

Review of the Project

“Development of an open educational environment to support research priorities in nuclear physics”

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The Joint Institute for Nuclear Research deals with a wide range of scientific, engineering, technological and technical challenges. As an international scientific center the Institute needs to solve educational problems also involving modern information and communication technologies. The current Project will contribute to the development of educational content at the level of the leading research centers in order to attract talented young people and highly qualified specialists to work at the Institute, as well as to raise brand awareness of JINR and the NICA project for a wider audience.

1. Scientific importance, novelty aspects, and relevance of the Project

The implementation of research projects comparable to the NICA project makes an invaluable contribution to such a fundamentally important problem as the raise of educational and cultural awareness of people in Russia. The funds spent on the creation of such high-tech and sophisticated devices as high-energy accelerators of charged particles and multi-purpose detectors can largely serve as the investment into the education sector of the national economy. An extremely wide range of engineering, technological and technical tasks in the field of electrical engineering, magnetic technology, superconducting and low-temperature techniques, high frequency and pulse technology, devices for detecting particles and radiation, and many other areas of engineering challenges should be applied in order to train specialists and, in general, to perform an educational function, along with the scientific one. The integrated approach which includes the mega-project NICA and the development of a qualitatively new open educational environment is required.

First of all, it is the development of new educational programs to train specialists for work at the accelerator complex NICA in the mid-term and long-term perspective. Next, the integration of scientific and applied results obtained at the accelerator complex NICA into the curriculum of undergraduate and post-graduate education. The expected scientific results obtained at the NICA collider will undoubtedly broaden the horizons of the world's knowledge about the structure and evolution of matter at the early stage of the Universe evolution and, in the light of experimental data, will allow one to discover the unsolved mysteries of nature, such as, for example, the origin of the nucleon spin. Such scientific findings and technological solutions should be accompanied by popular-science and outreach projects intended for a wider audience, including school students. In the future, it will allow us to overcome a serious social problem – decline in young people's interest in scientific research and engineering professions.

Creation of a modern educational environment of continuous learning and training of highly qualified personnel in the framework of the mega-project “NICA complex” is a high-priority scientific task in the areas of information and telecommunication systems and fundamental research.

2. Expertise and technical resources allowing the team to implement the project within the specified terms

The Project team has extensive experience in the development of e-learning software for secondary and higher education, as well as in the development of multimedia interactive popular-science and educational outreach resources.

Over the past 10 years, the Project participants have developed electronic applications for the textbooks on various science courses in cooperation with “Prosveshchenie” Publishers”, e-learning courses for the leading universities of Russia published in the system of distance learning. They have also have developed sophisticated interactive 3D-models of the JINR basic facilities used at various events dedicated to the JINR 60th anniversary celebration and available in the JINR Visit Center and on JINR Laboratories’ websites. The Project team includes experts having extensive experience in the development of educational content conforming to modern teaching technologies of using e-learning tools in education. The Project participants also possess modern technologies for the development of educational portals and distance-learning systems, technologies of interactive 2D- and 3D-graphics and development of various knowledge assessment tools.

Over the past 2 years, the Project authors in cooperation with NRNU MEPhI have developed online courses for the most popular MOOC platforms – Coursera and edX. The Project participants in cooperation with RSA specialists have also developed the hardware-software complex “Virtual Laboratory of Nuclear Fission”. The complex includes a wide range of virtual laboratory works with the data obtained from the real experimental equipment. It allows employing this e-learning tool to train students for experimental work in nuclear physics.

The special attention should be paid to the development of multimedia interactive 3D-models of the NICA complex, taken as a whole and in details. The developed models are already available on the NICA project website. The activities related to this field should be continued and supported, as such the models will be used in the development of training courses and educational programs for the NICA project.

3. Adequacy of the requested funding to the tasks of the Project/theme

As a whole, the requested financial resources are adequate for the Project tasks stated for 2017–2019.

4. Availability of human resources at JINR and cooperating organizations

The strength of the Project is involvement of not only JINR specialists, but also representatives of universities of Russia, JINR Member States, and RSA. Only the cooperation of highly qualified specialists of JINR, the teachers, who understand the needs and specifics of the modern educational process, and experts in the development of advanced software and hardware systems, will enable the development of new educational programs and training courses related to the JINR research priorities, and their integration in the curriculum of JINR Member States’ universities.

The main emphasis of the review is made on the importance of the Project tasks related to the mega-project NICA and on the activity of the Laboratory of High Energy Physics. However, it

should be noted that one of the Project strengths is the fact that it covers all main scientific directions of JINR activity and is being implemented in close contact with the JINR laboratories.

In conclusion, it is worth noting that the creation of the open educational environment supporting research priorities in nuclear physics will allow developing open training courses and educational programs related to the NICA project and integrating them into the educational process of JINR Member States' universities. Moreover, the Project will contribute to the development of interactive multimedia 3D-models of the NICA accelerator complex, which can be used as an educational resource, as well as in outreach events. It will enhance the brand awareness of JINR and the NICA project for a wider audience.

In view of high practical relevance for JINR educational activities, it is recommended to provide financial support of the Project on a first-priority basis and in full.

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