I. Preamble

The Chair of the PAC for Condensed Matter Physics, D. L. Nagy, welcomed the PAC members, in particular, the new member M. Kozak, the ex officio members from JINR, the invited experts A. Ioffe, S. Kennedy, and J. Kulda, and the members of the JINR Directorate, and presented an overview of the implementation of the recommendations taken at the previous PAC meeting concerning JINR research in the areas of condensed matter physics. The PAC is pleased to note that these recommendations have been accepted by the Scientific Council and the Directorate of JINR.

JINR Vice-Director B. Sharkov informed the PAC about the Resolution of the 126th session of the JINR Scientific Council (September 2019) and the decisions of the JINR Committee of Plenipotentiaries (November 2019).

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

The PAC heard the progress report on developing the concept for a new neutron source at FLNP presented by V. Shvetsov. The PAC notes the results of consideration of two alternative concepts of DNS-IV: a pulsed neutron reactor IBR-3 with ^{237}Np core and an accelerator-driven spallation neutron source with PuO_2 core providing neutron multiplication factor of about 20-50. Both options have been under a feasibility study at the N. A. Dollezhal Research and Development Institute of Power Engineering (Moscow). The final recommendation made within this study is based on such criteria as achievable neutron characteristics, nuclear safety, engineering complexity, timeline and estimated costs. It was found that the engineering complexity of the second option made its implementation rather uncertain, both in terms of time and costs. Therefore, a pulsed neutron reactor IBR-3 with NpN fuel will become the working concept for further development of DNS-IV.

The PAC notes the beginning of JINR cooperation with the A. A. Bochvar High-technology Research Institute of Inorganic Materials (Moscow) aimed at developing a roadmap for NpN reactor fuel fabrication.

The PAC also welcomes presenting the detailed roadmap for the DNS-IV implementation.

Recommendation 1. The PAC congratulates the FLNP Directorate on determining the working concept of the new neutron source and recommends its deeper elaboration.

Recommendation 2. The PAC has significant concerns about the background of the new facility and draws attention to the crucial importance of achieving background levels at IBR-3 and its instruments corresponding to the world-best practice.

III. Scientific results in condensed matter research and instrumentation developments at IBR-2 achieved in 2019

The PAC was informed by D. Kozlenko about the main results of instrumentation developments and of scientific research in the field of condensed matter physics at the IBR-2 reactor in 2019. The PAC considers the activities focused on the upgrade of the IBR-2 instruments to be important for providing competitive research opportunities for the realization of the FLNP scientific programme to the external users and for expanding the research areas.

Recommendation. The PAC appreciates the demonstrated examples of the new scientific results and instrumentation developments at IBR-2 achieved in 2019. At its future meetings, the PAC requests that the instrumentation developments and the major scientific results obtained be reported separately.

IV. General recommendation on reporting new instrumentation developments

In future reports on the new instrumentation developments at IBR-2, the PAC recommends that their authors be explicit on possible threats and difficulties of the development or upgrade of each particular facility under consideration. The demands of the respective user community to a particular instrument should be clearly justified and the relevance to corresponding tasks of the current Seven-year plan for the development of JINR should be reflected in presentations.

V. FLNP User Programme

The PAC heard information presented by D. Chudoba on the statistics of the FLNP User Programme at the IBR-2 spectrometers. The PAC supports further development of the FLNP User Programme including the neutron activation analysis facility.

Recommendation. The PAC recommends considering a possibility of changing the application submitting period for the second round.

VI. Inelastic neutron scattering at IBR-2

The PAC heard reports presented by W. Zając and D. Chudoba on the current trends in neutron spectroscopy and on the status of inelastic neutron scattering spectroscopy at FLNP. The PAC notes the fact that the two spectrometers mentioned in the reports no longer satisfy the requirements of users from Eastern Europe. The PAC takes note of the progress of work for opening the new project of developing a new inelastic neutron scattering spectrometer within the theme “Investigations of Condensed Matter by Modern Neutron Scattering Methods” for 2021–2023.

Recommendation. The PAC supports the development of new inelastic neutron scattering instruments and the preparation for opening the new project for the period 2021–2023. The PAC expects a detailed proposal for this new project to be presented at the next PAC meeting.

VII. Development of a neutron radiography and tomography instrument at the WWR-K reactor

The PAC heard a report presented by K. Nazarov on developing a neutron radiography and tomography facility at the WWR-K reactor of the Institute of Nuclear Physics in Almaty (Kazakhstan) in collaboration with FLNP. The PAC takes note of the description of the main components of the experimental set-up and the results of the first test experiments.

Recommendation. The PAC compliments the results of this activity and recommends following up with the implementation of the suggested research programme.

VIII. Proposal of a new project

The PAC reviewed the report presented by Yu. Panebrattsev on the completed project “Development of an open information and educational environment to support research priorities in material science and structure of matter” and the proposal for opening a new project “Open information and educational environment for supporting fundamental and applied multidisciplinary research at JINR”. The PAC notes the results of the completed project which include, in particular, the creation of a system of online courses in the main fields of JINR research and the implementation of the megascience projects. Regarding the new project, the PAC considers its potential to attract a new generation of scientists to the JINR research teams. The PAC notes that the success of the project may largely depend on availability of modern multimedia interactive

educational technologies and vast experience of the project team in creating e-learning resources for university and school students. The requested funds should be relative to the scope of the project tasks. Besides developing the JINR Educational Portal, the project should focus on creating JINR mobile exhibitions to be used at the JINR Information Centres of education and research organizations of Member States.

Recommendation. As to the successful implementation of the project "Development of an open information and educational environment to support research priorities in material science and structure of matter", the PAC supports its completion and recommends opening the new project "Open information and educational environment for supporting fundamental and applied multidisciplinary research at JINR" for implementation in 2021–2023 within the theme "Organization, Support and Development of the JINR Human Resources Programme". In future reports on this new project, the PAC would like to be informed on the integration of the JINR educational environment into education schedules and plans of JINR Member States' universities and scientific organizations.

IX. Scientific reports

The PAC heard with interest the following scientific reports: "Microscopic mechanism of the spontaneous polarization in strontium hexaferrites", "Ultrasensitive detection of analyte molecules at attomolar concentration by Raman spectroscopy", "Superconductor spintronics based on Josephson nanostructures", "TEM examination of the ceramics irradiated with heavy ions of fission fragment energies", and "Structural modification of carbon materials by swift heavy ions". The PAC thanks the speakers V. Turchenko, G. Arzumanyan, Yu. Shukrinov, V. Skuratov, and A. Olejniczak respectively for their excellent presentations.

X. Information about the international conference

The PAC took note of the information about the International Conference "Radiobiological Basis of Radiation Therapy" (17–18 October 2019, Dubna) presented by I. Koshlan.

XI. Poster presentations

The PAC reviewed 15 poster presentations made by young scientists in condensed matter physics and related fields. The poster "Neutron activation analysis as a tool for tracing the accumulation of silver nanoparticles in tissues of female mice and

their offspring” by I. Zinicovscaia was selected as the best poster at the session. The PAC noted two other high-quality posters: “Synthesis and research of magnetic nanoparticles of the “core-shell” type for bioapplications” by A. Nazarova and “Investigation of the internal structure and atomic dynamics of pharmaceutical compounds under the influence of high pressure” by N. Belozerova. The authors of all these posters will be awarded diplomas at the next meeting.

Recommendation. The PAC recommends the poster “Neutron activation analysis as a tool for tracing the accumulation of silver nanoparticles in tissues of female mice and their offspring” to be reported at the session of the Scientific Council in February 2020.

XII. Next meeting of the PAC

The next meeting of the PAC for Condensed Matter Physics will be held on 2–3 July 2020.

Its tentative agenda will include:

– 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 (February 2020) and of the Committee of Plenipotentiaries (March 2020);
– reports and recommendations on themes and projects to be completed in 2020 and on new themes and projects;
– progress of the development of the concept for JINR’s new neutron source (reports by the FLNP Directorate and the WSG-5 Chair);
– report by the FLNP Directorate on its vision of the IBR-2 instrumentation development for the next five years;
– overview of all the themes and projects related to the PAC for Condensed Matter Physics;
– status reports on the upgrade of FLNP instruments;
– 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