

999/01



**JOINT INSTITUTE FOR NUCLEAR RESEARCH**

---

2000-302

S.P.Ivanova

**THE JINR EDUCATIONAL PROGRAMME  
IN 2000**

Report to the 89th Session  
of the JINR Scientific Council  
January 18–19, 2001

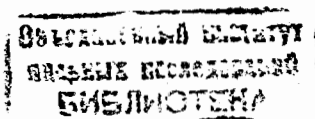
Dubna 2000

S.P.Ivanova

**THE JINR EDUCATIONAL PROGRAMME  
IN 2000**

Report to the 89th Session  
of the JINR Scientific Council  
January 18–19, 2001

Dubna 2000



In 2000, the University Centre (UC) of JINR continued its activities within the first-priority topic "Organization, Maintenance, and Development of the University-Type Educational Process at JINR." The realization of this topic is entrusted mainly to the UC.

The expected results upon the completion of the topic stages or projects are the following:

- ◆ Development and update of the curricula and programmes for physics students.
- ◆ Support of the postgraduate studies.
- ◆ Establishment of student and postgraduate exchanges between the UC and foreign universities on the basis of Agreements on Cooperation.
- ◆ Creation of a system of raising the professional skills of JINR's engineering and technical staff.
- ◆ Development of the computing and information technology complex for the university-type educational process, a remote instruction network, and a database of the programming courses.

Students of the fourth, fifth and six years complete their university education at the UC in the following areas: nuclear physics; elementary particle physics; condensed matter physics; theoretical physics; technical physics; and radiobiology.

In the spring semester (autumn semester in parentheses) of 2000, there were 76(82) students at the UC from different institutions of higher education of JINR Member States. The curricula are worked out jointly with the institutions of higher education that have assigned their students to graduate at the UC. The table below reflects distribution of the UC students over institutions of higher education.

Institution	Spring 2000	Autumn 2000
Moscow State University	16	16
Moscow Engineering Physics Institute	13	15
Moscow Institute of Physics and Technology	20	17
Institutions of other JINR Member States (Armenia, Belarus, Czech Republic, Georgia, Russia, Slovakia, Ukraine)	27	34
	76	82

The UC develops new programmes of special educational training for some student groups.

From autumn 1998, the first group of Slovak students were trained at the UC to become specialists for the Slovak cyclotron facility, which is being built with JINR's support. In 2000, they successfully defended their diploma theses. In January 2001, a second group of Slovak students are to defend their theses. Both of these groups are made up of students of Bratislava Technical University. In September 2000, a third Slovak group began their studies at the UC. This group is made up of students of Bratislava Technical University and the Komensky University.

At the UC, the Slovak students learn the specialty "Accelerator Physics and Engineering." The curriculum includes the following courses:

- ◆ Applied Mathematics;
- ◆ Dynamics of Accelerated Charged Particle Beams;
- ◆ Interaction of Radiation with Matter;
- ◆ Physics and Engineering of Heavy Ion Accelerators;
- ◆ Atomic and Plasma Physics;
- ◆ Heavy Ion Sources;
- ◆ High-Frequency Systems of Accelerators.

The lectures are given by specialists of the Flerov Laboratory of Nuclear Reactions, Laboratory of Particle Physics, Department of Radiation and Radiobiological Research, and Dzhelepov Laboratory of Nuclear Problems. This special programme requires that the students take an intensive course of Russian before attending courses in the specialty.

The UC tries to extend the range of its educational activities. It is known that actively used are medical beams at the accelerator of the Laboratory of Nuclear Problems. This has become the ground for establishing a new graduate department at Moscow Engineering Physics Institute – the Department of Physical Techniques in Applied Research and Medicine (Department No. 45). It is headed by Prof. I.A. Russakovich, Director of the Laboratory of Nuclear Problems.

The specificity of university education is its versatility. It means that the students can choose lectures and lecturers; and a wide range of additional courses, including optional subjects, are available to them.

Below follows the list of some courses given at the UC: Elementary Particle Physics; Relativistic Nuclear Physics; Theory of Fundamental Interactions (Quantum Chromodynamics); Theory of Fundamental Interactions (Theory of Nuclear Reactions); Atomic Nucleus Structure; Introduction to the Theory of Accelerators;

Experimental Nuclear Physics; Modern Techniques of Detecting Nuclear Reactions and Nuclear Radiation; Programmable Logical Units; Fundamentals of Radio Engineering; Digital Devices and Their Application; Electronic Techniques of Ionizing Radiation Detection; Radiation safety and the Environment Protection; Mathematical Statistics; Object-Oriented Programming in C++; Programming in UNIX; Computing in High-Energy Physics; Internet technologies; Computing Facilities in Nuclear Physics (seminar); Telecommunication Systems and World Information Resources; Computing (Visualization in Scientific Research); Operating the "Mathematica" System, English for Students, and English for Postgraduates.

During semesters, the UC offers to its students and postgraduates short lecture series on the latest developments in physics and related fields, which forms the lecture cycle "Modern Problems of Natural Science". This semester, the following courses have been given:

- ◆ Dr.C.Pagliarone, Universita di Cassino and INFN Pisa, "Modern Physics at Hadron Colliders ";
- ◆ Prof.Stephan Paul, Munich Technical University, "Hadron Physics at High Energies – Why and How".

The UC publishes manuals for its students and postgraduates. This year, Prof. Dr. R. Kragler's (FH Ravensburg – Weingarten / University of Applied Sciences) "Mathematica Tutorial Course" has been published.

In 2000, the JINR post-graduate studies continued to function in ten specialties of physics and mathematics.

Since 1995, altogether 49 students have completed JINR's postgraduate programmes; 36 remained at JINR for further work. JINR's postgraduate studies have now a total enrollment of 44.

The following table reflects the distribution of the UC post-graduates over the JINR Laboratories in 2000.

	Number of post-graduates Spring 2000	Number of post-graduates Autumn 2000
Laboratory of Theoretical Physics	3	3
Laboratory of Nuclear Problems	9	15
Laboratory of Nuclear Reactions	2	4

Laboratory of Neutron Physics	7	5
Laboratory of High Energies	3	1
Laboratory of Particle Physics	5	5
Laboratory Information Technology	8	9
Department of Radiation and Radiobiological Research	2	1
University Centre	1	1
	40	44

The first-enrollment postgraduates completed their studies in 1998. Up to now, 8 defended their postgraduate theses.

Two of UC's present postgraduates come from Egypt.

Taking into account JINR's international character, the UC actively develops international contacts.

Within the frames of the programme of the German Service of Academic Exchanges (DAAD) "Leonard Euler Scholarships," a joint project of the UC and the Institute of Theoretical Physics of the University of Giessen (Germany) has been supported for 1999-2000 and 2000-2001. Two UC post-graduates and one graduate student performing theoretical research in heavy ion physics are paid and additional scholarship during the current academic year and will have a month's practicum in Giessen.

In July 2000, a group of 18 students of the Technical University, Prague, visited the UC. They saw JINR's Laboratories and basic installations, and were acquainted with UC's activities.

On June 20-28, 2000, a regional forum of the European Physics Education Network (EUPEN) took place in Poznan, Poland. JINR was represented at the forum by the UC. Discussed at the forum were the cooperation within the EPS, EUPEN, and JINR; the organization of the International Student School "Nuclear Physics Techniques and Accelerators in Biology and Medicine" at JINR in 2001; and the student exchange issues.

The UC has received a grant from the European Physical Society, which will allow five UC students to spend a month at an Italian university.

All these activities require proper equipment. The UC has (Fig.1):

- four computer classrooms, one of which is dedicated to data visualization;
- three auditoriums with multimedia-equipped lecturer's places;
- one server room with an e-mail and WWW Alpha Server (DecUNIX), and classrooms subnet and multimedia server (Windows NT);
- one student laboratory, which has been equipped at the expense of a JINR Directorate grant. A Physics Practicum has been introduced into curricula of the University Centre. The Practicum is made up of two laboratory exercises. One of them consists in students learning the main performances of the spectrometer, measuring gamma spectra of gauged sources, and determining the energy and intensity of characteristic lines. The other is concerned with charged particle spectrometry.

Regularly updated has been UC's Web site (<http://uc.jinr.ru>).

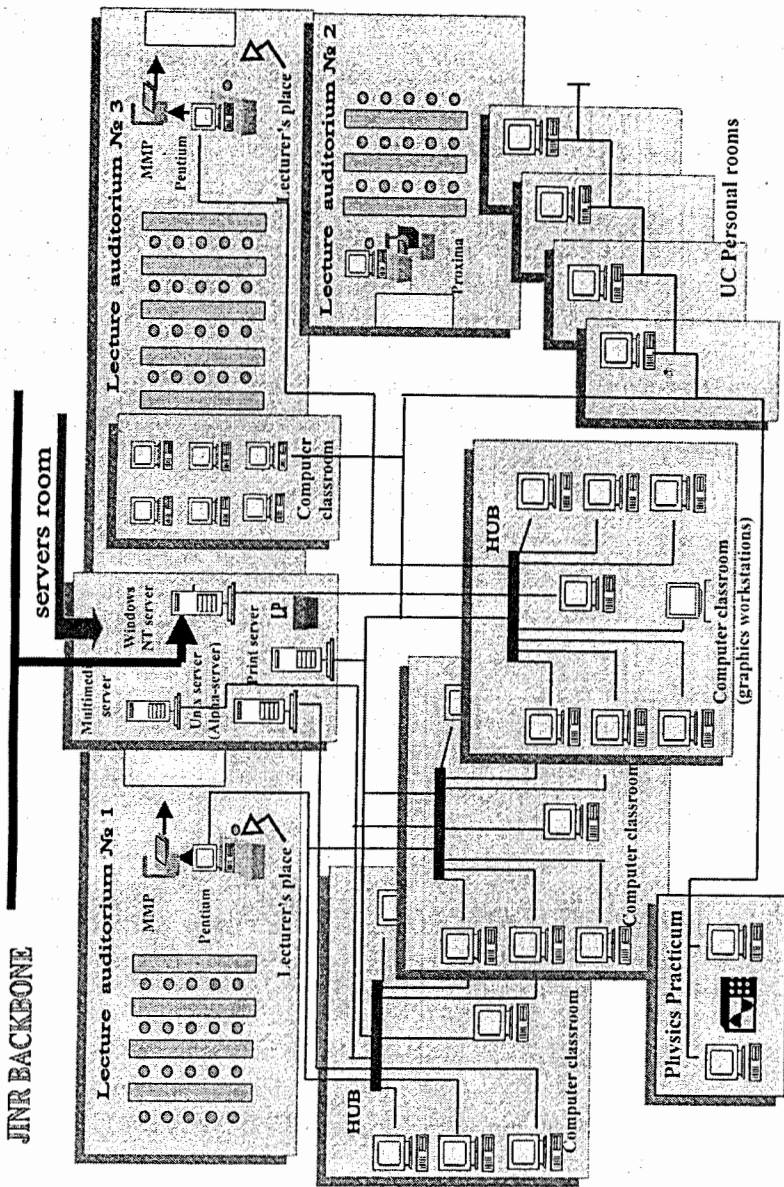
In the autumn of 1998, the top officials of JINR and Moscow Institute of Radio Engineering, Electronics, and Automatics (MIREEA) established at JINR a graduate department in the specialty "Electronics and automatics for physics facilities". The full-time programme for MIREEA students beginning with the first year of studies is given at the UC. The current total number of MIREEA students at the UC is 46. We have two auditoriums and one computer classroom for them.

Since 1999, the UC turns out and retrains workers and raises their qualifications. The UC organizes and controls their training on the basis of JINR's Laboratories and divisions. We are going to broaden the scope of the technical and engineering staff training, so the arrangements are underway to obtain the licenses for educational activities in radiation safety, industrial hygiene, and information technologies.

#### Cooperation with Polish universities

JINR's University Centre (UC) has traditionally friendly ties with the Polish university community.

UC and Polish students and postgraduates exchange acquaintance visits, and participate in schools and conferences held in Dubna and



Architecture of the UC JINR computer centre

Poland. The Bogoliubov – Infeld programme has been established to support Polish universities' and JINR's initiatives for the development and realization of projects in education. The programme is funded by a special grant from the Polish Plenipotentiary at JINR.

In May 1999, a workshop on cooperation in education within the frames of the Bogoliubov – Infeld programme was held at the UC. A group of professors from Białystok, Gdańsk, Kraków, Łódź, Lublin, and Wrocław Universities and Szczecin Polytechnic discussed with the UC Directorate the potentialities and fields of JINR's Educational Programme. The workshop participants were acquainted with scientific programmes of all JINR's Laboratories and visited basic JINR's installations. Special attention was paid during the discussion to the cooperation with Polish institutes and universities.

The resolution of the workshop notes the expedience of the student group exchange visits with specially prepared scientific and lecture programmes. It also promotes the exchange of information on schools, seminars, and conferences for students, postgraduates, and specialists, and the participation of both sides in them. Specially stressed is the benefit of performing diploma research at JINR's Laboratories and the UC under the joint supervision of scientists of Polish universities and JINR.

Year after year increases the number of Polish students and postgraduates visiting the UC, as well as that of UC students and postgraduates coming to Poland with return visits.

The first exchange of visits took place in 1992, when the UC accepted a number of students from Łódź University for two-week practice, and then a group of UC students came to Poland on a return visit. In 1996, a group of students from the Maria Curie-Skłodowska University, Lublin, had a two-week visit to the UC. In February 1997, three students and a postgraduate from the UC attended a School on Theoretical Physics in Karpacz, which is held annually by the Institute of Theoretical Physics of Wrocław University. In May 1997, a group of UC students visited the Universities of Łódź, Lublin, and Wrocław and the Adam Mickiewicz University (AMU), Poznań. In June 1997, AMU physics students returned a visit to Dubna. In September 1997, a group of students of Wrocław University visited JINR's Laboratories and the UC.

The table below shows the breakdown of the number of Polish students that visited JINR during the last 3 years into the universities and years.



University	Number of students		
	1998	1999	2000
University of Lodz	-	-	9
University of Wroclaw	15	-	24
Adam Mickiewicz University (AMU) of Poznan	-	12	-
Jagellonian University of Krakow and Academy of Mining and Metallurgy	40	19	-
University of Lublin	-	10	-

In 1998, Agnieszka Kucharska, a student of the Faculty of Physics of the Adam Mickiewicz University, Poznań, had three-month pre-diploma practice at the Department of Nuclear Physics of the Laboratory of Neutron Physics; then she brilliantly defended her Master's thesis.

In June 1998, a group of students from Poznań together with students of the Physics Faculty of Moscow State University (MSU) had educational practice in medical physics on the basis of JINR's Department of Radiation and Radiobiological Research and UC, and the Dubna branch of MSU's Institute of Nuclear Physics.

In February 1998, eight UC students and postgraduates participated in the theoretical school "From Quantum Mechanics to Quantum Technology", which was held in Karpacz, Poland.

In 1999, two UC postgraduates attended the 35th Winter School on Theoretical Physics "From Cosmology to Quantum Gravity"; in 2000, six UC students participated in the next School.

The UC Directorate gives serious consideration to the development of international student exchange. The importance of this activity has been appreciated by the participants of the past exchanges. Regular contacts will help young scientists of JINR Member States easily join the international scientific community.

The International Student School "Nuclear Physics Techniques and Accelerators in Biology and Medicine" will be held on June 27 – July 11, 2001, in Ratmino near Dubna, Moscow Region, Russia. It will be another School in the series of the Summer Student Schools organized by the Joint Institute for Nuclear Research, Dubna.

The wide application of ionizing and non-ionizing radiation, radionuclides, gamma therapy units, electron and proton accelerators, and computer tomographs in medicine has turned medical physics into a kind of "strategic arms" and one of the bases of medicine in the present and future. Modern applied medical physics incorporates radiation therapy, nuclear medicine, radiation diagnostics, non-ionizing diagnostics and therapy, computer facilities and mathematical modeling in diagnostics and therapy, radiation safety, and radioecology.

The purpose of the School is to acquaint students and postgraduates with latest achievements and current problems of applied medical physics.

The School will be divided into a number of thematic sessions and will cover the following topics:

- Medical physics;
- Radiopharmacology;
- Comparison between the potentialities of electron and proton accelerators (and  $\gamma$  therapy) from the medical point of view;
- Cyclotron and synchrotron facilities: recent results;
- Accelerator technology for hadron therapy.

In 2000, the reports on the JINR educational programme were presented at the:

- regional forum of the European Physics Education Network (EUPEN) in Poznan, Poland;
- international congress "Science and Education on the Threshold of the 21st Century" in Minsk, Belarus.

Within the frames of the joint project of the UC and the Institute of Theoretical Physics of the University of Giessen (Germany), theoretical research in heavy ion physics was performed at UC (Shneidman T.M., Ivanova S.P. et al., Nucl. Phys. A, 671, 119-135, 2000; Russian J. Physics of Atomic Nuclei, 63, 1716-1723, 2000; Adamian G.G., Ivanova S.P. et al., Phys. Rev. C, 62, 064303, 6p.; Antonenko N.V., Ivanova S.P. et al., Proc. Int. Conf. Nuclear Shells - 50 years, Dubna (1999), World Scientific, 286-295; Adamian G.G., Ivanova S.P. et al., Proc. Int. Conf. Dynamical aspects of nuclear fission, World Scientific, Singapore (in print)).

The establishment of the UC was a timely and significant step in developing the system of the educational training of young specialists for JINR and organizations cooperating with it. JINR attaches great importance to its Educational Programme. Continuing this activity within the Topical Plan will allow the Laboratories' efforts to be united.

In 2000, the Programme Advisory Committees for Particle Physics and Nuclear Physics highly appreciated the progress of the JINR Educational Programme and recommended that this activity be continued with the first priority.

Within the frames of the topic "Organization, Maintenance, and Development of the University-Type Educational Process at JINR" (leaders: A.N. Sissakian and S.P. Ivanova), it is planned to continue the development of the JINR Educational Programme, which is to meet modern, internationally accepted requirements to the training of young physicists. The organization of the programme of raising the professional skills of the Institute's engineering and technical staff and their retraining with the purpose of implementing modern job arrangement and using the most advanced computer technologies at working places is another aim of JINR's educational activity. Creation and application of modern educational techniques and programmes of support to the education process and postgraduate studies are also planned for the next three years.

Expected results in 2001:

- Development of the system of specialized training of highly skilled specialists for the JINR Member States.
- Further development of specialized practical work for the UC students.
- Development of the cooperation with international Funds (DAAD, EMSPS, EuPEN) aimed at organizing the student and postgraduate exchanges between the UC and foreign research centres regulated by special agreements.
- Publication of the lecture cycles given to the UC students and postgraduates.
- Development of the UC Web server on the basis of modern information technologies. Periodic update of the server reflecting the lectures given at the UC, and schools and courses conducted on the basis of the UC.
- Systematic publication of manuals on the courses given at the UC.

2001 will mark the 10<sup>th</sup> anniversary of the establishment of the UC.

Received by Publishing Department  
on December 19, 2000.