Work plan within theme "Synthesis and properties of superheavy elements, structure of nuclei at the limits of nucleon stability" and under projects within theme for 2024

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The theme "Synthesis and properties of superheavy elements, structure of nuclei at the limits of nucleon stability" includes two research projects: "Investigation of heavy and superheavy elements" and "Light exotic nuclei at the borders of nucleon stability". The PAC approved the theme and projects at the 57th Session in June 2023. Research under the theme will be conducted at three FLNR accelerators: DC280, U400, and U400M. According to the upgrade plan for the U400M cyclotron, first experiments with secondary beams of radioactive nuclei under the project "Light exotic nuclei at the borders of nucleon stability" are anticipated in spring 2024. A large infrastructure research project "The U400R accelerator complex" will be launched in the Flerov Laboratory of Nuclear Reactions in 2024. According to the plan for the project implementation, the U400 cyclotron is to be reconstructed and thus will be placed in shutdown status in summer 2024. Therefore, experimental programmes conducted at the U400 and U400M accelerators in 2024 will be shortened.

One of the most important tasks within the project "Investigation of heavy and superheavy elements" is synthesis of new elements 119 and 120 at the SHE Factory. The results obtained in 2023 using the 54Cr beam in the 238U+54Cr reaction showed that the cross section for producing 288Lv was around 0.1 pb, thus we are expecting sufficient statistics in experiments aimed at the synthesis of new elements. The prospect of conducting experiments with 54Cr beams at DGFRS-II is discussed.

In 2024 the commissioning of a target 480 mm in diameter is planned at the SHE Factory. Thus, due to lower radiation and more efficient cooling, the beam intensity at the target will increase, thereby boosting experimental statistics and speeding up its collection. In 2024 large targets will be used, in particular, in experiments on the spectroscopy of the 286,287Fl decay products synthesized in the 242Pu+48Cа reaction, as well as for measuring the excitation function in the 54Cr+238U reaction. With a view to preparing for the synthesis of new elements 119 and 120, we will continue to produce and study the decay properties of previously unknown neutron-deficient isotopes formed as their decay products. Furthermore, preparations will continue for an experiment aimed at studying the chemical properties of flerovium, which may be conducted at the end of 2024.

Following the upgrade of the U400M accelerator, experiments as part of the project "Light exotic nuclei at the borders of nucleon stability" will be performed at ACCULINNA, ACCULINNA-II, and CORSET. During the U400 reconstruction, the CORSET spectrometer is planned to be installed at the U400M cyclotron. The proposed experiments with secondary beams include mutually complementary studies of the 6Не and 6Li structures in reactions wherein two valence nucleons are transferred to the target nucleus 4Не. Discussed are also the prospects of conducting comparative investigations of mechanisms for populating the low-energy spectrum of states in nuclei beyond the nucleon stability in (d,p) and (p,d) reactions with the radioactive 6Не and 8Не beams.