JOINT INSTITUTE FOR NUCLEAR RESEARCH

science brings nations together

DUBNA | 2025

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.

There is a wide range of experimental facilities at JINR.

The megascience project to construct the NICA Superconducting Heavy Ion Collider.

JINR plays a significant role in implementing the megascience project to build the deep underwater Baikal–GVD Neutrino Telescope.

JINR scientists have discovered 10 new elements. The Institute has a unique IBR–2 High-Flux Fast Pulsed Reactor for research in neutron nuclear physics and condensed matter physics.

RESEARCH DIRECTIONS

Theoretical Physics

Relativistic Heavy Ion Physics

Spin Physics

Particle Physics

Low Energy Nuclear Physics

Neutron Nuclear 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 comparable in the research scale to a large academic institution

Frank Laboratory of Neutron Physics

flnph.jinr.ru

Veksler and Baldin Laboratory of High Energy Physics

lhep.jinr.ru

Flerov Laboratory of Nuclear Reactions

flerovlab.jinr.ru

Dzhelepov Laboratory of Nuclear Problems

dlnp.jinr.ru

Meshcheryakov Laboratory of Information Technologies

lit.jinr.ru

Bogoliubov Laboratory of Theoretical Physics

theor.jinr.ru

Laboratory of Radiation Biology

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 scientific agenda for cutting-edge research and discoveries aimed to understand the fundamental properties of matter.

The JINR Long-Term Development Strategic Plan 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 and high-performance computing.
The Institute is based on internationally recognised scientific schools. Development of the idea of neutrino oscillations, synthesis of new superheavy elements, ultracold neutrons, nuclear matter superfluidity, postradiation cell recovery, quantum field theory, harmonical superdimension in supersymmetry, a new generation of neutron pulsed reactors, and a hyperconverged heterogeneous computing cluster are just some of the notable scientific subjects associated with modern JINR.

Our Institute and its laboratories are also setting the agenda at the forefront of innovations. These frontiers include novel materials and energetics, biomedicine, quantum technologies, data science, etc.

JINR primarily focuses on basic science. Undoubtedly, the quality of our scientific output is determined by essential aspects reinforcing the Institute's status as a modern dynamic international scientific organization. These aspects are worldwide scientific cooperation, science diplomacy, favourable social environment, digitalisation, and innovation policy.

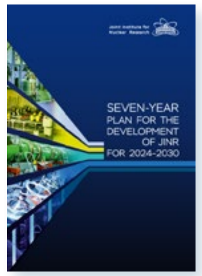
Our international team is diverse but united through the passion for research and sharing the value of international cooperation.
The JINR Sofia Declaration signed in November 2021 highlights the value of international scientific and technological integration in solving the tasks of strengthening peace,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

JINR is open to 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.

I hope this brochure inspires you to become a missionary of the Joint Institute. On behalf of the JINR team I wish you pleasant acquaintance with our international research centre.

Grigory Trubnikov

JINR Director



Seven-Year Plan for JINR Development (PDF)

JINR Development Strategy (PDF)

ORGANIZATION

The Committee of Plenipotentiaries of the Governments of the JINR Member States (CP) is the supreme governing body of the Institute, making key decisions regarding the activities. The JINR Member States share the financing of the JINR activities and have equal rights in the management of the Institute. The Member States make contributions in the amount established by the Committee of Plenipotentiaries. The Finance Committee and the Scientific Council operate under the CP JINR.

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

The Programme Advisory Committees (PACs) are advisory bodies to the JINR Directorate and Scientific Council in three fields of study: particle, nuclear, and condensed matter physics. The PACs evaluate experimental projects proposed by scientific collaborations, institutes, JINR laboratories, and individual researchers.

The Science and Technology Council of the Institute is an advisory body to the JINR Directorate. It aims to ensure the participation of the Institute's scientists in organizing 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 investigation of the fundamental properties of matter. Over almost 70 years, JINR has conducted a wide range of research and trained highly qualified scientific personnel for the Member States.

To successfully develop as a multidisciplinary international centre for fundamental studies in nuclear physics and related fields of science and technology, the Institute will make efficient use of its theoretical and experimental results as well as high technology methods and applied research in industrial, medical, and other types of technical advancements. The Institute's development strategy is detailed in the Seven-Year Plan for the Development of JINR.

JINR IS A MEMBER OF 19 MAJOR COLLABORATIONS OF THE WORLD SCIENTIFIC CENTRES, INCLUDING 5 INSTITUTE-BASED

800+ PARTNER ORGANIZATIONS

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

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

Full text

JINR'S RANK among **international intergovernmental research organizations**

2 PERSONNEL

6 BUDGET natural science only

8 BUDGET

The list of international intergovernmental research organizations is received from the open database of the Yearbook of International Organizations. Information on budget and personnel is taken from the organizations' annual reports.

RELATIVISTIC HEAVY ION PHYSICS & SPIN PHYSICS

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's evolution using high-intensity heavy ion beams.

NICA covers an energy range where most important and interesting physics phenomena occurs: 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

Extracted beams:
energy — up to **4.5 GeV/nucleon**
intensity —
$5{\cdot}10^8$ s^{-1} for heavy ions
10^{10} s^{-1} for protons

Design luminosity:
10^{27} cm^{-2} s^{-1} for heavy ions
10^{32} cm^{-2} s^{-1} for light nuclei and polarised protons as well as deuterons

nica.jinr.ru

Energy $\sqrt{S}$=4–11 GeV/nucleon

Collider ring circumference 503 m

JINR IN EXTERNAL PARTICLE PHYSICS EXPERIMENTS

Employees of the Institute are involved in external experiments, which benefits all participants thanks to the exchange of new scientific data and technological know-how with the emphasis on the tasks initiated and supported by JINR teams.

In LHC experiments at CERN, JINR physicists participate in analysing the data obtained and upgrading the detectors.

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. FAIR/GSI–NICA collaboration is mutually beneficial for the participants:

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

ARIADNA beamlines

APPLIED **R**ESEARCH **I**NFRASTRUCTURE FOR **AD**VANCED **D**EVELOPMENTS AT **N**ICA **FA**CILITY

Channels for transporting charged particle beams and irradiation stations are being developed and put into operation at NICA. They are designed for research in life sciences, radiation materials science, radiation resistance of electronics, and the development of advanced technologies for nuclear power problems. ARIADNA was launched in 2023.

100%

of **dipole** and **quadrupole magnets** manufactured and tested for the project

99%

capital construction

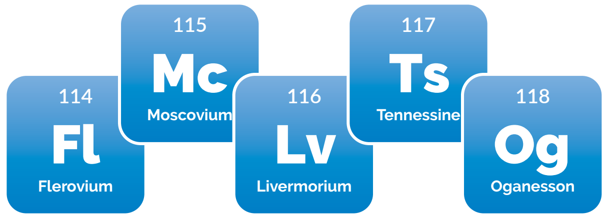
88%

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

AT PRESENT

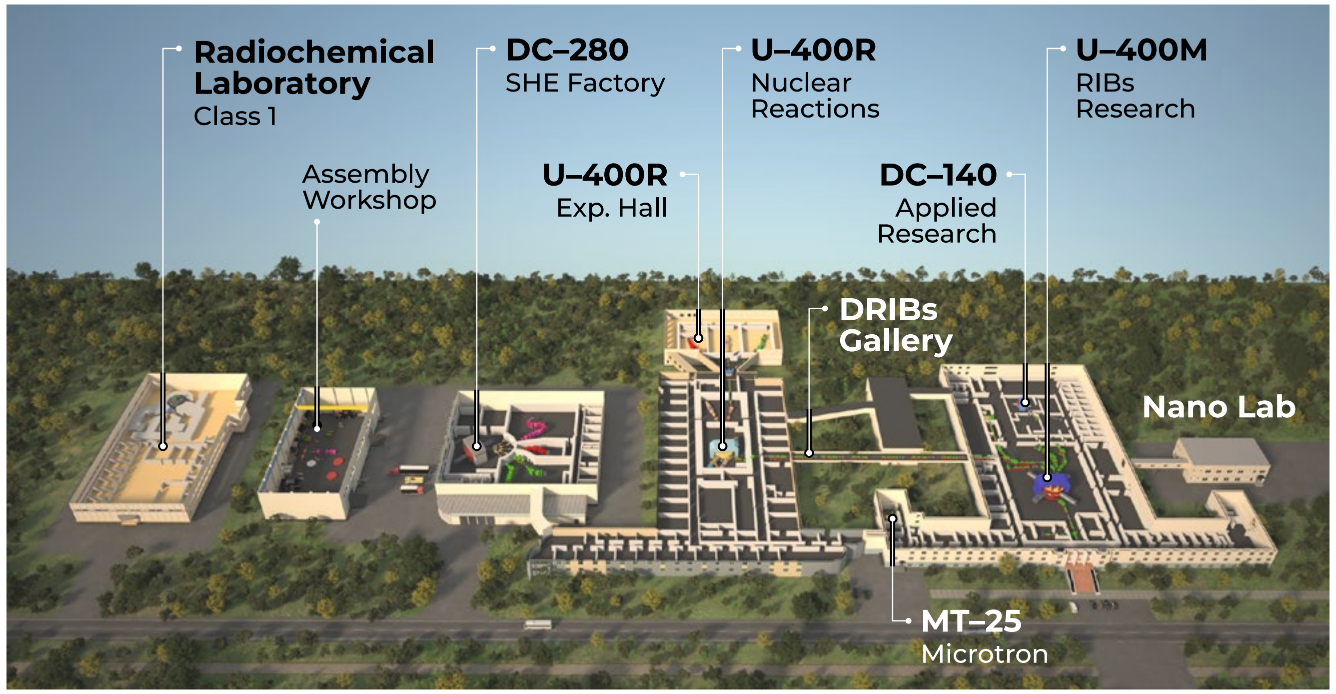
The development of works on the synthesis and study of the properties of superheavy elements is associated with the creation of a new accelerator complex called the Superheavy Element Factory (SHE Factory) based on the DC–280 Cyclotron. The key task of the complex is to enable scientists to synthesise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

Record parameters of accelerated heavy ion beams have been achieved at the accelerator complex of the Superheavy Element Factory. The ^{48}Ca beam intensity exceeds 8 pμA. The ^{40}Ar beam at the SHE Factory has reached its design intensity of 10 pμA.

The scientific infrastructure of the SHE Factory is gradually improving. In addition, the U–400 and U–400M Accelerators are developing, a new facility for applied research in track membranes and materials science, DC–140, is under construction.

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**, after whom new, 118th, element was named for his pioneering contributions to transactinide 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".***



BASIC FACILITY — DRIBs–III ACCELERATOR COMPLEX

SUPERHEAVY ELEMENT Factory

Strategic research directions:

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

SUMMARY OF EXPERIMENTS:
2020–2025

~250 new events of synthesis of superheavy nuclides

VS

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

~50 isotopes' decays were studied

8 new isotopes were discovered:
^{288}Lv, ^{289}Lv, ^{286}Mc, ^{276}Ds, ^{275}Ds, ^{272}Hs, ^{268}Sg, ^{264}Lr

New properties of superheavy nuclei, channels of their formation, and modes of radioactive decay

Test of target stability up to
8 pμA ^{48}Ca

NEUTRINO PHYSICS AND ASTROPHYSICS

JINR neutrino physics and astrophysics research programme 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 1300 m. Baikal–GVD is the largest in the Northern Hemisphere and the second in size in the world.

The task of the Baikal–GVD Project: identification of astrophysical sources of ultra-high energy neutrinos (exceeding tens of TeV).

Topicality: their sources are still unknown. The identification of sources will help 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 Institute for Nuclear Research of the Russian Academy of Sciences (Moscow) and the Joint Institute for Nuclear Research.

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.

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

- Determination whether 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

The discovery of **gravitational waves** is one of the most remarkable discoveries in the history of physics.

VIRGO

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

CONDENSED MATTER AND NUCLEAR NEUTRON PHYSICS

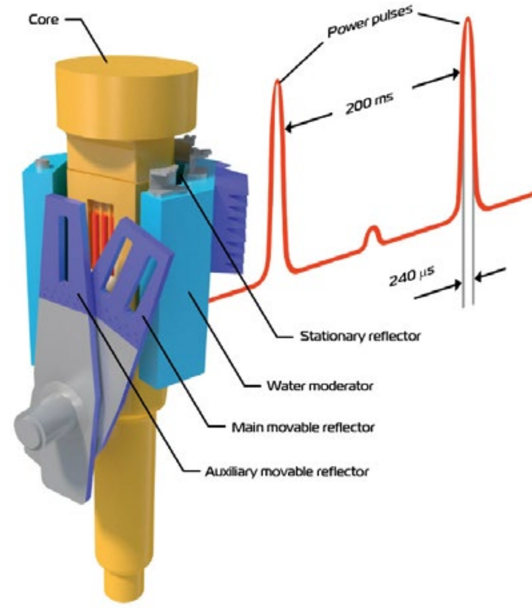
ibr-2.jinr.int

This scientific programme is implemented primarily, but not exclusively, at two main facilities: the IBR–2 Pulsed Periodic Reactor and the IREN Resonance Neutron Source based on a linear electron accelerator.

The **IBR–2 Reactor** is among top 5 "brightest" neutron sources in the world, and an international user programme is being implemented using its facilities to fulfil a wide range of tasks in physics, chemistry, biology, geology, materials science, ecology, etc. A set 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 using neutron resonance method, and applied research for the study of cultural heritage objects.

JINR is considering the possibility of creating a new high intensity pulsed neutron source. In combination with a modern complex of moderators, neutron extraction systems, sample environment systems, and spectrometers, such a source has every chance to become the best one in the world and open unprecedented possibilities for scientists from the JINR Member States and the entire neutron community.



Schematic representation of **the IBR–2 Reactor**

LIFE SCIENCES

RADIOBIOLOGY, BIOMEDICINE, STRUCTURAL BIOLOGY, ASTROBIOLOGY, ECOLOGY

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

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

NICA ARIADNA

- 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 primates
- Member of International Biophysics Collaboration

PROTON THERAPY AT JINR

Expertise since 1968.

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

JINR worked out the method of conformal 3D irradiation of deep-seated tumours, where the dose distribution precisely conforms (up to millimetres) to the target shape.
1300 patients underwent proton beam therapy at the JINR Medico-Technical Complex.

- **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's 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.**
- **Research at the IBR–2 neutron beamlines deepens understanding of mechanisms of health protection and 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, acoustic neuromas, astrocytomas, paragangliomas, pituitary adenomas, AVMs, brain and other metastases; other neck and head tumours, melanomas, skin diseases, lung carcinoma metastases, breast cancer.

- The TANGRA Collaboration at the Laboratory of Neutron Physics at JINR is developing a mobile facility 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 spacecrafts. 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 specialists at JINR developed and patented a novel method that allows modelling mixed radiation fields, which are generated by the Galactic cosmic rays inside a spacecraft in deep space, in accelerators.
- In 2024, the Astrobiology monograph was published at JINR. The book describes the evolution of perspectives on life's origin, explores the facts and models these views are based on, presents the stages of the formation of astrobiology as a science, and outlines a range of unresolved issues and promising areas of astrobiology.
- For the first time the synthesis of prebiotic compounds was observed after irradiation of formamide and meteorite matter with high energy hadron beams.
- LRB and MLIT, together with the University of Belgrade, conduct research on the development and implementation of algorithms for automating radiobiological research.
- JINR has further plans to develop vibrational spectroscopy & microscopy: Raman and FT–IR, as well as micro-spectroscopic study of programmed cell death — NETosis and Apoptosis.

ADVANCED INSTRUMENTS

SARRP

(**S**mall **A**nimal **R**adiation **R**esearch **P**latform)

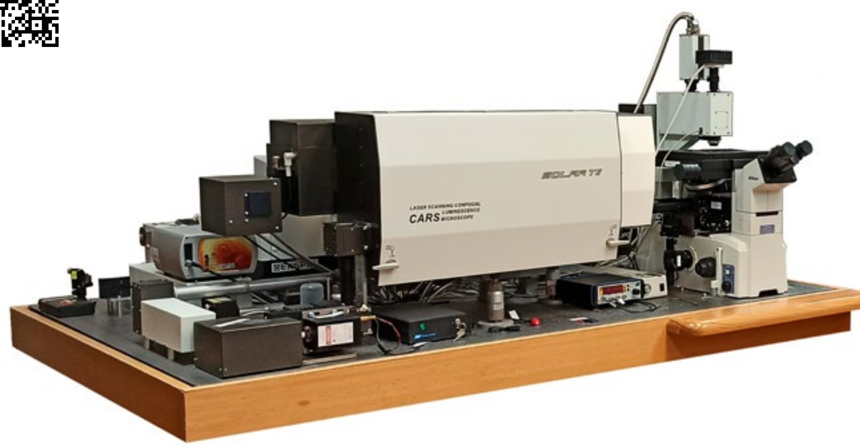
X-ray irradiation facility designed for radiobiological studies on small laboratory animals.
This is the only SARRP system installed in the territory of Russia and Eastern Europe.

MULTIFUNCTIONAL "CARS" MICROSCOPE

(**C**oherent **A**nti-Stokes **R**aman **S**cattering)

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.



XEUSS 3.0

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

THEORETICAL PHYSICS

Research in theoretical physics at JINR is carried out by the Bogoliubov Laboratory of Theoretical Physics (BLTP) and teams of theoretical physicists 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 tasks defined by the JINR main facilities, primarily the NICA Project, and 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 have gained worldwide acknowledgement.

Theory of Fundamental Interactions

Theory of Atomic Nucleus

Condensed Matter Theory

Modern Mathematical Physics

1/3 of JINR publications

230 scientists

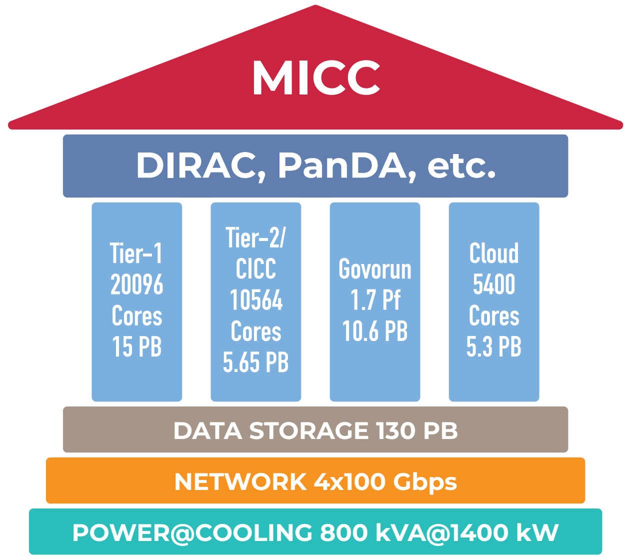
>500 scientific papers published per year

~15 annual scientific meetings

INFORMATION TECHNOLOGY & HIGH-PERFORMANCE COMPUTING

Development of information technologies and mathematical methods based on them, data processing and storage, experimental data analysis, big data, quantum computing, machine and deep learning.

KEY PROJECT — MULTIFUNCTIONAL INFORMATION AND COMPUTING COMPLEX AT JINR



Distributed computing and data storage systems based on grid technologies and cloud computing, hyperconverged 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)
- 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 and experiments at NICA
- Tier–2 for ALICE, ATLAS, CMS, LHCb, BM@N, MPD, SPD, NOvA, ILC, etc.

Brochure of the Laboratory of Information Technologies
PDF in English

JINR CLOUD INFRASTRUCTURE

- Baikal–GVD, JUNO, and NOvA neutrino experiments
- Included in DICE — Distributed Information and Computing Environment (JINR & Member States)

HybriLIT Platform consists of the Govorun Supercomputer and the HybriLIT Education and Testing Site.

GOVORUN SUPERCOMPUTER

Hyperconverged software-defined system

Total Peak Performance: 1.7 PFLOPS for DP

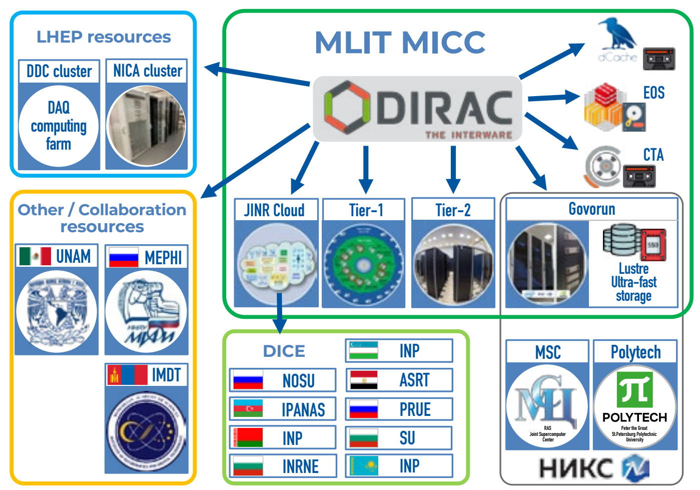
Storage performance > 300 GB/s

GOVORUN SUPERCOMPUTER KEY PROJECTS

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

A heterogeneous computing environment, based on the **DIRAC Platform**, was created for data processing and storage.

DIRAC at JINR



EDUCATION

STUDENT PROGRAMMES

Directions: **science, engineering, IT**

START: STudent **A**dvanced **R**esearch **T**raining
Offline. All countries. 6–8 weeks.
students.jinr.ru

INTEREST: INTErnational **RE**mote **S**tudent **T**raining
Online. All countries. 4–6 weeks.
interest.jinr.ru

ISP: International **S**tudent **P**ractice in JINR Fields of Research
"3-week introduction to JINR"
Offline. Member States only.
uc.jinr.ru/en/isp

Engineering and Physics Training
http://uc.jinr.ru/en/engineertraining

OUTREACH PROGRAMMES

Schools for Science Teachers. 1 week.
teachers.jinr.ru

Workshops, visits, lectures for foreign school students
uc.jinr.ru/ru/visit-school

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

edu.jinr.ru
E-learning resource

LANGUAGE COURSES

For JINR employees

AYSS 4 ANNUAL CONFERENCES

ASSOCIATION OF YOUNG SCIENTISTS AND SPECIALISTS

The Association is an active community uniting more than 1200 young people under 36 working at JINR. AYSS runs annual scientific conferences, schools, workshops, and seminars, and shares information about JINR. The Association assists employees with social issues, organizes public and cultural events, and fosters unity of the scientific community both in and outside the Institute.

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

JINR POSTDOC PROGRAMME

The Programme provides an opportunity for talented early stage researchers to get involved in the cutting-edge international projects at JINR in Dubna.

BLTP JINR holds regular educational activities as part of the Dubna International Advanced School of Theoretical Physics (DIAS–TH), scientific and educational project for young researchers and students from many countries.

MLIT JINR has created an educational and research infrastructure based on the HybriLIT Education and Testing Site, 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.

The JINR School of Information Technology is held for undergraduate and Master's students
itschool.jinr.ru

MSU BRANCH IN DUBNA

The Dubna branch of Moscow State University was established on JINR's initiative. It makes use of the Institute's resources 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, the Academician Kadyshevsky Physics and Mathematics Lyceum opened in Dubna. Best teachers of Dubna and Russia work there as part of the lyceum's big pedagogic community. Children from the 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 personnel, and popularise research, JINR builds a network of its information centres.

A JINR Information Centre is a local "embassy" and intermediary of the Institute in science and education. Information centres aim to attract potential partners, employees, students, and schoolchildren. They initiate events to increase awareness about JINR. Twelve JINR Information Centres already operate in **Cairo** (Egypt), **Sofia** (Bulgaria), **Yerevan** (Armenia), **Vladikavkaz**, **Petropavlovsk-Kamchatsky**, **Arkhangelsk**, **Tomsk**, **Vladivostok**, **Irkutsk** (Russia), **Almaty** (Kazakhstan), **Arab Atomic Energy Agency** (Tunis), and **Cape Town** (South Africa).

INNOVATIONS

INTERNATIONAL CENTRE FOR NUCLEAR TECHNOLOGIES RESEARCH TO BE CREATED AT JINR

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

Main stages:

- Radiation biology: OMICS@LRB and neuroradiobiological studies. Approaches to increasing radiosensitivity: pharmaceuticals, transgene systems, targeted delivery (molecular vectors), and radionuclides;
- Ion beams in broad energy range (3 MeV/nucleon to 4.5 GeV/nucleon) for innovation in life sciences, biomedicine, space exploration, radiation materials science, radiation testing of semiconductor electronics, and advanced nuclear physics technologies. Unique technologies for long-term irradiation of samples with high energy ion beams for up to several months;
- New facility with the DC–140 Cyclotron for electronic component testing, radiation materials science, track pore membrane research and production, etc. Implementation year: 2025;
- New MSC–230 Research Proton Cyclotron for R&D in beam therapy: treatment planning, radiomodificators 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: 2022–2025;
- New facility: Radiochemical Laboratory Class 1 for production of radioisotopes (^{225}Ac, ^{99m}Tc) for nuclear medicine in photonuclear reactions @ 40 MeV Rhodotron accelerator. Period of implementation: 2031–2037.

JINR R&D

- Production of track membranes for water purification and plasmapheresis
- Design and construction of systems for detection of explosives and narcotic 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)

FOR NOTES

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