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Study of the ^{11}B nucleus states in the transfer reaction ^{10}B(^{7}Li, ^{6}Li)^{11}B

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One of the most striking examples of a nuclear cluster structure consisting of three weakly interacting α-particles is the second excited 0^+ state of the ^{12}C nucleus at excitation energy of 7.65 MeV (the Hoyle state). The properties of the Hoyle state can serve as arguments supporting the theory of α-particle condensate in nuclei [1].
In our work on the analysis of α-particle scattering on the ^{11}B nucleus [2], it was shown that the $3/2^-$ 8.56 MeV state is an analog of the Hoyle state and has an increased radius, similar to that of the Hoyle state in ^{12}C.
A new experiment was performed using a ^{7}Li ion beam from the U-400 accelerator at the FLNR JINR (Dubna) at the energy of 58 MeV. Angular distributions were obtained for the reaction ^{10}B(^{7}Li, ^{6}Li)^{11}B for the ground state and the 8.56 MeV excited state of the ^{11}B nucleus.
The experimental data were analyzed within the optical model and the distorted wave Born approximation (DWBA). The radial dependences of the form factors and the ANC (asymptotic normalization coefficient) values for the studied states were obtained. The ANC values for the ground state of ^{11}B consistent with literature data. For the 8.56 MeV state, the results were obtained for the first time. A comparison of the radial dependences of the form factors shows that the wave function of the ^{11}B nucleus in the excited ^{11}B (8.56 MeV) state has an increased spatial size compared to the ground state, which may indicate an enlarged radius of this state.

1. A. Tohsaki, H. Horiuchi, P. Schuck, and G. Rőpke, Phys. Rev. Lett. 87, 192501 (2001).
2. A. N. Danilov, A. S. Demyanova, S. V. Dmitriev [et al.] // Nuclear physics. –2015. –V. 78, № 9. –P. 828.

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