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**THE JINR EDUCATION PROGRAMME
IN 2006**

Report to the 101st Session
of the JINR Scientific Council
January 18–19, 2007

Dubna 2007

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Объединенный институт
ядерных исследований
ФОНД ПЛОТНОСТИ

THE JINR UNIVERSITY CENTRE IN 2006

The results of the JINR Education Programme were discussed at the University Centre (the UC) Scientific Council session held on December 13, 2006. It was pointed out by the JINR Director Prof. A.N. Sisakian that the UC successfully fulfilled its duties in 2006 regarding organizing, running, and supporting the education process at JINR. In addition to the UC's traditional activities (graduate and postgraduate programmes, international actions, and work with secondary school pupils), a new task was started in 2006: the establishment of the UC's student laboratories. The UC's main activities are briefly considered below.

A new structure within the UC: the student laboratories

In 2006, a new structure emerged within the UC: the student laboratories, which will be located on the fifth floor of Building 113. This event was preceded by great efforts to attract finances for the acquisition of the laboratory equipment as well as vacation and repairs of the rooms. An important contribution to the acquisition of equipment was made by Dubna University; of great help were also sponsors' investments.

The UC laboratories will first be used for the students of the JINR-based Departments performing the general physics practicum exercises. In the future, special practicum equipment is planned to be installed there, which will be interesting to graduate students of the JINR Member States.

By 2007, equipped were the laboratories of thermodynamics and molecular physics, optics, and atomic physics; founded was a nuclear physics laboratory.

International cooperation and the Summer Practice

The key mission of the JINR Education Programme and the UC's activities is to attract the youth of the JINR Member States to the Institute. With this aim, short-term actions are carried out for the

youth of the Member States that help them to know JINR better and, possibly, to find their prospective scientific supervisors at JINR.

The UC organizes international student schools and practices, as well as acquaintance visits for secondary school pupils, students, and postgraduates of Member States. The visit programmes include excursions to the JINR Laboratories, seeing the Institute's basic research facilities, studies at the laboratories, and performing the physics practicum exercises.

On 2 – 22 July 2006, the UC hosted the Third International Summer Student Practice in JINR Fields of Research. It was remarkable for a record high number of its participants: 51 students came from higher education institutions of the Czech Republic, Poland, Romania, and Slovakia. There were more applications for attending the practice than planned; so the organizers had to select the participants. This points to the growing publicity of this Practice. The largest group – 20 students – was the Polish one; it was made up by students of the universities of Gdansk, Krakow, Lodz, Lublin, Poznan, Szczecin, and Wroclaw. The second largest group came from the Czech Republic (14 students). The number of the Romanian and Slovak participants has also grown (nine and eight, respectively).

The Practice programme included lectures on special subjects by JINR's leading scientists, lecture presentations of the JINR Laboratories; and traditional exercises at the basic research facilities of the Flerov Laboratory of Nuclear Reactions (FLNR), Frank Laboratory of Neutron Physics (FLNP), Veksler and Baldin Laboratory of High Energies (VBLHE), Dzhelepov Laboratory of Nuclear Problems (DLNP), and Laboratory of Radiation Biology (LRB). The following lectures were given:

- **Yu.P. Gangrsky** (FLNR), «Spectroscopy at FLNR's Radioactive Nuclei Beams (the DRIBs project)»;
- **A.M. Balagurov** (FLNP), «Neutron Scattering in Condensed Matter Research»;
- **Yu. M. Gledenov** (FLNP), «Neutron Data for Nuclear Astrophysics»;

- **Kobzev** (FLNP), «Analytical Methods Based on Charged Particle Beams»;
- **M.V. Frontasyeva** (FLNP), «Neutron Activation Analysis for Life Sciences»;
- **V.N. Shvetsov** (FLNP), «Neutron Logging in Space: Seeking Water on Mars and Other Planets»;
- **V.Ye. Aleinikov** (LRB), «Conceptual Framework of Radiobiological Protection»;
- **Kh. Kholmurodov** (LRB), «Computer Simulation Studies of Nano- and Protein Structures: the Art and Methodology of Molecular Dynamics»;
- **I. Aleksandrov** (DLNP), «Comparative Genomics of Different Eukaryotic Kingdoms: Fungi, Plants, Animals, and Humans»;
- **G.V. Mitsyn** (DLNP), «Hadron Therapy at Phasotron Beams»;
- **G.V. Trubnikov** (DLNP), «Introduction to Accelerators»;
- **Yu.A. Vaseneva** (VBLHE), «Nuclotron Cryogenic System: Status and Recent Development»;
- **D.V. Fursaev** (the UC), «Black Hole Physics and Fundamental Issues of Gravitation»;
- **C. Granja** (Czech Technical University in Prague (CTU)), «Nuclear Spectroscopy with Neutrons»;
- **I. Stekl** (CTU), «Introduction to Astroparticle Physics»;
- **S.V. Sheshunova** (Dubna University), «Characters and Images in Russian Culture».

For the first time the lecture programme of the Practice included the presentations of the JINR Laboratories, which were made by G. Adam, A. Kovalik, Ye.A. Krasavin, A.G. Popeko, I.A. Savin, S.S. Shimansky, A.S. Sorin, and S.F. Vokal.

The topics of the laboratory exercises – the key part of the Practice – were announced in advance; therefore, when registering at the UC Internet site for participating in the Practice, the applicants, besides specifying their scientific interests in general, chose laboratory exercises from the list published at the site. The exercises were provided by FLNR, FLNP, VBLHE, DLNP, and LRB. The widest

range of topics was provided by FLNR and FLNP. For example, six exercises were arranged at FLNR's facilities, including "Studying nuclei at the stability border," "Studying micro-objects using an electronic microscope," and "Studying radiation properties of materials." FLNP organized ten laboratory exercises reflecting all the main fields of its research (nuclear physics, condensed matter physics, and neutron activation analysis). Students of JINR Member States show great interest in laboratory work on applying nuclear methods in biology and medicine. Therefore, LRB was involved in 2006 in the Practice; the Laboratory provided the following exercises: "Instrumental methods of radiation safety," "Cytology," "Microbiology," and "Molecular biology."

In their reports on the Practice, the students specially noted the high value of the following laboratory work: neutron activation analysis (supervised by M.V. Frontasyeva), nuclear physics (supervised by A. Kobzev, Yu.M. Gledenov, N. Rebrova, and K. Zhdanova), and neutron diffraction studies of the structure and magnetic properties of solids (supervised by M. Kraus) at FLNP; the exercises supervised by A.G. Artiukh, G. Kaminski, S.V. Mitrofanov, O.L. Orelovich, V.F. Reutov, R. Wolski, V. Zhemenik at FLNR; the exercises on the fabrication of a germanium detector supervised by Y. Jurkowski and D. Borowicz, and molecular biology supervised by I.D. Aleksandrov, M.V. Aleksandrova, and M. Mumot at DLNP; and heavy ion beams in microbiologic research (M. Deperas-Kaminska) at LRB

The Practice became possible thanks to the financial support by the grants from the Plenipotentiaries of the Czech Republic, Poland, and Slovakia, and to the programme of cooperation between JINR and Romania. Remarkably great help was given by W. Chmielowski (Poland), A. Constantinescu (Romania) A.-S. Dubnickova (Slovakia), and I. Stekl (the Czech Republic).

Undergraduate and graduate programmes

On the basis of JINR, offered are undergraduate and graduate programmes in physics reflecting the main fields of the Institute's research (nuclear physics, elementary particle physics, and condensed

matter physics). The programmes begin either with the first year of studies (for the students of the Dubna branch of Moscow Institute of Radio Engineering, Electronics, and Automatics (MIREEA); and the departments of Dubna International University of Nature, Society, and Man) or with the graduate years (for physics students coming from Moscow State University (MSU), Moscow Engineering Physics Institute (MEPI), Moscow Institute of Physics and Technology (MIPT), and higher education institutions of JINR Member States).

In 2006, more than 500 students attended courses or studied at the JINR Laboratories, including 34 students of MSU, nine of MEPI, 15 of MIPT, more than 200 students of Dubna University, and 120 of other higher education institutions of the following JINR Member States: Armenia, Belarus, the Czech Republic, Poland, Ukraine, and Uzbekistan.

One of the UC's functions is creating and supporting additional special advanced courses for graduate students delivered by JINR staff members. The program of the courses is based upon the recommendations and requests of the JINR-based departments of higher education institutions. The list of the courses along with the lecturers' names is given below.

Spring 2006

Telecommunications and world information resources	V.V. Korenkov
Statistical physics	G.G. Adamian
Mathematical statistics	V.V. Kurbatov
Selected topics of the elementary particle physics (seminar)	Ye.A. Strokovsky
Computer modelling of physics processes in detectors using the GEANTt4 software package	A.S. Zhemchugov M.A. Demichev
C++	V.G. Olshevsky

Database management systems (lectures)	V.V. Korenkov
Database management systems (practice)	I.A. Filozova
Introduction to the object-oriented analysis of data using the ROOT software package	T.M. Solovyova
Introduction to the theory of accelerators	G.V. Trubnikov
Elementary particle physics methodology	Ye.A. Strokovsky
C++	V.G. Olshevsky

Besides offering lectures on certain subjects, the UC participates in working out the education programmes in specific disciplines comprising lecture courses and seminar classes and supports them. In 2006, the Large Hadron Collider (LHC) special programme continued at the UC. The programme was initiated by Prof. I.A. Golutvin to train staff for the LHC experiments in which JINR participates. The programme was attended by students of MSU, MIPT, Voronezh University, Kostroma University, and MIREEA.

JINR postgraduate education

In 2006, the UC did a great job of preparing the documents for the prolongation of JINR license to offer postgraduate programmes.

JINR offers its own postgraduate programmes in ten specialties. The immediate organization of the postgraduate studies is performed by the UC. In particular, the UC holds postgraduate entrance examinations; prepares its postgraduates for taking the examinations in English and philosophy as required by the Candidate's degree (the Russian analogue of the PhD degree) minimal requirements; and provides living conditions for its postgraduates. The Laboratories' responsibility is to provide the conditions for the postgraduates performing research related to their dissertations (PhD theses), to do the official annual evaluation of their performance, and to participate in holding the Candidate's degree examinations in their specialties.

In 2006, JINR's total postgraduate enrolment was 67. The following table shows the distribution of the postgraduates over the JINR Laboratories in 2006.

Laboratory	Number of postgraduates
Laboratory of Theoretical Physics	20
Laboratory of Nuclear Problems	21
Laboratory of Nuclear Reactions	5
Laboratory of High Energies	6
Laboratory of Neutron Physics	4
Laboratory of Particle Physics	1
University Centre	1
Laboratory of Information Technologies	7
Laboratory of Radiation Biology	2
Total	67

The following table shows the distribution of the postgraduates over the specialties in 2006.

Specialty	Number of postgraduates
Nuclear and Elementary Particle Physics	26
Theoretical Physics	19
Charged Particle Beam Physics and Accelerator Techniques	3
Solid State Physics	3
Physics Experiment Techniques, Instrument Physics, and Physics Research Automation	5
Mathematical and Software Support of Computers, Computational Complexes, and Networks	1
Mathematical Modelling, Numerical Methods, and Software Complexes	7
Radiobiology	3

18 applicants were admitted in the postgraduate studies in 2006. It is certainly interesting to examine from which higher education institutions postgraduates came to JINR. About half of those admitted in 2006 graduated from Moscow's elite institutions (four came from MSU and four from MIPT); others graduated from institutions of JINR Member States (mostly from Russian ones). In 2006, JINR's total postgraduate enrolment from its Member States was 16, including seven from Armenia, five from Belarus, three from Ukraine, and one from Uzbekistan.

Pre-university studies

In the modern world the formation of a prospective physicist actually begins before the person enters a university. Besides, the choice of a career by a secondary school pupil depends on his or her mental outlook and interests. Therefore the UC attaches great importance to its activity aimed at secondary school pupils of JINR Member States to raise their interest in physics and research carried out at JINR.

In 2006, the UC was visited by eight secondary school pupils and their two teachers from Poland (the cities of Leszno, Poznan, Swinoujscie, and Tarnowskie Gory), ten students of Opole University (Poland), and 15 school pupils from Berlin.

Throughout 2006, the UC was offering an optional physics course for the 10th and 11th-year school pupils of Dubna, which included lectures and laboratory work.

In March 2006, the UC and Dubna University held together an Open Scientific Conference on Physics and Mathematics for Moscow Region's School Pupils. The conference was attended by more than 50 secondary school pupils of Russia, Ukraine, and Belarus.

Staff training and retraining and qualification improvement

In 2006, the UC continued the training, retraining, and improvement of the qualifications of its working staff and specialists.

JINR's ten staff were trained in an allied profession; ten, in a second profession.

At the JINR courses training personnel for operating facilities that are within the jurisdiction of the Federal Technical Inspection, 60 JINR's staff were trained. 86 JINR's staff were trained and certified to operate and maintain machines, mechanisms, and pressurized vessels.

50 JINR's management staff and leading specialists were trained and certified according to the standards and regulations on using atomic energy. JINR's seven staff improved their qualifications at different seminars held by education institutions of Moscow, Obninsk, and Dubna.

Information support of the UC's activities

In January 2007, the UC opens its new Internet site. It will meet the requirements to modern sites and will better present the JINR education programmes and the UC's activities to all its potential partners in the JINR Member States.