Structure of ^{18}B

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The investigation of the light neutron-rich dripline nuclei, including in particular those exhibiting halos, is a central theme of nuclear structure physics. In the present work a series of measurements, aimed at elucidating the structure of the two heaviest candidate two-neutron halo systems, ^{19}B and ^{22}C[1–3], and the associated unbound sub-systems ^{18}B and ^{21}C, the level schemes of which are critical to the defining the ^{17}B-n and ^{20}C-n interactions for three-body models, have been undertaken. In addition to being of direct importance to halo physics, ^{18,19}B and ^{21,22}C are of considerable interest in terms of the evolution of shell-structure far from stability as they span the N=14 and 16 subshell closures below doubly-magic ^{22,24}O.

The measurements were accomplished using the SAMURAI spectrometer[4] coupled to the large area neutron array NEBULA[5] and were performed as part of the first phase of SAMURAI experiments. The analysis to date has concentrated on the fragment+neutron channels and, in particular, ^{17}B+n which is known to exhibit a strongly interacting virtual s-wave threshold state[6]. Beyond the intrinsic physics interest noted above, a well defined threshold state provides an ideal means to validate the calibration and analysis procedures.

In addition to populating ^{18}B via proton removal from ^{19}C (which should populate almost exclusively s-wave strength), the complementary probe of neutron removal from a ^{19}B beam has been investigated. Figure 1 shows the reconstructed ^{17}B+n invariant mass (or relative energy) spectra for the two reactions. As may be clearly seen the proton removal populates a very narrow threshold structure, the form of which is consistent with the s-wave virtual state deduced by Spyrou *et al.*[6]. The neutron removal, however, in addition to the threshold peak shows clear evidence for the population of a state or states in the region of 0.5–1 MeV.

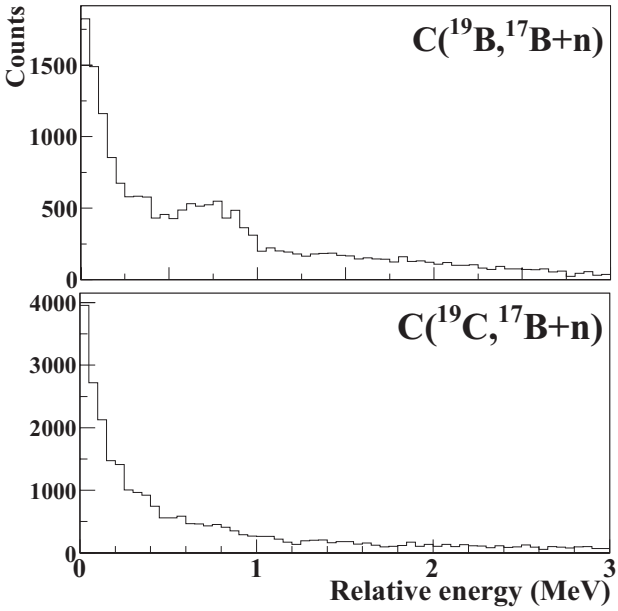

Fig. 1. Preliminary results for the ^{17}B+n relative energy spectra obtained for proton and neutron removal reactions at 240 MeV/nucleon.

The further analysis of these preliminary results is currently underway as are the data sets for the analogue reactions populating ^{21}C.

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