^{13}B β^- decay

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

Parent: ^{13}B: E=0; J^π=3/2$^-$; T$_{1/2}$=17.30 ms 17; Q(β^-)=13436.9 10; %β^- decay=100

^{13}B-T$_{1/2}$: From Adopted Levels.

^{13}B-Q(β^-): From (2021Wa16).

1962Ma19: ^{13}B(β^-) from ^{11}B(t,p); measured β particles, and γ rays. Deduced ratio of T$_{1/2}$(^{13}B/^{12}B)=0.86 2. This presently implies T$_{1/2}$=17.39 ms 41. Deduced dominant decay branches to ^{13}C*(0,3.68 MeV) with I$\beta\approx$93% and 7%, respectively; limits are set on other branches, including <1.5% from β-n events.

1968Ch28: Activated a natural boron target with tritons and measured β particles and delayed neutrons. Deduced T$_{1/2}$=16 ms 1 and %β-n=0.52 26. Compared with ^{13}O β-p.

1969Jo21: ^{13}B(β^-) from ^{11}B(t,p); measured $\beta\gamma$-coin, E$_\beta$, β-n. Deduced branches to ^{13}C*(0,3.68,7.58 6,8.79 10) with Iβ(%)=92.1 8, 7.6 8, 0.094 20 and 0.16 3, respectively.

1971Wi07: ^{13}B(β^-) from ^{11}B(t,p); measured T$_{1/2}$=17.33 ms 17.

1974Al12: ^{13}B(β^-) from ^{11}B(t,p); measured βn-coin; deduced %Iβ(9.90)=0.022 7 by normalizing to %Iβ(8.86)=0.16 3 from (1969Jo21). Set upper limit on %Iβ(9.50)<0.01. Discussed J^π values.

1988Sa04: ^{13}B(β^-) from ^{181}Ta(^{22}Ne,^{13}B);^{13}B; measured T$_{1/2}$=17.6 ms 12.

1991Re02,1994ReZZ, 1995ReZZ, 2008ReZZ: ^{13}C(β^-) using spallation products from p+^{232}Th. Ions were implanted in a Si detector and identification via standard techniques. %β-n from polyethylene moderated ^{3}He counter (zero-threshold). The β-delayed neutron probability (P$_n$= P$_{1n}$+2P$_{2n}$+3P$_{3n}$+...) and half−life were deduced. The evaluator favors the values from (1994ReZZ,2008ReZZ) T$_{1/2}$=16.7 ms 6 and P$_n$=0.24 15, but other values based on this work are (1991Re02) T$_{1/2}$=11 ms 9 and P$_n$=0.3 1.

1997So34: ^{13}B(β^-n); measured β-delayed neutrons, En, In; deduced limit on %Iβ and T$_{1/2}$=17.0 ms 4. Results are generally excluded due to the limited description of the method.

2002GeZT,2005GeZY: ^{13}B(β^-) from ^{11}B(t,p); measured reaction excitation function from analysis of Eγ=3681 keV yield. Deduced T$_{1/2}\approx$17.36 ms.

2004Na38: ^{13}B(β^-); measured I$_\beta$(θ,H,t), β-NMR and β-NQR spectra from polarized source. Deduced ^{13}B quadrupole moment and μ.

2006Ge21: ^{13}B(β^-) from ^{11}B(t,p); measured reaction excitation function from analysis of Eγ=3681 keV yield. Deduced T$_{1/2}\approx$16.59 ms 2; discussed observed lifetime and suggested (t,d) contamination gives higher lifetime.

2010Ma44: ^{13}B(β^-); measured E$_\beta$, I$_\beta$(θ) from aligned ^{13}B; deduced alignment correlation coefficient, G-parity tensor coupling constant.

Theory:

1977Ri08: Analysis of log ft values for A=10-15.

2003Fo11: ^{13}B; analyzed β-delayed neutron decay data; deduced ground-state configuration features.

2003Sm02: ^{13}B(β^-); calculated Gamow-Teller decay rates. Comparison with data. ^{13}C calculated μ, quadrupole moments.

^{13}C Levels

E(level)†	$J^{\pi\dagger}$	T$_{1/2}$†	Comments
0	1/2$^-$	stable	
3089.451 19	1/2$^+$	0.98 fs 9	
3684.496 22	3/2$^-$	1.13 fs 6	
3853.796 21	5/2$^+$	8.6 ps 2	
7547 3	5/2$^-$	1.2 keV 3	%n$\approx$100
8866 9	1/2$^-$	179 keV 17	%n$\approx$100
9894.50 17	3/2$^-$	23.7 keV 4	%n$\approx$100

† From Adopted Levels.

^{13}B β^- decay (continued)

β^- radiations

av Eβ: Additional information 1.

E(decay)	E(level)	I$\beta^{-\dagger\#}$	Log ft	Comments
(3542.4 *14*)	9894.50	0.022‡ *7*	4.95 *14*	av Eβ=1575.00 *48*
(4571 *9*)	8866	0.16 *3*	4.59 *8*	av Eβ=2073.8 *44*
(5889.9 *33*)	7547	0.094 *20*	5.33 *9*	av Eβ=2718.1 *16*
(9583.1 *14*)	3853.796	≤0.7	≥5.5	av Eβ=4533.61 *49*
(9752.4 *14*)	3684.496	7.6 *8*	4.453 *46*	av Eβ=4617.01 *49*
(10347.5 *14*)	3089.451	≤0.7	≥5.6	av Eβ=4910.19 *49*
(13436.9 *17*)	0	92.1 *8*	4.037 *6*	av Eβ=6433.44 *49*
				Iβ^-: From 100%-Σ(decay to excited states).

† From (1969Jo21), except where noted.
‡ From (1974Al12) intensities are determined relative to %Iβ=0.16 to ^{13}C*(8.86) from (1969Jo21).
$^{\#}$ Absolute intensity per 100 decays.

$\gamma(^{13}$C$)$

E$_\gamma$‡	I$_\gamma$$^{\dagger\#}$	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.‡	$\delta^{\ddagger}$	Comments
169.300 *4*	≤0.009	3853.796	5/2$^+$	3684.496	3/2$^-$	[E1]		
595.22 *8*	0.057 *7*	3684.496	3/2$^-$	3089.451	1/2$^+$	[E1]		%Iγ=0.057 *7*
764.316 *10*	≤0.3	3853.796	5/2$^+$	3089.451	1/2$^+$	[E2]		
3089.049 *20*	≤0.7	3089.451	1/2$^+$	0	1/2$^-$	[E1]		
3684.01 *6*	7.6 *8*	3684.496	3/2$^-$	0	1/2$^-$	M1+E2	−0.094 *9*	%Iγ=7.6 *8*
3854 *1*	≤0.5	3853.796	5/2$^+$	0	1/2$^-$	[E3+M2]	+0.12 *3*	

† Deduced from Iβ and adopted γ branching ratios.
‡ From Adopted Gammas.
$^{\#}$ Absolute intensity per 100 decays.

^{13}B β^- decay

Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

$I_\gamma < \ 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

$3/2^-$ 0   17.30 ms *17*
Q_{β^-}=13436.9 *10* $\%\beta^-$=100

$^{13}_{5}B_{8}$

$I\beta^-$	Log ft			
0.022	4.95	$3/2^-$	9894.50	23.7 keV *4*
0.16	4.59	$1/2^-$	8866	179 keV *17*
0.094	5.33	$5/2^-$	7547	1.2 keV *3*
≤0.7	≥5.5	$5/2^+$	3853.796	8.6 ps *2*
7.6	4.453	$3/2^-$	3684.496	1.13 fs *6*
≤0.7	≥5.6	$1/2^+$	3089.451	0.98 fs *9*
92.1	4.037	$1/2^-$	0	stable

3854 [E3+M2] ≤0.5
764.316 [E2] ≤0.3
169.300 [E1] ≤0.009
3684.01 M1+E2 7.6
595.22 [E1] 0.057
3089.049 [E1] ≤0.7

$^{13}_{6}C_{7}$