## ${}^{11}B(t,p)$ 1964Mi04,1978Aj02

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

1960Mu07: <sup>nat</sup>B(t,p) E=5 MeV;  $\theta$ =10°-61°;  $\Delta E_{res}$ =15 keV; Q=-0.233 MeV 4 and  $\Delta M$ =20.397 MeV 4. University of Manchester. 1962Ma19: <sup>11</sup>B(t,p) E=3.3 MeV; <sup>13</sup>B ions were produced in a 2 mg/cm<sup>2</sup> <sup>11</sup>B target at the University of Manchester. The <sup>10</sup>B content was measured to be less than 0.2%. Beam on/beam off periods were 100 ms, with counting starting 5 ms after the beam was removed and lasting an additional 65 ms. The  $\beta$  and  $\gamma$  particles were measured in singles and coincidence mode using a plastic phosphor detector for  $\beta$ s and a NaI scintillator for  $\gamma$  rays. The decay is mainly to <sup>13</sup>C. Deduced ratio of <sup>13</sup>B/<sup>12</sup>B lifetimes =0.86 2 initially resulting in  $T_{1/2}$ =18.6 ms 5; using the present  $T_{1/2}(^{12}B)$ =20.22 ms 4 gives 17.39 ms 41. Deduced  $\beta$  branch to  $^{13}C^*(3.67 \text{ MeV } 2)$  as 7.0% 15 and set an upper limit for delayed neutrons as <1.5%. Other limits are set.

1964Mi04: <sup>11</sup>B(t,p) E=11 MeV. Tritons from the Aldermaston Tandem generator impinged on a  $\approx 50 \ \mu g/cm^2$  98.6% enriched <sup>11</sup>B target. Reaction protons were measured using a multi-channel magnetic spectrometer. The ground state and nine excited states were observed and measurements were taken over for  $\theta \approx 2^{\circ} - 170^{\circ}$ . The l and  $J^{\pi}$  values were determined via plane-wave analysis.

1968Ch28: <sup>11</sup>B(t,p) E=3.0 MeV. <sup>13</sup>B nuclei were produced via triton bombardment of a natural boron target at the Nippon Atomic Industry Group Laboratory in Kawasaki Japan. The beam was chopped and the beam-off period permitted counting for at least 80 ms. The target was surrounded by a pile of paraffin blocks and the yield of  $\beta$ -delayed was counted with a BF<sub>3</sub> scintillator counter. Analysis of the neutron counting rate indicated  $T_{1/2}=16$  ms *I*. Additionally, a plastic scintillator counter was placed near the target to count decay  $\beta$  rays. By comparing the  $\beta$  and neutron yields  $\%\beta$ -n $\approx$ (0.52 26) was determined.

1969Jo21: <sup>11</sup>B(t,p) E=3.0 MeV. The  $\beta$  decay of <sup>13</sup>B was studied at the BNL Van de Graaff.  $\beta$ ,  $\beta\gamma$  and  $\beta$ n measurements permitted a determination of the branching ratios to  ${}^{13}C$  states. The  $\beta$ -n branches through  ${}^{13}C^*(7.55, 8.86)$  are measured with 0.094% 20 and 0.16% 3.

1971Wi07: <sup>11</sup>B(t,p) at 3.0 MeV at BNL. Measured  $\beta$ s from <sup>13</sup>B decay using a plastic scintillator. Deduced T<sub>1/2</sub>=17.33 ms 17.

1971Wi09: <sup>11</sup>B(t,p). <sup>13</sup>B ions, produced using a 2 MeV triton beam on a <sup>11</sup>B target at the BNL Van de Graaff, were collected in Au, Pt and Pd metallic stopper foils that were held in a strong magnetic field. Measured g=2.11808 34.  $\mu$ =+3.17712  $\mu$ N 51 was deduced from analysis of the  $\beta$ -decay asymmetries. See also (1973HaZV).

1974A112: <sup>11</sup>B(t,p) E<sub>t</sub>=3 MeV. Measured  $\%\beta$ -n=(0.022 7) at BNL Van de Graaff facility.

1978Aj02: <sup>11</sup>B(t,p), A series of (t,p) reactions were studied at  $E_t=23$  MeV at the LANL three-stage Van de Graaff facility. The reaction products were momentum analyzed in a broad range magnetic spectrometer for  $\theta = 5^{\circ} - 55^{\circ}$ . Eighteen states up to E<sub>x</sub>=11.8 MeV were reported. Widths are deduced for the higher-lying states, and L values are deduced for  $^{13}B(0, 6.93 \text{ MeV})$ .

1983An15: <sup>11</sup>B(t,p), The authors determined Q=-233.54 keV 100 by measuring the <sup>11</sup>B(t,p) reaction protons at  $\theta$ =28°-40° using a  $30 \ \mu g/cm^2$  target at the Strasbourg Van de Graff. Using this,  $\Delta M(^{13}B)=16562.17$  keV 104 was deduced. The authors evaluated the IMME mass equation for the A=13 quartet.

2006Ge21: The <sup>11</sup>B(t,p) excitation function was measured for  $E_t=2.53-6.95$  MeV using the RFNC EGP-10 Tandem accelerator; The measurement utilized activation and off-line counting techniques and deduced information on <sup>14</sup>C.  $T_{1/2}$ =16.59 ms 2 was also deduced. Also see (2002GeZT, 2005GeZY).

## <sup>13</sup>B Levels

E(level) <sup>†</sup>	$J^{\pi \ddagger}$	$T_{1/2}$ or $\Gamma^{\dagger}$	L‡	Comments
0	3/2-	17.33 ms 17	0	$\mu$ =+3.17712 51 (1971Wi09)
				g=2.11808 34 (1971Wi09)
				E(level): (1983An15) deduced Q= $-233.36$ keV 100 and $\Delta M=16562.17$ keV
				104. Analyzed IMME equation.
				$T_{1/2}$ : From 17.39 ms 41 (1962Ma19) and 17.33 ms 17 (1971Wi07); see also
				16 ms 1 (1968Ch28) and 16.59 ms 2 (2006Ge21).
				$J^{\pi}$ : (1960Mu07).
3483 5	(1/2,3/2,5/2)+		1	E(level): Weighted average of 3483 keV 5 (1964Mi04) and 3482 keV 10 (1978Aj02).
3533 5	(1/2,5/2,7/2)-		2	E(level): Weighted average of 3533 keV 5 (1964Mi04) and 3531 keV 10 (1978Aj02).
3681 5	(1/2,3/2,5/2)+		1	E(level): Weighted average of 3681 keV 5 (1964Mi04) and 3681 keV 10 (1978Aj02).
3713 5	(1/2,5/2,7/2)-		2	E(level): Weighted average of 3712 keV 5 (1964Mi04) and 3715 keV 10
				Continued on next page (footnotes at end of table)

## $^{11}$ **B**(t,p) 1964Mi04,1978Aj02 (continued)

## <sup>13</sup>B Levels (continued)

E(level) <sup>†</sup>	$J^{\pi \ddagger}$	$T_{1/2}$ or $\Gamma^{\dagger}$	L <sup>‡</sup>	Comments
			_	(1978Aj02).
4129 10	$(1/2, 5/2, 7/2)^{-}$		2	E(level): Average of 4130 keV <i>10</i> (1964Mi04) and 4128 keV <i>10</i> (1978Aj02).
4827 10				E(level): Weighted average of 4820 keV 10 (1964Mi04) and 4834 keV 10 (1978Ai02).
5017 10	(1/2,3/2,5/2)		1	E(level): Average of 5010 keV 10 (1964Mi04) and 5023 keV 10 (1978Aj02).
5106 10		60 keV 10		
5387 10		14 keV 4		E(level): Average of 5380 keV 10 (1964Mi04) and 5393 keV 10 (1978Aj02).
				Γ: Weighted average of 15 keV 5 (1964Mi04) and 10 keV 10 (1978Aj02).
6165 10		<20 keV		E(level): Weighted average of 6170 keV 20 (1964Mi04) and 6164 keV 10 (1978Aj02).
				Γ: In Fig. 10 of (1978Aj02) this state is narrower than the $E_x=5.39$ MeV state. $\Gamma$ <20 keV is assigned.
6434 10		36 keV 5		č
6932 10		55 keV 15	>4	L: From (1978Aj02).
8138 10		100 keV 15		
8684 10		89 keV 20		
9.44×10 <sup>3</sup> 3		81 keV 25		
$10.22 \times 10^3 2$		210 keV 20		
$10.89 \times 10^3 \ 2$ 11800?				

<sup>†</sup> From (1978Aj02), except where noted.
<sup>‡</sup> From plane-wave analysis in (1964Mi04), except where noted.

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