Nuclear structures near and beyond the neutron drip line studied by breakup reactions at SAMURAI
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Some of the first results from kinematically complete measurements of breakup reactions on neutron-rich boron to oxygen isotopes, along and beyond the neutron drip line, are presented and discussed. These experiments were performed at the recently-commissioned large-acceptance multi-purpose spectrometer SAMURAI (Superconducting Analyser for Multi-particles from Radio-Isotope Beam) at the new-generation RI beam facility, RIBF, at RIKEN. The experiments aimed at probing the two-neutron Borromean halo nuclei, $^{19}$B and $^{22}$C, and at exploring the heavy oxygen isotopes, $^{25,26}$O, which are beyond the neutron drip line. The study of $^{19}$B and $^{22}$C has been made primarily by the Coulomb breakup, which is sensitive to the halo states and associated two-neutron correlations [1,2]. $^{22}$C has drawn much attention due to the possibility that it has the largest halo known [3]. In addition, $^{22}$C may also exhibit features consistent with the new magic number $N=16$, as was recently suggested by our inclusive measurement of the momentum distribution of $^{20}$C following breakup on a C target [4]. $^{25}$O and $^{26}$O have drawn much attention since these unbound nuclei may have keys to understand why the neutron drip line ends anomalously closer to the stability for oxygen isotopes. $^{25}$O and $^{26}$O have been produced by the proton removal reactions on $^{26}$F,$^{27}$Ne, and $^{27}$F,$^{28}$Ne, respectively, at 220-250 MeV/nucleon. Preliminary data are shown and discussed. Finally, some perspectives on future projects using the SAMURAI facility are presented.