Study of the spatial dimensions of 6Li nuclear states by measuring differential cross sections for the 10B(7Li,6Li)11B reaction

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The angular distributions of the 1-n transfer reaction 10B(7Li,6Li)11B, as well as the elastic scattering of 7Li, were measured at E_lab = 58 MeV. Experiment was done using U-400 accelerator beam of the FLNR JINR, Dubna.
The attention was paid to ground state (g.s.) and excited (J= 0+, T= 1, E= 3.56 MeV) state of 6Li which is an isobar analogue state (IAS) of 2n-halo nucleus 6He.
Angular distribution for 1-step direct reaction 10B(7Li,6Li)11B with excitation of the 3.56 MeV state (6Li*) is present for the first time.*
The DWBA analysis of the differential cross section of the 10B(7Li,6Li)11B the 6Li_g.s. and 6Li(3.56 MeV) transition was performed. The optical model potentials were obtained by fitting of measured elastic scattering data and evaluating parameters for the output reaction channels. Phenomenological approaching based on solving an approximate equation for the reaction form factor was used to determine its radial dependence and empirical values of asymptotic normalization coefficient (ANC). Obtained values of ANC's for the 6Li_g.s. and 6Li*(3.56 MeV) states are similar to literature one. Comparison of the radial dependences of form factors shows that the wave function of the 6Li nucleus in excited (J= 0+, T = 1, E = 3.56 MeV) state has increased spatial dimension compared to the ground state, and in both cases some larger spatial size than the ground states of the 11B and 10B.Within the framework of our analysis, we can confirm that the radius of the 6Li nucleus in the 3.56 MeV state is larger than in the ground state.*
This result, obtained within the framework of the ANS analysis, is an argument in favor of the existence of a halo in the 6Li(3.56 MeV) state, while the question of a halo in 6Li_g.s. still leaves open.

Notes: