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Experimental study of ^{4}n with ^{8}He(p,2p) reaction

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The tetraneutron(^{4}n), has attracted a lot of attention in the last decades. Its existence, whether as bound or resonant states, is of fundamental importance in nuclear physics, serving as a sensitive probe to investigate the nuclear force free from the Coulomb interaction. In case the four constituent neutrons are detected, it will also provide direct information about many-neutron correlations, which are crucial for a deeper understanding of neutron stars. Despite many experimental and theoretical efforts in the past decades, there is still no unambiguous conclusion on its existence or non-existence as a low-lying resonant state [1-6]. No measurements based on four-neutron detection have hitherto been reported.

We carried out new measurement on tetraneutron by using the ^{8}He($p,2p$)^{7}H$\{t+^{4}n\}$ reaction in inverse kinematics at RIKEN RIBF facility. Taking advantage of the SAMURAI spectrometer [7], the liquid hydrogen target MINOS, an array of NaI crystals, and a large neutron detector array combining the NeuLAND demonstrator from GSI and the existing NEBULA array, we achieved the kinematically complete measurement of all the reaction products including the four decay neutrons.

The multi-neutron analysis is now in progress, and some preliminary results will be presented.

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Field of your work

Experiental nuclear physics

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