

I. General considerations

The Scientific Council takes note of the comprehensive report by JINR Director V. Matveev, covering the recent highlights of JINR development, the progress in implementing JINR's flagship programmes, the decisions of the latest session of the JINR Committee of Plenipotentiaries (November 2018), and events in JINR's international cooperation.

The Scientific Council appreciates the milestones achieved in the development of JINR's flagship programmes, in particular:

- the establishment of international collaborations for the MPD and BM@N experiments, the organization of two meetings of these collaborations, and the holding of a targeted competition on “Megascience–NICA” for grants of the Russian Foundation for Basic Research, which contributes to attracting a wide international community, including Russian institutions, to the realization of the NICA project;

- the production of the first beam of accelerated heavy ions at the DC-280 cyclotron, which indicates the emergence of JINR's new basic facility as the core part of the Factory of Superheavy Elements;

- the implementation of priorities between all ongoing neutrino experiments aimed at improving the coordination of the JINR Neutrino Physics Programme, and the continuing development of the BAIKAL-GVD detector;

- the maintenance of the operational conditions of the IBR-2 facility and the continued upgrade of its instruments within the FLNP User Programme; the in-progress development of two possible concepts for the future neutron source at JINR;

- the start of the active use of the Govorun supercomputer being a promising part of JINR's IT infrastructure.

The Scientific Council congratulates the Directorate and staff of JINR on the opening of the International Year of the Periodic Table of Chemical Elements (IYPT), noting with satisfaction the numerous dedicated events with JINR's participation. The significant level of JINR's representation in the IYPT cornerstone programme contributes to higher visibility of JINR as a world centre with leading positions in the synthesis of new elements.

The Scientific Council recognizes the efforts being taken by JINR Directorate towards strengthening cooperation with JINR partners as well as extending the general horizons of international cooperation. The Scientific Council appreciates, in particular,

the signing of the framework agreement on cooperation between GSI, FAIR and JINR, and of the roadmap for the development of the JINR–Egypt cooperation. The Scientific Council also welcomes broadening ties with France and the Republic of Korea.

The Scientific Council welcomes the initiative by the Directorate to establish a JINR Science and Innovation Centre.

II. Analysis of the implementation of JINR's flagship projects

The Scientific Council takes note of the analysis of implementation of the schedules of realization of JINR's flagship projects presented in the reports by VBLHEP Director V. Kekelidze (NICA), by FLNR Director S. Dmitriev (SHE Factory), and by DLNP Deputy Director D. Naumov (BAIKAL-GVD).

NICA. The analysis of the implementation of the schedule of the NICA complex project has been presented in the following main aspects: accelerator complex, experimental facilities, and infrastructure. Work is being carried out actively in all these areas and is continuously monitored by the Directorates of VBLHEP and JINR.

The first goal of the project has been achieved — the launching of the BM@N experimental set-up with extracted beams and the successful collection of first data within the experimental physics programme during the 55th run of the Nuclotron.

The ongoing installation of the booster synchrotron corresponds to the plans for its commissioning (end of 2019). There is progress in building the first experimental facility at the collider, the MPD detector. The project management has taken measures to eliminate the delay in developing MPD elements caused by force majeure and to continue the work in accordance with the plan.

The preparation of the conceptual and technical reports of the second experimental facility, the SPD detector, continues.

Work on the construction of the accelerator infrastructure and other facilities of the NICA complex is well underway.

SHE Factory. The work on the Factory of Superheavy Elements is proceeding according to schedule. In 2018, a certificate of compliance of the constructed object with the requirements of technical regulations by the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostekhnadzor) was obtained. Complex commissioning work was conducted at the DC-280 cyclotron. On 26 December 2018, the first beam of accelerated krypton ions was produced inside the DC-280 cyclotron; on 17 January 2019 it was successfully extracted from the cyclotron.

The most important tasks for FLNR to focus on in the current year are the following: production of heavy-ion beams with design parameters (first quarter, 2019); commissioning work and start-up of the GFS-2 gas-filled recoil separator (first quarter, 2019); preparation and conduct of Day-1 experiments on the synthesis of moscovium isotopes in the $^{48}\text{Ca}+^{243}\text{Am}$ reaction (second quarter, 2019); preparation for experiments on the synthesis of new element 120 in the $^{50}\text{Ti}+^{249-251}\text{Cf}$ reaction (second half, 2019).

BAIKAL-GVD. The implementation of the project “Baikal Neutrino Telescope” is under way according to schedule. Three clusters with a total number of 864 optical modules were installed during 2016–2018. This facility has become the largest neutrino telescope in the northern hemisphere. All three clusters are operating normally. Data analysis is in progress. Three PhD theses have been successfully defended.

A good deal of work has been done to update the infrastructure of the Baikal neutrino telescope. A laboratory complex for the assembly and testing of optical modules, including long-term tests, for testing electronics, deep-water connectors, cables and other equipment was built at DLNP. On the site of the experiment, new residential premises, a data collection centre, a coastal centre, a canteen and a hostel were put into operation; a laboratory for the assembly of deep-water cables was constructed in Baikalsk.

Within the 2019 campaign, two more clusters will be installed, which will bring the total number of optical modules to 1440. According to the plan, the first phase of the Baikal neutrino telescope will be commissioned in 2021. The number of optical modules will reach 2592.

The Scientific Council appreciates highly the ongoing efforts to implement these major projects of the current Seven-year plan for the development of JINR (2017–2023). However, considering the existence of competitive projects in several research centres elsewhere, the Scientific Council emphasizes the importance of strict observance of the approved timelines.

The Scientific Council recommends that the JINR Committee of Plenipotentiaries, which plans to consider a similar issue at the next session in March 2019, give an overall positive assessment to the analysis presented.

III. Status of the establishment of the SOLCRYST Laboratory at SOLARIS

The Scientific Council takes note of the information presented by FLNP Director V. Shvetsov about the progress of the joint work being done by the Jagiellonian University in Kraków (Poland) and the Frank Laboratory of Neutron Physics to develop

the concept for and establish JINR's new research infrastructure — a Laboratory for Structural Research of Macromolecules and New Materials (SOLCRYS) at the SOLARIS National Synchrotron Radiation Centre of the Jagiellonian University

The Scientific Council welcomes the start of tendering activities for the supply of equipment and installation of SOLCRYS workstations. At the same time, the Scientific Council would like to draw attention to the need for progress in resolving the issue of constructing a superconducting wiggler capable of providing maximum radiation intensity at an energy of at least 20 keV, as indicated in the Agreement between the Jagiellonian University and JINR concerning the establishment of SOLCRYS.

The Scientific Council takes note of the possibility to explore a future collaboration with the CERIC ERIC consortium.

IV. Recommendations in connection with the PACs

The Scientific Council takes note of the recommendations made by the PACs at their meetings in January 2019, as reported at this session by I. Tserruya, Chairman of the PAC for Particle Physics, M. Lewitowicz, Chairman of the PAC for Nuclear Physics, and D. L. Nagy, Chairman of the PAC for Condensed Matter Physics. The Scientific Council requests the JINR Directorate to consider these recommendations while preparing the JINR Topical Plan of Research and International Cooperation for the year 2020.

Particle physics

The Scientific Council shares the PAC's concern about the series of delays (mainly in civil construction), which affect the overall schedule of the NICA project, and urges the NICA management to critically scrutinize the current schedule of the entire project to ensure that no further delays occur. The Scientific Council notes with satisfaction the successful implementation of the plan for the renewal of heating, water and drainage networks (12 km of networks have already been renewed) and welcomes the efforts of the Laboratory's management to eliminate the backlog from the plans to build a compressor station.

The Scientific Council is pleased to note the official establishment of the international experimental collaborations MPD and BM@N after their 2nd Collaboration meetings. The Scientific Council welcomes the admission of new institutions to the collaborations and congratulates the elected Spokespersons and Institutional Board Chairpersons, the appointed Project Managers and Deputy Spokespersons, and wishes

them all very fruitful work at the NICA facility. The Scientific Council supports the plans for the formation of organizational structures of the Collaboration.

The Scientific Council notes the steady progress in constructing the main subsystems of the MPD detector: the superconducting magnet, TPC and ToF. It supports the plans for the installation of the BM@N transport line and the vacuum beam pipe through the experimental set-up, which are necessary for operation with heavy-ion beams. The Scientific Council concurs with the PAC's reiterated recommendations for the BM@N team to focus efforts on the physics analysis of the large data sets collected both in the BM@N research programme and in the study of short-range correlations.

The Scientific Council supports the PAC's recommendations on the approval of new projects and the continuation of ongoing projects in particle physics within the suggested time scales, as outlined in the PAC recommendations. In particular, it endorses the PAC's recommendations to start the preparation of a Conceptual Design Report (CDR) for the Spin Physics Detector (SPD) at the NICA collider, followed after its acceptance by a Technical Design Report. The CDR must contain a full concept which should guarantee much better spin physics results than those that could be achieved with MPD at NICA. Technical solutions should be of latest state-of-the-art and should not necessarily be based on in-house existing technologies. The Scientific Council seconds recommendations of the PAC that the full SPD Collaboration should be involved in the concept elaboration process and that a dedicated core of people is needed in order to achieve the task. The Scientific Council supports the PAC's recommendations to approve the project until the end of 2021 with first priority.

The Scientific Council endorses the PAC's recommendations for the continuation of the JINR's participation in the BES-III project until the end of 2022 with second priority. The JINR group has made many significant contributions in the BES-III experiment since 2005, and the Scientific Council agrees with the PAC that the experiment has reached most of the aimed at goals and further studies could be conducted with a commensurate lower effort.

The Scientific Council considers JINR's participation in the R&D project for the PHOS detector as an important contribution to the upgrade of the ALICE photon spectrometer and supports the PAC's recommendation for continuation of JINR's participation in the R&D project until the end of 2020 with first priority.

The Scientific Council recognizes the important results achieved by the JINR group in the LHC experiments: the analysis of ultraperipheral Pb+Pb and p-Pb collisions and the study of kaon femtoscopy in the ALICE experiment; the observation of the

Higgs boson decay into a pair of *b*-quarks, recent results on searches for new physics in $\gamma+Z/W/H$ final states and the progress in the mass production of micromegas chambers for the Phase-1 upgrade of the ATLAS detector; the results on the search for high-mass resonances decaying into dilepton pairs, the measurements of asymmetries and cross-sections of Drell–Yan pair production and the progress in the R&D work for a new hadron calorimeter of the CMS detector.

Nuclear physics

The Scientific Council thanks the PAC for Nuclear Physics for its initiative to follow up on the construction work for the Factory of Superheavy Elements (SHE factory) and notes the significant progress achieved by the Flerov Laboratory of Nuclear Reactions for this major project.

The Scientific Council recognizes the efforts made by the Laboratory in order to prepare for the commissioning of the SHE Factory as well as the progress in constructing new facilities for the SHE Factory, in particular, the GFS-2 gas-filled separator, appreciates this work, and supports its continuation. In the first quarter of 2019, it is planned to continue the work at DC-280 to obtain heavy-ion beams of design parameters, to complete the commissioning work for the GFS-2 separator, and to initiate the implementation of the experimental programme on the synthesis and study of the properties of SHE at the Factory.

At the first stage a set of test experiments will be carried out. They will be aimed at achieving the design parameters of the GFS-2 separator, using fusion reactions of rare-earth elements with ^{40}Ar , ^{48}Ca , ^{50}Ti ions accelerated at the DC-280 cyclotron. In this set of experiments, it is necessary to study the transmission of GFS-2 at different thicknesses of the target, the resistance of targets to an increased beam intensity and accumulated dose, the clearing of background reaction products, etc.

The first commissioning experiments on SHE will concern the synthesis of moscovium isotopes in the $^{48}\text{Ca} + ^{243}\text{Am}$ reaction and at a later stage the study of the chemical properties of Fl and Cn. The programme will further be focused on preparing and conducting experiments on the synthesis of elements 120 and 119 in the reactions of ^{50}Ti beam with $^{249-251}\text{Cf}$ and ^{249}Bk targets respectively.

The Scientific Council congratulates the FLNR staff on the successful start-up of the DC-280 cyclotron and recommends that the Directorates of JINR and FLNR concentrate their efforts to complete all commissioning work, including the DC-280 cyclotron and the GFS-2 separator, and to prepare for the test experiments. The Scientific Council endorses the programme of first experiments at the SHE Factory.

Neutrino physics

The Scientific Council congratulates the PAC for Particle Physics and the PAC for Nuclear Physics for the careful evaluation, in a joint session of the two PACs on 22 January 2019, of all projects and research themes carried out at JINR in the areas of neutrino physics, astrophysics and dark matter. There are currently 13 such projects, 7 of them are regularly evaluated by the PAC for Particle Physics whereas the other 6 by the PAC for Nuclear Physics. In order to achieve “a better coordination of the neutrino physics programme therefore allowing implementation of priorities in a more concerted and efficient manner” as outlined in the Resolution of the Scientific Council’s previous session, all 13 projects have been jointly evaluated by both PACs with the ultimate goal to classify them into three categories A, B or C, based on the scientific merit of the project and the performance of the JINR group involved:

Category A: excellent projects, which should be fully funded with adequate resources and encouraged to continue and expand their impact;

Category B: very good projects, but with some weaknesses. They should be funded together with a strong recommendation on where improvement is needed;

Category C: good projects, which did demonstrate relatively low performance.

The project leaders were requested to answer a common questionnaire prepared by representatives of the two PACs in coordination with the JINR management. Each project was reviewed by one referee from the PAC for Particle Physics and one from the PAC for Nuclear Physics. The final assignment of each project into category A, B or C was done taking into account the opinions of two referees and the subsequent discussion of the project at the joint session of both committees.

The evaluation resulted in specific recommendations for each one of the 13 projects, emphasizing their strengths and weaknesses as outlined in the recommendations of the joint session, and in the following classification of the projects in the area of neutrino physics, astrophysics and dark matter: Category A: BAIKAL-GVD, DANSS, Daya Bay/JUNO, NOvA; Category B: COMET, EDELWEISS-LT, GEMMA-III, GERDA, NA64, SuperNEMO, TAIGA; Category C: BOREXINO, Mu2e/g-2.

The Scientific Council endorses the recommendations of the PACs and considers that the recommendations and the classification developed will be useful for the DLNP and the JINR Directorates in their efforts towards concentration of resources in the selected directions and strengthening the research programme.

Condensed matter physics

The Scientific Council takes note of the information on the current state of the IBR-2 facility as well as on the results of theoretical and experimental studies of the reactor's dynamical characteristics considered by the PAC for Condensed Matter Physics. The Scientific Council supports the efforts of the FLNP Directorate to secure the operational conditions of the IBR-2 facility and welcomes the plans for its maintenance and upgrade.

The Scientific Council appreciates the quality and the interdisciplinary character of the scientific results produced at IBR-2 instruments and the instrumentation developments in 2018. The Scientific Council agrees with the PAC that continuous upgrade of the IBR-2 instruments should be provided together with a more detailed analysis of the research outcome for each particular instrument and of its potential for improvement.

The Scientific Council takes note of the results of implementing the FLNP User Programme in 2018 and of the recent efforts to improve the process of collection and evaluation of research proposals. The Scientific Council is pleased to note that the IBR-2 facility has been operating stably according to the User Policy Programme since 2012 with calls for proposals being issued twice a year. In 2018, however, due to technical reasons at the reactor, less than originally scheduled number of cycles was assigned for experiments within the User Programme. The Scientific Council also welcomes the PAC's request to provide detailed statistics for each particular instrument with relation to this Programme.

The Scientific Council is pleased with the assessed current state of the FSD Fourier stress diffractometer at the IBR-2 facility and concurs with the PAC that FLNP's achievements in developing correlation diffractometry are particularly successful for the IBR-2 research programme.

The Scientific Council notes strengthening collaboration between JINR and the SOLARIS National Synchrotron Radiation Centre of the Jagiellonian University in Kraków (Poland) towards developing a laboratory for structural research using synchrotron X-rays. The Scientific Council expects that this joint activity will extend the variety of experimental approaches to the condensed matter research pursued at JINR. The Scientific Council also shares the PAC's recommendation calling for more technical details on potential scientific use of this new laboratory at the SOLARIS Centre.

The Scientific Council takes note of the general endorsement by the PAC of FLNP's intents to open two new themes: "Development of the critical design report for a

new Dubna Neutron Source (DNS-IV)” and “Construction of a Laboratory for Structural Research of Macromolecules and New Materials at the SOLARIS National Synchrotron Radiation Centre of the Jagiellonian University in Kraków (Poland)” and expects the consideration of full proposals at the PAC’s next meeting.

Common issues

The Scientific Council is pleased with the present state and trends in the development of a concept for the future neutron source at JINR considered by the PAC for Condensed Matter Physics and the PAC for Nuclear Physics. The Scientific Council notes the progress in the current stage of the conceptual design process and welcomes the two principle schemes proposed for such a source: a pulsed fast reactor IBR-3 (NEPTUN) and a pulsed neutron source driven by a proton accelerator (PLUTON). The Scientific Council recommends that FLNP continue developing both concepts of the new neutron source, compare their parameters and costs between each other also with those of other existing or projected neutron sources. A broader discussion on the possible condensed matter physics and nuclear physics programme for the new source is required and elaboration of the scientific case for a desired instrumental suite of each option should also be performed. In this context, the Scientific Council recommends that the conceptual design and scientific programme of the future neutron source be evaluated at a duly held joint session of the PAC for Nuclear Physics and the PAC for Condensed Matter Physics.

Reports by young scientists

The Scientific Council followed with interest the reports by young scientists, selected by the PACs for presentation at this session: “East-west asymmetry effect in atmospheric muon flux in the Far Detector of NOvA”, “Upgrade of the GERDA experiment”, and “Clusterization aspects of fullerene C₇₀ in toluene/N-methyl-2-pyrrolidone mixture according to SANS, SAXS and DLS data”, and thanks the respective speakers: Olga Petrova (DLNP), Nadezhda Rumyantseva (DLNP), and Tetiana Nagorna (FLNP), three talented scientists. The Scientific Council welcomes such selected reports in the future and looks forward to the Management enhancing the visibility of and empowering female scientists at JINR.

V. Scientific report

The Scientific Council thanks A. Sergeev, President of the Russian Academy of Sciences and member of the JINR Scientific Council, for his excellent lecture on “Exawatt science”.

VI. Awards and prizes

The Scientific Council congratulates DLNP Chief Researcher V. Komarov on the award of the V. Dzhelepov Prize for his pioneering work on the construction of the first channel for proton therapy at the JINR synchrocyclotron.

The Scientific Council approves the Jury's recommendations presented by JINR Director V. Matveev on the award of the B. Pontecorvo Prize to Professor F. Halzen (University of Wisconsin, Madison, USA) for his leading role in the construction of the IceCube detector and experimental discovery of very-high-energy cosmological neutrinos.

The Scientific Council approves the Jury's recommendations presented by Vice-Director M. Itkis on the award of JINR annual prizes for best papers in the fields of scientific research, instruments and methods, and applied research (Appendix).

The Scientific Council congratulates E. Rabinovici, member of this Council, on having been awarded the 2019 Award for Science Diplomacy by the American Association for the Advancement of Science, together with other distinguished scientists: Z. Sayers, C. Llewellyn Smith, H. Schopper (member of the JINR Scientific Council during 1993–2003), and K. Toukan, for their central contributions to the founding and development of the international physics centre SESAME (Allan, Jordan).

The Scientific Council congratulates DLNP Chief Researcher J. Budagov and JINR Vice-Director M. Itkis on the award of the Jubilee Diplomas of Honour of the Presidium of the National Academy of Sciences of Ukraine for scientific achievements and on the occasion of the 100th anniversary of the Academy, presented at this session by member of the JINR Scientific Council and the Plenipotentiary of the Government of Ukraine to JINR, B. Grynyov.

VII. Endorsement of appointments of Deputy Directors of DLNP and LIT and announcement of the vacancy of the position of the Director of FLNR

The Scientific Council endorsed the appointment of V. Glagolev, A. Kovalik, and D. Naumov as Deputy Directors of the Dzhelepov Laboratory of Nuclear Problems (DLNP), until the completion of the term of office of DLNP Director V. Bednyakov.

The Scientific Council endorsed the appointment of O. Chuluunbaatar as Deputy Director of the Laboratory of Information Technologies (LIT), until the completion of the term of office of LIT Director V. Korenkov.

The Scientific Council announces the vacancy of the position of the Director of the Flerov Laboratory of Nuclear Reactions. The election will take place at the 127th session of the Scientific Council in February 2020.

VIII. Next session of the Scientific Council

The 126th session of the Scientific Council will be held on 19–20 September 2019.



V. Matveev

Chairman of the Scientific Council



C. Borcea

Co-chairman of the Scientific Council



A. Sorin

Secretary of the Scientific Council

JINR PRIZES FOR 2018

1. Theoretical physics research

First prizes

1. "Multidimensional supersymmetric mechanics, Witten-Dijkgraaf-Verlinde-Verlinde equation and its generalization".

Authors: S. Krivonos, O. Lechtenfeld, A. Sutulin.

2. "Vortical excitations in nuclei".

Authors: J. Kvasil, W. Kleinig, V. Nesterenko, P.-G. Reinhard, A. Repko.

Second prize

"Description of low-energy meson production at colliding $e+e-$ beams and in decays of tau leptons within the extended Nambu-Jona-Lasinio model".

Authors: M. Volkov, A. Arbusov, A. Pivovarov, K. Nurlan.

II. Experimental physics research

First prizes

1. "Study of pp-chain solar neutrino properties with the Borexino detector".

Authors: A. Vishneva, O. Smirnov, A. Sotnikov.

2. "Correlation of structure and physical properties in ordered iron-based alloys".

Authors: A. Balagurov, I. Bobrikov, S. Sumnikov, I. Golovin, V. Palacheva.

Second prize

"Manifestation of the cluster structure of ^9Be nuclei in the mechanism of their interaction".

Authors: S. Lukyanov, A. Denikin, V. Maslov, M. Naumenko, Yu. Penionzhkevich, J. Mrazek, W. Trzaska, K. Mendibaev, N. Skobelev, Yu. Sobolev,

III. Physics instruments and methods

First prize

“ACCULINNA-2 project: the physics case and technical challenges”.

Authors: A. Bezbakh, L. Grigorenko, M. Golovkov, A. Gorshkov, S. Krupko, S. Sidorchuk, S. Stepansov, G. Ter-Akopian, A. Fomichev, P. Sharov.

IV. Applied physics research

First prize

“Structure and properties of aqueous solutions of C_{60} and C_{70} fullerenes for biological applications”.

Authors: E. Kyzyma, V. Petrenko, O. Ivankov, M. Avdeev, V. Aksenov, L. Bulavin, Yu. Prylutskyy.

Second prize

“Determination of the elemental content of Moldavian wines and soils by neutron activation analysis”.

Authors: I. Zinicovscaia, O. Culicov, M. Frontasyeva, S. Gundorina, O. Dului, R. Sturza.

Encouraging prizes

1. “Symmetry effects in quantum dots”.

Authors: R. Nazmitdinov, M. Dineykhan, N. Simonović, A. Puente.

2. “Study of the structure of a proton in hard p-p processes of production of prompt photons or vector bosons accompanied by heavy jets”.

Authors: V. Bednyakov, S. Brodsky, G. Lykasov, A. Lipatov, J. Smiesko, S. Tokar.

3. "Discovery and prospects of investigation of transitional dynamics in three-body decays of exotic nuclei".

Authors: T. Golubkova, L. Grigorenko, M. Zhukov, P. Sharov.

4. "Position-sensitive twin ionization chamber for nuclear fission investigations".

Authors: Sh. Zeynalov, P. Sedyshev, O. Sidorova, V. Shvetsov, L. Svetov.