I. General considerations

The Scientific Council takes note of the comprehensive report by the JINR Director, G. Trubnikov, covering the decisions of the latest session of the Committee of Plenipotentiaries of the Governments of the JINR Member States (22 March 2024), the results of the implementation of the Seven-Year Plan for the Development of JINR for 2024–2030, the progress in the realization of the projects included in the Topical Plan for 2024 as well as recent events in JINR's scientific activities and international cooperation.

The Scientific Council notes with satisfaction JINR's activities to enhance cooperation with research organizations in JINR Member States and Associated Member States.

The Council notes with gratitude the high level of attention of the Russian Federation to the maintenance and development of favourable and fruitful conditions for the work of JINR, in particular, as a co-founding state and place of residence of the international mega-science project NICA, as evidenced by the visit of the President of the Russian Federation Vladimir Putin to JINR and holding of a meeting of the Council for Science and Education under the President of the Russian Federation at the Institute's site.

The Scientific Council appreciates the decision of the CERN Council to benefit further from the participation of JINR in CERN's activities and expresses confidence that scientists and the Directorates of CERN and JINR will ensure effective mutually beneficial cooperation despite the geopolitical complications.

The Scientific Council highly welcomes the signing of a high-level agreement between JINR and the Ministry of Science and Technology of the People's Republic of China (MOST) on the beginning of implementation of eight joint projects, and also strongly supports the ongoing strengthening of cooperation with Mexico, Brazil, and India.

The Scientific Council appreciates recent achievements of the Institute, in particular:

– progress of technological tests of the NICA collider ring, including installation of the collider magnetic cryostat system, two RF stations and final focusing lenses, the merging of the high-vacuum volume sections in the West and East arcs, installation of cryogenic equipment and power supplies in the collider building, connection of power lines and energy evacuation systems;

– striving to achieve the goal of detecting the first Xe-beams collisions in the MPD in August 2025;

– progress in the analysis of Λ and K^0_s production and collective flow of protons in Xe+CsI experimental data recorded by the BM@N experiment and publication of the BM@N detector paper in NIM A;

– successful cooling of the MPD solenoid down to the temperature of 72 K, preparations for the analysis of the first data sets in fixed-target mode;

– finalization of the updated SPD Technical Design Report (TDR) and its approval at the PAC meeting in June 2024, progress in the development of detector prototypes;

– development of the ARIADNA collaboration and its research programme, preparation for the biosatellite experiment scheduled in 2025;

– progress in developing the Baikal-GVD deep-water neutrino telescope during the 2024 campaign that has resulted in the total number of installed optical modules reaching 4104 and 8 laser stations, as well as in significant improvement of the on-shore infrastructure;

– successful continuation of experiments at the Factory of Superheavy Elements aimed, first of all, at preparing experiments on the synthesis of elements 119 and 120 with ^{54}Cr and ^{50}Ti beams. The experimentally known region of the nuclear chart has been enlarged by the discovered isotopes ^{288}Lv, ^{289}Lv synthesized in the ^{50}Ti+^{242}Pu and ^{54}Cr+^{238}U reactions. The testing of a new large-diameter target (480 mm) will significantly speed up upcoming experiments on the spectroscopy of superheavy nuclei due to the possibility of having a twice larger beam current on a target. The first such experiment on isotopes of element 114 and their decay products synthesized in the ^{48}Ca+^{242}Pu reaction are scheduled for autumn 2024;

– completion of the upgrade of the U-400M accelerator, acceleration and transportation of ^{16}O, ^{40}Ar, ^{132}Xe ion beams, continuation of work to reach the accelerator's design parameters and preparation for the first experiments scheduled for autumn 2024;

– rapid progress in the construction of the new experimental hall of U-400R, and completion of the construction of a gallery from the U-400 cyclotron hall to the new experimental hall;

– preparatory work underway at the Frank Laboratory of Neutron Physics to start the IBR-2 reactor after a long shutdown. A license for the operation of the IBR-2 reactor was recently obtained from the supervisory authority. One of the two air heat exchangers has been replaced, work is underway to replace the second one. The technical readiness of the IBR-2 reactor for its start-up is scheduled for November 2024. Experimental work on external beams is scheduled for spring 2025;

– important results in fundamental and applied areas of research related to materials science and ecology carried out at FLNP, and in the field of life sciences due to the development of the interlaboratory research programme, in particular, at the Laboratory of Radiation Biology;

– interesting results in the field of theoretical physics of elementary particles, atomic nuclei, condensed matter physics, and advanced mathematical physics, aimed, in particular, at supporting the JINR experimental programme;

– successful operation and development of the JINR Multifunctional Information and Computing Complex (MICC), including an increase in the power of the Govorun supercomputer, extension of the functions of the JINR grid sites with the inclusion of their resources in the system for modelling, processing and storage of data from the BM@N, MPD and SPD experiments, increase in the tape storage capacity from 50 PB to 90 PB, and ranking the JINR Tier1 centre first among Tier1 world centres for CMS by the CPU time for data processed;

– successful participation of the Institute in the work of collaborations at CERN, including the second phase of the upgrade programme of the ATLAS, CMS, and ALICE detectors at the CERN-LHC complex, and new results in the experiments at CERN-SPS;

– efficient participation of the JINR group in the first phase of the COherent Muon to Electron Transition (COMET) experiment at J-PARC.

II. Discussions of the Director's report

After the report by the JINR Director, G. Trubnikov, the members of the Scientific Council noted with great satisfaction the successful fulfilment of the current 7-year plan for the development of JINR, obtained remarkable results in scientific research and the development of research infrastructure as well as the positive dynamics of all important indicators of the JINR development. The members of the Scientific Council asked the following questions, which were then answered by the Director.

Roumen Tsenov: My question is about the MPD plans for the next year. The idea to have fixed target collisions inside the MPD detector is rather new for me and I don't see scientific reasons behind that. Does it simply mean that the team is afraid that the collisions of beams will not be achieved in that year and this is kind of replacement for the programme?

G. Trubnikov: The answer is "No", our plans are to have the operational collision experiment in the end of the next year. The presented experiment scenario has two goals. First one, to get the statistics and to provide calibrations of the MPD detector. The

luminosity in beam-beam collisions on the first stage is expected to be very low, we are not sure that the sensitivity of all subdetectors will be enough to get the full-scale data. That's why we propose two complementary experiments: a collision-mode and a fixed-target experiment. The fixed-target experiment will also be interesting to have some cross-check with the BM@N experiment results.

I. Tserruya mentioned that operating the MPD experiment in fixed-target mode will broaden the scientific scope of the MPD. It will enlarge the center-of-mass energy range covered by the experiment toward lower energies as well as the pseudo-rapidity coverage toward forward pseudo-rapidities.

Michel Spiro: Will the CERN–JINR school for young scientist be soon, that is very important? Could we have an indicator of the gender balance at JINR, so we can monitor the evolution?

G. Trubnikov: Concerning the CERN–JINR school, unfortunately, the current format of cooperation, which is limited by the decision of the CERN Council of March 2022, does not allow us to organize joint events, such as student schools. We rely very much on cooperation with collaborations in CERN – they are really unpoliticized and support very much all our specialists and communications. So, may be, they will support us in releasing with organizations of the CERN–JINR student school.

I hope that with the Directorate of CERN we will find a way how to overcome these limitations. Concerning the gender balance, yes, we are moving and progressing. You can see it both in official positions and in the statistics for JINR scientific prizes, etc. We always pay much attention to the gender balance and I think that now we have a good dynamics in this respect.

R. Rashkov: Nowadays it is very important to attract more young people from all over the world. Moreover, it looks like that cooperation between the countries is growing. In this respect I am extending the question by Michel Spiro. I just learned that there will be a traditional conference of young scientists in Dubna, but it's not allowed to participate there online. This is a huge obstacle, because to travel to Dubna these days is not easy. In this respect, are you planning to include online participation of young scientists and specialists in activities in Dubna, because a lot of young scientists could participate and bring some bridges between the countries?

G. Trubnikov: Indeed, this is a sensitive question. The first thing, which comes to my mind, is excellent, fantastic, successful student schools in Bulgaria, which we held every year in Varna, Sozopol, etc. Unfortunately, we cannot hold them in some Member Countries due to limitations with visa and travel things. But in Armenia, we had several

events: conferences, student schools. Also, we held events in Vietnam, Egypt, Belarus, Serbia, Cuba. We understand that in order to have deeply involved Member Countries, many scientists from them and support from governments, we have to hold a lot of scientific and educational events in Member Countries. Concerning online participation in our events, it is always available as a regular practice.

C. Borchea: At the chapter of international collaborations, I would like to stress the importance of the fact that Dubna is providing a number of magnets for FAIR, and this is important both from the point of view of in-time realization of the project and also, it's important financial effort.

G. Trubnikov: Yes, around half a year or more, we have been trying to get required allowances. We fulfil our obligations for FAIR in accordance with all agreements, but we have a lot of difficulties with the customs and even more with the transfer of money. The latter is much more complicated than the delivery of equipment. We hope for the help and assistance from the German side to overcome formal obstacles, particularly with the money transfer. But we stay on our position that we keep the collaboration, keep all agreements, and the work here in Dubna is not stopped. And cooperation must be symmetrical, mutually beneficial and respectful.

A. M. Cetto: I would like to convey our thanks from the Mexican scientists that have been benefiting from the collaboration with JINR. They are very enthusiastic, very happy about what they have achieved in Dubna so far, what they have learned. I see that the Institute is becoming more international. But are there any expectations that could not be met, not achieved as expected?

G. Trubnikov: As I already answered to Catalin Borchea, the main show-stopper now are sanctions against Russia. We have almost no opportunity to fulfil payments to our international partners. Especially the last couple of months have been very challenging. Another issue, which is both bad and good, this year we have an increased arrival of scientists from Member States, Partner Countries, and Russian research centres to JINR either for permanent work or midterm stay within ongoing collaboration. The bad thing is that we don't have sufficient infrastructure to accommodate them all with modern conveniency, and we have to put dedicated funding and resources to create new residential infrastructure.

III. Recommendations of the Programme Advisory Committees taken at the meetings in June 2024

The Scientific Council takes note of the recommendations made by the PACs at their meetings in June 2024, as reported at this session by I. Tserruya, Chair of the PAC for Particle Physics, V. Nesvizhevsky, Chair of the PAC for Nuclear Physics, and D. L. Nagy, Chair of the PAC for Condensed Matter Physics.

Particle physics

The Scientific Council appreciates the PAC's support for the plans of the Institute's Directorate to ensure full-fledged cooperation of scientists and specialists from the JINR Member States with CERN, as well as the efforts undertaken to enhance ongoing cooperation and establish new scientific connections with China, India, Mexico, Brazil.

The Scientific Council acknowledges the successful completion of the first stage of the mega-science project NICA: commissioning of the injection complex of the collider, including the heavy ion source KRION-6T, HILAC, Booster, Nuclotron, and beam transfer lines, and the start of the program of fundamental and applied research at the fixed target facilities. Presently, most of the collider equipment is ready for commissioning. The Scientific Council joins the PAC in congratulating the NICA team on these achievements. The launch of the experimental program at the collider is planned for 2025 with a gradual increase in luminosity. The Scientific Council endorses the recommendation of the PAC to extend the Nuclotron-NICA project until the end of 2027 with ranking A.

The Scientific Council notes the progress in the production of the MPD first-stage detector and in the preparations of the MPD solenoid for magnetic field measurements planned in October 2024. Installation of the carbon fibre support frame and detector subsystems is foreseen for the beginning of 2025. The detector should be ready to move to the beam position by July 2025 to meet the NICA accelerator schedule. The Scientific Council also notes the first physics results obtained by the BM@N team from the data collected in 2023 on 3.8 AGeV Xe+CsI collisions.

The Scientific Council appreciates the achievements of the SPD team in performing extensive R&D to prepare the Conceptual and Technical Design Reports of the detector. The team is now planning to start building the subsystems of the first phase. The Scientific Council joins the PAC in thanking the SPD Detector Advisory Committee, which conducted a thorough review of the updated SPD TDR and supports the PAC's recommendation to extend the SPD project until the end of 2029 with ranking A.

The Scientific Council endorses the recommendation of the PAC to extend JINR's participation in the NA61/SHINE experiment at SPS CERN and in the STAR experiment at RHIC until the end of 2026 with ranking B. The Scientific Council concurs with the PAC in encouraging the JINR teams to gradually shift their focus to the in-house flagship projects.

The Scientific Council appreciates the achievements of the JINR team participating in the NA62 experiment aimed at studying rare kaon decays to test the Standard Model and refine the parameters of chiral perturbation theory. The Scientific Council supports the PAC's recommendation to continue JINR's participation in the NA62 experiment until the end of 2027 with ranking A.

The Scientific Council notes with satisfaction the important contribution made by the JINR group participating in the COMET project at J-PARC in the development and construction of some main subdetector systems. The experiment explores physics beyond the Standard Model by searching for a possible charged lepton flavour violation (CLFV) through the neutrinoless process of muon-to-electron transition. The Scientific Council appreciates the participation of representatives of the JINR group in the management structures of the COMET collaboration and endorses the PAC's recommendation to continue the participation of the JINR group in the COMET experiment until the end of 2029 with ranking A.

The Scientific Council supports the PAC's recommendation to open the new project "Development of a particle registration technique in future experiments with the participation of JINR", which is aimed at R&D for new detectors and novel methods for processing and analysing experimental data, for one year with ranking A. The Scientific Council seconds the PAC in encouraging the team to prepare a more elaborate program outlining the specific goals and objectives of the project and to submit it to the PAC in one year.

The Scientific Council appreciates the contributions of the JINR teams participating in the LHC experiments in physics analyses and detector upgrades.

Nuclear physics

The Scientific Council notes the extensive work on the upgrade of the U-400M cyclotron, aimed at increasing the intensity and energy of heavy ion beams, as well as improving the reliability and stability of the accelerator. As a part of the modernization, the main magnet coils, accelerator vacuum system components, control system, and radiation control system were replaced. The commissioning of the U-400M accelerator and first experiments using it are planned for the second half of 2024.

At the FLNR SHE Factory, experiments to synthesize isotopes ^{275,276}Ds in the reaction ^{48}Ca+^{232}Th were continued, in which six decay chains of the new isotope ^{275}Ds were identified. ^{275}Ds was for the first time produced in a reaction with ^{48}Ca and identified through sequential α-decays leading to the known nuclei ^{271}Hs, ^{267}Sg, and ^{263}Rf previously synthesized in the ^{248}Cm(^{26}Mg,3n)^{271}Hs reaction. For the first time, the new isotope ^{288}Lv was synthesized in the reaction ^{238}U+^{54}Cr and the cross section of its formation was measured to be at around 70 fb. The Scientific Council notes that the experiment with the ^{54}Cr beam is an important step for setting up experiments on the synthesis of elements with Z>118. The SC recommends that work on the synthesis of the isotopes of superheavy elements and study of their decay properties be continued, in particular, using ^{54}Cr and ^{50}Ti beams.

The Scientific Council notes the important results obtained in the analysis of the first experiments carried out at the commissioned ACCULINNA-2 fragment separator conducted prior to upgrading the U-400M accelerator complex. In particular, these are new data on the low-energy spectra of the unbound nuclear systems 4n, $^{5–7}$H, ^{7,9}He, ^{8,10}Li produced in transfer reactions, with resolution of ^{6}H and ^{7}H ground states with extremely low cross sections.

In the second half of 2024, experiments are planned to study the neutron, proton, and α-particle transfer reactions using radioactive ^{6,8}He beams and a cryogenic ^{2}H gas target. The reaction ^{2}H(^{6}He,^{6}Li)2n was proposed, which can provide additional data on the formation mechanism of the dineutron and tetraneutron.

Within the project “Nuclear bolometer”, funded by the federal budget of the Russian Federation and Rosatom, DLNP JINR is involved in the development of low-temperature detection systems operating in the energy range below 1 eV. Such detectors would allow the measurements of coherent elastic scattering of low energy neutrinos on helium and silicon nuclei, as well as designing compact detectors for the solar pp-neutrino flux monitoring. The Scientific Council agreed that it is timely and important to develop novel detection systems intended for studying rare events in the domain of low energies. The SC highlights that the project “Nuclear bolometer” does not require extra funding from JINR and endorses the recommendations of the PAC for Nuclear Physics that the above-mentioned work be carried out as an activity within the theme “Non-Accelerator Neutrino Physics and Astrophysics”.

Radiochemical research carried out at the DLNP JINR is implemented within the project “Radiochemistry and spectroscopy for astrophysics and nuclear medicine”. It is devoted to the development of radiochemical methods for studying rare processes,

associated with weak interaction and a number of problems in astrophysics, as well as for synthesizing radiopharmaceuticals. The SC notes the following methods developed at DLNP JINR: 1) production and purification of radionuclides for the synthesis of radiopharmaceuticals and manufacture of spectrometric sources; 2) production of low-background materials with a uniquely low content of radioactive impurities; 3) analysis of radiopharmaceuticals and their precursors, as well as the purity of resulting radiopreparats and low-background materials. The SC highly appreciates the radiochemical research carried out at DLNP JINR, its high-quality and high-precision results, and notes a significant contribution of this research to nuclear medicine, spectrometry and astrophysics. The SC recommends that work on radiochemical research be continued within the framework of the project “Radiochemistry and spectroscopy for astrophysics and nuclear medicine”.

Condensed matter physics

The Scientific Council welcomes the efforts of the FLNP team working on the development of the new neutron source. The Scientific Council supports the main directions of this activity, including work to outline the suite of necessary instruments of the facility, develop models of reactor dynamics, and study the heating of the modulator elements and the reactor vessel. The Scientific Council concurs with the PAC that in further work on the project of the new reactor facility, the most pressing tasks are to study the mechanisms of power feedback formation and develop mathematical models describing the processes leading to fluctuations in pulse energy, on the basis of the IBR-2 operation experience. The Scientific Council shares the PAC’s opinion on the need to continue work on the project for the development of the new neutron source.

The Scientific Council takes note of the information on the progress of obtaining a license to operate the IBR-2 nuclear research facility and on the preparatory work to replace the air heat exchangers of the secondary cooling circuit of the reactor. The Scientific Council welcomes the intention of the FLNP Directorate to restart the operation of the IBR-2 nuclear research facility in 2024–2025 and resume the FLNP User Programme in 2025.

The Scientific Council endorses the progress of instrument modernization at the IBR-2 reactor and notes the active preparations of instruments for the reactor start-up at the end of 2024. All important elements of the spectrometers are being tested and adjusted for correct operation. The detector systems of the spectrometers are undergoing routine testing to ensure their readiness for the reactor start-up. Two new scintillation detectors (ASTRA-M, BSD) have been installed on the IBR-2 beamlines and are ready

for test measurements after the IBR-2 reactor starts its operation. At present, implementation of the BJN project and activity on the SANSARA instrument are in progress. The Scientific Council endorses overall progress in preparing spectrometers and equipment for the reactor start-up, highly appreciates the development of the BJN project and recommends continuing its implementation.

The Scientific Council is pleased with the current state of the DN-6 diffractometer for the study of materials at ultrahigh pressures. In particular, the Scientific Council notes a significant modernization of the instrument, which will improve the quality of experimental data. Considering that the DN-6 diffractometer is one of the most advanced facilities in the world for neutron scattering studies of materials under extreme conditions, the Scientific Council shares the PAC's opinion on the continuation of the development of this instrument.

The Scientific Council supports the PAC's recommendations to open a new FLNR project, "High-sensitivity sensors based on molecular recognition for virus detection", for its implementation in 2025–2029, and to continue activities within the DLNP project "Protection against physical and chemical stresses with tardigrade proteins (TARDISS)".

Reports by young scientists

The Scientific Council followed with interest the reports by young scientists, selected by the PACs for presentation at this session: "Study of Λ-hyperon production in carbon collisions with solid targets in BM@N experiment" by Ksenia Alishina (VBLHEP), "Real-time follow-up of multimessenger alerts at the Baikal-GVD telescope" by Victoria Dik (DLNP), and "Pressure effect on crystal, magnetic structure and vibrational properties of van der Waals materials" by Olga Lis (FLNP). The Scientific Council thanks the speakers and welcomes such selected reports in the future.

IV. Memberships of the PACs

On the proposal by the JINR Director, G. Trubnikov, the Scientific Council appoints

– Amaresh Jaiswal (NISER, Bhubaneshwar, India),

– Leandar Litov (Sofia University "St. Kliment Ohridski", Bulgaria),

– Gobinda Majumder (TIFR, Mumbai, India),

as members of the PAC for Particle Physics for a term of three years;

– Ravi Kumar N V (IIT Madras, Chennai, India),

as a member of the PAC for Condensed Matter Physics for a term of three years.

V. Scientific report

The Scientific Council heard with interest the scientific report “The Search for Quark-Gluon Plasma at the Large Hadron Collider: What is Next?” presented by Raghunath Sahoo (IIT Indore, India) and thanks the speaker.

VI. Awards and prizes

The Scientific Council approves the Jury’s recommendations on the award of the V. Dzhelepov Prize to Marina Frontasyeva (FLNP, JINR) for her significant contribution to the development of international programme on the assessment of air quality using neutron activation analysis.

The Scientific Council approves the Jury’s recommendations on the award of the G. Flerov Prize to:

– Academician Radiy Ilkaev (All-Russian Scientific Research Institute of Experimental Physics, VNIIEF), co-author of the discovery of element 114 (flerovium), for his great contribution to the synthesis and study of the properties of superheavy nuclei;

– Evgeniy Denisovich Donets (VBLHEP, JINR), Evgeniy Evgenievich Donets (VBLHEP, JINR), Zhao Hongwei (Institute of Modern Physics, Chinese Academy of Sciences) for the development of sources of highly charged ions to produce intense accelerated beams of medium and high energies.

The Scientific Council approves the Jury’s recommendations on the award of the N. N. Bogoliubov Prize to Álvaro de Rújula (CERN) and Ivan Todorov (INRNE, BAS) for their outstanding achievements in theoretical and mathematical physics and promoting international cooperation.

The Scientific Council thanks Álvaro de Rújula for his brilliant presentation.

The Scientific Council welcomes the Jury’s decision presented by JINR Director, G. Trubnikov, to award the Oganesson Prize to Tatiana Chernigovskaya, Galina Knyazheva, Aliya Nurmukhanbetova, Zeblon Vilakazi, and Yuri Zolotov.

The Scientific Council congratulates the winners of JINR annual prizes for best scientific, methodological, technological, and applied research papers.

VII. Election and announcement of vacancies in the directorates of JINR Laboratories

The Scientific Council elected A. Bugay as Director of the Laboratory of Radiation Biology (LRB) for a second term of five years.

The Scientific Council announces the vacancies of positions of LRB Deputy Directors. The endorsement of appointments will take place at the 137th session of the Scientific Council in February 2025.

VIII. Next sessions of the Scientific Council

The 137th session of the Scientific Council will be held on 13–14 February 2025 (to be confirmed).

The 138th session of the Scientific Council will be held in September 2025, the dates to be decided at the 137th session.

G. Trubnikov
Chair of the Scientific Council

S. Kilin
Co-chair of the Scientific Council

S. Nedelko
Secretary of the Scientific Council