**I. Preamble**

The Chair of the PAC for Condensed Matter Physics, D. L. Nagy, welcomed the PAC members, the ex officio members from JINR, the invited experts A. Ioffe, A. Ivanov, and S. Kennedy, and the members of the JINR Directorate, and made a brief note about the procedure of the PAC operation in a videoconference mode.

**II. Development of the concept for a new neutron source at FLNP**

The PAC took note of the report on the development of a new neutron source at FLNP presented by V. Shvetsov. The PAC notes the achieved results in technical design of the IBR-3 reactor as well as the beginning of JINR cooperation with the potential fuel manufacturer. The PAC welcomes the FLNP efforts in experimental studying and modelling of the neutron background situation at the IBR-2 instruments in accordance with PAC recommendation from January 2020. The technical requirements for the next stage of design of the new neutron source, specifically, development of the Technical Proposal, were prepared in cooperation with N. A. Dollezhal Research and Development Institute of Power Engineering (Moscow). Presently, the contract for this work is being developed. This stage is to be concluded at the end of 2021.

A collaborative workgroup from both FLNP's Department of Spectrometer Complex and Department of Neutron Investigations of Condensed Matter has continued activities on the experimental determination, modeling and search for means of suppressing the backgrounds at the extracted beams of the IBR-2 reactor. During the first three operation cycles in 2020, a series of measurements were conducted to continue during the second half of 2020. The PAC expects that a detailed report about the results of these activities will be presented at the next meeting of the PAC.

Recommendation. The PAC recommends deeper elaboration of the IBR-3 technical proposal and continuation of the FLNP activity on studying and suppressing neutron background at the IBR-2 instruments.

**III. Construction of the SOLCRYS laboratory at the SOLARIS National Synchrotron Radiation Centre**

The PAC took note of the information about recent developments regarding the joint facility for structural research using synchrotron X-rays at the SOLARIS National Synchrotron Radiation Centre, presented by N. Kučerka. These JINR–SOLARIS

collaborative efforts in building the SOLCRYS laboratory will extend the suite of condensed matter research approaches at JINR.

Recommendation. The PAC welcomes the ongoing progress in constructing the SOLCRYS laboratory, while recommends paying close attention to the design details.

**IV. Reports and proposals on themes and projects approved for completion in 2020, proposals on new and ongoing themes and projects**

The PAC took note of the report on the concluding theme “Investigations of Condensed Matter by Modern Neutron Scattering Methods” and of the proposal for opening a new theme “Investigations of Functional Materials and Nanosystems Using Neutron Scattering” presented by D. Kozlenko.

Recommendation. Given the successful realization of the concluding theme, the PAC supports its closure and recommends opening of the new theme “Investigations of Functional Materials and Nanosystems Using Neutron Scattering” for 2021–2025.

The PAC took note of the proposal for opening a new project “Development of inverse geometry inelastic neutron scattering spectrometer at the IBR-2 reactor” presented by D. Chudoba. The use of modern neutron optics and the location of the spectrometer at a distance of about 105 m from the neutron source will ensure high resolution, excellent signal-to-noise ratio, which will allow analysis of small-size samples. The estimated parameters of the new spectrometer are up to two orders of magnitude better than those of the NERA spectrometer. The new spectrometer with the proposed parameters expected to be competitive to similar devices already existing in leading European neutron laboratories.

Recommendation. The PAC recommends opening of the new project “Development of inverse geometry inelastic neutron scattering spectrometer at the IBR-2 reactor” within the theme “Investigations of Functional Materials and Nanosystems Using Neutron Scattering” for 2021–2023.

The PAC took note of the report presented by S. Kulikov on the activities within the concluding theme “Development of Experimental Facilities for Condensed Matter Investigations with Beams of the IBR-2 Facility”. The PAC also considered the report by V. Kruglov on the project “Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer (BSD project)” and the written report by A. Chernikov on the projects “Development of a PTH sample environment system for the DN-12 diffractometer at the IBR-2 facility (PTH project)” being completed under this theme. The PAC notes with

satisfaction that all the work planned for this theme has been successfully completed and highly appreciates the results achieved.

Recommendation 1. Given the successful realization of the theme “Development of Experimental Facilities for Condensed Matter Investigations with Beams of the IBR-2 Facility”, the PAC supports its closure and opening the new theme “Scientific and Methodological Research and Developments for Condensed Matter Investigations with IBR-2 Neutron Beams” for 2021–2025.

Recommendation 2. The PAC also recommends closure of the BSD and PTH projects and opening the new project “Construction of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer” to be implemented in 2021–2023 under the new theme “Scientific and Methodological Research and Developments for Condensed Matter Investigations with IBR-2 Neutron Beams”.

The PAC considered the written report presented by M. Avdeev on the concluding project “A system for neutron *operando* monitoring and diagnostics of materials and interfaces for electrochemical energy storage devices at the IBR-2 reactor” within the theme “Investigations of Condensed Matter by Modern Neutron Scattering Methods”. The PAC is pleased to note that the project objectives on wide adaptation of neutron scattering methods (diffraction, reflectometry, small-angle scattering) and sample environment systems for studying the evolution of the structure of electrochemical interfaces and electrode materials in *operando* mode, have been fully achieved. Considering the relevance of investigations related to electrochemical energy storage, the accomplishment of the project is an important step in developing IBR-2 instruments for condensed matter research.

Recommendation. Given the successful completion of the project “A system for neutron operando monitoring and diagnostics of materials and interfaces for electrochemical energy storage devices at the IBR-2 reactor”, the PAC recommends its closure.

The PAC took note of the report presented by G. Arzumanyan on the concluding theme “Modern Trends and Developments in Raman Microspectroscopy and Photoluminescence for Condensed Matter Studies” and of the proposal for its extension. The PAC notes the significant progress in the development of this theme, in particular in the field of highly contrast SECARS microspectroscopy currently operating at a world-class competitive level and ultrasensitive detection of analyte molecules at attomolar

concentration achieved by the Surface-Enhanced Raman Spectroscopy. The PAC considers these advances as an appropriate basis for biosensing using Raman spectroscopy. The PAC also considered the information on the expiring project “Ultrasensitive SECARS microspectroscopy and luminescent core-shell nanostructures (Nanobiophotonics project)”, the proposal for its closure and opening a new project “Raman microspectroscopy in biomedical study (Biophotonics project)”.

Recommendation. The PAC recommends extension of the theme “Modern Trends and Developments in Raman Microspectroscopy and Photoluminescence for Condensed Matter Studies” for 2021–2023. Given the successful realization, the PAC recommends closure of the Nanobiophotonics project and supports opening the Biophotonics project for implementation in 2021–2023.

The PAC took note of the report on the concluding theme and project “Novel Semiconductor Detectors for Fundamental and Applied Research” and of the proposal for their extension presented by G. Shelkov. The PAC notes the significant progress in the development of this theme in the field of scientific research with a number of publications in high-impact journals, two PhD dissertations, two approved patents and two Master degree diplomas. The PAC notes that the Timepix4 latest-generation pixel chip was developed in the international collaboration Medipix with JINR’s participation. The PAC considers the proposal for extending the theme and project for the next three years to be well motivated, based on previous achievements and aimed at the applied use of products of fundamental research. The funding request is reasonable.

Recommendation. The PAC finds the presented proposal well formulated and recommends extension of the theme and project “Novel Semiconductor Detectors for Fundamental and Applied Research” for 2021–2023.

The PAC took note of the report on the concluding project “Experiment technology development and applied research with slow monochromatic positron beams (PAS project)” and of the proposal for its extension presented by K. Siemek. The PAC notes with satisfaction the progress in developing the PAS method at DLNP including construction of a reactive ion etching system and development of a system of positron ordered flux based on Cryogenic Source of Monochromatic Positrons (CSMP), which allows positron annihilation lifetime spectroscopy to be implemented in the near future. Realization of the programme presented in this project will bring the facility to a qualitatively new level

opening new opportunities for experimental research in condensed matter physics and materials science.

Recommendation. The PAC recommends extension of the PAS project for its implementation within the theme “Novel Semiconductor Detectors for Fundamental and Applied Research” in 2021–2023.

The PAC took note of the proposal presented by E. Kravchenko on the opening of a new project “Study of the radioprotective properties of the Damage Suppressor (Dsup) protein on a model organism *D. melanogaster* and human cell culture HEK293T” within the theme “Biomedical and Radiation-Genetic Studies Using Different Types of Ionizing Radiation”. The PAC notes the novelty and importance of the research proposed, and the high methodological level of the expected experiments.

Recommendation. The PAC recommends the opening of the project “Study of the radioprotective properties of the Damage Suppressor (Dsup) protein on a model organism *D. melanogaster* and human cell culture HEK293T” within the theme “Biomedical and Radiation-Genetic Studies Using Different Types of Ionizing Radiation” for 2021–2022.

The PAC took note of the report on the theme and project “Research on the Biological Effect of Heavy Charged Particles with Different Energies” and of the proposal for their extension, presented by A. Bugay.

Recommendation. The PAC recommends extension of the theme and project for 2021–2023.

The PAC took note of the written progress report on the ongoing theme “Methods, Algorithms and Software for Modeling Physical Systems, Mathematical Processing and Analysis of Experimental Data” for the period of 2019–2020, presented by G. Adam. The PAC notes the achievements within this theme, bringing specific contributions to the (1) advancement of JINR’s research as a whole, (2) advances in addressing specific tasks in research projects, (3) development of specialized computing tools for JINR research teams, (4) contributions to JINR’s excellence in the worldwide research landscape, and (5) growth of scientific competence in using JINR computing tools. The PAC welcomes further continuation of the reviewed activities within the reported theme.

**V. General recommendation**

The PAC recommends that the JINR Directorate consider the possibility to encourage young scientists to apply for additional projects to develop their own ideas in the field of science and instrumentation.

**VI. Next meeting of the PAC**

The next meeting of the PAC for Condensed Matter Physics will be held on 25–26 January 2021.

The PAC expects clear indication of milestones and deliverables (tables) for the whole period of all the projects and an indication of progress towards these in written form.

The preliminary agenda of the next meeting of the PAC includes:

– information by the PAC Chair on the implementation of the recommendations of the current PAC meeting;
– information by the JINR Directorate on the sessions of the Scientific Council (September 2020) and of the Committee of Plenipotentiaries (November 2020);
– reports and recommendations on themes and projects to be completed in 2021 and on new themes and projects;
– progress in developing the concept for JINR's new neutron source (reports by the FLNP Directorate and the WSG-5 Chair);
– status reports on the upgrade of FLNP instruments;
– report by the FLNP Directorate on its vision of IBR-2 instrumentation developments for the next five years;
– overview of all the themes and projects related to the PAC for Condensed Matter Physics;
– information about scientific meetings;
– scientific reports (not more than three);
– poster session.

D. L. Nagy
Chair of the PAC
for Condensed Matter Physics

O. Belov
Scientific Secretary of the PAC
for Condensed Matter Physics