$^{12}B\ \beta^-$ decay:20.20 ms 1981Ka31,2009Hy01,2016Mu06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, J. E. Purcell and C. G. Sheu	NP A968,71 (2017)	1-Jan-2017

Parent: ^{12}B: E=0.0; $J^\pi=1^+$; $T_{1/2}$=20.20 ms *2*; $Q(\beta^-)$=13369.4 *13*; $\%\beta^-$ decay=100
^{12}B-$Q(\beta^-)$: From (2017Wa10).
^{12}B-J^π,$T_{1/2}$: From Adopted Levels for ^{12}B in ENSDF database.
1972Al31: $^{12}B(\beta^-)$, measured $\beta\gamma$-coin. Deduced log *ft*, β-branching.
1974Mc11: ^{12}B, measured E_β, I_β, $\beta\gamma$-coin. Deduced log *ft*.
1978Al01: $^{12}B(\beta^-)$, measured E_β, I_β, $\beta\gamma$-coin, $T_{1/2}$. Deduced β-branching, mirror asymmetries, *ft*.
1981Ka31: $^{12}B(\beta^-)$, measured $\beta\gamma$-coin, $\beta\gamma$(t). Deduced I_β, log *ft*.
1988Na09: ^{12}B, measured I_β, I_γ, $\beta\gamma$-coin. Deduced mirror asymmetry. Deduced Gamow-Teller β-decay branching ratio.
1988Sa04: $^{12}B(\beta^-)$, measured β-decay $T_{1/2}$.
1990Ca10: $^{12}B(\beta^-)$, measured spectral shape factors.
1993Mi36, 1993Oh05: $^{12}B(\beta^-)$, measured modified β-NMR spectra. Deduced quadrupole moment.
2000St19: $^{12}B(\beta^-)$, measured E_β, I_β.
2005Di16: $^{12}B(\beta^-)$, measured β-delayed E_α, $\alpha\alpha$-coin. ^{12}C deduced excited states, J, π. R-matrix analysis.
2007PeZY: $^{12}B(\beta^-)$, measured branching β-decay ratios.
2009Di06: $^{12}B(\beta^-)$, measured E_α, E_γ, $\alpha\alpha\alpha$-coin. ^{12}C deduced levels, J, π, triple-α continuum states and their decay modes.
2009Hy01: $^{12}B(\beta^-)$, deduced branching ratio, log *ft*, β(GT) to various ^{12}C states.
2009Hy02: $^{12}B(\beta^-)$, measured E_α, I_α, E_γ, I_γ, E_β, $\beta\gamma$-, $\beta\alpha$-, $\alpha\alpha\alpha$-coin. ^{12}C deduced levels, β feedings, and log *ft*. Triple-α method and R-matrix analysis.
2010Hy01: $^{12}B(\beta^-)$, measured 3α summed spectra and associated branching ratios for breakup via the ^{8}Be ground-state and via excited states of ^{8}Be. ^{12}C deduced levels, resonances, Gammow-Teller strengths and widths using multilevel, many-channel R-matrix formalism.
2009Hy01,2009Hy02,2010Hy01: The authors performed two measurements of ^{12}B decay into α unbound states of ^{12}C using two different techniques. In addition ^{12}N decay was also measured. The first method involved implantation of ^{12}B into a thin carbon foil located in the center of a large solid angle Si Strip array (at IGSOL/JYFL) that measured breakup α particle kinematics; a HPGe detector measured the ^{12}C*(4.44 MeV) de-excitation gamma-rays, and the measurement was normalized to the value presently adopted in ENSDF. The second method involved implantation of ^{12}B into a thick Si detector (at TRIuP/KVI) and measuring the total 3α decay energy.
(2009Hy02) gives details of the JYFL measurement, while (2009Hy01) is reported as giving the most precise analysis of the KVI and JYFL measurements.
(2010Hy01) gives a detailed multi-channel multi-level R-matrix analysis of 0^+ and 2^+ levels above the E_x=7.65 MeV level that may contribute to the shape of the 3α energy spectrum observed in ^{12}B and ^{12}N decay to ^{12}C. The analysis focuses mainly on these higher-lying state and is difficult to fold in with the analysis given in (2009Hy01,2009Hy02). A significant difference from the prior work is the assumption that the E_x=10.3 MeV bump ($J^\pi=0^+$) is from interference; they suggest instead the $J^\pi=0^+_3$ state at E_x=11.2 MeV *3* with Γ=1.5 MeV *6*.
2016Mu06: The authors measured the ^{12}C γ rays produced following ^{12}B β decay and deduced the branching ratio to ^{12}C*(7654).
^{12}B atoms were produced at the center of the Gammasphere detector by irradiating a thick deuterated titanium foil with 40 MeV ^{11}B ions from the ANL/ATLAS accelerator. The γ rays emitted following ^{12}B decay were detected using the Gammasphere, a 110 element Compton suppressed HPGe detector array; in the present measurement 98 array elements were utilized. Throughout the measurement a low-Z target chamber was used to minimize the bremsstrahlung background caused by the high-energy β rays emitted in the decays.
The γ singles and γ-γ coincidence spectra were analyzed to determine yield of the $J^\pi=2^+_1\rightarrow0^+_1$ γ rays (4.44 MeV) and $J^\pi=0^+_2\rightarrow2^+_1$ γ rays (3.21 MeV). The γ-ray energies are reported. A total of 10^9 $\gamma\gamma$ coincidence events are observed. The $\gamma\gamma$ angular correlations are analyzed yielding a_2=−3.3 *7* and a_4=4.2 *9*.
In the discussion, the branching ratio feeding ^{12}C*(7654), B(7.65), is related to the γ(4.44)-γ(3.21) coincidence yield, Γ_γ/Γ(7.65), the B(4.44) and a set of variables that depend on the experimental configuration. The authors used $\Gamma_\gamma/\Gamma(7.65)=(4.07\ 11)\times10^{-4}$ (see discussion) and B(4.44)=(1.23 *5*)%, which is the unweighted average of values given in (1990Aj01).
For other references see (1980Aj01).

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^{12}C Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$[‡]	Comments
0	0$^+$		
4439.82 *31*	2$^+$	10.8×10^{-3} eV *6*	
7657.8 *10*	0$^+$	9.3 eV *9*	E(level): Based on the atomic mass of ^{4}He and the decay energy for the breakup of this state into 3α, 379.6 keV *20*: See (1980Aj01).
10.3×10^3	(0$^+$)	3.0 MeV *7*	
12710	1$^+$	18.1 eV *28*	

[†] From recoil corrected γ-ray energies, except where noted.
[‡] From Adopted Levels.

β^- radiations

E(decay)	E(level)	Iβ^-[†]	Log *ft*	Comments
(659.4 *13*)	12710	0.00026 *2*	3.91 *4*	av Eβ=243.62 *54* Iβ^-: From weighted average of renormalized values 3.2×10^{-4} *7* (JYFL) and 2.6×10^{-4} *2* (KVI) in (2009Hy02). See Table 12.24 in (2017Ke05).
(3069.4 *13*)	10300	0.062 *3*	4.287 *21*	av Eβ=1351.93 *63* Iβ^-: From weighted average of the renormalized values 0.055 *7* (JYFL) and 0.063 *3* (KVI) in (2009Hy02). See Table 12.24 in (2017Ke05). In (2010Hy01)the authors indicate that the J$^\pi$=0^+_3 resonance has parameters E_x=11.2 MeV *3* with Γ=1.5 MeV *6*, suggesting that the previously observed E_x=10.3 MeV bump results from interference. They further indicate that the J$^\pi$=2^+_2 resonance has parameters E_x=11.1 MeV *3* and Γ=1.4 MeV *4*. In addition, for these two states (2010Hy01) find B(>)=0.07 *3* and B(>)=0.06 *4* (log *ft*=4.75 *25* and log *ft*=4.82 *35*) for the J$^\pi$=0^+_3 and 2^+_2 states, respectively. See Table 12.24 in (2017Ke05).
(5711.6 *17*)	7657.8	0.54 *2*	4.572 *17*	av Eβ=2642.55 *81* Iβ^-: The adopted value is dominated by renormalized (KVI) results reported in (2009Hy01). See Table 12.24 in (2017Ke05).
(8929.6 *13*)	4439.82	1.182 *19*	5.143 *7*	av Eβ=4234.18 *67* Iβ^-: Iβ(4440) is used as a global normalization in most measurements. Iβ^-: We adopt Iβ=1.182 *19* from (1981Ka31) since the experimental approach aimed to overcome most systematic effects that influence the value. In some other analyses, the unweighted average of 1.283 *40* (1978Al01) and 1.182 *19* (1981Ka31) was used to normalize the reported values. In (1990Aj01), both values were listed with no preference or average value given. The value given of (1981Ka31) is based on their measured value, while the value in (1978Al01) is a weighted average of 1.276 *50* measured by them and 1.29 *5* previously adopted by (1974Mc11). See Table 12.23 in (2017Ke05).
(13369.4 *13*)	0	98.216 *28*	4.0617 *5*	av Eβ=6438.65 *65* Iβ^-: Unity minus the sum of branching to higher states. See discussion (2017Ke05) Table 12.24.

[†] Absolute intensity per 100 decays.

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$\gamma(^{12}C)$

E_γ	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Comments
3216.9 *8*	2.3×10^{-4} *1*	7657.8	0^+	4439.82	2^+	I_γ: From $\Gamma\gamma/\Gamma=(4.16\ 11)\times10^{-4}$ and $I\beta(0.54\ 2)\%$. E_γ: From (2016Mu06).
4438.91 *31*	1.182 *19*	4439.82	2^+	0	0^+	E_γ: From (1967Ch19).

† Absolute intensity per 100 decays.

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Decay Scheme