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Possible existence of neutron-proton halo in 6Li

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One of the most recent results was the development of an analog of the MDM method for the charge exchange reactions (3He, t), the use of which made it possible to determine the proton halo in the first excited state of the 13N nucleus. It turned out that this state has the same radius as the mirror state 1/2 +, 3.09 MeV in 13C, in spite of the fact that one of them lies under the threshold of neutron emission, and the second one lies above the threshold of proton emission. This observation allows us to take the next step and try to apply this approach to measure the radii of isobar - analog states. The increased radii in the first excited states of the 6He-6Li-6B triplet, which may also have a halo structure, are not excluded. The neutron halo in 6He is well known. A proton-neutron halo is predicted in the excited state of 0+, 3.56 MeV in 6Li, which lies only 137 keV below the 6Li -> 4He + p + n threshold. Its radius is not known, but it is predicted to be about 0.25 fm larger than the 6He radius. One can expect the appearance of a two-proton halo in the ground state of 6Be. As a first step, we analyzed the published differential cross sections for inelastic scattering of 3He + 6Li with the excitation of the 2.19 MeV, 3+ state at energies 34 and 72 MeV and 3.56 MeV, 0+state at energies 24.6 and 27 MeV. Probably the state 0+, 3.56 MeV has the same radius as its “Borromean” isobar analogue 6He. The increase in the radius predicted in [1] because of the more extended wave function p - n, apparently, does not take place. Thus, the transition from the Borromean to the tango structure does not change the radius of the state. We recall that the spatial structure of the 6He nucleus was predicted to be quite complex, in which correlations of two types appeared: “cigar” and “dineutron.” The question arises: does the structure of the state change so much when passing from 6He to the isobar analog in 6Li, which requires the introduction of a special kind of tango-halo. [1] K. Arai, Y. Suzuki, and K. Varga, Phys. Rev. C 51, 2488 (1995)

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