

## **Programme Advisory Committee for Condensed Matter Physics**

**54th meeting, 28 June 2021**

**(in videoconference mode)**

### **Recommendations**

#### **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 and F. Fernandez-Alonso, as well as the members of the JINR Directorate. He announced that a further invited expert, L. Liskay will join the meeting for a part of the project prioritization exercise. The Chair presented an overview of the implementation of the recommendations made at the previous regular and extraordinary PAC meetings concerning the JINR research in the area of condensed matter physics.

JINR Vice-Directors L. Kostov and S. Dmitriev informed the PAC about the resolution of the 129th session of the JINR Scientific Council of February 2021 and the decisions of the JINR Committee of Plenipotentiaries of March 2021.

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

The PAC took note of the report on the status of the new “Neptune” neutron source of JINR and plans of activities on it presented by M. Bulavin. Following the previous recommendations of the PAC, the FLNP has updated the roadmap for the development of the new neutron source for approval by the JINR management and Rosatom State Atomic Energy Corporation. Approval of the roadmap will enable R&D activities on the development of fuel elements with neptunium-nitride-based fuel and on the preparation of technical specifications for a conceptual design of the “Neptune” reactor.

Recommendation. The PAC recommends presenting a detailed report on the R&D activities on the development of fuel elements and on the preparation of the conceptual design of the “Neptune” reactor at the next meeting of the PAC. The PAC also expects to hear the report on the principal points of the design of cold moderators, primary neutron optics and shielding as an integral part of the neutron source.

#### **III. Report on the spectrometer complex of the IBR-2 facility**

The PAC considered the report on the status of the YuMO small-angle neutron scattering diffractometer at beamline 4 of the IBR-2 reactor presented by O. Ivankov. The

PAC recognizes the high demand for the diffractometer and the importance of the research results obtained with it and published in high-ranked journals.

The PAC noted with satisfaction that the installation of a new cold neutron source leads to a significant gain in the cold neutron flux at YuMO without a significant decrease in thermal neutron flux.

The PAC noted new possibilities for user experiments resulting from the extension of the YuMO sample preparation lab and acquiring a new sample environment.

Recommendation. The PAC supports further development of the small-angle neutron scattering method at present and future pulsed neutron sources of JINR. The PAC recommends continuing work on the upgrade of the YuMO diffractometer and expects that the detailed upgrade program will be presented at the next meeting.

#### **IV. Report on the expiring theme "Radiation Physics, Radiochemistry, and Nanotechnology Investigations Using Beams of Accelerated Heavy Ions" and proposal for its extension**

The PAC took note of the report by P. Apel on the expiring theme "Radiation Physics, Radiochemistry, and Nanotechnology Investigations Using Beams of Accelerated Heavy Ions" and the proposal for its extension for the period 2022–2023. The PAC appreciates the wide range of the R&D studies that have been realized and the high quality of the obtained results. The proposal for the extension of the theme allows synchronizing the activity within the framework of the theme with the Seven-Year Plan for the Development of JINR, i.e. through 2023. This additional two-year period is necessary to complete the modernization of the heavy-ion irradiation facilities that constitute the basis for all research directions within the theme. The suggested plan for 2022–2023 is a logical continuation of the research work performed in the previous 5-year period. The requested funding is justified. The researchers and technical personnel involved are well-qualified and have good experience to carry out the planned work. The PAC considers the proposal for extending the theme for the next two years well-reasoned.

Recommendation. The PAC finds the presented proposal well-formulated and recommends extending the theme "Radiation Physics, Radiochemistry, and Nanotechnology Investigations Using Beams of Accelerated Heavy Ions" for 2022–2023.

#### **V. Prioritization of JINR projects**

The PAC took note of the updated reports on the projects "Construction of a complex of cryogenic moderators at the IBR-2 facility", "New semiconductor detectors for fundamental

and applied research" and "Development of experimental techniques and applied research with slow monochromatic positron beams" presented by K. Mukhin, G. Shelkov and K. Siemek, respectively.

Recommendation. The PAC ranks the projects "Construction of a complex of cryogenic moderators at the IBR-2 facility", "New semiconductor detectors for fundamental and applied research" and "Development of experimental techniques and applied research with slow monochromatic positron beams" to Category A.

The written report and oral presentation on the project "Construction of a complex of cryogenic moderators at the IBR-2 facility" were well received by the PAC. The points criticized at the extraordinary meeting were clarified and the project was given full support.

The concerns expressed at the previous extraordinary PAC meeting about the project "New semiconductor detectors for fundamental and applied research" were addressed by the report and presentation at this PAC meeting. The excellence of this project and, with the updated information, the plan of work and the relevance to the topics covered by the PAC are clear.

With regard to the project "Development of experimental techniques and applied research with slow monochromatic positron beams" the PAC appreciates the excellent publication performance of the group as well as the efforts exerted for building the monochromatized positron beam. At the same time, it stresses the need of securing sufficient human resources (FTE) for getting the ordered slow-positron beam operational by 2023 and draws the attention of both the DLNP and the JINR Directorates to the fact that the project team needs their help in solving the FTE problem. Furthermore, the PAC asks for re-defining the detailed content of the project. An interim report on the progress of these tasks seems to be timely at the June 2022 PAC meeting.

The PAC discussed additional reviews requested following the extraordinary PAC meeting held on 29 April 2021 with regards to the projects "Research on the biological effects of heavy charged particles with different energies", "Research on cosmic matter on Earth and in nearby space; research on the biological and geochemical specifics of the early Earth", "RADIOGENE: Molecular genetics of radiation-induced changes at the gene, genome and transcriptome level in *Drosophila melanogaster*", "Study of the radioprotective properties of the Damage suppressor (Dsup) protein on a model organism *D. melanogaster* and human cell culture HEK293".

Recommendation. The PAC recommends assigning the projects "Research on the biological effects of heavy charged particles with different energies", "Research on cosmic

matter on Earth and in nearby space; research on the biological and geochemical specifics of the early Earth”, “RADIOGENE: Molecular genetics of radiation-induced changes at the gene, genome and transcriptome level in *Drosophila melanogaster*”, “Study of the radioprotective properties of the Damage suppressor (Dsup) protein on a model organism *D. melanogaster* and human cell culture HEK293” to Category A.

## **VI. Scientific reports**

The PAC heard with interest the scientific reports “Magnetic fluids and elastomers: structural studies for innovative applications” presented by M. Balasoiu and “Investigating model lipid membranes complementarily by neutron and Raman scattering” presented by D. Soloviov and Y. Arynbeke. The PAC thanked the speakers for their excellent presentations.

## **VII. Virtual poster presentations**

The PAC reviewed 12 poster presentations made by young scientists in the field of condensed matter theory and information technology. The virtual poster presentation “Effect of charged lipids on  $\beta$ -amyloid peptide interactions with a phospholipid membrane” by D. Badreeva was selected as the best presentation of the session. The PAC noted two other high-quality virtual poster presentations: “Distributed information and computing infrastructure of the JINR Member State organizations” by Ye. Mazhitova and “Information system for analyzing behavioral and morphological changes in the central nervous system in the study of the effects of ionizing radiation and other factors (joint project of MLIT and LRB JINR)” by I. Kolesnikova. All three authors will be awarded diplomas of the PAC.

Recommendation. The PAC recommends the poster “Effect of charged lipids on  $\beta$ -amyloid peptide interactions with a phospholipid membrane” to be reported at the session of the Scientific Council in September 2021.

## **VIII. Next meeting of the PAC**

The next meeting of the PAC for Condensed Matter Physics is scheduled for 20–21 January 2022.

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

- report by the PAC Chair on implementation of the recommendations of the current PAC meeting;
- report by the JINR Directorate on the sessions of the Scientific Council of September 2021 and of the Committee of Plenipotentiaries of November 2021;

- reports and recommendations on themes and projects to be completed in 2022 and on new themes and projects;
- progress in developing the concept for the new neutron source of JINR;
- status reports on the upgrade of FLNP instruments;
- discussion about the approach to assigning reviewers for projects;
- information about scientific meetings;
- scientific reports (not more than three);
- poster (or electronic presentation) session.



D. L. Nagy

Chair of the PAC  
for Condensed Matter Physics



O. Belov

Scientific Secretary of the PAC  
for Condensed Matter Physics