

I. General considerations

The Scientific Council congratulates JINR Director V. Matveev for his excellent report, presenting the recent highlights in the activities of JINR in the context of the world's fundamental nuclear physics science, and covering the decisions of the latest session of the JINR Committee of Plenipotentiaries (November 2017), results of implementation of the JINR scientific programme in the first year of the new seven-year plan, major events in JINR international cooperation, and some organizational issues.

The Scientific Council is impressed by the wealth of high-quality physics results obtained by JINR scientists in 2017 at home facilities of the Institute as well as at external accelerators, reactors and in various collaborations.

The Scientific Council is pleased to note the successful development of the JINR research infrastructure, including the NICA megaproject, the Factory of Superheavy Elements (SHE) and the IBR-2 spectrometer complex, and highly appreciates the efforts undertaken by the JINR Directorate and staff towards achieving the important milestones of constructing and upgrading these facilities.

The Scientific Council is also pleased to note that the international visibility of JINR and of its flagship projects is ramping up. The NICA project has already been included in the ESFRI roadmap and in the NuPECC long-range plan, and every effort should be made in order for it to become also part of the European Strategy for Particle Physics. Synthesis of superheavy elements by JINR is a world-leading programme. IBR-2 is part of the European neutron roadmap. Neutrino research projects at the Kalinin NPP and at Lake Baikal are also flagship programmes and should be on the APPEC roadmap. The Scientific Council supports this trend and appreciates highly the JINR Directorate's attention to the advice given by the Scientific Council on the integration of these facilities into the European and global research infrastructure landscapes.

The Scientific Council takes note of the meeting of the Supervisory Board of the NICA complex project held on 2 February 2018 and its recommendations on the NICA development programme for the next several years, on the structure of its management bodies, on its financial support, on its research programme, and on the civil construction of the NICA complex.

The Scientific Council expects that the first phase envisaging construction of the SHE Factory will be completed in July 2018 and that the first experiments will begin in

October-November 2018, according to the timeline of commissioning this important complex as presented at the previous session of the Scientific Council.

The Scientific Council takes note of the 10th Meeting of the Group of Senior Officials on Global Research Infrastructures, which was held at JINR on 9–12 October 2017, and underlines the importance of acquainting its participants with the largest facilities of the JINR research infrastructure.

The Scientific Council notes with great satisfaction the decision of the UN General Assembly to proclaim 2019 as the International Year of the Periodic Table of Chemical Elements and looks forward to the active participation of JINR, which gave outstanding contributions to the discovery of new superheavy elements, in these celebrations including those planned by UNESCO.

The Scientific Council welcomes the work carried out by the JINR Directorate for developing a Code of professional ethics of the JINR staff and a Regulation on the implementation of JINR's right to independently confer academic degrees and to issue the relevant diplomas.

II. Cooperation with the National Synchrotron Radiation Centre SOLARIS of the Jagiellonian University in Kraków (Poland)

The Scientific Council takes note of the reports "SOLCRYST — new laboratory for structural research at the Polish synchrotron SOLARIS: proposed concept" and "Complementarity between neutron and synchrotron X-ray scattering, the potential of the synergy between IBR-2 and SOLARIS" presented by SOLARIS Director M. Stankiewicz and FLNP Director V. Shvetsov.

The Scientific Council considers fruitful the idea of building a Laboratory for Structural Research of Macromolecules and New Materials belonging to JINR in one of its Member States — Poland, using its high-tech national research infrastructure. The Scientific Council supports this plan of JINR and of the Jagiellonian University, which will strengthen their experimental capabilities in solid-state physics and biology, and encourages them to develop a detailed project encompassing a planned research programme, which should take into account world's cooperation in the use of synchrotron radiation. At its next session, the Scientific Council would like to hear a detailed concept report for the new laboratory agreed upon by the two sides as is described in more detail in the section "Condensed matter physics issues".

III. Status and future development of LIT

The Scientific Council takes note of the report “Status and future development of the Laboratory of Information Technologies” presented by LIT Director V. Korenkov, noting with satisfaction the comprehensive efforts being undertaken by LIT towards developing Information Technology at JINR.

The Scientific Council welcomes the activities on the project of the Multifunctional Information and Computing Complex aimed at further development of the network and computing infrastructure for scientific research underway at JINR and its Member States on the basis of advanced information technologies in accordance with the Seven-year plan for the development of JINR for 2017–2023.

The Scientific Council supports the development of high-performance computing (HPC), new architectures and principles of the organization of computations leading to innovative changes in the research strategy and notes the key basis of the scientific IT-ecosystem which is a distributed software-configured HPC-platform which combines supercomputer (heterogeneous), grid- and cloud technologies. This platform provides a way for the most efficient use of present-day computing architectures.

The Scientific Council notes with satisfaction the efforts aimed at developing new and upgrading existing algorithms for track recognition and reconstruction based on the principles of machine learning which allow improvement of experimental data processing. The Scientific Council approves the active participation of LIT in implementing the priority tasks of JINR and its Member States, in particular those related to the NICA megaproject.

The Scientific Council recommends that the JINR and LIT Directorates pay particular attention to the comprehensive development and improvement of the entire IT-ecosystem at JINR which contributes to refining scientific research, accelerating the production of results and new scientific knowledge, increasing management efficiency, singling out new forms of education, improving communication and interaction between scientists, and ensuring access to a wider range of information.

IV. Activities of NuPECC and its long-range plan in nuclear physics

The Scientific Council takes note of two reports concerning the activities of the Nuclear Physics European Collaboration Committee (NuPECC) and its long-range plan “Perspectives in nuclear physics” presented by the former and current Chairpersons of this Committee, A. Bracco (Italy) and M. Lewitowicz (France).

The process of preparation of the NuPECC long-range plan has involved efforts from 200 physicists from the nuclear physics community and from all NuPECC members. Present-day nuclear physics is defined in this document as a field including different research domains sharing the difficult, but stimulating task of studying nuclear matter in all its forms and exploring their possible applications. This knowledge is essential for scientists to find answers to the fundamental questions that concern the origin and the evolution of the Universe. The future of facilities is well presented in the plan, with particular focus on FAIR, ISOL facilities (SPIRAL2, ISOLDE, SPES), ELI-NP, NICA and the SHE Factory, as well as the recommendations concerning the nuclear physics science to be addressed at these facilities. In particular, the plan highlights the importance of the NICA and SHE Factory projects on the European roadmap for nuclear physics. In addition, the role of theory, applications, R&D for future projects, and of the education of young scientists is emphasized.

As a member of NuPECC, JINR has actively participated in the elaboration of the long-range plan and will be one of the major driving forces in its implementation phase. Realization of this plan on the European and international levels proposed by NuPECC is coherent with the Seven-year plan for the development of JINR (2017–2023) and should tighten the links between JINR and the entire nuclear physics community in Europe.

V. Recommendations in connection with the PACs

The Scientific Council takes note of the recommendations made by the PACs at their meetings in January-February 2018 as reported at this session by I. Tserruya, Chairman of the PAC for Particle Physics, by M. Lewitowicz, Chairman of the PAC for Nuclear Physics, and by P. Alekseev, member of the PAC for Condensed Matter Physics. The Scientific Council proposes that the JINR Directorate should take these recommendations into account while preparing the JINR Topical Plan of Research and International Cooperation for 2019.

Particle physics issues

The Scientific Council appreciates the significant progress achieved in the successful preparation of the KRION-6T heavy-ion source for operation in the Nuclotron run, welcomes the regular commissioning of new equipment and supports the programme of timely modernization of existing elements of the accelerator complex, in particular, the upgrade of the LU-20 linac and the associated substantial increase in beam intensity.

The Scientific Council is aware of the forced interruption of Run 55 of the Nuclotron due to a failure of the cooling system of the superconducting magnets. It notes with satisfaction the successful completion of the rapid restoration at the cryogenic helium facility and appreciates the information provided by the VBLHEP management on the measures taken to prevent recurrence of similar accidents in the future.

The Scientific Council recognizes the steady progress in developing key infrastructure elements including the upgrade of the power supply system of beam channels, the launch of the new Nuclotron control system, the commissioning of the new helium liquifier, the progress in upgrading the existing cryogenic complex, the preparation for the installation of the booster synchrotron, and the work carried out for the preparation of the collider magnet system. The Scientific Council is pleased with the progress achieved in the civil construction of the collider complex and with the roadmap for the construction of the NICA Centre building.

The Scientific Council welcomes the plans to hold a three-day meeting at JINR in April 2018 to officially launch the MPD and BM@N international collaborations and strongly encourages the initiative to establish a grant programme to attract and support research conducted at the NICA facility.

The Scientific Council acknowledges the efforts undertaken by the JINR and VBLHEP Directorates to strengthen the participation of China's groups in the construction of the MPD electromagnetic calorimeter. The international team should focus on the optimization of the detector specifications and design in view of finalizing the ECAL TDR. The Scientific Council appreciates the recent advance in the MPD magnet construction and shares the PAC's concern about the delay in the magnet delivery to JINR. The contract should be successfully completed with no additional slippage.

The Scientific Council welcomes the commissioning of new equipment of the BM@N experiment and the first use of the large-area GEM tracking detectors. The Council also reiterates its concern about the lack of manpower for an in-depth analysis of the data collected in recent runs. It looks forward to the detector operation during Run 55 with the new heavy-ion source, KRION-6T, and to the forthcoming study of short-range correlations.

The Scientific Council supports the recommendations of the PAC for Particle Physics 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. It endorses, in particular, the proposed plan for the formal establishment of the SPD Collaboration and preparation of the Conceptual Design Report of the SPD detector, backed by local theoretical support, by January 2019. The Scientific Council supports the continuation of JINR's participation in the upgrade of the ATLAS and CMS detectors until the end of 2020. It also supports the PAC's approach in the evaluation of the Borexino/SOX/DarkSide/ project where three distinct experiments with rather diversified physics goals and timelines were put in one proposal. The Scientific Council concurs with the PAC recommendations that the proponents should carry on the data analysis of the Borexino experiment until the end of 2019; with respect to SOX, due to the potential delays mentioned, the proponents should present a detailed status report to the PAC in order to decide on a possible recommendation. Concerning DarkSide 20k, the proponents are asked to present to the JINR Directorate an overall strategy to be considered by the PAC in order to allow for a thorough evaluation of all aspects of the project related to science, contributions and consistency of the group, investments and timeline.

Nuclear physics issues

The Scientific Council highly appreciates the results of scientific research carried out within the theme "Non-Accelerator Neutrino Physics and Astrophysics" consisting of six distinct projects. The theme is devoted to the studies of rare phenomena associated with the weak interaction by methods of modern nuclear spectroscopy. The rare processes under study include search for neutrinoless double-beta decay (GERDA (G&M) and SuperNEMO projects), experiments with reactor antineutrinos (DANSS and GEMMA-III projects), direct search for dark matter particles (EDELWEISS-LT project), and investigations of high-energy neutrinos from space with the deep-water neutrino telescope at Lake Baikal (BAIKAL-GVD project). The Scientific Council is pleased to note the world-leading results obtained in all these projects. It supports the general direction in which the theme is developing, when the participation in highly prestigious international projects provides an access to know-how for the development of home-based neutrino experiments at two basic facilities — the laboratories located at the Kalinin NPP and at Lake Baikal.

The Scientific Council recommends continuation of the rigorous support of these projects and research programmes for 2019–2021, and the Baikal project for a longer period until the end of 2023. It underlines the necessity to continue the efforts to improve the local infrastructures at JINR and at Lake Baikal and to ensure the sufficient human resource for the timely data analysis.

The Scientific Council notes the progress of construction of the Factory of Superheavy Elements (SHE). The installation work for the DC-280 cyclotron is well advanced and is now planned to reach an end in the first half of 2018. The start-up and adjustment are to be accomplished by mid-2018. The commissioning of the DC-280 accelerator should start by September 2018.

Significant progress has also been made in the construction of the experimental set-ups including the target system, separators and detection systems. In particular, a new gas-filled recoil separator has been manufactured and delivered to Dubna; its assembly is scheduled for January-March 2018. First test experiments are planned for October-November 2018.

In addition to the technical work, an important effort of FLNR and JINR concentrates on the licensing process, which should be accomplished to begin experiments on the synthesis and studies of superheavy elements.

The Scientific Council supports the well-considered decision of the FLNR Directorate concerning the continuation of the operation of U-400 for several years in parallel to the operation of experiments at GFS-1. Both experiments, spectroscopy and reaction studies at SHELS and new elements at GFS-1, are complementary.

In order to meet the deadlines for commissioning and first experiments at the SHE Factory, the Scientific Council recommends that the JINR and FLNR Directorates provide maximum possible resources to accomplish the work for all the systems of the accelerator, for the separator, the target and detection units in 2018.

In 2016, a new fragment separator ACCULINNA-2 was constructed on the beam line of the U400M cyclotron. With the ^{15}N primary beam, the fragment separator was tested to produce various secondary beams of radioactive isotopes. Intensities of the obtained secondary beams were 25 times higher than those obtained with the previous facility ACCULINNA-1. The Scientific Council supports the plan according to which ACCULINNA-2 will become the major facility to study exotic nuclei at the FLNR JINR.

The Scientific Council highly appreciates the results obtained in the main research directions of the concluding theme "Theory of Nuclear Structure and Nuclear Reactions": structure of nuclei far from stability, nucleus-nucleus collisions at low energies, fusion dynamics, few-body systems, nuclear dynamics at relativistic energies, properties of hot and dense nuclear matter. The Scientific Council is pleased to note that these topics are strongly connected with the main experimental activities in the main facilities at JINR and other centres. The Scientific Council supports the smooth transition of nuclear theory activities under the new theme "Theory of Nuclear Systems"

for 2019–2023 that should continue incorporating complex and broad views on the various aspects of nuclear structure and reactions in close synergy with the experimental programme of JINR and in other facilities operating or in the construction phase such as FAIR, SPES, HIE-ISOLDE, SPIRAL2, and ELI-NP.

Neutrino physics issues

After the presentations of the various neutrino experiments reported by the Chairmen of the PAC for Nuclear Physics and of the PAC for Particle Physics, the Scientific Council reiterates its recommendation that all these ongoing and recently planned neutrino experiments be presented and discussed within a joint meeting of the two PACs leading to a more coordinated neutrino physics programme and therefore allowing implementation of priorities in a more concerted and efficient way.

Condensed matter physics issues

The Scientific Council notes the progress in the discussion of the scientific case for a new JINR neutron source replacing the IBR-2 reactor after its shut-down and welcomes the continuation of this programme in close connection with FLNP's scientific plans. Potential instruments of the new source should be considered in developing the scientific case.

The Scientific Council takes note, with interest, of the principles of construction and the parameters of one of the possible concepts of a new source, presented at the meeting of the PAC for Condensed Matter Physics, where the subcritical assembly of ^{237}Np with a mechanic reactivity modulation controlled by a pulsed proton accelerator (superbooster) is considered as an option of the future facility. If successfully implemented, such a source can take one of the world's leading positions among the high-flux pulsed sources of the middle of the current century. The Scientific Council, however, shares the PAC's opinion that taking a univocal position in the matter of the physical scheme of the new neutron source would be premature at this stage. For selecting the optimal physical scheme, all reasonable options should be carefully analysed and compared with each other by an expert group representing the potential user community at international level.

The Scientific Council notes the timeline proposed by the PAC for the preparation of JINR's new neutron source, which includes:

- establishing an international working group (IWG) (in 2018);
- organizing international workshops by FLNP and scientifically coordinated by the IWG (from 2018 until the conceptual design report is concluded);
- publishing a short kick-off document elaborated by the IWG on the idea of the

new facility (until mid-2019);

- elaborating and publishing a detailed scientific case (until early 2020);
- elaborating a detailed conceptual design report (until late 2020);
- elaborating the administrative and financial model for the construction, commissioning, operation and decommissioning phases (until 2021);
- taking decision on the construction of the new facility (until 2023).

Summarizing, the Scientific Councils recommends continuation of work to study other options for the facility with a clear analysis of the parameters of the new source in terms of strengths, weaknesses, opportunities and threats with respect to the envisaged long-term user programme.

The Scientific Council highly appreciates the ongoing upgrades of the existing IBR-2 spectrometers and development of new ones, which results in improvement of their parameters and extension of research areas, as well as making them more attractive for potential users. It supports the plans towards the further development of the IBR-2 spectrometer complex, which take into account the reactor's specific features (high flux, long pulse, availability of cryogenic moderator) and will assure the maintenance of the instruments at the level comparable with other leading research centres in the world as well as the extension of research areas and improvement of research quality. The Scientific Council especially notes the progress in upgrading the DN-6 high-pressure neutron diffractometer for investigations of microsamples under extreme conditions, sharing the PAC opinion that the ongoing improvement of this instrument should remain one of the priority activities towards development of the whole IBR-2 spectrometer complex at the moment. The Scientific Council supports the further development of DN-6 and its subsequent introduction to the User Programme.

The Scientific Council highly appreciates FLNP's efforts to run the User Programme at an internationally recognized level. The Scientific Council considers the User Programme to be the key instrument for securing the position of IBR-2 as one of the leading neutron sources in the world and encourages the FLNP Directorate to further support this highly important activity, taking into account the PAC's recommendations on the need to upgrade the proposal assessment web applications being utilized within a professional system supporting the work of proposers, reviewers and the FLNP management as well as on a strict need of submitting experimental reports by all successful proposers as the necessary feedback.

Regarding the establishment of a Laboratory for Structural Research of Macromolecules and New Materials at the SOLARIS synchrotron of the Jagiellonian

University in Kraków, the Scientific Council supports the PAC's recommendation to the directorates of JINR Laboratories working in the field of condensed matter physics to elaborate the details of envisaged cooperation based on a more detailed scientific case in terms of well-established user demands and the existing synchrotron radiation landscape. The Scientific Council welcomes the PAC's recommendation to the JINR Directorate, to establish, together with the Jagiellonian University, a working group from both organizations with the participation of interested representatives of scientific centres of JINR Member States and provide it with the necessary financial support in order to develop the concept of the laboratory and its future research programme.

Reports by young scientists

The Scientific Council appreciates the following reports by young scientists which were selected by the PACs for presentation at this session: "Sensitive neutron detection method using iodine-containing scintillators" and "Limit on the effective magnetic moment of solar neutrinos using Borexino data" and thanks the respective speakers: D. Ponomarev (DLNP) and A. Vishneva (DLNP). The Scientific Council welcomes similar reports in the future.

VI. Memberships of the PACs

As proposed by the JINR Directorate, the Scientific Council appoints A. Maj (INP, Kraków, Poland) and V. Nesvizhevsky (ILL, Grenoble, France) as new members of the PAC for Nuclear Physics, each for a term of three years.

VII. Awards and prizes

The Scientific Council approves the Jury's recommendations on the award of the B. Pontecorvo Prize to Professors G. Fogli (University and INFN, Bari, Italy) and E. Lisi (INFN, Bari, Italy), for their pioneering contribution to the development of global analysis of neutrino oscillation data from different experiments.

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

VIII. Elections and announcement of vacancies in the directorates of JINR Laboratories

The Scientific Council elected V. Shvetsov as Director of the Frank Laboratory of Neutron Physics (FLNP) and V. Korenkov as Director of the Laboratory of Information Technologies (LIT), each for a second term of five years.

The Scientific Council announces the vacancies of positions of Deputy Directors of FLNP and LIT. The endorsement of appointments will take place at the next session of the Scientific Council in September 2018.

The Scientific Council endorsed the appointment of N. Antonenko, M. Hnatič, and A. Isaev as Deputy Directors of the Bogoliubov Laboratory of Theoretical Physics, until the completion of the term of office of BLTP Director D. Kazakov.

IX. In memory of colleagues

The Scientific Council deeply regrets the sad loss of Nguyen Manh Shat (Vietnam), member of the JINR Scientific Council during 1995–2017, and Adam Sobiczewski (Poland), member of the JINR PAC for Nuclear Physics during 1995–2017, who made outstanding contributions to the development of JINR and its international cooperation.

X. Next session of the Scientific Council

The 124th session of the Scientific Council will be held on 20–21 September 2018.



V. Matveev

Chairman of the Scientific Council



M. Waligórski

Co-chairman of the Scientific Council



A. Sorin

Secretary of the Scientific Council

JINR PRIZES FOR 2017

I. Theoretical physics research

First Prizes

1. "Pseudotoric structures: Lagrangian tori and Lagrangian fibrations".

Author: N. Tyurin.

2. "Spin dynamics in arbitrary gravitational and electromagnetic fields".

Authors: Yu. Obukhov, A. Silenko, O. Teryaev.

3. "Strong electron correlations in underdoped high-temperature superconductors".

Authors: A. Ferraz, I. Ivantsov, E. Kochetov, M. Maška, M. Mierzejewski.

II. Experimental physics research

First Prize

"Delayed neutron emission of exotic nuclei".

Authors: D. Testov, Yu. Penionzhkevich, E. Sokol, E. Kuznetsova, V. Smirnov, M. Ivanov, A. Severyukhin, D. Verney, F. Ibrahim.

Second Prize

"Search for 2p decay of the first excited state of $^{17}\text{Ne}(3/2^-)$ ".

Authors: A. Bezbakh, R. Wolski, M. Golovkov, S. Krupko, Yu. Parfenova, S. Sidorchuk, R. Slepnev, G. Ter-Akopian, A. Fomichev, P. Sharov.

III. Physics instruments and methods

First Prize

“Development and construction of gas-filled detectors based on a new type of straw tubes for operation in vacuum into a track spectrometer of the NA62 experimental set-up”.

Authors: L. Glonti, H. Danielsson, T. Enik, V. Kekelidze, A. Kolesnikov, D. Madigozhin, S. Movchan, Yu. Potrebenikov, V. Samsonov, S. Shkarovskiy.

Second Prize

“Structure of deterministic mass, surface and multiphase fractals: theory and methods of analysing the intensity of small-angle scattering”.

Authors: A. Cherny, E. Anitas, V. Osipov, A. Kuklin, M. Balasoiu.

IV. Applied physics research

First Prizes

1. “Development and construction of the permanent magnet ECR ion source, DECRIS-PM, for the DC-280 cyclotron”.

Authors: V. Bekhterev, S. Bogomolov, A. Bondarchenko, A. Efremov, K. Kuzmenkov, A. Lebedev, V. Loginov, V. Mironov, N. Yazvitsky, N. Konev.

2. “Construction of a facility for assembling and testing superconducting magnets, investigation of the characteristics of magnets”.

Authors: N. Agapov, V. Borisov, A. Galimov, A. Donyagin, V. Karpinskiy, V. Kekelidze, S. Kostromin, D. Nikiforov, G. Trubnikov, H. Khodzhbagiyan.

Encouraging prizes

1. “Study of ultracold neutron diffraction by a moving grating”.

Authors: G. Kulin, A. Frank, S. Goryunov, D. Kustov, A. Bushuyev, P. Geltenbort, M. Jentschel, A. Panzarella.

2. "Determination of the decay time of scintillators and investigation of space correlation of nuclear radiation by the autocorrelation method".

Authors: V. Morozov, N. Morozova, V. Zlokazov.

3. "Investigation of the nonlinear dynamics of waves in the terahertz frequency range in condensed media and living systems".

Author: A. Bugay.

4. "Monte-Carlo simulation of neutron spectrometers and neutron scattering experiments".

Authors: A. Belushkin, S. Manoshin, V. Bodnarchuk, A. Joffe.