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SPECTROSCOPY OF HEAVY HELIUM ISOTOPE 9He IN REACTIONS OF STOPPED PION ABSORPTION

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The unbound heavy helium isotope 9He has one of the largest neutron-to-proton ratios. In spite of a significant number of experimental and theoretical works, the problem of the spectroscopy of 9He remains open [1, 2]. Even for the ground state, there is uncertainty in determining the resonance energy and spin-parity (1- or 1+). The situation with the excited states of 9He is also uncertain. The results obtained in different studies differ more strongly than the given measurement errors. One of the reasons for this discrepancy is poor statistics. Highly excited (Ex ˜ 7 MeV) states were observed only in two works [3, 4]. In this work, the study of 9He spectroscopy is carried out on the basis of a joint analysis of the results obtained in three absorption reactions of stopped pions: 11B(π-,pp)X, 14C(π-, p4He)X and 14C(π-, d3He)X. The experiment was taken at low energy pion channel of LANL with two-arm multilayer semiconductor spectrometer. In these measurements missing mass resolution was 1 MeV for 11B target and 3 MeV for 14C target.
The advantages of using this method are the ability to study a wide range of excitation energies (up to 30 MeV) with sufficiently high statistics, which was previously demonstrated by us for 6-8He isotopes [5-7]. Reaction (π-,pp) has a pronounced selectivity: the yield of the ground state of the residue is strongly suppressed [7].
s-wave resonance in 9He just above threshold is not observed in all three reactions. The position of the lowest-lying state (Er =1.3(3) MeV) is consistent with the results of most other measurements [1, 2]. For the first time highly excited states are observed in following reactions: 11B(π-,pp)X (Er =10.5(2) MeV and G = 1.5(5) MeV) and 14C(π-, p4He)X (Ex ˜ 12.5 MeV and G ˜1.5 MeV).

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