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Study of 4n continuum in the 8He + 2H collisions at ACCULINNA-2 fragment separator

Recently in the experiment [M. Duer et al., Nature 606, 678 (2022)] a peak, reported as “resonance-like structure” in 4n system, was observed in the 1H(8He,pα)4n reaction at E(4n) = 2.37 MeV with Γ = 1.75 MeV. Here we present the results of the experiment performed at ACCULINNA-2 fragment separator with a 26 AMeV secondary 8He beam to study low-energy continuum of 4n system in the reactions on deuterium target. These data were previously analyzed for the studies of 7H and 6H systems in the 2H(8He,3He)7H and 2H(8He,4He)6H reactions [I.A. Muzalevskii et al., Phys. Rev. C 103, 044313 (2021), E.Yu. Nikolskii et al., Phys. Rev. C 105, 064605 (2022)]. Evidence for a hump in the 4n continuum at 3.5 ± 0.7 and 3.2 ± 0.8 MeV was observed in the 2H(8He,6Li)4n and 2H(8He,3He)7H⟶3H+4n reactions, respectively. The obtained statistics is very low (6 and up to 40 events) corresponding to very low cross sections of few microbarns or tens of microbarns. The background conditions for the 2H(8He,6Li)4n reaction are shown to be good, favoring the physical nature of the observed events. The 2H(8He,3He)7H⟶3H+4n process transforms to the 2H(8He,6Li*)4n reaction in the limit of the highest 7H decay energies. The population of the low-energy region in the 4n spectrum is found to be correlated with the population of the lowest 6Li states in the 3He+3H continuum.
Theoretical calculations of 8He in a five-body α+4n and of 4n in a four-body hyperspherical models are presented. The 8He wave function is shown to contain strong specific correlations, which may give rise to very low-energy structures in 4n continuum in extreme-peripheral reaction scenarios.

Section

Nuclear physics (Section 1)

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