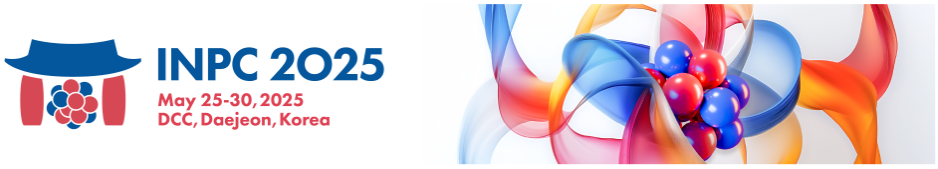

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Population of tetraneutron continuum in reactions of 8He on deuterium

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The search for the the multineutron systems is old, but still unsettled problem of the low-energy nuclear physics. Numerous attempts of search for the existence of the tetraneutron as a bound or resonant state have been realized using multiple approaches (e.g. uranium fission reactions, pion-induced double-chargeexchange and transfer reactions). However, no certain evidence of tetraneutron existence have bee obtained.

The situation has changed with the recent studies of 4n population in reactions with 8He, where four neutrons can be found in a spatially-separated neutron-halo configuration. The result of the recent 1H(8He,pα) experiment [1] showed the population of the "resonance-like structure" at E(4n) = 2.37 MeV with Γ = 1.75 MeV.

In this work we demonstrate that an evidence for the low-energy structures analogous to the observation of [1] can be found in the other reactions with the 8He beam. The high intensity 8He secondary beam with energy 26 A MeV, produced at the ACCULINNA2 fragment separator [2], was used for the population of the tetraneutron in the 8He+d interaction. The detection the low-energy recoils 6Li and 3He made with high energy and angular resolution allowed us to reconstruct the tetraneutron missing-mass spectra in the two reactions: 2H(8He,6Li)4n and 2H(8He,3He)7H->3H+4n [3]. Both of these approaches provided evidence for a hump in the 4n continuum at about 3.5 MeV. The applied experimental techniques, the results of the data analysis and simulations are presented in the report, as well as possible theoretical interpretation of the data.

[1] M. Duer et al., Nature 606 (2022) 678–682.
[2] A.S. Fomichev, L.V. Grigorenko, S.A. Krupko, S.V. Stepantsov, G. M. Ter-Akopian, The EPJ A 54 (2018) 97.
[3] I.A. Muzalevskii et al., arXiv:2312.17354, Phys. Rev. C (in print).

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