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Missing-mass spectroscopy of the 4n system by exothermic double-charge exchange reaction 4He(8He, 8Be)4n

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Tetra-neutron systems in nuclei have attracted considerable attention since candidates of bound tetra-neutron system were reported[1]. While later theoretical paper using ab- initio calculations[2] suggest that bound tetra-neutron cannot exist, the possibility of the tetra-neutron system forming a resonance state is still an open and fascinating question. We performed missing-mass spectroscopy of the 4n system via the exothermic double- charge exchange reaction 4He(8He,8Be)4n. The experiment was carried out at the RI Beam Factory (RIBF) at RIKEN using the SHARAQ spectrometer and liquid He target system. The secondary beam, 8He at 190A MeV, had a large internal energy, it was possible to produce the 4n system in small momentum transfers of less than 20 MeV/c. To obtain the missing-mass spectrum, we measured momentum of the 8He beam with the High-Resolution Beamline and momentum of two alpha particles which were the decay products of the 8Be projectile, with the SHARAQ spectrometer. In the present analysis, a method for treating multi-hits in Multi-Wire Drift Chambers (MWDCs) under high beam rate condition (2 MHz) was developed for good statistics. At focal plane Cathode Readout Drift Chamber (CRDC), 8Be can identified by measuring the invariant mass of the coincident two-alpha particle with a good signal-to-noise ratio. We can be identified about a hundred candidate events for 4n system. We will show the preliminary result of missing-msss spectrum and evaluation of the cross section.

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