C(^{14}B,^{13}Be) 2014Ra07

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, C. G. Sheu and J. E. Purcell	NDS 198,1 (2024)	1-Aug-2024

2004Le29: ^{12}C(^{14}B,^{13}Be) E=41 MeV/nucleon, Measured ^{12}Be+n relative energy spectrum. Preliminary data from GANIL. The relative energy spectrum is fit with an s-wave resonance at low energies (≈800 keV), along with a d-wave resonance around 2 MeV and perhaps some influence from a higher state.

2014Ra07: XUNDL dataset compiled by TUNL, 2014. Includes ^{12}C(^{15}B,^{13}Be) reaction.

Beams of 35 MeV/nucleon ^{14,15}B ions were separately tuned by fragmenting a 55 MeV/nucleon ^{18}O beam on a thick ^{9}Be target at GANIL. The beams were optimized at the LISE target position, where nuclides were clearly identified event-by-event via time-of-flight. The incident beam particle trajectories were measured using two position sensitive drift chambers, and the position on a ^{nat}C target was determined with a resolution of ≈1.5 mm (FWHM).

Reaction products were detected by either a 5×5 cm^2 position sensitive ΔE-ΔE-E Si-strip array or by the 90 element DEMON neutron array. The ^{12}Be+n events were analyzed for the one proton removal reactions on ^{14}B, while ^{12}Be+n+n events were analyzed for ^{15}B breakup events. In the case of the ^{14}B→^{13}Be+p→(^{12}Be+n)+p breakup events, the decay energy is straight forward to determine. On the other hand, the breakup of ^{15}B→^{13}Be+n+p→(^{12}Be+n)+n+p can involve more complex processes and requires further analysis to consider the two neutrons in the final state and potential involvement of ^{14}Be states; essentially a non-resonant continuum shape that is generated by random fragment-neutron event mixing is subtracted from the net kinematic energy reconstructed spectrum.

The potential systematic involvement of ^{12}Be excited states was evaluated by analyzing the γ-ray energy deposited in the DEMON array for ^{12}Be+γ events. Limits of ≈<5% were estimated for participation of excited states.

The analysis of ^{15}B→(^{12}Be+n+n)+p data indicated that ^{14}Be*(1.5 MeV) breakup events, with E(^{12}Be+n+n)<800 keV, contribute significantly to the structure of the ^{12}Be+n relative energy spectrum, by creating/enhancing a peak in the spectrum at E(^{12}Be+n)≈200 keV.

Initial analysis suggested that the ^{14}B breakup data could be fit with either a single E(^{12}Be+n)=2.40 MeV *20* resonance with Γ=0.90 MeV *22*, or a better fit with s-wave and d-wave resonances located at E(^{12}Be+n)=0.70 MeV *11* and 2.40 MeV *14* with Γ=1.70 MeV *22* and 0.70 MeV *32* respectively.

A significant discussion on the shell structures of both, the N=9 isotones and the ^{12}Be structure, led to a third interpretation, which is preferred by the authors. The data are well fit by $J^\pi=1/2^+$ and $5/2^+$ resonances at E(^{12}Be+n)=0.40 MeV *3* and 0.85^{+15}_{-11} MeV with Γ=0.80^{+18}_{-12} MeV and 0.30^{+34}_{-15} MeV, and a higher energy $J^\pi=5/2^+$ state at E(^{12}Be+n)=2.35 MeV *14* with Γ=1.50 MeV *40*.

^{13}Be Levels

E(level)[#]	J^π[@]	Γ	E′ (MeV)[†‡]	Comments
0	$1/2^+$	0.80 MeV *+18−12*	0.40 *3*	E(level): The state has an intensity defined as I=1.0.
0.40×10^3 *15*	$5/2^+$	0.30 MeV *+34−15*	0.85 *15*	E(level): From E(^{12}Be+n)=0.85 MeV *+15−11*. E(level): The state has an intensity of I=0.40 *7* relative to the E_{res}=0.40 MeV state.
1.90×10^3 *14*	$5/2^+$	1.50 MeV *40*	2.35 *14*	E(level): The state has an intensity of I=0.80 *9* relative to the E_{res}=0.40 MeV state.

† E′ is a relative excitation energy scale with E′=0 at the neutron separation energy. We use this scale because most articles report level energies with respect to the n+^{12}Be$_{g.s.}$ center of mass energy.

‡ From (2014Ra07).

The ground state is taken as $E_{c.m.}$(n+^{12}Be$_{g.s.}$)=0.45 MeV *1*; see Adopted Levels.

@ From analysis of the n+^{12}Be energy distributions and associated γ rays of (2014Ra07).