

60th ANNIVERSARY OF THE JOINT INSTITUTE FOR NUCLEAR RESEARCH (JINR) PACS numbers: **01.52.+r**, **01.65.+g**

JINR: the initiator of future discoveries

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Abstract. On 26 March 2016, the Joint Institute for Nuclear Research (JINR) will mark its 60th anniversary as an internationally known research center that is a unique example of how fundamental theoretical and experimental studies can be integrated with the development and application of cutting-edge technologies and with university education. JINR member states number 18, of which Hungary, Germany, Egypt, Italy, Serbia, and the Republic of South Africa are each under a government-level cooperation agreement with the institute. Three factors combine to form a solid foundation on which JINR bases its work: commitment to traditions of internationally renowned research schools; unique performance hardware capable of solving problems of current interest in various fields of modern physics; and status as a UN intergovernmental body. Ranked high within the world's scientific community, the institute has conducted a wide range of research and trained high quality research personnel for its member states over the 60-years period since its foundation. In accordance with its Charter, JINR is open to participation by all interested states and ensures equal and mutually beneficial cooperation among them.

Keywords: JINR, member states, international cooperation, fundamental properties of the microworld, elementary particles, nuclear physics, condensed matter physics, mega-projects, experimental facilities, nuclear physics research, research staff, nanotechnologies, innovations, educational activities

Science is not and will never be a closed book.
Albert Einstein

The outstanding French physicist Frederic Joliot-Curie, who visited Dubna and whose name is borne by one of the central streets of the city, once said: "Science is the basic element which unites the thoughts of people scattered over the globe, and this is one of its lofty destinations. In my opinion, there is no other human activity in which consent between people is so evident."

A lesson of paramount importance was learned from the disasters endured by humanity in the first half of the past century: the advancement of nuclear science and the peaceful use of atomic energy are ensured by broad international cooperation and not by secret laboratories. There emerged a clear awareness of the fact that only the tremendous research work of many hundreds and thousands of physical scientists who had devoted their lives to the study of the world of elementary particles and atomic nuclei was able to direct the gigantic energy of atomic nuclei into a peaceful channel.

The idea of consolidating the effort to study the fundamental properties of the microworld was realized by West-European countries, which set up the Conseil Européen pour la Recherche Nucléaire (CERN) near Geneva (Switzerland) in 1954 and built there large-scale experimental facilities for conducting nuclear physics research. At about the same time, the countries which then belonged to the socialist commonwealth decided, on the initiative of the USSR Government, to organize the Joint Institute for Nuclear Research (JINR).*

JINR was organized on the basis of the agreement signed by the authorized representatives of eleven founder countries in Moscow in March 1956 for the purpose of combining their scientific and material capabilities to study the basic properties of matter (Photo 1).

The founding countries of the Joint Institute for Nuclear Research are: Albania, Bulgaria, Hungary, German Democratic Republic, People's Republic of China, Korean Democratic People's Republic, Mongolia, Poland, Romania, USSR, and Czechoslovakia. In 1956, the agreement on the establishment of JINR was signed by the governmental representative of the Democratic Republic of Vietnam.

The decision to set up the joint institute on the site of the future Dubna — 120 km away from Moscow — was made 60 years ago and had several serious prerequisites. One of them was that at the time JINR was being organized there already existed the Hydrotechnical Laboratory (HTL) of the USSR Academy of Sciences (renamed later the Institute of Nuclear Problems of the USSR AS), in which an extensive scientific program of basic and applied research on nuclear matter properties was deployed at the then largest accelerator of charged particles — a synchrocyclotron (1949) [3]. These investigations were supervised by M G Meshcheryakov [4–6] and V P Dzhelepov [7–9]. Also organized there in 1953 was the Electrophysical Laboratory of the USSR AS (EPhLAS), in which academician V I Veksler [10, 11] supervised research aimed at developing a new accelerator — a synchrophasotron — with record parameters for that time [12–14].

Therefore, at its inception the Joint Institute for Nuclear Research — the first intergovernmental scientific organization of socialist states — included two large laboratories with the highest-power accelerators, unique research facilities, equipment of first rank, and experienced personnel.

When we look into the past, we cannot help noticing that the history of the organization, philosophy, and, in general, activities of the two largest international scientific centers —

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* For the history of the establishment of the Joint Institute for Nuclear Research (JINR), see also Refs [1, 2].

Photo 1. Meeting of the representatives of eleven founding states of the Joint Institute for Nuclear Research. Speaking is the Chief Scientific Secretary of the Presidium of the USSR Academy of Sciences A V Topchiev (Moscow, 26 March 1956).

JINR and CERN — are irrefutable proof that it is precisely science which wonderfully unites and brings together millions of people all over the world. And it was no mere chance that the joint JINR–CERN poster exhibition, which was successfully held in many capitals of the world, was named precisely so: "Science brings nations together."

Upon the signing of the agreement an JINR's formation, researchers from 12 countries of the world came to Dubna. Here, research was started on a variety of lines in nuclear physics, which were of interest to the scientific centers of the JINR member states. Professor D I Blokhintsev, who had just completed the construction of the world's first atomic power station in Obninsk, was elected director of the joint institute. Professors M Danysh (Poland) and V Votruba (Czechoslovakia) became vice-directors of JINR (Photo 2).

One of the most difficult and crucial periods in the life of the Joint Institute for Nuclear Research — the period of its astablishment — fell to the lot of the first directorate. The history of the joint institute's formation is associated with the names of outstanding scientists and research supervisors like N N Bogolyubov, L Infeld, I V Kurchatov, G Nevodnichanskii, A M Petros'yants, E P Slavskii, I E Tamm, A V Topchiev, Kh Khulubei, and L Yanoshi.

Outstanding physicists took part in putting together the main research avenues of the institute: N S Amaglobeli, A M Baldin, Van Ganchan, V I Veksler, V Votruba, N N Govorun, M Gmitro, M Danysh, V P Dzhelepov, I Zvara, I Zlatev, V G Kadyshevskii, D Kish, N Kroo, Ya Kozheshnik, K Lanius, Le Van Thiem, A A Logunov, M A Markov, V A Matveev, M G Meshcheryakov, G Nadzhakov, Nguen Van Kh'eu, Yu Ts Oganesyan, V I Ogievetskii, L Pal, V Petrzhilka, G Poze, B M Pontekorvo, V P Sarantsev, A N Sisakyan, Ya A Smorodinskii, N Sodnom, V G Solov'ev, R Sosnovski, A Sendulesku, A N Tavkhelidze, I Todorov, I Ulegla, I Ursu, G N Flerov, I M Frank, Kh Khristov, A Khrynkevich, Sh Tsitseika, Chzhou Guanchzhao, I V Chuvilo, F L Shapiro, D V Shirkov, D Ebert, E Yanik, and others. (Photo 3).

Since the time of the institute's inception, events of epochal significance have occurred in the area of nuclear research. In 1960, the team of physicists headed by academician V I Veksler and Chinese professor Van Ganchan made an important discovery: a new particle — antisigma-minus hyperon — was detected in an experiment on the synchrophasotron. This discovery was announced at the Rochester Conference in Berkeley (USA). This was a triumph for Dubna scientists.

Several years later, this elementary, as was believed earlier, particle was ruled as being elementary in nature, as were the proton, neutron, π- and K-mesons, and other so-called hadrons. These objects turned out to be complex particles made up of quarks and antiquarks, which acquired the right to be termed elementary. Dubna physicists (N N Bogolyubov et al.) clarified the understanding of the quark structure of hadrons: the conception of color quarks, the quark model of hadrons, which received the name 'the Dubna bag', etc. (Photo 4).

Nowadays, 18 states are JINR members: Republic of Azerbaijan, Republic of Armenia, Republic of Belarus, Republic of Bulgaria, Socialist Republic of Vietnam, Republic of Georgia, Republic of Kazakhstan, Korean Democratic People's Republic, Republic of Cuba, Republic of Moldova, Mongolia, Republic of Poland, Russian Federation, Romania, Slovak Republic, Republic of Uzbekistan, Ukraine, and Czech Republic. Hungary, Germany, Egypt, Italy, Serbia, and the Republic of South Africa participate in JINR activities on the basis of bilateral cooperation agreements. The supreme governing body of the institute is a committee of the authorized representatives of all 18 member countries.

Photo 2. First JINR directorate and laboratory directors (from left to right): Director of the Laboratory of Neutron Physics (LNP) I M Frank, JINR Vice-Director M Danysh, Director of the Laboratory of Nuclear Problems (LNP) V P Dzhelepov, JINR Vice-Director V Votruba, JINR Director D I Blokhintsev, JINR Administrative Director V N Sergienko, Director of the Laboratory of High-Energy Physics (LHEP) V I Veksler, JINR Assistant Director A M Ryzhov, Director of the Laboratory of Theoretical Physics (LTP) N N Bogolyubov, Director of the Laboratory of Nuclear Reactions (LNR) G N Flerov (Dubna, 1957).

The scientific policy of the institute is drawn up by the Scientific Council, which includes, apart from outstanding scientists that represent the member countries, well-known physicists from Germany, Greece, India, Italy, China, the USA, France, Switzerland, the European Laboratory for Particle Physics (CERN), etc.

The institute is renowned for outstanding findings; it maintains close scientific contact with world's largest scientific centers on the basis of cooperation agreements. Over the 60 years since JINR's founding, a broad spectrum of investigations have been performed here and scientific personnel with the highest qualifications have been trained for the Institute's member countries. Among them have been presidents of national academies of science and supervisors of the largest nuclear institutes and universities in many of the institute's member states.

JINR comprises seven laboratories, each of which is comparable on the scale of research to a large institute. The main lines of theoretical and experimental investigations performed at JINR are the physics of elementary particles, nuclear physics, and condensed-matter physics. JINR's scientific program is aimed at achieving highly significant results of fundamental importance.

The institute's staff numbers about 4500 people, of which over 1200 are researchers, including full members and corresponding members of national academies of science, over 260 doctors of science and 570 candidates of science (PhDs), and about 2000 technicians and engineers.

The institute has a remarkable set of physical experimental facilities: a superconducting accelerator of nuclei and heavy ions — a nuclotron, which is the only one in Europe and Asia, U-400 and U400M heavy ion cyclotrons with record beam parameters intended to carry out experiments

Photo 3. One of the founders of nuclear physics, Paul Dirac, at JINR. In the photo from left to right: Dirac (Great Britain), D I Blokhintsev, M Danysh (Poland), M G Meshcheryakov, N N Bogolyubov, Ya A Smorodinskii (Dubna, 1958).

Photo 4. JINR guest: the outstanding scientist Niels Bohr. In the photo from left to right: V P Dzhelepov, D I Blokhintsev, A M Ryzhov, Bohr (Denmark) (Dubna, 1961).

in the synthesis of heavy and exotic nuclei, a unique IBR-2 pulsed neutron reactor employed for research in neutron nuclear physics and condensed-matter physics, and a proton accelerator — a phasotron, which is used for beam therapy.

The entire experimental scientific program of JINR is supported by its brilliant school of theoretical physics, the physical experimental techniques adequately developed in the institute, and modern information technologies, including grid technologies.

JINR is successfully implementing its development strategy, which implies concentrating resources for renewing the accelerator and reactor basis of the institute, as well as integrating its main facilities with the united European science information system.

Work on the Nuclotron Project, which will become the basis for the new superconducting NICA collider — a mega-project of the Russian Federation — is proceeding according to schedule. The facility under construction will be equipped with a mulipurpose detector, MPD, with the aim of carrying out investigations of hadronic matter and its phase transformations, a PSD for studying spin effects, and a BM@N detector for studying baryonic matter.

Intensive work is underway to make a modern heavy ion accelerator facility — Dubna Radioactive Ion Beams (DRIBs) — and to construct the key element of this project — a factory of superheavy elements for conducting experiments to study the mechanisms of reactions with stable and radioactive nuclei — a new basic JINR facility, which will provide qualitatively new capabilities in the area where JINR undoubtedly holds the leading position.

The user program is being successfully realized on the upgraded spectrometer complex of the IBR-2 pulsed research reactor. This program was included in the 20-year European strategic program of research in neutron scattering. Researchers from 16 countries and JINR staff members perform experiments in physics, materials sciences, chemistry, biology and biophysics, geology, and applied research. These experiments are aimed at studying the structure and properties of nanosystems, new materials, and biological subjects, as well as at the development and elaboration of new electronic, bio-, and information nanotechnologies.

JINR possesses high-performance computers, which are integrated with world computer networks using high-speed communication channels. The scalable Dubna–Moscow communication channel with an initial transmission capacity of 20 Gb s^{-1} permits its enhancement to 720 Gb s^{-1}. JINR's communication grid unites the local networks of all laboratories and departments into an integrated JINR network. The Central Data-Computing Complex (CDCC) is the heart of the computational infrastructure of the institute. The JINR grid segment made on its basis is an important element of the grid infrastructures Russian Data Intensive Grid (RDIG), the Worldwide LHC Computing Grid (WLCG), and Enabling Grids for E-SciencE (EGEE).

A data processing and storage center at a Tier-1 level was set up on the basis of JINR's CDCC for the CMS experiment (LHC, CERN). The Tier-1 center is used as a part of the global system for processing experimental and event simulation data delivered from the Tier-0 level center (CERN), as well as Tier-1 and Tier-2 level centers, of the global LHC–WLCG grid system for the CMS experiment.

The basic facilities of the joint institute are efficiently used as ionizing radiation sources in the execution of fascinating experiments in the area of radiobiology, space medicine, and, since recently, in the area of astrobiology related to the study of the problem of the origin of life on Earth.

JINR has always operated in conformity with concrete plans. The conceptual basis of contemporary programs for the institute's development is the science–education–innovations triad, which also corresponds to the strategy of economic development of the JINR member states. The basic element of the triad — basic science — is the so-called carcass projects, i.e., projects associated with major experimental facilities. Their implementation leads to the opening of new scientific avenues and the advent of new technologies.

The institute carries out projects aimed at the development of the scientific base of JINR member states, the construction of new facilities and development of scientific programs for them, for instance, the cyclotron center of the Slovak Republic in Bratislava, etc. In Astana (Kazakhstan), the Interdisciplinary Research Complex of the L N Gumilev Eurasian University operates successfully on the basis of the DC-60 heavy ion accelerator made at JINR.

Broad international cooperation is an important aspect of JINR activities. The institute is linked to more than 700 science centers and universities in 64 countries around the world. In Russia alone, JINR's largest partner country, the institute cooperates with more than 170 research centers, universities, industrial enterprise, and companies from 50 Russian cities. Among the Russian scientific partners of the joint institute are 92 research organizations in 23 cities. The geography of JINR's cooperation with Russian institutions of higher education is not limited to Moscow and extends throughout the territory of the country. The institute's partners are 40 universities in 25 Russian cities. Over 200 scientific centers, universities, and enterprises from CIS countries participate in the execution of the scientific program of the institute.

The Russian Academy of Sciences has always been one of the most authoritative scientific partners for JINR and has had a fruitful influence on the development of basic research carried out at the international scientific center in Dubna. Numerous connections of scientists and JINR laboratories with scientific centers of the RAS in the field of scientific and technical cooperation, which have existed for many years, continue to develop at the present time.

Significant scientific results have been obtained in collaboration with the Institute of High-Energy Physics (Protvino), the National Research Center (NRC) Kurchatov Institute (Moscow), the Petersburg Nuclear Physics Institute (Gatchina), the Institute for Theoretical and Experimental Physics (Moscow), the Institute for Nuclear Research (Troitsk), the Physical Institute of the RAS (Moscow), G I Budker Institute of Nuclear Physics (Novosibirsk), and others.

The cooperation between JINR and the NRC Kurchatov Institute covers a wide spectrum of research lines, beginning with the coordination of joint basic and applied research and ending with educational activities and commercialization of scientific-technical products.

The close collaboration between JINR and IHEP (Protvino) formed largely due to the organizational talent of one of the most outstanding theoretical physicists A A Logunov [15], which he displayed as IHEP director in the construction of the U-70 accelerator, which was the world leader in accelerated particle energy for many years.

Based on agreements between JINR and Rosatom State Corporation, Russian scientific organizations have the opportunity to actively participate in the most promising JINR projects, which are implemented at basic facilities of the institute, and leading Russian scientific centers, as well as on foreign accelerators and reactors. Furthermore, the Educational and Scientific Center of JINR is engaged in the educational programs of Rosatom.

JINR has observer status at several European scientific structures: Physical and Engineering Sciences Strategy Workgroup of the European Strategy Forum on Research Infrastructures (ESFRI), Astroparticle Physics European Consortium (ApPEC). In 2014, CERN and JINR made important decisions on mutual assignment of observer statuses: on the CERN Council for JINR, and for CERN at the Committee of Authorized Representatives of the Governments of JINR Member States. Since recently, JINR has its representative also at the Nuclear Physics European Collaboration Committee (NuPECC).

The institute has accumulated immense experience in mutually beneficial scientific-technical cooperation on an international scale. JINR maintains contact with the IAEA, UNESCO, the European Physical Society, and the Abdus Salam International Centre for Theoretical Physics in Trieste. Over one thousand scientists from the organizations collaborating with JINR come to Dubna every year (Photo 5).

Along with 'homework', JINR continues participating in major international projects (LHC, FAIR, XFEL) and research programs on the RHIC and Tevatron accelerators (USA), and is among the participants of the International Linear Collider (ILC) construction project.

The joint institute cooperates actively with the European Laboratory for Particle Physics (CERN) in the solution of many theoretical and experimental problems in high energy physics. Today, JINR physicists are participating in 20 CERN projects.

JINR's significant contribution to the implementation of the project of the century — the Large Hadron Collider (LHC) — was highly appreciated by the world's scientific community. All of JINR's obligations to develop and make separate systems of ATLAS, CMS, and ALICE detectors and of the LHC machine itself were carried out successfully and in time. In recent years, JINR groups have played an important role in the technical development of the Large Hadron Collider, upgrade of LHC detectors, and acquisition of new physical results from the data accumulated during LHC runs.

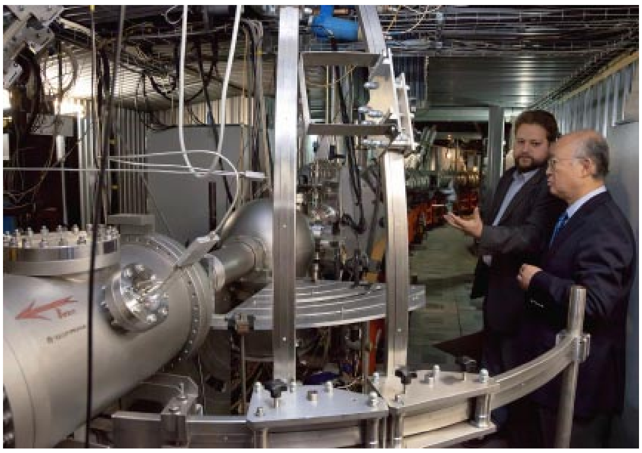

Photo 5. IAEA Director General Yu Amano (right) at the nuclotron (Dubna, 2013).

One of the most striking findings was the discovery of the Higgs boson on the collider at CERN, and here, as recognized by the world's scientific community, a major intellectual contribution is due to Dubna physicists.

Here are only a few examples of the briliant scientific results obtained at JINR in recent years, as well as with JINR's participation in other scientific centers.

In recent years, JINR has seen the synthesis of six new chemical elements with atomic numbers 113–118 and about 50 new isotopes of transactinoid elements. It was possible for the first time to obtain direct experimental proof of the existence of the 'stability island' of superheavy elements centered near $Z = 114$ and $N = 184$. Solid evidence of Dubna physicists' leadership in heavy ion physics is the JINR application for the discovery of four new superheavy elements submitted to the International Union of Pure and Applied Chemistry (IUPAC).

The 2013 Nobel Prize in physics was awarded for the discovery of the Higgs boson [16]. At the same time, as observed in the world, the contribution made by Dubna physicists to the discovery of the Higgs boson was highly significant. This is not only a contribution to the making of experimental facilities and the collider itself, but also a major intellectual contribution [17], which has led to one of the greatest achievements of physical thought — the construction of the Standard Model (SM) of elementary particles. Dubna made a tremendous contribution to the creation of the principles which underlay this theory. A case in point is the notion of spontaneous symmetry breaking, which was introduced into the field theory and particle physics precisely by the work of Nikolai Nikolaevich Bogolyubov [18–23]. He transferred to the quantum theory of field and elementary particles notions which had already become established in condensed-matter physics. One of the most important notions of the SM — a new quantum number of quarks — color — was also introduced in Dubna as was a renormgroup — the most important method for calculating quantum effects in the Standard model. Very many achievements in this area were originated in the work of Dubna theorists, Russian scientists, and their colleagues from other JINR member countries. Therefore, the contribution of Dubna scientists to the discovery of the Higgs boson is quite high.

At present, many researchers are concerned with the quest for physics beyond the SM. And here, too, Dubna hoists a flag, because the only effect which obviously goes beyond the limits of the theory is the process of neutrino oscillations. Both the effect and the physical notion itself were proposed in Dubna in the work of Bruno Pontecorvo [19–26].

The study of neutrino properties is a traditional research area of Dubna physicists, founded by Bruno Pontecorvo [27–32]. The existence of neutrino masses and their smallness, which was proved by the discovery of neutrino oscillations, is a serious indication that new physics exists beyond the framework of the Standard Model. And here the problems of neutrino physics are closely related to astrophysical problems. Furthermore, the detection of neutrinos from cosmic objects even received the special name of neutrino astronomy. In Lake Baikal, in particular, a start has been made on the first construction stage of the deep-water gigaton neutrino telescope BAIKAL-GVD, which will be a new JINR research base for investigating ultrahigh-energy neutrino fluxes from the cosmos.

In the framework of the BOREXINO experiment (Gran Sasso, Italy) with the participation of JINR researchers, it was possible for the first time to obtain experimental proof that the so-called PEP reaction takes place in the Sun, in which two hydrogen nuclei and an electron produce deuterium.

The BES-III collaboration (China), which includes a group from JINR, reported an interesting result: the observation of a new charmonium-like state Zc(3900). Discovered in this experiment were new decay modes of the Zc$\pm$, charged states, as well as the neutral particle Zc0(4020), which supposedly is the isospin partner of the charged state Zc$\pm$(4025). A measurement of the tau-lepton mass was made, which is practically as accurate as all previous measurements. It is pertinent to note that JINR scientists are among the key designers of programs for processing BES-III experiment data.

A group of Dubna scientists calibrated the flight module of a ''Mercurial gamma and neutron spectrometer'' (MGNS), which comprised a gamma-ray spectrometer and a neutron detector for the new European Space Agency's BepiColombo mission to Mercury.

In the framework of cutting-edge radiobiological investigations on the U-400M, samples of formamide doped with particles of meteorite dust were irradiated by heavy nuclei with a high-linear energy transfer for the first time.

These experiments are aimed at investigating the conditions for the formation of prebiotic compounds in cosmic space. Representatives of all classes of molecules required for the origin of terrestrial life have been obtained: carboxylic acids, amino acids, sugars, nucleic bases, nucleosides, and other complex compounds. These investigations bring us closer to the answer to the question of the origin of life in the Universe. The experiments were carried out in collaboration with Italian research groups.

Excellent conditions were established at JINR for educating talented young researchers. JINR's scientific-educational center (SEC) annually organizes a practical training session at the intitute's facilities for students of institutes of higher education in Russia and other countries. The number of students and postgraduate students who finished the SEC school and entered the institute's laboratories has increased manyfold during recent years. All JINR member countries display keen interest in the establishment of institute-based educational programs for training national personnel in the areas of JINR research activity. Jointly with CERN, SEC organizes annual scientific schools for physics teachers from JINR member countries (photo 6).

The institute is a strategic partner of the ''Dubna'' International University. Seven university departments were set up and function actively on the basis of JINR: the Chairs of theoretical and nuclear physics, nanotechnology and new materials, electronics for physics facilities, biophysics, grid technologies, and personal electronics. These departments are headed by leading JINR researchers, scientists of world class. Graduates of Dubna University are welcomed by the laboratories and departments of the institute.

Scientists from the institute are customary participants in many international and national scientific conferences. JINR, in turn, holds annually up to 10 large conferences, over 50 international meetings, and schools for young scientists, which have become a tradition. The institute annually submits over 1500 papers and reports to many journals and conference committees, which represent about 3000 authors.

Photo 6. Students from European countries which participate in the international student practice are on an excursion in the Laboratory of High Energy Physics of JINR (Dubna, 2014).

JINR publications are distributed to more than 50 countries around the world. Also published are the world-known journals *Fizika Elementarnykh Chastits i Atomnogo Yadra* (*Physics of Particles and Nuclei*), *Pis'ma v EChAYa* (*Physics of Particles and Nuclei Letters*), the annual report of JINR activities, the information bulletin Novosti OIYaE (JINR News), as well as collected papers of conferences, schools, and meetings organized by the institute.

JINR accounts for more than 40 percent of discoveries in the realm of nuclear physics. In light of the latest achievements of the institute, special mention should be made of the program of superheavy element research. The decision of the International Union of Pure and Applied Chemistry to confer the name Dubnium on the 105th element of the Periodic Table and the name Flerovium on the 114th element in honor of the JINR Laboratory of Nuclear Reactions and its founder, academician G N Flerov, was recognition of the outstanding contribution of JINR scientists to modern physics and chemistry. These important discoveries crowned with success the effort mounted by scientists of different countries for many years to find the 'stability islands' of superheavy nuclei.

The philosophy of further development of JINR as a multifaceted international center of basic research in the area of nuclear physics and related branches of science and technology implies efficient use of the results of theoretical, experimental, methodical, and applied research at JINR in the area of high technologies by introducing them into industrial, medical, and other technical products. This will make available additional financing sources for basic research and provide new jobs. To develop basic research lines at the institute, theoretical disciplines, computer and grid research, and development of new instrumentation will be pursued as before, as will the selection of young personnel.

For over 20 years, JINR has been participating in the implementation of a program to develop the innovation belt of Dubna. In 2005, the Government of the Russian Federation signed a regulation ''On the development of a special techno-innovation economic zone on the territory of the town of Dubna.'' JINR's specific character was reflected in the problem orientation of the special economic zone (SEZ):

nuclear physical and information technologies. The techno-innovation Dubna zone is developing in collaboration with scientific colleagues — RAS and Rosatom science centers — as well as with partners in industry and business.

One of the central SEZ segments — a shared-use center in the area of nanotechnologies — is the International Nano-technology Innovation Center (INTIC) of the CIS and Europe in Dubna. This is an instrument of integration of the innovation activity into the international global system with the participation of the states which are members and partners of the Joint Institute for Nuclear Research. Therefore, JINR is the initiator of new large-scale projects. INTIC's activities are aimed at the formation of an internationally competitive high-tech nanoindustry market in the CIS.

In the course of repeated visits by representatives of the higher echelons of power of the Russian Federation, clear statements have been made about the importance of basic science as the foundation for developing research infrastructures, so-called mega-science facilities; the necessity of developing an innovative economy; and the critical importance of involving young people in science and adapting education to an innovative system (Photos 7 and 8).

The Joint Institute for Nuclear Research entered the 21st century as a major multidisciplinary international scientific center. Its history is rich in dramatic events and world-class discoveries, and is part and parcel of the life stories and fates of a whole generation of scientists, engineers, and workers. Owing to their professional skills, enthusiasm, and commitment to science, the Joint Institute for Nuclear Research in Dubna has gained world-wide recognition and managed to achieve outstanding results and train a new generation of talented young people in the course of persistent scientific quest.

The milistone anniversary of the institute's foundation — 'our home on the banks of the Volga', as it is often called by colleagues from the member countries whose lives have been related to Dubna for many years — should give rise to enhancement of its prestige in the world scientific community and still stronger rallying of all staff generations to achieve common goals. As before, we look ahead with hope and recognize the need to fulfill all our tasks. To achieve our objectives, we will need not only excellent professional skills, buy also the ability to focus on the backbone problems in science, education, and innovation activity, as well as on improving the scientific and social infrastructure, which is indispensable to further progress.

Photo 7. Dmitry Medvedev's visit to JINR. From left to right: V E Prokh, A N Sisakyan, Medvedev (Dubna, 2008).

Photo 8. Vladimir Putin's visit to JINR. In the photo from left to right: M G Itkis, Putin, V A Matveev, V D Kekelidze (Dubna, 2011).

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