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Unbound states in 17C probed via single-neutron removal from 18C at 245 MeV/u

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A study of unbound states in 17C by means of one-neutron knockout from first moving 18C beam at an energy of 245 MeV/u on a carbon target was performed at RIKEN-RIBF laboratory utilizing SAMURAI [1]. The energy spectrum of unbound 17C constructed from momentum vectors of the forward going beam velocity 16C fragment and neutron covered an energy range of the decay neutron below about 6 MeV in the center of mass of 17C*. The adopted experimental scheme was featured by (1) high detection efficiencies for decay neutrons which inherently acquire high velocity in the laboratory, (2) large coverage of phase space of the final decaying system due to kinematical focusing of decay products toward forward angles, (3) large geometrical acceptance down to a vanishing relative energy Erel ensured by magnetic separation of charge fragments and neutrons, (4) maintained good Erel resolution well suited for spectroscopy. The Erel spectrum was characterized by two resonances at Erel=1.92 and 3.24 MeV and a bump at Erel~0.7 MeV. With Sn=0.735(18) MeV, the former two states turned out to correspond to the Ex=2.71(2) and 3.93(2) MeV states reported in a β-delayed neutron spectroscopy study of 17B [2], where respective Jπ assignments of 1/2- and 3/2- have been suggested with the assumption that these were populated through the Gamow-Teller transition. Momentum distributions of the knockout residue for the corresponding states, well matched to those of p-wave neutron removal, provided a model independent confirmation of negative parity assignments for these states. The proposed level scheme of 17C was compared with a range of different shell-model predictions; it turned out that the YSOX shell-model interaction [3], developed from the monopole-based universal interaction and incorporating a larger model space in terms of $\hbar\omega$, gave a consistent account of it, including the locations of the 1/2- and 3/2- cross-shell states.

[1] T. Kobayashi et al., Nucl. Instrum. Methods Phys. Res., Sect. B 317, 294 (2013).

[2] H. Ueno et al., Phys. Rev. C 87, 034316 (2013).

[3] C. Yuan et al., Phys. Rev. C 85, 064324 (2012).

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