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Structure of the unbound systems $^{10,12}\text{Li}$ and ^{13}Be

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The unbound systems $^{10,12}\text{Li}$ and ^{13}Be have been studied via nucleon removal from a ^{14}B beam of 35 MeV/nucleon. The invariant mass spectra were reconstructed from the measured $^9\text{Li-n}$ and $^{12}\text{Be-n}$ coincidences. Simulations, taking into account the effects of the experimental setup and the reaction, were developed. The reconstructed decay energy spectra and momentum distributions were interpreted using theoretical lineshapes folded with the experimental response, as well as uncorrelated distributions obtained from the data by event mixing. In the case of ^{10}Li , the data were reproduced with an s-wave virtual state of scattering length $a_s = -10 \pm 3$ (stat) ± 3 (syst) fm, combined with an $l = 1$ resonance of energy $E_r = 0.55 \pm 0.02$ (stat) ± 0.05 (syst) MeV and a width of 0.35 ± 0.05 (stat) ± 0.15 (syst) MeV. This result confirms the $1p_{1/2}$ - $2s_{1/2}$ inversion.

For ^{12}Li , evidence was found for excited states with an energy between 0.2 and 0.8 MeV above the threshold.

In the case of ^{13}Be , the decay energy, as well as the other observables, were reproduced assuming an $l = 0$ resonance at 0.7 ± 0.05 (stat) ± 0.07 (syst) MeV and a width of 1.7 ± 0.1 (stat) ± 0.1 (syst) MeV, combined with an $l = 2$ resonance with energy $E_r = 2.4 \pm 0.1$ (stat) ± 0.1 (syst) MeV and a width of 0.6 ± 0.2 (stat) ± 0.1 (syst) MeV.

This hypothesis is supported by the selectivity of proton knockout, whereby the neutron configuration of the states populated in ^{13}Be should directly reflect that of ^{14}B .

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