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Search for halo structures in ^{8}Li

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One of the main directions of modern nuclear physics is the study of exotic nuclei far from the stability line, i.e. nuclei with an excess of neutrons or protons. One of the most famous representatives of exotic nuclei is halo.
In the A=8 multiplet, a halo was firstly discovered in ^{8}B in [1] based on increased quadrupole moment. It was shown that the halo structure is ^{7}Be core and a valence proton. It should be noted that the halo is detected despite the presence of both the Coulomb and centrifugal barriers. In [2], the presence of a proton halo in ^{8}B was confirmed using the total cross section, as well as the root-mean-square radius R_{rms} = 2.58 fm and the halo radius R_h = 4.24 fm. The question arises about the possibility of the halo in ^{8}Li. In [1], using the value of quadrupole moment for ^{8}Li, it is said that there is a thin neutron skin around the ^{7}Li core. In [2], using total cross section, it is stated that there is no halo in ^{8}Li. To analyze the possibility of the halo in ^{8}Li, we propose to use (d,p) reaction. Deuteron stripping is usually used as a sample of the single-neutron structure of nuclear states for last decades. The ^{7}Li(d,p)^{8}Li experiment was performed using the deuteron beam of the U-150M cyclotron at the Institute of Nuclear Physics (Almaty, Republic of Kazakhstan) at an energy of 14.5 MeV. The ^{7}Li isotope (enrichment ≈ 90%) was used as a target. The angular distributions were measured in the angle range from 18° to 80° (lab). Angular distributions were obtained for the ground and first two excited states 0.98 and 2.26 MeV.
[1] T. Minamisono et al., Phys. Rev. Lett. 69, 2058 (1992).
[2] G.A. Korolev et a., Phys. Lett. B 780, 200 (2018).

Section

Nuclear structure: theory and experiment

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