I. Preamble

The Chair of the PAC for Nuclear Physics, V. Nesvizhevsky, presented an overview on implementing the recommendations taken at the previous meeting.

JINR Vice-Director S. Dmitriev informed the PAC about the resolution of the 137th session of the JINR Scientific Council (February 2025) and the decisions of the JINR Committee of Plenipotentiaries (March 2025).

The PAC is pleased to note that the recommendations of the previous PAC meeting concerning JINR research in the area of nuclear physics were accepted by the JINR Scientific Council and the JINR Directorate.

The PAC congratulated G. Trubnikov on his election as Director of JINR for a five-year term starting from 1 January 2026.

The PAC congratulated JINR Vice-Director V. Kekelidze on being awarded the title of Academician of the Russian Academy of Sciences.

The PAC congratulated JINR Vice-Director S. Dmitriev on being awarded the title of Corresponding Member of the Russian Academy of Sciences.

II. Experiments on studying the physical and chemical properties of superheavy elements at FLNR: status and plans

The PAC heard a report on the status of investigations of the chemical and physical properties of superheavy elements (SHE) at FLNR presented by A. Isaev. The four-week experiment aimed at studying the chemical properties of the superheavy elements Cn and Fl by gas adsorption thermochromatography was completed using the upgraded Cryodetector setup placed in the focal plane of the GRAND separator of the SHE Factory. The preliminary data analysis has shown that the Cryodetector is ready for long-term experiments and is highly efficient. The analysis of the experimental data is underway.

To further increase the efficiency of experiments aimed at studying the chemical properties of SHE at FLNR, a new GASSOL separator based on a superconducting gas-filled solenoid is being developed. The construction of the magnetic system is nearing completion. Preparations are being made for installation of the separator in one of the SHE Factory experimental halls. Subsequently, the Cryodetector is planned to be placed in the focal plane of the GASSOL separator.

Furthermore, offline test measurements are being conducted using the gas catcher. The development of construction documentation is continuing for the components of the

multi-reflection time-of-flight (MR-ToF) mass spectrometer for precision measurements of SHE masses, which is one of the key tasks in studying superheavies.

Recommendations. The PAC acknowledges the importance of further work aimed at studying the physical and chemical properties of the heaviest elements at the existing and developed separators and the detection systems of the SHE Factory. The PAC recommends that experiments with beams of very high intensity be thoroughly examined, with special attention drawn to their influence on materials and physics setups. In addition, the PAC recommends that secondary neutron and gamma-ray shielding of the detection equipment be further enhanced.

Furthermore, the PAC considers the development of the GASSOL and MR-TOF-MS devices to be of extreme importance and therefore recommends that the project be implemented with full priority.

III. Modernization of the EG-5 accelerator and its experimental infrastructure: current status

The PAC heard the interim report on the status of the project “Modernization of the EG-5 accelerator and its experimental infrastructure” at FLNP JINR for the period from 2023 to 2025, presented by A. Doroshkevich. The EG-5 electrostatic accelerator is part of the modern park of basic facilities and remains one of the most effective and convenient nuclear physics instruments. It is used to solve a wide range of topical scientific problems in nuclear physics, including obtaining nuclear data for nuclear and thermonuclear power engineering as well as for astrophysical research.

At present, the main service systems of the EG-5 accelerator (vacuum system, gas-cylinder equipment, automated radiation monitoring systems and interlock control systems) have been modernized, and the rated technical parameters have been practically achieved. By the end of 2025, it is planned to resume operation of EG-5 in the basic configuration with the old ion source and the old accelerator tube and reach an operating mode with an operating time of at least 1500 hours/year.

Recommendation. The PAC took note of the interim report on the status of the project “Modernization of the EG-5 accelerator and its experimental infrastructure” and notes the progress achieved in its implementation. The PAC recommends resuming work on EG-5 in the basic configuration until the new elements of the high-voltage system, such as the ion source and the accelerator tube, are completed, and continuing work on upgrading EG-5, including replacing the high-voltage system in 2026–2027.

The PAC also noted that the proposed EG-5 machine, delivering low-energy, high-current light isotopes, is highly suited for reactions of nuclear astrophysics, especially, proton capture reactions suitable for studying the so-called p-nuclei and also reactions of the Big Bang nucleosynthesis. The PAC also feels, that if reactions of nuclear astrophysics are to be pursued, definite steps should be taken to provide cooled target ladders and also arrangements for gaseous targets. The PAC recommends that the performances of the EG-5 accelerator be compared with similar modern facilities worldwide.

IV. Proposal for opening a new project "Development of the concept of an ultracold neutron (UCN) source at the IBR-2 pulsed reactor"

The PAC heard proposals to open a new project titled "Development of the concept of an ultracold neutron (UCN) source at the IBR-2 pulsed reactor" presented by G. Kulin. The aim of the project is to develop a concept of a world-class UCN source at the IBR-2 pulsed reactor profiting from the achieved pulse neutron flux at IBR-2. The conceptual design of the source is based on a number of engineering solutions with no analogues in world practice. During the implementation of the project, a prototype source will be built. Its construction would make it possible to verify the correctness of the proposed technical solutions, as well as to carry out experimental studies needed to develop the complete concept of the projected source. Moreover, the operation of the prototype source will provide practical experience of working with neutrons to the younger members of the group, who will build a full-scale UCN source and carry out physical research on it.

Recommendations. The PAC notes that the development of a world-class UCN source at JINR is an important task and recommends opening the new project "Development of the concept of an ultracold neutron (UCN) source at the IBR-2 pulsed reactor" for a period of 2 years, 2026–2027. The PAC recommends comparing options for overcoming all the challenges of the project and identifying reliable solutions for all of them. Particular attention should be given to the development of the optimum moderator based on liquid hydrogen or hydrogen-containing materials.

V. Proposal for opening a new project "Creating test benches to check single systems of the MSC-230 cyclotron"

The PAC heard proposals to open a new project "Creating test benches to check single systems of the MSC-230 cyclotron" presented by S. Yakovenko. Building the medical superconducting cyclotron MSC-230 and its research infrastructure allows continuing studies in proton-beam therapy, which have been conducted with proton beams of the Phasotron at

DLNP JINR over decades, at a new level. The planned high intensity of the proton beam — with the maximum current of 1 μA in continuous mode and that of 10 μA in pulsed mode — will enable the investigation of a new method of radiotherapy known as the FLASH therapy.

The PAC appreciates the already completed activities on preparing the launch of MSC-230, including calculations of the characteristics of the electromagnet, resonance system, proton beam dynamics, etc., designing and manufacturing the cyclotron, assembling test benches to check single systems of the cyclotron, developing the infrastructure for the cyclotron commissioning.

Recommendations. The PAC welcomes the ambitious plans on the cyclotron launch in 2026 and highlights the importance of developing new infrastructure at JINR for conducting radiobiology research by the Member States. The PAC recommends opening the new project “Creating test benches to check single systems of the MSC-230 cyclotron” for a period of 2 years, 2026–2027. The PAC also feels that the proton beam delivered by the proposed cyclotron is highly useful for a certain kind of measurements in nuclear physics research. Therefore, exploration of possibilities of using the beam in a limited manner is advised.

VI. Scientific reports

The PAC heard with interest the report “Advances in the description of spontaneous fission of transfermium nuclei” presented by T. Shneidman. The presented model of spontaneous fission can efficiently describe a large set of observables, including mass and charge distributions, distributions of total kinetic energy (TKE), and neutron multiplicity. The model assumes that, after crossing the fission barrier, the fissile nucleus can be described as a superposition of the systems of two interacting fragments specified by the masses, charges, and deformations of their constituent fragments. The model was successfully applied to the description of recent measurements of neutron multiplicities in spontaneous fission of ^{250}No, ^{246}Fm and ^{256}Rf. The investigation of fission properties of even-even $^{244\text{-}260}$Fm have shown that in addition to the competition between symmetric and asymmetric fission modes, another type of bimodality, associated with the coexistence of spherical and deformed mass symmetric fission modes, is manifested in the vicinity of ^{258}Fm. Moreover, it was shown that most of the energy available to the binary system at scission is stored in the deformation energy, while the excitation energy is rather small.

The PAC heard with interest the report “Nucleon and cluster transfer in reactions with the ^{9}Be nucleus” presented by A. Azhibekov. The report presents the results of experimental

investigations on nucleon and cluster transfer in reactions involving various projectile nuclei on the ^{9}Be target (^{6}Li+^{9}Be, ^{3}He+^{9}Be, *d*+^{9}Be) and their theoretical interpretation. The analysis of the measured angular distributions confirms the following single-cluster transfers from the ^{9}Be nucleus: ^{5}He cluster in the ^{9}Be(*d*,^{4}He)^{7}Li reaction channel at backward angles; triton cluster (*t*) in the ^{9}Be(^{3}He,^{6}Li)^{6}Li reaction channel; deuteron cluster (*d*) in the ^{9}Be(*d*,^{4}He)^{7}Li reaction channel at forward angles; dineutron cluster (^{2}*n*) in the ^{9}Be(^{6}Li, ^{8}Li)^{7}Be reaction channel. A theoretical justification for the structure of the ^{9}Be nucleus has been proposed, suggesting that, in addition to the most probable configuration with a valence neutron between α-clusters, other configurations such as α+^{5}He and the formation of nucleon clusters ^{2}n, d, t, and ^{3}He are also possible.

VII. Presentations by young scientists

The PAC reviewed 6 short presentations in the field of nuclear physics research by young scientists from BLTP and MLIT. The PAC appreciates the high quality of all presented works and given talks. The Committee selected three best presentations: “Low-energy spectra of nobelium isotopes” by M. Mardyban, “Alpha-decay and spontaneous fission of superheavy elements in the DNS approach” by I. Rogov and “Investigation of spectral structure of ^{11}Be in breakup reactions within quantum-quasiclassical approach” by D. Valiolda.

The PAC recommends the presentation “Low-energy spectra of nobelium isotopes” to be reported at the session of the JINR Scientific Council in September 2025.

VIII. Next meeting of the PAC

The next meeting of the PAC for Nuclear Physics will be held on 22–23 January 2026.

Its tentative agenda includes:

– reports on the results of projects to be completed in 2026;
– experiments at the SHE Factory and its scientific programme;
– progress report on the JINR participation in double beta-decay experiments;
– report on the status of the GASSOL project;
– consideration of new experiments and projects;
– status of research on the chemical properties of superheavy elements;
– scientific reports;

– presentations of the new results and proposals by young scientists in the field of experimental and theoretical nuclear physics.

V. Nesvizhevsky

Chair of the PAC
for Nuclear Physics

N. Skobelev

Scientific Secretary of the PAC
for Nuclear Physics