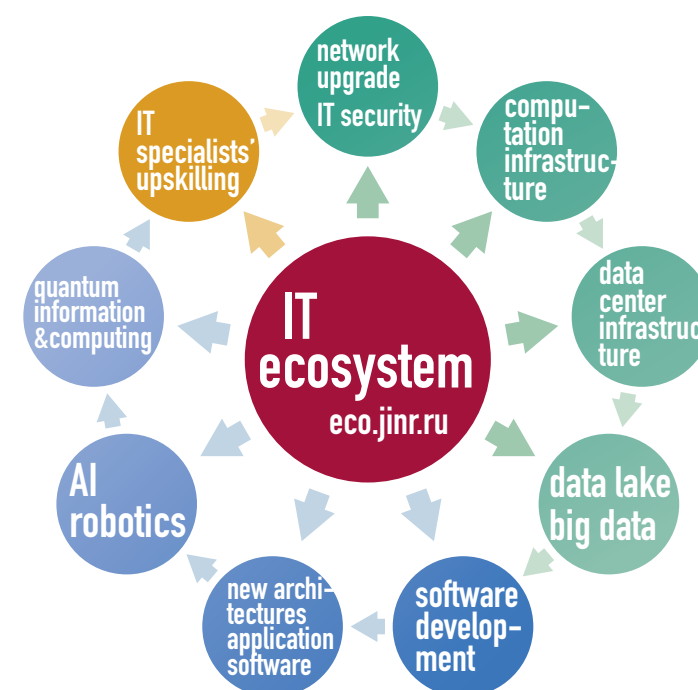
Total Peak Performance: 1.1 PFLOPS for DP

Storage performance >300 GB/s, DAOS technology (1st place among Russian supercomputers in IO500)

### GOVORUN KEY PROJECTS

- NICA megaproject
- Calculations of the lattice quantum chromodynamics
- Research in the field of radiation biology
- Calculations of radiation safety of JINR facilities
- Govorun is included in the unified supercomputer infrastructure based on the National Research Computer Network of Russia (NIKS)

JINR is developing a unified information and computing environment, a scientific IT ecosystem that combines many different technological solutions, concepts, and techniques.



Promising areas of modern IT technologies developed at MLIT are artificial intelligence and robotics, machine learning, quantum technologies and big data analytics.



## EDUCATION

### STUDENT PROGRAMMES

directions: **Science, Engineering, IT**

**START:** Student Advanced Research Training  
Offline. All countries. 6–8 weeks.

[students.jinr.ru](https://students.jinr.ru)

**INTEREST:** International REmote  
Student Training

Online. All countries. 4–6 weeks.

[interest.jinr.ru](https://interest.jinr.ru)

**ISP:** International Student Practices  
in JINR Fields of Research

**“3-week introduction to JINR”**

Offline. Member States only.

[uc.jinr.ru/en/isp](https://uc.jinr.ru/en/isp)

### OUTREACH PROGRAMMES

**Schools for Science Teachers.** 1 week.

[teachers.jinr.ru](https://teachers.jinr.ru)

**Workshops, visits, lectures  
for foreign school students**

[uc.jinr.ru/ru/visit-school](https://uc.jinr.ru/ru/visit-school)

Online and offline visits  
to the JINR labs for university  
and school students



[edu.jinr.ru](https://edu.jinr.ru)

E-learning  
resource

### SKILL IMPROVEMENT

For engineers

### LANGUAGE COURSES

For JINR staff

AYSS **3**  
ANNUAL  
CONFERENCES  
PER YEAR

## ASSOCIATION OF YOUNG SCIENTISTS AND SPECIALISTS

The Association is an active community uniting more than 1,000 young people under 35 working at JINR. It runs 3 annual conferences, as well as schools, workshops, and seminars, popularises scientific knowledge, and spreads information about JINR. Another goal of the Association is to provide help to the staff with social issues and organize social and cultural events.

### JEMS TRAINING PROGRAMME

**“JINR Expertise for Member States  
and Partner Countries”**

for administrative and scientific  
personnel from research  
and educational organizations.

Excursions, lectures,  
round tables, networking. 1 week.

[jinr.ru/jems](https://jinr.ru/jems)

### BLTP JINR

BLTP JINR has traditional educational activities on the platform of the Dubna International School of Theoretical Physics (DIAS–TH), scientific and educational project for young scientists and students from many countries.

### MLIT JINR

MLIT JINR has created an educational and research infrastructure based on the HybriLIT training and testing polygon, on the basis of which training courses on modern technologies of distributed computing and parallel programming are conducted for students and specialists from many countries.



**JINR POSTDOC  
PROGRAMME**



### MSU BRANCH IN DUBNA

The MSU branch in Dubna has been established on the initiative of JINR. It will use the Institute's abilities as a unique international

organization in the Russian Federation to establish contacts and use scientific results and best educational practices through interaction with foreign partners, participation in international projects to train personnel for fundamental research in the JINR Member States.



### PHYSICS AND MATHEMATICS LYCEUM

On the initiative of JINR,  
a physics and mathematics lyceum  
named after Academician

V. G. Kadyshevsky was opened in Dubna. Best teachers of Dubna and Russia work there as part of the big teacher community of the lyceum. Children from JINR Member States are among students of the lyceum.

## JINR INFORMATION CENTRES

To extend and strengthen the JINR research partner network, contribute to the training of scientific staff, and popularise science, JINR builds a network of its information centres.

The JINR Information Centre is a local “Embassy” and intermediary of JINR in science and education. Information centres aim to attract potential partners, staff members, students, and schoolchildren. They initiate events to increase awareness about JINR.

Eight JINR Information Centres already operate in **Cairo** (Egypt), **Sofia** (Bulgaria), **Yerevan** (Armenia), **Vladikavkaz**, **Petropavlovsk-Kamchatsky**, **Arkhangelsk**, **Tomsk**, and **Vladivostok** (Russia).





Development of technologies and methods in the fields of nuclear and radiation medicine, radiation materials science, advanced training of specialists for JINR Member States for radiation biology, medical physics, material studies.

Main stages:

- Radiation biology: OMICS@LRB and neuroradiobiological studies. Radiation neuroscience. Approaches to increase radiosensitivity: pharmaceuticals, transgene systems, targeted delivery (molecular vectors) and radionuclide;
- ARIADNA: Applied beams@NICA (ions from MeV/N to GeV/N): radiobiological studies (400–800 MeV/N); radiation testing of semiconductor electronics (3; 150–350 MeV/N); nuclear physics @ 1–4.5 GeV/N. Full-scale start in 2023;
- New facility with DC-140 cyclotron for electronic component testing, radiation materials science, track pore membrane research and production, etc. Period of realisation: 2021–2023;
- New research proton cyclotron MSC-230 for R&D in beam therapy: treatment planning, radiomodifiers for photon and proton therapy, flash-therapy, pencil beam (10 μA, >5 Grey/litre target @ 50 ms pulse). The cyclotron is considered a pilot facility for a future medical centre. Period of implementation: 2021–2024 (beam start in 2023).
- New facility: Radiochemical Laboratory Class-I for production of radioisotopes (<sup>225</sup>Ac, <sup>99m</sup>Tc) for nuclear medicine in photonuclear reactions @ 40MeV Rhodotron accelerator. Period of realisation: 2022–2027.

JINR R&D

- Production of track membranes for water purification and plasmapheresis
- Design and construction of systems for detection of explosives and narcotics substances hidden in various containers, suitcases, safes, and parcels
- Design and construction of neutron detectors for investigation of novel functional materials on the nanoscale
- Performing reactor- and accelerator-based radiation hardness tests for electronic components of space and aviation technology and large scientific facilities

JINR EXPERTISE

- Design and construction of neutron and gamma detectors for spacecrafts
- Design and construction of superconducting magnets for large-scale scientific facilities for nuclear physics research
- Design and construction of dedicated accelerators for particle therapy
- Design and construction of accelerators for scientific research and production of track membranes



SOChI Beamline is ready (Dec 2021)







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