

# INTRODUCTION

In 2006 the Joint Institute celebrated its 50th anniversary. Ceremonial events dedicated to the jubilee were held in all the JINR Member States. The Institute received plenty congratulation addresses and telegrams that marked the leading role of JINR as a coordinating centre for fundamental research in the Member States and an international centre of the highest level in the field of innovation technology and education.

The scientific activities at JINR concentrated on the main research trends which have historical background: high energy physics, nuclear physics and condensed matter physics. In 2006, JINR researchers achieved significant scientific results which were acknowledged worldwide and marked with prestigious international awards and JINR prizes.

Expecting the launch of the LHC accelerator, as well as preparing to search for SUSY, the Institute theorists conducted an analysis of the parameter space of the Minimal SUSY Standard Model with an account of the latest astrophysics data on the amount of Dark Matter. An interpretation of data was suggested on the diffuse gamma-ray flux as a signal from the Dark Matter annihilation into the galaxy halo.

A team of JINR physicists showed the possibility of direct extraction of the transversity and the accompanying  $T$ -odd parton distribution function from Drell–Yan processes with unpolarized pion beam and with both unpolarized and transversely polarized proton targets.

A new method of polarized semi-inclusive deep inelastic scattering (SIDIS) data analysis in the next-to-leading order QCD was proposed and developed.

Active discussions initiated by the Institute theorists in 2006 brought about a conceptual project of the development of the Nuclotron accelerator complex aimed at the search of the mixed phase and critical phenomena in strongly interacting matter, which was called the «Design and construction of Nuclotron-based Ion Collider Facility (NICA) and Mixed Phase Detector (MPD)». The project was regarded and evaluated by a representative international expertise board.

Simultaneously, nuclear emulsions were for the first time irradiated at the Nuclotron in the beam of radioac-

tive  $^8\text{B}$  nuclei and data were obtained on probability of fragmentation channels of  $^8\text{B}$  nucleus in peripheral interactions at an energy of  $1.2A$  GeV.

In the experiments on the synthesis of superheavy elements much progress was achieved in the region of closed spherical shell for proton  $Z \approx 114$  and neutron  $N \approx 184$ . Experiments were conducted to study chemical properties of element  $Z = 112$  obtained as a daughter product in the  $^{48}\text{Ca} + ^{242}\text{Pu}$  reaction. The fugitiveness of element 112 was studied with a cryogenic detector. It was found out that according to its properties this element is closer to mercury than to radon. The obtained results confirm independently the production of element 112 in the fusion reaction  $^{48}\text{Ca} + ^{242}\text{Pu}$ .

The charge asymmetry parameter  $A_g$  was measured in decays of charged kaons into three charged pions, as well as the analogous asymmetry parameter in decays of charged kaons into one charged and two neutral pions, in the NA48/2 experiment (CERN, SPS) with an essential contribution of JINR staff members. The obtained restrictions are one order more accurate than the results of previous measurements and accord with the Standard Model predictions which account for the measurements of the direct CP violation in decays of neutral kaons.

Active work was launched at the Institute to modernize the park of basic facilities. The construction of the first stage of the IREN setup was conducted according to the schedule. Repair and rehabilitation operations to eliminate the impact of the fire in 2005 were accomplished in 2006 at the Phasotron of the JINR Laboratory of Nuclear Problems. In 2006 an extracted proton beam was obtained and the beam transport channel was adjusted to medical procedure boxes; it was an important step in the hadron therapy programme and biomedical research with extracted ion beams.

In December 2006 the pulsed reactor IBR-2, the main basic JINR facility for condensed matter physics research, was decommissioned for experiments after almost 50 thousand hours of operation. It will be fully dismantled. Actually, a new reactor is planned to be

constructed — the modernized pulsed reactor IBR-2M. Schedules and dates have been arranged; the work is under way that will result in the development of the new reactor which will occupy a well-deserved place in the European programme. In autumn 2006 an important stage of the IBR-2 modernization was successfully fulfilled: fuel assemblies for the IBR-2M reactor were produced.

On the basis of JINR's CICC, the Institute specialists developed a Grid infrastructure as a component of the world Grid infrastructure in the framework of the EGEE/LCG projects. A special server for centralized monitoring of Russian LCG sites is supported at JINR. Sessions of mass generation of events for the CMS, ALICE, ATLAS and LHCb experiments are held on the basis of this infrastructure.

In radiobiological research, studies were continued of the origin of the DNA cluster damages, of regularities and mechanisms of heavy-ion action on biological membranes, simulation of the molecular dynamics of nano- and biostructures was performed.

A most important task is the participation of the Institute in the development of the International Linear Collider (ILC). Certain progress has been achieved in this aspect. Resulting from the negotiations with the leaders of the ILC Global Design Effort (GDE), JINR (Dubna), as well as Fermilab (USA), KEK (Japan), CERN, and DESY (Germany), has been acknowledged an official candidate for the location of the ILC accelerator complex in its territory.

The year 2006 was definitely marked by one more event that was of vital importance for science. In September 2006 in Astana (Kazakhstan), the Interdisciplinary Scientific-Research Complex on the basis of the heavy ion cyclotron DC-60 (JINR) was inaugurated at the Gumilev Eurasian University. On 1 December a double-charge nitrogen ion beam was successfully injected into the cyclotron and accelerated up to an energy of 1 MeV/nucleon.

International cooperation broadened. In February 2006 the first coordinating meeting on the cooperation of JINR with the Republic of South Africa as an Associate Member of the Institute was held. It laid the basis for a new round of joint scientific programmes. Certain results were obtained in strengthening the cooperation with China, Venezuela and other countries.

Educational process is one of JINR's priority trends and a cornerstone in the policy of the Institute. In

2006, more than 500 students from MSU, MEPI, MPTI, the «Dubna» University, MIREA and higher education institutions from JINR Member States (Armenia, Belarus, Poland, Uzbekistan, Ukraine, Czechia) studied at the JINR University Centre. A new structure was established at the UC in 2006 — training laboratories. Those were the optics and atomic physics laboratories; work was started to organize the laboratory of nuclear physics.

III International Summer Student Practice course on JINR research trends had a tremendous success. In 2006 a record number of students (51) attended it; they were from higher education institutions in Poland, Romania, Slovakia and Czechia. The agenda of the course included lectures by leading JINR scientists on specialized subjects, presentation lectures from laboratories and traditional practice classes at the basic facilities of the Institute.

XXXIII International (Rochester) Conference on High Energy Physics was one of the brightest events of the year and one of the most important issues of JINR activities. The Institute took an essential part in the organization and holding of this forum. The Institute physicists made 17 reports at the conference parallel sections and one plenary report; several JINR staff members headed the conference sections. The Institute provided the bulk of technical and information support for the successful work of this largest international conference.

In May 2006 in Geneva, the joint international exhibition «Science Bringing Nations Together» was held at the Palace of Nations of the Geneva UN Office (Switzerland). It was dedicated to 50 years of JINR–CERN cooperation in global projects of modern elementary particle physics and application of results in fundamental high-energy physics in various spheres of life.

Innovation component of the Institute activities becomes more and more important. RF Minister of Economic Development and Trade G.Gref visited Dubna on 26 December 2006, while he attended a meeting on the establishment of the technology innovation special economic zone. In his speech, the minister stressed the fact that the Joint Institute, with its scientific potential and international contacts and prestige, serves as a core and generator of the whole zone that will open a new page in the life of the city and its specialists, and of all Russian science.



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