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Invariant mass spectroscopy of 17C via one-neutron knockout reaction

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The nuclei far from beta-stability often exhibit exotic properties, such as shell-gap quenching and large nuclear deformation. An appearance of anomalous parity intruder states at a low excitation energy region, for example, will provide a clue to identify the phenomena. The present study focuses on low-lying negative parity states in 17C above the neutron decay threshold. In the neighboring 16C nucleus, the lowest-lying negative parity state was detected at a relatively high excitation energy of Ex = 5.45(1) MeV (Y. Satou et al., Phys. Lett. B 728, 462 (2014)). In 17C, on the other hand, the lowest-lying negative parity state is expected to be located at a much lower excitation energy region. A shell-model calculation suggests the presence of the first 1/2- state at Ex = 0.783 MeV (E. C. Simpson et al., Phys. Rev. C 79, 024616 (2009)). Ueno et al. have observed a lowest-lying negative parity state at Ex = 2.71(2) MeV by the beta-delayed neutron measurement of 17B (H. Ueno et al., Phys. Rev. C 87, 034316 (2013)). Raimann et al. have suggested an unbound state at Ex = 1.18(1) MeV with indefinite spin-parity from the beta-decay study (G. Raimann et al., Phys. Rev. C 53, 453 (1996)).
To clarify the situation and further to add spectroscopic information, the measurement was performed for the 12C(18C,17C*) one-neutron knockout reaction channel at 250 MeV/nucleon using the SAMURAI spectrometer at RIKEN-RIBF, during the first physics runs of the apparatus. The nucleon knockout reaction utilizing the secondary beams in inverse kinematics has become recognized as a powerful tool for spectroscopy of the nuclei far from beta-stability. In the presentation we will discuss the details of the measurement and analysis, by focusing on an attempt to extract the orbital angular momenta of the low-lying states in 17C from the parallel momentum distributions of the knockout residues.

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