

Preamble

The Chairperson of the PAC, W. Greiner, welcomed the PAC members, the invited experts, the ex-officio members from JINR, and presented the implementation of the recommendations taken at the previous meeting.

JINR Vice-Director M. Itkis informed the PAC about the Resolution of the 104th session of the Scientific Council (September 2008), the decisions of the Committee of Plenipotentiaries (November 2008), and about the preparation of the Seven-Year Plan for the Development of JINR for 2010–2016.

**Recommendations on the themes and projects to be completed in 2009
and proposals of new themes*****Investigation of Fundamental Interactions in Nuclei at Low Energies***

The PAC heard with great interest the report on the closing theme “Investigation of Fundamental Interactions in Nuclei at Low Energies” (03-2-1039-2001/2009). The new results on $2\nu\beta\beta$ -decays and new upper limits on $0\nu\beta\beta$ -decays obtained by the NEMO-3 experiment on seven different isotopes are very impressive. The next step in preparation will be the SUPER-NEMO experiment with greatly increased sensitivity.

Also the GERDA experiment at the Gran Sasso underground laboratory (Italy) for $0\nu\beta\beta$ -decay in germanium detectors with enriched ^{76}Ge isotope has made excellent progress. It will be continued with the GERDA-3 enlarged set-up. Of equal importance is the TGV-2 project searching for double-beta decays of the ^{106}Cd isotope in the Modane underground laboratory (France). This experiment is in final analysis, a continuation is planned with measurements of the ^{48}Ca isotope.

The GEMMA experiment searching for antineutrino magnetic moment with Ge detectors underneath the Kalinin Power Plant has reached an excellent new upper limit and will be continued in 2009–2011 with the improved GEMMA-II set-up.

The EDELWEISS project is searching for dark matter (see comments below).

In the BAIKAL project experiments, 400 events from local neutrino sources have been observed, and the record limits for neutrino flux from WIMP annihilation have been found as well for the flux of diffused neutrino above 10 GeV.

The LESI project aims at a measurement of the astrophysical S -factors and effective cross sections of pd and dd reactions.

Recommendation 1. The PAC recommends completion of the theme “Investigation of Fundamental Interactions in Nuclei at Low Energies” by the end of the year 2009.

Recommendation 2. The PAC recommends continuations of these programmes within the new theme “Non-Accelerator Neutrino Physics and Astrophysics” (projects NEMO, GERDA-MAJORANA, GEMMA, EDELWEISS-II, BAIKAL, and LESI) in the years 2010–2012 with highest priority.

Nucleus and Particle Interactions at Intermediate Energies

The PAC took note of the report on the closing theme “Nucleus and Particle Interactions at Intermediate Energies” (03-2-1040-2001/2009). The PAC is impressed by the progress achieved and by the wide range of DLNP studies of pion and muon rare decays, the production of light mesons in proton-proton and proton-neutron collisions, cumulative proton-nucleus interactions, the interaction of slow pions with light nuclei, the first experimental observation of single γ production and of the Δ -resonance production in pion interactions with the ${}^4\text{He}$ nucleus at an energy well below the pion production threshold, the search for a scalar Goldstone boson (familon), the search for meson decays forbidden in the Standard Model, and a study of meson interactions with matter. The PAC stresses the importance of intermediate-energy physics, to which the Dubna groups contribute in a significant way. The PAC highly appreciates the results obtained under this theme.

Recommendation. The PAC recommends completion of this theme by the end of the year 2009.

New theme “Physics of Light Mesons” (Projects: SPRING, PEN-MEG, PAINUC)

SPRING (*Spring physics at storage rings*)

The PAC recognizes the fundamental importance of polarization studies on the nucleon structure and meson production in nucleon-nucleon collisions proposed in the project. Single and double polarized measurements at ANKE will yield new insight into short-range NN properties. Preparatory studies for the PAX experiment which aims at measurement of transversity, the last missing piece in QCD description of the nucleon structure, will provide the basis for the future experiment at GSI. The expertise of the DLNP group in the field of this project has been recognized in previous experiments of the ANKE collaboration.

PEN-MEG (*Precise investigation of rare pion decays and search for forbidden muon decays*)

The PAC noted the information about the important programme on $\pi^+ \rightarrow e^+ \nu$ rare decay, which will provide a test of the electron-muon universality, and the search for neutrinoless $\mu^+ \rightarrow e^+ \gamma$ decay, which may provide evidence of new physics beyond the Standard Model.

PAINUC (*A study of pion interactions with helium nuclei at intermediate energies*)

The PAC heard information about the programme of studies of pion interactions with helium nuclei at intermediate pion energies (below the Δ -resonance). The project will reveal whether the production of single γ 's (akin to prompt photons) in $\pi^+ {}^4\text{He}$ interactions depends on the incident pion energy, as well as the influence of the nuclear matter density on the Δ -resonance excitation. The programme also includes studies of 3-prong reaction channels, in particular pion absorption, involving low-energy strongly ionizing secondaries. The collaboration also intends to study the possibility of improving direct measurement of the ν_μ mass, given the small number of such direct measurements.

Recommendation. The PAC recommends approval of the new theme “Physics of Light Mesons” for the years 2010–2012 with first priority.

Start-up of the IREN facility

The PAC notes that in December 2008 the accelerated electron beam with the energy 20 MeV and peak current 0.4 A was delivered to the experimental prototype tungsten target placed at the ceiling between target and lower accelerator halls. Neutrons, produced at interaction of the bremsstrahlung gamma radiation with target, were registered by means of the neutron proportional counter, located at the floor of the target hall. Time-of-flight neutron spectra were registered and neutron yield was estimated. The results prove experimentally the earlier calculated parameters of the IREN Phase I.

The PAC appreciates the success of FLNP, VBLHEP, and of the Budker Institute of Nuclear Physics (Novosibirsk) in the construction and commissioning of the LUE accelerator.

Recommendation. The PAC recommends that FLNP and VBLHE complete as soon as possible the precommissioning operations at the IREN facility and start the first experiments in the second half of this year. The PAC also recommends that the JINR Directorate provide funding for the development of the IREN Phase I stage by stage within the request by FLNP during 2010–2016 to be annually adjusted depending on the achieved progress in the realization of the research programme.

The Plan for the Development of JINR for 2010–2016

BLTP

The PAC heard the proposal of the Bogoliubov Laboratory of Theoretical Physics into the Plan for the Development of JINR for 2010–2016. The proposal follows the present complex and broad activities of the Laboratory, includes important trends in nuclear theory, and is flexible enough to incorporate future developments and needs. The important contribution of BLTP to the JINR educational programme should also be much appreciated.

DLNP

The PAC heard with interest the proposals of the Dzhelepov Laboratory of Nuclear Problems for the Plan of the Development of JINR for 2010–2016. The PAC highly appreciates the results obtained at DLNP and stresses the leading role of DLNP in the field of experimental neutrino physics at JINR. The PAC supports the continuation of this highly ambitious neutrino and astrophysics programme of DLNP.

LIT

The PAC took note of the proposed main directions of the activities of the Laboratory of Information Technologies for the years 2010–2016. The PAC recognizes that LIT serves wide ranges of computational needs and purposes inside and outside JINR. The PAC is particularly pleased with the outstanding results concerning the optimization and performances achieved in the computing facilities.

The PAC also appreciates the LIT activities in the advanced educational programmes and welcomes a stronger involvement in the GRID computational environment.

In order to make the results of the valuable work performed at LIT more easily accessible to the scientific community, the PAC recommends the construction of an environment of network services devoted to this purpose.

FLNP

The PAC recommends including in the Plan for the Development of JINR for 2010–2016 the following main directions of modernization of the IREN facility:

- facility operation at two-shift basis with expansion to the round the clock operation;
- beam power increase by means of implementing assembly of two klystrons TH2129 with single pulse transformer;
- subsequent increase of the beam power by means of the second two klystrons assembly and second accelerating section;
- modulators upgrade to reach the designed operation frequency 150 Hz.

In the seven-year plan of the FLNP Nuclear Physics Research Experimental

Department for 2010–2016, a proper balance between work at JINR home facilities and abroad should be aimed at.

The PAC recommends strengthening the continuation of work on fundamental physics with slow neutrons, in particular the development of first-class experiments, e.g. on gravity, hadronic parity violation and neutron decay, to be carried out using the most intense neutron beams available in different centres of the world.

FLNR

The PAC discussed in detail the prospects for the development of the experimental base for heavy-ion physics at the Flerov Laboratory of Nuclear Reactions. The proposed plan includes ambitious projects, such as DRIBs-III, construction of a new accelerator which has to provide intense heavy-ion beams for the synthesis of superheavy elements, as well as the creation of new physics facilities. The PAC notes that the plan should be realized within the proposed period of seven years and therefore needs to be timely financed. The PAC endorses the proposed plan and supports the efforts of the Flerov Laboratory aimed at the development and extension of the experimental base.

The PAC recommends elaborating the final design and presenting the details at the next meeting.

UC

The PAC takes note of the extensive proposals by the JINR University Centre to be included in the seven-year plan for the development of JINR for 2010–2016.

The PAC embraces and supports the strong connection of the proposed educational activities with the scientific interests pursued at JINR. In particular, the PAC recognizes as important the organization of module courses based on modern approaches to strategic fields of research at JINR, and encourages the continuation of the participation of JINR researchers in the educational programmes devoted to attract young students.

The PAC also recommends the consolidation of the network between JINR and educational institutes in the Member States with activities specifically devoted to such purpose.

The PAC welcomes with appreciation the construction of new facilities to be used as student scientific laboratories and advises a more precise time scale for the scheduling of activities in such laboratories.

EDELWEISS experiment

The PAC heard with interest the status report on the EDELWEISS experiment on the direct search of dark matter in WIMP or Neutralino forms. The DLNP group participates very actively in the preparation of the experiment, especially in construction of the set-up, investigation of low-energy background discrimination, and its calibration. With detectors being added to the set-up in the two coming years, the sensitivity of EDELWEISS will be sufficient to verify the predictions of most SUSY models for WIMP-nucleon cross sections.

Recommendation. The PAC recommends that the EDELWEISS project be continued by DLNP with highest priority.

Research programme at the LEPTA facility

The PAC heard with interest the report on “Research programme at the LEPTA facility” and recognized the fundamental character of the experimental studies with Positronium in-flight when the commissioning of the LEPTA facility is completed. Of special interest are a search of the Light Axion and an investigation of “The Mirror World” hypothesis. The performance of experiments with Positronium in-flight method has significant advantages for searches of rare processes compared with traditional set-ups of such experiments. Significant progress was reached, connected with the increase of the life time of the beam, completion of the injector construction and the delivery of positron source of high radioactivity from iThemba LABS (South Africa).

Recommendation. The PAC recommends completion of the construction of the LEPTA facility and preparation of first experiments with Ortho-Positronium in-flight.

Scientific report

The PAC heard with interest the report “Chemistry of superheavy elements: achievements and prospective”, excellently presented by R. Eichler. The report described the impressive chemical experiments on superheavy elements 112 and 114, performed at FLNR. The results on element 114 indicate a need of further studies, both experimental and theoretical.

Poster session

The PAC was particularly pleased with the presentations of new results and proposals by young scientists in the field of nuclear physics research. This type of presentations should be continued in future.

Next meeting of the PAC

The next meeting of the PAC for Nuclear Physics will be held on 22–23 June 2009.

Its tentative agenda will include:

- Reports and recommendations on themes and projects to be completed in 2009
- Consideration of new projects
- Consideration of the Draft Seven-Year Plan for the Development of JINR for 2010–2016
- Poster presentations of new results and proposals by young scientists in the field of nuclear physics research
- Scientific reports.

A handwritten signature in black ink, appearing to read "Walter Greiner".

Walter Greiner

Chairperson of the PAC