INTRODUCTION

In 2011 the Joint Institute for Nuclear Research celebrated its 55th anniversary. On the whole, the year 2011 was marked with very important events and impressive results in the progress of implementation of major scientific research programmes, along with achievements in upgrading of the accelerator and reactor base and in information technologies and education sphere.

The visit of the RF Prime Minister V. Putin to JINR is undoubtedly a landmark of the year. The Prime Minister visited laboratories of the Institute and was acquainted with the international project NICA, its unique opportunities and potential for discoveries in the research of new states of the superdense baryon matter, antimatter and strange matter, as well as fundamental laws of the microworld. A session of the Russian Government Commision on High Technology and Innovation was held in Dubna under the chairmanship of V. Putin. One of the main results of the session was the decision to include the NICA project in the list of megaprojects that may receive considerable dedicated support from the RF Government.

In 2011, significant progress was achieved in the design work-out and development of the prototypes of the NICA complex elements: superconducting magnets, an ion source, a source for polarized particles and magneto-optic structure of the collider, and in the design work-out of the MPD detector. Along with the work on designing and developing new accelerator setups of the NICA complex, two runs were conducted at the Nuclotron with total duration of 2000 h; 800 h of this period were devoted to the physics research programme.

Among of the most prominent results of the year are the completion of the energy start-up of the upgraded reactor IBR-2 with the nominal mean power of 2 MW and first experiments on the extracted neutron beams. Active work was continued on upgrading the reactor spectrometer complex and development of the user infrastructure.

The leading position of JINR in heavy ion physics has been once again proved and maintained by the successful series of experiments on the synthesis and studies of radioactive properties of isotopes of element 115. These convincingly confirmed the discovery of superheavy elements 113, 115 and 117.

In June 2011 the International Union of Pure and Applied Chemistry officially acknowledged the discovery of new superheavy elements with $Z = 114$ and 116. The priority of the discovery was recognized for the Russian–American team of scientists from JINR's FLNR and the Livermore National Laboratory. The synthesis of elements 114 and 116 turned out to be an experimental discovery of the existence of the «stability island» in the region of superheavy elements, which is of fundamental importance for physics and chemistry.

JINR theorists considered the restrictions on MCCM space parameters in the context of the latest data from the LHC which result from the restrictions on rare B-meson decays, the Higgs boson mass and the amount of dark matter in the Universe.

Analysis was done of neutrino–antineutrino pair production by electrons that move in polarized electromagnetic field of ultra high intensity (for example, laser pulse). A method was worked out that allows summing all partial harmonics thus accounting for nonlinear electrodynamic effects and peculiarities of neutrino production.

In the framework of the NICA project, the specialists on radiation safety conducted detailed simulation of double differential cross sections of nucleon production in interactions of aurum nuclei with the ring material with an energy of 4.5 GeV/nucleon on the GEANT4 programme, as well as of the dependences of lengths of fluence weakening and the neutron dose in the standard cement for the neutron energy up to several GeV and large shield thickness.

JINR radiobiologists studied the mechanisms of forming the radiation-induced cataract. For the first time the uniformity of molecular mechanisms in the origin of the age and radiation cataract was established. It was shown that the hidden damage of crystallines induced by heavy charged particles is uncovered at UV irradiation.

JINR staff members made a considerable contribution to the development of grid segments in JINR Member States. Besides, the Internet site of JINR, which was acknowledged as one of most efficient sites of the Tier2 level in the WLCG (Worldwide LHC Computing Grid) infrastructure, provided more than 40% of the total time spent for LHC tasks in RDIG. Above 4.5 million tasks were accomplished for almost a year.

JINR scientists obtained important results in physics research in external experiments. When analyzing experimental data from an ion run of muon pair production in the finite state, the JINR–RDMS group that works in the CMS experiment (LHC, CERN) discovered the effect of the yield suppression of excited states upsilon (in comparison to proton data). A new modified form of gluon distribution functions in proton was suggested in the framework of JINR participation in the studies at the ATLAS facility (LHC, CERN), which can be applied in both semi-hard and soft processes at LHC energies.

The involvement of JINR specialists in the Borexino experiment (Gran Sasso, Italy) brought the first experimental proof of the so-called *pep* reaction on the Sun where two nuclei of hydrogen and an electron produce deuterium.

Much attention was paid to the educational activities — one of the priority trends in JINR development. In 2011, more than 450 students from the basic chairs of JINR Member States universities and the «Dubna» University studied at the JINR University Centre. Above 70 students attended JINR postgraduate courses. In November 2011 the Russian Federal Education and Science Supervision Agency issued a perpetual license to the University Centre for the activities of the JINR postgraduate courses.

The application of modern technology for popularization of educational activities accomplished at the JINR UC fully strengthened the role of the educational component in JINR work. In 2011, a number of video conferences were held with teachers and senior school students from Russian schools.

The annual student practice courses, as well as the school of physics teachers from JINR Member States, which has already become traditional (the latter was organized jointly by JINR and CERN in 2009), were as fruitful as in previous years. That time, the special feature of the practice courses was in the fact that among participants were teachers not only from Russia but also from Bulgaria, and Russian school students.

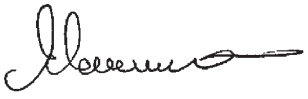
In 2011, Prime Minister of the Republic of Kazakhstan K. Massimov visited the Joint Institute for Nuclear Research and expressed great interest in deepening cooperation with JINR in the sphere of educational programmes and further development of cooperation between JINR and Kazakh scientific centres. The honorary guest was acquainted with advanced scientific trends and new projects at the Institute that could lay the foundation for further development of partnership relations between Kazakh scientific centres and JINR.

In the context of the development of international scientific cooperation, the new Agreement on cooperation signed in June 2011 between JINR and INFN (Italy) for a term of six years opens up new important prospects. Positive tendencies should be mentioned in the development of mutually advantageous cooperation between JINR and Serbia, as well as the visit of a representative delegation of the Chinese Academy of Sciences to JINR in October 2011. Close scientific contacts of JINR with research centres of the Republic of South Africa and Egypt continue to develop on a mutually beneficial basis.

More than 80 conferences, meetings, seminars and schools were held in 2011. These were organized solely by JINR and jointly with scientific centres of Russia, the USA, Germany, Finland, Austria, Poland, Czechia, Belarus, Ukraine, Georgia, Bulgaria, and Mongolia.

Among the bright events that concluded the year 2011 — the year of the Russian culture in Italy and of the Italian culture in Russia — was the Italy–Russia round-table conference held in Dubna, which consisted of two sections: «Astrobiology: New Ideas and Research Trends» and «Black Holes in Mathematics and Physics». The topics of the round-table conference included a wide range of issues on the origin of life on the planet Earth and in space, evolution on the Earth and in space, the existence of life in extreme conditions, etc. Important agreements were achieved on cooperation among scientists from Italy and JINR.

In 2011, the Committee of Plenipotentiaries of the Governments of JINR Member States unanimously elected by open ballot RAS Academician Viktor Anatolievich Matveev Director of the Joint Institute for Nuclear Research. Addressing the CP session with a keynote speech, V. Matveev spoke about his vision of the immediate and long-range tasks in the development of fundamental scientific research, innovative and educational programmes of JINR, and stressed that he intended to proceed from the uniqueness principle for the scientific policy worked out at the Joint Institute.



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