^{12}N β^+ decay:11.000 ms 1981Ka31,2009Hy01

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}N: E=0.0; $J^\pi=1^+$; $T_{1/2}$=11.000 ms *16*; Q(β^+)=17338.1 *10*; %β^+ decay=100
^{12}N-Q(β^+): From (2017Wa10).
^{12}N-J^π,$T_{1/2}$: From Adopted Levels for ^{12}N in ENSDF database.
1972Al31: ^{12}N, measured $\beta\gamma$-coin. Deduced log *ft*, β-branching.
1974Mc11: ^{12}N,measured E_β, I_β, $\beta\gamma$-coin. Deduced log *ft*.
1978Al01: ^{12}N,measured E_β, I_β, $\beta\gamma$-coin, $T_{1/2}$. Deduced β-branching, mirror asymmetries, *ft*.
1981Ka31: ^{12}N, measured $\beta\gamma$-coin, $\beta\gamma$(t). Deduced I_β, log *ft*.
1988Na09: ^{12}N, measured I_β, I_γ, $\beta\gamma$-coin. Deduced mirror asymmetry. ^{12}B, ^{12}N deduced Gamow-Teller β-decay branching ratio.
1990Ca10: ^{12}N(β^+), measured spectral shape factors.
1991Li32: ^{12}N, measured β-decay asymmetry.
1993Mi32: ^{12}N(β^+), measured $I_\beta(\theta)$. Deduced alignment coefficients.
1998Mi14: ^{12}N(β^+), measured β-ray angular distribution from oriented nuclei.
1998Se04: ^{12}N(β^+), measured β^+ polarization asymmetry from decay of polarized nuclei.
1999Mi41,2000Mi11: ^{12}N(β^+), measured E_β, $I_\beta(\theta)$ from aligned nuclei.
2001Th18: ^{12}N(β^+), measured positrons longitudinal polarization following decay.
2002BoZY: ^{12}N(β^+p), analyzed β-delayed multi-particle emission data. Deduced branching ratios, decay mechanism features.
2002Fy02,2003Fy02,2003Fy04,2004Fy02,2004Fy03: ^{12}N(EC), measured β-delayed E_α, $\alpha\alpha$-coin. ^{12}C level deduced three-body decay mechanism, excited states.
2002Mi01,2002Mi03,2002Mi36,2002Mi49,2003Mi24: ^{12}N(β^+), measured E_β, angular distributions from spin-aligned sources.
2004Bo43: ^{12}N(β^+), measured β-delayed particle spectra, yields. ^{12}C deduced excited states particle-decay features.
2009Di06: ^{12}N(β^+), measured E_α, E_γ, $\alpha\alpha\alpha$-coin. ^{12}C deduced levels, J, π, triple-α continuum states and their decay modes. R-matrix analysis.
2009Hy01,2009Hy02,2010Hy01: ^{12}N(β^+), 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*.
The authors performed two measurements of ^{12}N decay into α unbound states of ^{12}C using two different techniques. In addition ^{12}B decay was also measured. The first method involved implantation of ^{12}N 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 mesured 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}N 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*.

^{12}C Levels

E(level)	J^π †	$T_{1/2}$ †
0	0^+	
4439.82 *31*	2^+	10.8×10^{-3} eV *6*
7654.07 *19*	0^+	9.3 eV *9*
10.3×10^3 *3*	(0^+)	3.0 MeV *7*
12710	1^+	18.1 eV *28*
15110	1^+	43.6 eV *10*

† From Adopted Levels.

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ε,β^+ radiations

E(decay)	E(level)	$I\beta^{+\dagger}$	$I\varepsilon^{\dagger}$	Log *ft*	$I(\varepsilon+\beta^+)^{\dagger}$	Comments
(2228.1 *10*)	15110	0.0023 *15*	4.×10^{-6} *3*	3.6 *3*	2.3×10^{-3} *15*	av Eβ=495.21 *45*; εK=0.001824 *5*; εL=0.0001020 *3* Iε: From average of (2009Hy01) and (1967Al03) See discussion in Table 12.42 of (2017Ke05).
(4628.1 *10*)	12710	0.120 *3*		3.924 *11*	0.120 *3*	av Eβ=1624.94 *49* Iε: Mainly from the KVI data in (2009Hy01). See other values in Table 12.42 of (2017Ke05).
(7.04×10^3 *30*)	10300	0.403 *9*		4.42 *11*	0.403 *9*	av Eβ=2.80×10^3 *15* Iε: From weighted average of 0.38 *5* (JYFL) and 0.404 *9* (KVI). In (2009Hy01) this is listed as the sum of feeding to E$_x$=9-12 MeV. See discussion in Table 12.42 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(>)=0.06 *2* and B(>)=0.05 *3* (log *ft*=4.82 *18* and log *ft*=4.90 *40*) for the J$^\pi$=0^+_3 and 2^+_2 states, respectively.
(9684.0 *10*)	7654.07	1.41 *3*		4.622 *10*	1.41 *3*	av Eβ=4113.48 *51* Iε: from (KVI) in (2009Hy01). See other values in Table 12.42 of (2017Ke05).
(12898.3 *11*)	4439.82	1.898 *32*		5.148 *8*	1.898 *32*	av Eβ=5711.13 Iε: Iβ(4440) is used as a global normalization in most measurements. Iε: We adopt Iβ=1.898 *32* from (1981Ka31) since the experimental approach aimed to overcome most systematic effects that influence the value. For other values see Table 12.23 in (2017Ke05).
(17338.1 *10*)	0	96.17 *5*		4.1106 *7*	96.17 *5*	av Eβ=7922.87 Iε: unity minus the sum of branching to higher states. See discussion in (2017Ke05) Table 12.42.

† Absolute intensity per 100 decays.

$\gamma(^{12}C)$

$E_\gamma{}^{\dagger}$	$I_\gamma{}^{\ddagger}$	E_i(level)	J^π_i	E_f	J^π_f	Comments
3213.8	5.9×10^{-4} *2*	7654.07	0$^+$	4439.82	2$^+$	I$_\gamma$: From Γγ/Γ=(4.16 *11*)×10^{-4} and Iβ=(1.41 *3*)%.
4438.91	1.90 *3*	4439.82	2$^+$	0	0$^+$	

† From adopted gammas.
‡ Absolute intensity per 100 decays.

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Decay Scheme

Legend

Intensities: I_γ per 100 parent decays