^{33}Na β^-n decay (8.0 ms) 2001Nu02

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 201,1 (2025)	31-Oct-2024

Parent: ^{33}Na: E=0.0; J^π=(3/2$^+$); $T_{1/2}$=8.0 ms *3*; Q(β^-n)=16.54×10^3 *45*; %β^-n decay=47 *6*

^{33}Na-J^π: Systematics of odd Na nuclides and possible β feeding of (3/2$^+$) g.s. of ^{33}Mg (2004Co29, 2002Ra16, 2021Ko07). 2001Nu02 suggest (3/2$^+$,5/2$^+$).

^{33}Na-$T_{1/2}$: From 2002Ra16, weighted average of results from three measurements: 7.9 ms *4* (β timing), 8.0 ms *7* (neutron timing) and 8.1 ms *4* (γ timing). Others: 8.0 ms *6* (1984La03), 20 ms *15* (1972Kl04, same lab as 1984La03), 8.2 ms *4* (1981ThZV, same lab as 1984La03), 8.5 ms *4* (1998NoZW, tentative result).

^{33}Na-Q(β^-n): 16540 *450* from 2021Wa16.

^{33}Na-%β^-n decay: %β^-n=47 *6*, %β^-2n=13 *3* (2002Ra16). Other: %β^-n=52 *20*, %β^-2n=12 *5* (1984Gu19).

2001Nu02 (also 2002Nu02,2002Ra16): ^{33}Na source was produced by fragmentation of an UC target with 1.4 GeV protons at CERN/ISOLDE. β particles were detected with a plastic scintillator; γ rays were detected with two Ge counters or a small BaF_2 counter; neutrons were detected with 8 neutron detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\beta\gamma$-coin, nγ-coin, decay curves. Deduced levels, parent $T_{1/2}$.

Others:

1984La03,1984Gu19: measured $T_{1/2}$, Eγ, Iγ. Two γ rays reported.

1981ThZV: measured $T_{1/2}$.

1972Kl04: measured $T_{1/2}$.

1998NoZW: measured $T_{1/2}$.

1999YoZW: measured $T_{1/2}$, %β^-n (preliminary report) at 885.5 and 2550.7.

The decay scheme is probably incomplete. Based on results from 2001Nu02, the total absolute intensity of observed transition (885γ+2551γ) to g.s. amounts to 26% *9* using a multiplying factor of 0.22 *8* with relative Iγ, which is from the β^-n feeding to excited states in ^{32}Mg, while %β^-n(^{33}Na) is 47 *6* from measured β-delayed neutrons. The missing intensity could be accounted for by β^-n feeding to g.s. and/or unobserved γ transitions to g.s. from higher levels.

^{32}Mg Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[‡]	Comments
0.0	0$^+$	80.4 ms *4*	
885.31 *10*	2$^+$	13.1 ps *10*	Neutron feeding from 3780 and 4000 levels in ^{33}Mg, with E(n)=800 *60* and 1020 *80*, respectively (2001Nu02).
2322.35 *32*	4$^+$	0.62 ps *15*	
2551.1 *10*	(1$^-$,2$^+$)		
2858.3 *5*	(1$^-$,3$^-$)		
3037.79 *14*	(2$^-$)		

[†] From a least-squares fit to γ-ray energies.
[‡] From Adopted Levels.

γ(^{32}Mg)

Iγ normalization: From %β^-n(^{33}Na)=47 *6* and the factor of 0.22 *8* for multiplying quoted relative Iγ to obtain absolute Iγ per 100 ^{33}Na decays (2001Nu02). The factor 0.22 *8* is from 2001Nu02 based on measured ^{33}Na activity and γ intensities, while absolute Iγ values are not explicitly listed in 2001Nu02.

E$_\gamma$[†]	I$_\gamma$[†‡]	E$_i$(level)	J_i^π	E$_f$	J_f^π
885.3 *1*	100	885.31	2$^+$	0.0	0$^+$
1437.0 *3*	4.7 *8*	2322.35	4$^+$	885.31	2$^+$
1972.9 *5*	5.9 *10*	2858.3	(1$^-$,3$^-$)	885.31	2$^+$

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^{33}Na β^-n decay (8.0 ms) 2001Nu02 (continued)

$\gamma(^{32}Mg)$ (continued)

E_γ [†]	I_γ [†‡]	E_i(level)	J_i^π	E_f	J_f^π
2152.4 *1*	10.3 *21*	3037.79	(2^-)	885.31	2^+
2551 *1*	16.1 *17*	2551.1	$(1^-,2^+)$	0.0	0^+

† From 2001Nu02.
‡ For absolute intensity per 100 decays, multiply by 0.22 *8*.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays