Brief information about the project

Name of the project	AP14972391 «Investigation of exotic states of 1p shell nuclei» (0122PK00739)
Relevance	In recent years, the study of light, weakly bound nuclei has not lost interest due to the successful development of experimental techniques. It is known that nucleons in light nuclei tend to group into clusters, the relative motion of which mainly determines the properties and characteristics of the nuclei under study. Exotic states in most cases have a sparse structure and increased size, reflected in root-mean-square radii. Such peculiar properties are manifested, for example, in the second excited state of the ^{12}C nucleus 7.65 MeV, which, in the framework of many well-known models, has a cluster structure. A similar behavior is also predicted for excited states in the ^{11}B and ^{13}C nuclei, possibly also having Hoyle states. Another most interesting phenomenon in nuclear physics is also the discovery of a neutron halo in some neutron-rich light nuclei. Until recently, the neutron halo was observed almost exclusively in the ground states of some radioactive nuclei. In ^{9}Be and ^{13}C nuclei, such states are known near neutron thresholds (states 1/2+, 1.68, and 3.09 MeV, respectively).
Purpose	The aim of the project is experimental and theoretical study of exotic excited states of light nuclei ^{9}Be and ^{13}C. Determination of new parameters and characteristics of the excited exotic state by analyzing it based on folding and modified diffraction models.
Objectives	1) measurement of differential cross sections of elastic and inelastic scattering, at the energy of incident deuterons of 14.5 and 18 MeV and helium isotopes (^{3}He and ^{4}He) 30 and 40 MeV on ^{9}Be and ^{13}C nuclei in a wide angular range. 2) analysis of the resulted differential cross sections for elastic and inelastic scattering of deuterons on ^{13}C nuclei within the framework of the optical model and the modified diffraction model to determine optimal parameters of the optical potential and the values of the root-mean-square radii of excited exotic states of 3.09, 8.86 and 9.9 MeV; 3) analysis of the resulted differential cross sections of elastic and inelastic scattering of helium isotopes (^{3}He and ^{4}He) on ^{9}Be nuclei within the framework of the optical model and the modified diffraction model to determine optimal parameters of the optical potential and the values of the root-mean-square radii of excited exotic state of 1.68 MeV. All three tasks will provide new information about root-mean-square radii and about interaction of accelerated

	stable deuterons and helium isotopes with ^{9}Be and ^{13}C nuclei.
Expected and achieved results	During the implementation of this project, the following results are expected: - differential cross sections ^{13}C(d,d*)^{13}C will be measured at E(d) = 14.5 and 18 MeV; - differential cross sections of reactions ^{9}Be(^{3}He,^{3}He*)^{9}Be and ^{9}Be(^{4}He,^{4}He*)^{9}Be will be measured at energies of 30 and 40 MeV; - new rms radii of exotic states (3.09, 8.86 and 9.9 MeV) of the ^{13}C nucleus at low energies will be determined within the modified diffraction model; - a new root-mean-square radius of exotic states (1.68 MeV) of the ^{9}Be nucleus at low energies of 30 and 40 MeV will be determined within the modified diffraction model. The databases required for local scientists and EXFOR will be expanded.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	1. Valiolda Dinara, PhD, h index – 3, Scopus author ID: 56165917100, ORCID: 0000-0003-2969-3720. 2. Janseitov Daniyar, PhD, h index – 6; Scopus Author ID: 56161954400, ORCID: 0000-0002-8355-3131.
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