THE PROPERTIES OF ^{12}C STATES AT HIGH EXCITATION ENERGIES

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The experiment was done on K-130 cyclotron in Jyväskylä (Finland) to study ^{11}B(^{3}He,d)^{12}C reaction with energy $E(^3\text{He}) = 25$ MeV. The aim of the experiment was to determine the properties of high-lying excited state of ^{12}C: 1) to verify the spin-parity value of the 13.35 MeV state (2^- [1–3] or 4^- [4–5]); 2) to search for states with large spin (5^- or 6^+) around the excitation energy 20 MeV and check if they belong to rotational bands.

From our experimental data spin-parity of the 13.35 state was confirmed to be 4^-.

In [6] new 22.4 (5^-, $T = 1$) MeV state was observed and an assumption was made that it is a member of proposed negative parity branch (9.64 (3^-) – 13.35 (4^-)) of g.s. rotational band (g.s. (0^+) – 4.44 MeV (2^+) – 14.08 MeV (4^+)). However, there are facts which contradict this prediction: 1) all states except 22.4 MeV have isospin $T = 0$; 2) in [7] was shown that 9.64 MeV state has an increased radius while all other members have normal radii.

In our experiment we observed the state at 22.4 MeV. Coupled-channel analysis of angular distribution for this state showed the following variants of spin-parity: 5^- with probability of 30% and 6^+ with probability of 70%. The question remains whether we can assume that the state of 22.4 MeV is the next member of the Hoyle band: 7.65 (0^+) – 9.9 (2^+) – 13.75 (4^+).

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