^{33}Mg β^- decay (90.5 ms) 2008Tr07,2006AnZW

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 112, 1393 (2011)	31-Mar-2011

Parent: ^{33}Mg: E=0; J^π=3/2$^-$; $T_{1/2}$=90.5 ms *16*; Q(β^-)=13477 *76*; %β^- decay=100.0

^{33}Mg-Q(β^-): From 2009AuZZ. Other: 13420 *80* (2003Au03).

^{33}Mg-$T_{1/2}$: From 2002Mo29. Others: 93 ms *11* (2006AnZW), 90 ms *20* (1984La03), 89 ms *1* (2008Tr07).

^{33}Mg-J^π: From Adopted Levels for ^{33}Mg. Note that 2008Tr07 assign positive parity based on allowed β transition and shell-model calculations.

^{33}Mg-%β^- decay: %β^-n=14 *2* (2006AnZW). Other: 17 *5* (1984La03,1984Gu19); 24 *2* from absolute intensities of 8 *1* and 11 *2* for 735γ and 2765γ, respectively, in ^{32}Al from ^{33}Mg β^-n decay as measured by 2008Tr07; and 4.9% *1* feeding of g.s. of ^{32}Al by neutron branches as reported in 2006AnZW (reference 10 in 2008Tr07).

2008Tr07: ^{33}Mg produced in the reaction Be(^{48}Ca,X) with an E=140 MeV/nucleon beam provided by the National Superconducting Cyclotron Lab at MSU. A1900 fragment separator used to isolate ^{33}Mg. Detected charged particles using the double-sided silicon strip detector of the beta counting system. Measured Eγ, Iγ, $\gamma\gamma$ using 16 Ge detectors of the Segmented Germanium Array.

2006AnZW: ^{33}Mg produced by fragmentation of ^{36}S beam, measured Eγ, En, $\beta\gamma$ coin, βn coin. Detector system: EXOGAM clover (Ge) detectors, a low-energy photon spectrometer (LEPS), eight low-energy neutron detectors, and delayed neutron detector array TONNERRE at GANIL facility.

Others:

2002Mo29: Measured ^{33}Mg isotope half-life.

1984La03, 1984Gu19: Measured β-delayed neutrons, ^{33}Mg isotope half-life and βn coin, %β^-n.

^{33}Mg also decays to ^{32}Al by delayed neutrons.

Based on shell-model calculations 2008Tr07 propose 1p-1h and 3p-3h mixed configuration for g.s. of ^{33}Mg; and 0p-0h and 2p-2h mixed configuration for ^{33}Al g.s.

^{33}Al Levels

E(level)†	J^π#	E(level)†	J^π#	E(level)†	J^π#
0	$(5/2)^+$	3714.2 *8*	$(3/2^-,5/2^-)$	6820‡	$(1/2^-,3/2^-,5/2^-)$
1617.9 *7*	$(1/2^+$ to $9/2^+)$	4310.3 *9*	$(1/2^-,3/2^-,5/2^-)$	7250‡	$(1/2^-,3/2^-,5/2^-)$
1838.2 *8*	$(3/2^-,5/2^-)$	4730.4 *8*	$(3/2^-,5/2^-)$	7470‡	$(1/2^-,3/2^-,5/2^-)$
2365.1 *10*	$(3/2^-,5/2^-)$	5930‡	$(1/2^-,3/2^-,5/2^-)$	8870‡	$(1/2^-,3/2^-,5/2^-)$
3264.5 *9*		5980‡	$(1/2^-,3/2^-,5/2^-)$		

† From least squares fit to Eγ data.
‡ From 2006AnZW, this level decays by neutrons to ^{32}Al.
# From Adopted Levels.

β^- radiations

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
$(4.61\times10^3$ *8*)	8870	1.96 *5*	4.3	av Eβ=2089 *38*
$(6.01\times10^3$ *8*)	7470	0.90 *3*	5.2	av Eβ=2776 *38*
$(6.23\times10^3$ *8*)	7250	1.32 *4*	5.1	av Eβ=2885 *38*
$(6.66\times10^3$ *8*)	6820	0.71 *4*	5.5	av Eβ=3096 *38*
$(7.50\times10^3$ *8*)	5980	3.3 *3*	5.1	av Eβ=3511 *38*
$(7.55\times10^3$ *8*)	5930	1.9 *2*	5.3	av Eβ=3535 *38*
$(8.75\times10^3$ *8*)	4730.4	15 *5*	4.7	av Eβ=4127 *38* Iβ^-: 18 *2* in 2006AnZW.
$(9.17\times10^3$ *8*)	4310.3	13 *2*	4.9	av Eβ=4335 *38*

Continued on next page (footnotes at end of table)

^{33}Mg β^- decay (90.5 ms) 2008Tr07,2006AnZW (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(9.76×10^3 *8*)	3714.2	12 *3*	5.0	av Eβ=4629 *38*
(1.021×10^4[#] *8*)	3264.5	2 *2*	>5.4	av Eβ=4851 *38*
(1.111×10^4 *8*)	2365.1	7 *2*	5.6	av Eβ=5296 *38*
(1.164×10^4 *8*)	1838.2	6 *2*	5.7	av Eβ=5556 *38* Iβ=6 *2*, log *ft*=5.69 *15* in figure 3 of 2008Tr07.
(1.348×10^4 *8*)	0	37 *8*	5.2	av Eβ=6463 *38* Iβ^-,Log *ft*: feeding to the g.s. is based on γ-ray efficiency and total β-decaying implants. log *ft*=5.2 is small for first-forbidden decay. Low log *ft* value may either be due to ^{33}Mg nuclide being near N=20 closed shell or due to incomplete decay scheme and unobserved weak γ transitions from possible higher energy levels.

† From 2008Tr07, unless otherwise noted.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{33}Al)

Iγ normalization: The absolute (per 100 decays of ^{33}Mg) gamma-ray intensities are given by 2008Tr07 from known number of ^{33}Mg implants and detector efficiencies.

E$_\gamma$[†]	I$_\gamma$[†‡]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
596	5 *1*	4310.3	(1/2$^-$,3/2$^-$,5/2$^-$)	3714.2	(3/2$^-$,5/2$^-$)	
1046	4 *1*	4310.3	(1/2$^-$,3/2$^-$,5/2$^-$)	3264.5		
1466	3 *1*	4730.4	(3/2$^-$,5/2$^-$)	3264.5		
1618	16 *2*	1617.9	(1/2$^+$ to 9/2$^+$)	0	(5/2)$^+$	
1647	7 *1*	3264.5		1617.9	(1/2$^+$ to 9/2$^+$)	
1838	9 *2*	1838.2	(3/2$^-$,5/2$^-$)	0	(5/2)$^+$	
2096	9 *2*	3714.2	(3/2$^-$,5/2$^-$)	1617.9	(1/2$^+$ to 9/2$^+$)	
2365	7 *1*	2365.1	(3/2$^-$,5/2$^-$)	0	(5/2)$^+$	
2692	4 *2*	4310.3	(1/2$^-$,3/2$^-$,5/2$^-$)	1617.9	(1/2$^+$ to 9/2$^+$)	I$_\gamma$: not listed by 2008Tr07, deduced by the evaluators from intensity balance=13 *2* at 4310 level.
2892	3 *1*	4730.4	(3/2$^-$,5/2$^-$)	1838.2	(3/2$^-$,5/2$^-$)	E$_\gamma$: 2897 (2006AnZW).
3714	8 *2*	3714.2	(3/2$^-$,5/2$^-$)	0	(5/2)$^+$	
4730	10 *3*	4730.4	(3/2$^-$,5/2$^-$)	0	(5/2)$^+$	E$_\gamma$: 4735 (2006AnZW).

† From 2008Tr07.
‡ Absolute intensity per 100 decays.

^{33}Mg β^- decay (90.5 ms) 2008Tr07,2006AnZW

Decay Scheme

Intensities: I_γ per 100 parent decays