

I. Preamble

The members of the PAC commemorated Academician Valeriu Kantser who made outstanding contributions to the development of JINR, its international cooperation and to the successful activity of the PAC for Condensed Matter Physics which he chaired during 2008–2017. The PAC deeply regrets the loss of V. Kantser.

The Chairman of the meeting, D. L. Nagy, introduced the members of the PAC, in particular the new member R. Hall-Wilton, the ex officio members from JINR and members of the JINR Directorate and presented an overview of the PAC report delivered at the session of the JINR Scientific Council in February 2017 concerning the implementation of the recommendations of the previous PAC meeting.

JINR Vice-Director M. Itkis informed the PAC about the Resolution of the 121st session of the JINR Scientific Council (February 2017) and the decisions of the JINR Committee of Plenipotentiaries (March 2017). The PAC is pleased to note that the recommendations of the previous PAC meeting concerning JINR research in the areas of condensed matter physics have been accepted by the Scientific Council and the Directorate.

II. Development of a concept for JINR's new neutron source

The PAC heard with interest a report on the plan for the preparation of a concept for JINR's new neutron source presented by A. Vinogradov. The PAC notes the growing need for neutrons in modern sciences due to the unique properties of a neutron in its interaction with matter. At the same time, the number of neutron sources constantly decreases worldwide since obsolete reactors are being shut down. In this regard, the PAC considers starting the strategic planning of a possible project for JINR's new neutron source replacing IBR-2 after reactor shut-down to be an important task and takes note of the presented plan for its implementation.

The PAC heard a report on user demands to the parameters of a future neutron source at JINR presented by N. Kučerka. The PAC appreciates that already in the preliminary design phase attention is being given to the needs of the scientific community regarding principal parameters of the new source.

Recommendations. The PAC recommends that the JINR Directorate start the strategic planning process of a potential new neutron source at JINR after the IBR-2 reactor shut-down. The necessary first step of the planning process should be a

comprehensive paper containing a clear science case and identifying the specific added value of the future JINR neutron source within the global and the European neutron source landscape as well as the realistic user needs. The PAC offers its involved contribution to preparing this document. A prerequisite to a new neutron source is the continued successful operation of the IBR-2 User Programme and enhancement of its performance through instrumentation upgrades.

III. Reports and proposals on concluding themes and projects

The PAC took note of the report on the concluding theme “Investigations of Condensed Matter by Modern Neutron Scattering Methods” and a proposal for its extension presented by D. Kozlenko. The PAC appreciates the high quality of the obtained scientific results, the significant progress achieved in the development of the IBR-2 spectrometer complex, and the broad cooperation with Member States in the realization of the theme. Implementation of the User Programme was also a very important activity of the theme.

Recommendation. The PAC recommends extension of the theme “Investigations of Condensed Matter by Modern Neutron Scattering Methods” until the end of 2020. The PAC reiterates the importance of the continuous upgrade of the IBR-2 spectrometers and their experimental environment that will lead to considerably increasing their performance.

The PAC heard a proposal presented by M. Avdeev on the opening of a new 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”.

Recommendations. The PAC supports the opening 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” for the period 2018–2020 and encourages cooperation with manufacturers. Furthermore, the PAC endorses the implementation of additional sample environment facilities at the IBR-2 reactor.

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” and of the project “Development of PTH sample environment system for the DN-12 diffractometer at the IBR-2 facility”. The PAC notes that all the work planned within the framework of the theme has been performed and highly appreciates the results obtained. At the same time, the report points out that during the pre-commissioning period and tests of the magnet developed under the PTH project, a

discrepancy between the technical characteristics of the high-temperature superconducting tape and the characteristics specified in the Manufacturer's Certificate has been revealed, which has not made it possible to achieve the design parameters of the magnet.

At present, negotiations are being held with the supplier to replace the tape. In this regard, it seems reasonable to extend this project together with the theme in order to resolve the situation with the supplier and to complete the project. The report also contains a proposal for extension of the theme and the PTH project until the end of 2020 and opening of a new project "Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer". This project increases the HFRD detector solid angle coverage by more than an order of magnitude, as well as enhancing its capabilities and improves gamma/neutron discrimination. The detector upgrade additionally has the potential to enhance in-house capacity in detector construction, and involve students in the process. The PAC notes that this is a well-targeted and effective investment in improving the performance of instrumentation at IBR-2.

Recommendation 1. The PAC recommends extension of the theme "Development of Experimental Facilities for Condensed Matter Investigations with Beams of the IBR-2 Facility" and project "Development of PTH sample environment system for the DN-12 diffractometer at the IBR-2 facility" until the end of 2020.

Recommendation 2. The PAC recommends opening a new project "Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer" for 2018–2020 within the framework of the theme "Development of Experimental Facilities for Condensed Matter Investigations with Beams of the IBR-2 Facility".

The PAC considered a report on the concluding theme "Multimodal Platform for Raman and Nonlinear Optical Microscopy and Microspectroscopy for Condensed Matter Studies" and proposals for opening a new theme "Modern Trends and Developments in Raman Microspectroscopy and Photoluminescence for Condensed Matter Studies" and project "Ultrasensitive SECARS microspectroscopy and luminescent core-shell nanostructures" presented by G. Arzumanyan. The PAC notes the significant progress in the development of this theme both in the field of scientific research with a number of publications in high-impact journals and in the upgrade of trends in Raman spectroscopy, concretely of the SECARS microspectrometer modality based on four-waves mixing at plasmonic materials, currently operating at a world-class competitive level with respect to similar spectral analytical devices. The PAC welcomes the proposal of theme leaders

aimed at realization of Raman microscopy of single molecules as well as at studies of rare-earth element luminescence on the basis of promising core-shell nanostructures.

Recommendation. The PAC recommends opening the new theme “Modern Trends and Developments in Raman Microspectroscopy and Photoluminescence for Condensed Matter Studies” and the project “Ultrasensitive SECARS microspectroscopy and luminescent core-shell nanostructures” for 2018–2020.

The PAC took note of the report on the concluding theme and project “Research on the Biological Effect of Heavy Charged Particles with Different Energies” and of the proposal for its extension presented by E. Krasavin. The PAC notes that addressing the fundamental and practical problems urgently requires that the regularities and mechanisms of the heavy charged particle effects be studied in detail at the molecular, cellular, tissue and organismal levels of biological models. The approaches developed at LRB to the problem and studies of chromosomal instability in mammalian and human cell during their responses to exposure of different types of ionizing radiation at low doses will allow clearing up the mechanisms behind these reactions and evaluating the contribution of physicochemical processes and inducible repair mechanisms to their realization. Elucidating these fundamental cell processes as responses to exposure to charged particles of different energies can become the basis for understanding the tissue response of highly differentiated cell systems — the eye retina and central nervous system structures — after their irradiation. In turn, these studies will allow the assessment of the system’s integrity violation manifesting as cognitive and behavioural disorders. The PAC notes the availability of highly skilled staff for proposed theme realization. The required funds completely cover the theme needs.

Recommendation. The PAC finds the presented proposal well-formulated and recommends extension of the theme and project “Research on the Biological Effect of Heavy Charged Particles with Different Energies” until the end of 2020.

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 S. Kotov. The PAC highly appreciates the successful implementation of the project and, in particular, welcomes JINR’s membership in the Medipix collaboration. 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 recommends extension of the theme and project “Novel semiconductor detectors for fundamental and applied research” until the end of 2020.

The PAC heard a report on the project “Experiment technology development and applied research with slow monochromatic positron beams (project PAS)” and a proposal for its extension presented by P. Horodek. The PAC notes with satisfaction the progress in the development of the PAS method at the LEPTA facility at DLNP including construction of a specialized channel of slow monochromatic positrons (SCSMP) and the elaboration of a proposal for the formation of the ordering flux of positrons based on SCSMP which allows one to implement in the near future the positron annihilation lifetime spectroscopy. The implementation 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 until the end of 2020 for its implementation under the theme “Novel Semiconductor Detectors for Fundamental and Applied Research”.

IV. Scientific reports

The PAC heard with interest the following scientific reports in condensed matter physics and related fields: “Fermi surface reconstruction in underdoped cuprates”, “Magnetic phenomena in intermetallic compounds RCo_2 : studies of the limits of the itinerant electron metamagnetism concept” and “Simulation of damage threshold and structure in swift heavy-ion tracks in Al_2O_3 ”, and thanks the speakers E. Kochetov, S. Kichanov, and R. Rymzhanov respectively.

V. Poster presentations

The PAC is pleased with the poster presentations by young scientists in the field of radiation biology and with the summarizing report by O. Belov. The poster “Neurochemical alterations in central nervous system of rodents after exposure to different radiation modalities” by K. Belokopytova was selected as the best poster at the session. The PAC also noted two other high-quality posters: “Structure induction and repair of DNA double-strand breaks in hippocampal neurons of mice of different age after exposure to ^{60}Co γ -rays *in vivo* and *in vitro*” by R. Kozhina and “Microfossils in carbonaceous meteorites” by A. Ryumin. The authors of these papers will receive diplomas at the next meeting.

Recommendation. The PAC recommends the poster “Neurochemical alterations in central nervous system of rodents after exposure to different radiation modalities” to be reported at the session of the Scientific Council in September 2017.

VI. Common issues

The PAC acknowledges the high level of the implementation of the IBR-2 User Programme which has made this basic facility of JINR one of the world's leading open-access research infrastructures.

VII. Next meeting of the PAC

The next meeting of the PAC for Condensed Matter Physics will be held on 22–23 January 2018.

Its tentative agenda will include:

- information by the PAC Chairman on the report at the next session of the Scientific Council, and the implementation of the recommendations of the current PAC meeting;
- information by the JINR Directorate on the sessions of the Scientific Council (September 2017) and of the Committee of Plenipotentiaries (November 2017);
- reports and recommendations on themes and projects to be completed in 2018 and status reports about ongoing themes;
- discussion of the progress of the scientific case for JINR’s new neutron source including the landscape of relevant scientific facilities;
- information on the new cooperation between JINR and the SOLARIS synchrotron source in Kraków (Poland);
- IBR-2 scientific and technical report including the progress in the FLNP User Programme;
- status reports on the upgrades of FLNP instruments and in the context of the JINR Seven-year plan;
- information about scientific meetings;
- scientific reports;
- poster session.



D. L. Nagy

Chairman of the meeting of the PAC
for Condensed Matter Physics



O. Belov

Scientific Secretary of the PAC
for Condensed Matter Physics

