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Cluster rotational bands in 11B

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Differential cross-sections of the 11B + α inelastic scattering at E(α) = 65 MeV leading to the most of the known 11B states at the excitation energies up to 14 MeV were measured [1]. The data analysis was done by DWBA and in some cases by the Modified Diffraction Model [2] allowing determining the radii of the excited states. The radii of the states with excitation energies less than ~ 7 MeV with the accuracy not less than 0.1-0.15 fm coincide with the radius of the ground state. This result is consistent with the traditional view of the shell structure of the low-lying states in 11B. Most of the observed high-energy excited states are distributed among four rotational bands:
K = 3/2-: 8.56 (3/2-) – 10.34 (5/2-) – 11.60 – 13.14 (9/2-) MeV,
K = 1/2+: 6.79 (1/2+) – 9.88 (3/2+) – 11.60 (5/2+) – 13.16 (7/2+) MeV,
K = 3/2+: 7.98 (3/2+) – 9.27 (5/2+) – 10.60 (7/2+) – 12.63 (9/2+) MeV,
K = 5/2+: 7.29 (5/2+) – 9.19 (7/2+) – 11.27 (9/2+) MeV.

Fig. 1. Predicted [3,4] rotational bands in 11B at excitation energies higher 7 MeV. For comparison, rotational band [5], based on the Hoyle state (0+2. 7.65 MeV) of 12C, is shown.

The moments of inertia of band states are close to the moment of inertia of the Hoyle state of 12C. The determined radii, related to these bands, are 0.7 - 1.0 fm larger than the radius of the ground state, and are close to the radius of the Hoyle state. These results are in agreement with existing predictions about various cluster structure of 11B at high excitation energies.

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