INTRODUCTION

In the year of 2005 the activities of all the laboratories and divisions of JINR were aimed at strengthening the position of the Institute as an international scientific centre which integrates fundamental physics research, the development of advanced technology and university education. Immense efforts were directed to polish up the Institute scientific programme and to cut down the number of projects in order to concentrate the financial and staff resources on the most important trends of research and, what is no less important, to work out the plan of strategic development («the road map») of the Institute in the fields of particle physics, nuclear physics and condensed matter physics for the coming 10 years.

The year of 2005 was marked at the Institute by a number of significant scientific results noted by JINR prizes and prestigious international awards.

A group of JINR theoreticians made a detailed comparison of quantum chromodynamic predictions with the data for structure functions of the processes of deep inelastic lepton scattering on nucleons. The results of the studies were used, in particular, in the discussion of the LHC scientific programme and future neutrino factories.

The Drell–Yan processes were discussed for both the interaction of two unpolarized hadrons and the interaction of an unpolarized hadron with a polarized one. It was found that starting from the data on such processes it is possible to obtain transversely polarized parton distributions and T-odd parton distributions (the so-called Boer functions), accompanying them, without any models or additional assumptions.

The Institute theoreticians were the initiators of the discussions on the possible search for a mixed phase of strong interacting matter at the JINR Nuclotron. Theoretical model evaluations show that the conditions that arise in heavy (with atomic numbers around 200) nuclei collisions at the energies accessible at the Nuclotron (about 5 GeV/nucleon) may be sufficient to form a mixed phase. It opens new opportunities in the physics research programme at the Nuclotron and is of obvious interest for the leading world scientific centres of high-energy physics.

In 2005 the world's best data for the top-quark mass were obtained due to the method of the top-quark mass measurement and efficient operation of the CDF software. Both the method and the software were developed by a group of JINR scientists (CDF, FNAL project).

A group of JINR physicists who take part in the NA48 experiment (CERN) conducted a precision analysis of about 6 million reconstructed events of semileptonic decays of neutral kaons. The obtained results firmly refuted all previous pseudodiscoveries which were related to the search for small deviations in experimental data from theoretical predictions of the Standard Model. Thus, the basis was laid for the search of manifestations of truly new physics.

In the field of heavy-ion physics the main attention in 2005 was focused on the synthesis of element 118 in the $^{249}\mathrm{Cf} + {}^{48}\mathrm{Ca}$ reaction. The $^{245}\mathrm{Cm} + {}^{48}\mathrm{Ca}$ reaction was also studied as it leads to the production of isotopes of element 116 which are daughter products of the element 118 decay. The whole obtained data confirm the synthesis of element 118.

An important landmark in the research of superheavy elements was the chemical identification of dubnium as a product of the decay chain of element 115 obtained in the $^{48}\mathrm{Ca} + {}^{243}\mathrm{Am}$ reaction. Within the bounds of studies in gamma spectroscopy a series of measurements was successfully conducted in the nobelium and lawrencium decay in the on-line mode.

Methods of ion-implantation nanotechnology were further developed. With the help of nanotechnology it is possible to construct nanoextraction phases practically from any chemical elements in any material. The studies base on new ideas, worked out by the Institute staff members, of irradiation of objects with a multielement beam of charged ions and separation of birth processes and growth of nanoextractions in a solid body.

Due to unique parameters of the Fourier diffractometer of high resolution (FDHR), which was devel-

oped by JINR specialists, the method of neutron diffraction was employed to study inner tension in materials. The method allows measurements of insignificantly small shifts of diffraction peaks from the nominal positions which are caused by inner tension in the material or object under study.

Protons, heavy ions and polarized deuterons were accelerated at the Nuclotron. The deuteron beam intensity was increased by 60% in 2005.

Regular physics experiments with accelerated ^{6}He beams in the context of the first run of the DRIBs setup started at the new complex. Optimization of channels and production of an ^{8}He beam were also conducted. The first experiments done at DRIBs to study accelerated secondary beams have great potential.

A superconducting ion source on the electron-cyclotron resonance (ECR) was launched at the new IC-100 cyclotron and ions were accelerated.

At the close of 2005 the IBR-30 reactor was successfully dismantled, including the most important part of work of unloading fuel cassettes from the active zone of the reactor.

JINR groups worked out their proposals in the topics of physics research they intend to conduct in experiments at LHC (CERN), RHIC and Tevatron (USA). CERN stressed the fact that JINR always fulfilled its responsibilities in developing the detectors ALICE, ATLAS and CMS for the LHC experiments.

Physics results were obtained by JINR staff members in the experiments STAR and PHENIX at the RHIC cooler (BNL, USA) and CDF and D0 at the Tevatron (FNAL, USA). Besides, students and young scientists were actively involved in these studies, which is very important for the Institute. In 2005, a special course for training young specialists to be involved in the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC, CERN) was organized at the JINR University Centre.

The achievements in the development of the information-computer infrastructure of JINR and Grid technology are noteworthy. In 2005 the capacity of the peripheral channel of the JINR computer net was increased up to 1000 Mbit/s. The Gigabit Ethernet technology with a rate of 1 Gbit/s provided stable operation of the JINR basic network. The LCG/EGEE infrastructure, which functions on the basis of the JINR CICC, is a constituent part of the world Grid infrastructure. A special server was developed in 2005 for centralized monitoring of Russian LCG sites and runs were conducted of mass generation of events for LHC experiments. One of the most important achievements in telecommunication technology was the launching of the super-high-speed Dubna–Moscow channel with bandwidth capacity of 2.5 Gbit/s.

The number of laboratories at the Institute enlarged in 2005 — the Division of Radiation and Radiobiological Research was reorganized into a Laboratory of Radiation Biology. In the context of radiation biological research, studies were continued of biological action of ionizing radiation with various physical parameters on the cell genetic structures. Extensive studies and practical work were conducted in the field of biomedical physics in treatment of oncological diseases at the medical beams of the Phasotron and at the new ion beam of the Nuclotron.

Emphatic success was achieved in the international cooperation. On 5 October 2005 an Agreement was signed in Moscow on the associate membership of the Republic of South Africa at the Joint Institute for Nuclear Research. This remarkable event in the development and strengthening of bilateral relations will open new prospects in the joint research.

The good tradition, welcomed by the scientific community, to hold annual summer practice courses at JINR for students from JINR Member States was carried on in 2005. The courses were organized by the Institute UC in collaboration with JINR laboratories. This work is very important to attract youth to JINR and widen contacts with the Institute Member States. The programme of the courses included lectures and practice work in the Institute laboratories and departments and participation in the international conference «Nucleus Theory and Its Application in Astrophysics». Much success was achieved in the project of advanced education courses for young theoretical physicists «Dubna International School of Modern Theoretical Physics» (DIAS-TH).

In 2005, more than 60 conferences, meetings and schools were held. They were organized by JINR, solely or in collaboration with scientific centres of Russia, the USA, Germany, Finland, Austria, Poland, Czechia, Belarus, Ukraine, Georgia, Bulgaria and Mongolia.

The presentation of the CERN–JINR exhibition «Science Bringing Nations Together» in Thessaloniki (Greece) was an outstanding event of the year. It was organized by Greece, JINR and CERN. The location of the exhibition was not chosen by chance. Greece is a CERN member state; at present it prepares to enter JINR as an associate member.

Suggested by the RF Ministry of Economic Development and Trade, JINR took part in the exhibition «Innovation Projects in Russia» which accompanied the 9th international economic forum in St. Petersburg, or the Russian Davos, as it was often called in mass media. The key elements of the JINR exposition were the projects which were developed together with specialists from JINR's FLNR, SCAR and SIC Aspekt. The Institute exposition was visited by RF Minister of Economic Development and Trade G. Gref and other high-ranking officials.

And finally, one of the most remarkable events of the year was the conferring of the status of a special economic zone on Dubna, in the field of nuclear physics and information technology. It is of immense importance for the development and consolidation of the innovation belt around JINR and all the scientific and technical complex of Dubna. On 28 November 2005 RF

Minister of Economic Development and Trade G. Gref announced the results of the competition on conferring the special economic zone status, held according to the decision of the government of the Russian Federation. On 21 December 2005, RF Prime-Minister M. Fradkov signed the Regulation on establishing an economic zone in the territory of the town of Dubna. Dubna has won this status to a great extent due to the fact that it is a town where an international scientific centre is located.

In 2005, the new JINR Director, Professor A. Sissakian, was elected. The members of the new Directorate will have to seek for up-to-date approaches to attack urgent tasks of the Institute, for the sake of welfare and prosperity of the centre and future science.