

INTRODUCTION

A resumé of the activities at JINR in 2007 makes it possible to conclude that the period of «survival» has ended. We have entered on a new stage — the stage of sustainable development. The road map — the strategic programme for JINR development — provides these grounds: fundamental science, innovation development, and education. For the first time in many years the JINR budget has overtopped the «frozen» bar and amounted to US\$46 million, according to the resolution of the Committee of Plenipotentiaries. The budget inflow has reached its 100%.

The first stage in compliance with the road map envisages a renovation of the scientific-innovative infrastructure of JINR and, primarily, an upgrading of all our basic facilities and a start for the development of new ones. The main part of these activities began in 2006. As a result, by 2010 the Institute will possess a modernized park of accelerators (the Nuclotron-M, the Dubna complex of the radioactive ion beam DRIBs-II), the totally upgraded IBR-2M reactor and the IREN resonance neutron source. The international status of JINR commits us to have an attractive experimental base for a new generation of scientists from JINR Member States.

Today JINR is a universally acknowledged leader in low-energy heavy-ion physics; it plans to develop a unique collider NICA (Nuclotron-based Ion Collider fAcility) to accelerate heavy ions to high energies and a MultiPurpose Detector (MPD) to study the properties of hot highly compressed nuclear matter. To concentrate the resources necessary to implement this project, the JINR Committee of Plenipotentiaries approved the initiative of the Institute Directorate to consolidate the Laboratory of High Energies and the Laboratory of Particle Physics into one body.

Among the successful accomplishments of the year 2007 are the following: JINR's theoreticians have studied the effect of the weak homogeneous magnetic field on the electron structure of spheroidal fullerenes. It has been discovered that the thin structure of the electron energy spectrum is sensitive to the magnetic field direction. This argument indicates a possibility to change the electron levels structure in spheroidal fullerenes by

altering the magnetic field direction, which is crucial for practical applications in nanoelectronics.

Systematic research has been done on hadron form factors and photo- and electroproduction amplitudes, as well as on the double diffracted meson production using analytical properties of amplitudes, sum rules and QCD factorization theorems. Radiation corrections have been obtained by means of two-photon exchange in lepton–nucleon processes. The results are important for processing the precision experimental data from the LHC.

For the first time at the JINR Nuclotron, the effect of the deuteron tensor polarization was observed in the experiment with an extracted nonpolarized 5 GeV/c deuteron beam passed through the carbon nonpolarized target. That was an indication of the existence of the spin deuteron dichroism phenomenon while passing through substance, predicted by V. Baryshevsky.

Studies were continued of the chemical properties of superheavy elements 112 and 114. The acquisition and registration system parameters were considerably improved compared with the measurements of 2006. For the first time it was found out experimentally that the volatility of element 114 was closer to heavy noble gases than to its lighter homologue lead.

Experimental data from the IBR-2 reactor were processed as a continuation of the studies of the characteristics of delayed neutrons from the fission of main and minor reactor isotopes. These characteristics are important nuclear constants used in reactor kinetics calculations that determine the significance of such studies and strict requirements on results accuracy.

Research into the ferromagnetic superconducting composite structure that consists of a vanadium superconducting layer and a periodic structure was conducted with the neutron reflectometry method using still waves of polarized neutrons. For the first time, phenomena of a domain structure generation were observed in the vicinity of the vanadium–iron border and antiferromagnetic normalization in the periodic structure. Thus, it was shown that the magnetic state of a nanostructure can be controlled with a superconducting transition.

These results provide opportunities to elaborate principally new logic elements for nanoelectronics where the state is coded both in the magnetic moment value and in resistance.

Polarized valence quark distributions in the processes of semi-inclusive deep inelastic scattering (DES) of polarized muons on a deuterium target were measured in the COMPASS experiment (JINR–CERN). The results of the DES inclusive processes analysis assessment make the nonsymmetric polarization of light quarks in nucleon more preferable. The data analysis of the difference asymmetry in hadron production was based on the research conducted by JINR physicists.

JINR CICC resources (computation and data storage) are used both locally and for distributed computation in the framework of the world grid structure LGG/EGEE. The JINR CICC input in the problems solution in 2007 along the RDIG grid infrastructure was 44 %.

The Institute has achieved much progress in education, cooperating with leading higher education institutions of Russia. A new chair of MPTI «Fundamental and Applied Issues in Microworld Physics» was opened at the JINR University Centre. The JINR-based chair «Nanotechnologies and New Materials» was opened at Dubna University. The first UC educational project for South African students was implemented. The MEPI chair, established at JINR long ago, was reorganized, with the number of its students doubled.

On 12 April, an Agreement was signed on the associate membership of Serbia to JINR. It consolidated the status of our long-standing cooperation, in particular, in the implementation of the TESLA accelerator complex project in Belgrade.

2007 saw several jubilee events. Among them is the centenary of the birth of one of the founders of JINR Academician V. Veksler, the creator of the Synchrotron which marked that year the 50th anniversary of its launching. Also the Institute celebrated the centenary of the birth of the outstanding Chinese scientist, JINR Vice-Director in 1959–1962 Wang Ganchang. In 2007 the Flerov Laboratory of Nuclear Reactions, one of the world's leading laboratories conducting research in heavy-ion physics at low and intermediate energies, celebrated its 50th birthday. On 7 November 1957 in

Dubna, which was very young at that time, the first issue of the newspaper «Za kommunizm» (now its title is «Dubna: Science, Cooperation, Progress») was published.

In June 2007 in Almaty, during the celebration of the 50th anniversary of the Institute of Nuclear Physics of the National Centre for Scientific Research of Kazakhstan, the participants of the festive events had an opportunity to see the joint JINR–CERN exhibition «Science Bringing Nations Together», replenished with additional posters on cooperation of JINR with Kazakh scientific centres. The photo exhibition «Romania at JINR» was organized at the Embassy of Romania in Moscow on the occasion of the state holiday of Romania — the Day of the National Solidarity.

In December 2007 agreements were signed between JINR and the Russian Academy of Sciences, the Lomonosov Moscow State University and the Ukrainian Academy of Sciences on further development of cooperation in scientific research and education.

As before, the Institute continues to develop its innovation activities. Much effort is rendered to elaborate the project to establish a multiple-access centre in nanotechnologies on the basis of JINR and SEZ, which will be oriented to cooperation with CIS countries and other JINR partners.

The activities to develop in Dubna a special economic zone of the technical-promotional type attracted the attention of the country and the region leaders — in 2007 First Deputy Prime Minister of RF S. Ivanov, accompanied by Plenipotentiary of the President of Russia in the Central Federal District G. Poltavchenko, Ministers A. Fursenko, Eh. Nabiullina, V. Putilin and Head of the Federal Agency on SEZ management M. Mishustin, visited JINR. Chairman of the State Duma of the RF Federal Assembly B. Gryzlov and Governor of the Moscow Region B. Gromov also came to JINR on official visits.

On the whole, a large amount of fundamental and applied research was accomplished in 2007, both at «home» facilities and in research centres of our partners. As usual, the Institute organized many conferences, schools and symposia (a total of about 60). JINR staff members published over 1600 scientific papers.



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