^{68}Cu β^- decay (3.75 min) 1975Ti01,1972Sw01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 113, 1735 (2012)	1-Mar-2012

Parent: ^{68}Cu: E=721.26 *8*; $J^\pi=6^-$; $T_{1/2}$=3.75 min *5*; Q(β^-)=4439.8 *18*; %β^- decay=14 *2*

^{68}Cu-%β^- decay: 14% *2*. Iγ's indicate 18.8 *16* β^- decays (3.75 min) and 114.5 *18* IT decays per hundred 525.9 γ transitions in ^{68}Cu. This has a correction due to the different $T_{1/2}$ of the two branches.

1975Ti01: ^{68}Cu activity produced by ^{68}Zn(n,p), E(n)=14.9 MeV. Measured Eγ, Iγ, and $T_{1/2}$ using a Ge(Li) detector.

1972Sw01: ^{68}Cu activity produced by ^{68}Zn(n,p), E(n)=14.7 MeV. Measured Eγ, Iγ, Eβ^-, Iβ^-, $T_{1/2}$, $\gamma\gamma$ and $\beta\gamma$ coin using Ge(Li) and NaI(Tl) detectors and a plastic scintillator.

Data are taken mainly from 1972Sw01 and 1975Ti01.

Others: 2002Ko31, 1971Si19, 1969Wa22, 1969Va16, 1964Ba13, 1960Yt03.

The decay scheme of ^{68}Zn given here is for the equilibrium decay of the 3.75-min ^{68}Cu isomer which proceeds 14% by direct β^- decay and 86% via IT decay with subsequent g.s. decay to ^{68}Zn. These branching fractions include a correction for the different $T_{1/2}$ of the two branches.

α: Additional information 1.

^{68}Zn Levels

E(level)†	Jπ‡	$T_{1/2}$‡	E(level)†	Jπ‡	E(level)†	Jπ‡
0	0^+	stable	2418.2 *11*	4^+	3459.2 *15*	5^-
1077.6 *5*	2^+		2510.5 *16*		3610.8 *18*	$(6)^-$
2339.5 *8*	2^+		2821.4 *16*	2^+	3725.3 *22*	
2370.6 *16*			2956.2 *22*		3733?# *3*	
					3971?@ *3*	

† From least-squares fit to Eγ's by evaluator, except as noted.
‡ From the Adopted Levels.
# From 1975Ti01. E=3735.9 in 1972Sw01.
@ From 1975Ti01. E=3964.4 in 1972Sw01.

β^- radiations

E(decay)‡	E(level)	Iβ⁻†#	Log *ft*	Comments
(1190@ *4*)	3971?	1.4 *6*	5.59 *19*	av Eβ=444.0 *16*
(1428@ *4*)	3733?	0.9 *4*	6.10 *20*	av Eβ=549.3 *16*
(1436 *3*)	3725.3	0.38 *13*	6.48 *15*	av Eβ=552.7 *13*
(1550 *3*)	3610.8	6.3 *17*	5.39 *12*	av Eβ=604.3 *12* E(decay): 1700 *100* (1972Sw01).
(1701.9 *24*)	3459.2	4 *3*	5.8 *4*	av Eβ=673.2 *11* E(decay): 1800 *100* (1972Sw01).
(2742.9 *21*)	2418.2	2.5 *23*	6.8 *4*	av Eβ=1160.0 *10*

† From Iγ imbalances in ^{68}Cu β^- decay (30.9 s + 3.75 min) in equilibrium. Branches to high-spin states are assumed to be from the 3.75 min ^{68}Cu parent state.
‡ Experimental values from $\beta\gamma$ coincidence measurements are given in the comments.
# Absolute intensity per 100 decays.
@ Existence of this branch is questionable.

^{68}Cu β^- decay (3.75 min) 1975Ti01,1972Sw01 (continued)

$\gamma(^{68}Zn)$

Iγ normalization: From Σ(Iγ+c.e.)(to ^{68}Zn g.s.)=100. With Iγ(526)=100, Iγ's give 18.8 *16* β^- decays (3.75 min).
For additional unplaced γ's see ^{68}Cu β decay (30.9 s).

E$_\gamma$[†]	I$_\gamma$[‡b]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[#]	δ[#]	α	Comments
151.6[@] *10*	6.5 *6*	3610.8	(6)$^-$	3459.2	5$^-$	M1(+E2)	−0.05 *+8−6*	0.0206 *17*	α(K)=0.0184 *15*; α(L)=0.00191 *17*; α(M)=0.000274 *24*; α(N+..)=1.08×10^{-5} *8*
585.6[@] *15*	0.7 *2*	2956.2		2370.6					
[x]670.7[a] *15*	0.74 *24*								
1014.5[@c] *15*	1.1 *5*	3971?		2956.2					Not observed by 1972Sw01. Eγ=1007.0 observed by 1972Sw01.
1041.0[@] *10*	11.3 *12*	3459.2	5$^-$	2418.2	4$^+$	(E1+M2)	+0.07 *5*	0.000120 *4*	α=0.000120 *4*; α(K)=0.000108 *4*; α(L)=1.07×10^{-5} *4*; α(M)=1.53×10^{-6} *6*; α(N+..)=6.17×10^{-8} *22*
1077.7 *5*	17[&] *2*	1077.6	2$^+$	0	0$^+$	E2		0.000247 *4*	α=0.000247 *4*; α(K)=0.000221 *4*; α(L)=2.22×10^{-5} *4*; α(M)=3.17×10^{-6} *5*; α(N+..)=1.272×10^{-7} *18*
1149.4[@c] *20*	0.35 *14*	3971?		2821.4	2$^+$				Not observed by 1972Sw01. Eγ=1142.4 observed by 1972Sw01.
1222.2[@c] *15*	1.0 *3*	3733?		2510.5					Eγ=1225.2 observed by 1972Sw01.
1261.8 *8*	0.35[&] *9*	2339.5	2$^+$	1077.6	2$^+$	M1+E2	−0.18 *4*	0.0001727 *25*	α=0.0001727 *25*; α(K)=0.0001418 *20*; α(L)=1.410×10^{-5} *20*; α(M)=2.02×10^{-6} *3* α(N+..)=8.19×10^{-8} *12*
1292.9 *15*	0.7[&] *3*	2370.6		1077.6	2$^+$				
1340.5[@] *10*	14.2 *14*	2418.2	4$^+$	1077.6	2$^+$	E2(+M3)	−0.05 *6*	0.000191 *5*	α=0.000191 *5*; α(K)=0.000138 *4*; α(L)=1.37×10^{-5} *4*; α(M)=1.97×10^{-6} *6*; α(N+..)=3.79×10^{-5} *7*
1385.8[@] *20*	0.40 *14*	3725.3		2339.5	2$^+$				
1432.8 *15*	1.0[&] *3*	2510.5		1077.6	2$^+$				
[x]1540.7[a] *15*	1.0 *3*								
1743.7 *15*	0.4[&] *2*	2821.4	2$^+$	1077.6	2$^+$	M1+E2	+0.27 *5*	0.000241 *4*	α=0.000241 *4*; α(K)=7.71×10^{-5} *11*; α(L)=7.64×10^{-6} *11*; α(M)=1.095×10^{-6} *16*; α(N+..)=0.0001550
2339.5 *15*	0.039[&] *16*	2339.5	2$^+$	0	0$^+$	(E2)		0.000529 *8*	α=0.000529 *8*; α(K)=4.71×10^{-5} *7*; α(L)=4.66×10^{-6} *7*; α(M)=6.68×10^{-7} *10*; α(N+..)=0.000477 *7*

[†] From 1975Ti01. Transitions with Eγ=498.6, 570.7, and 1074.0 reported by 1972Sw01 are not confirmed by 1975Ti01 and are not adopted here.
[‡] Weighted average of 1975Ti01 and 1972Sw01, relative to Iγ(525.9γ)=100 in ^{68}Cu IT decay. Taken or calculated from Iγ's observed in the equilibrium decay: ^{68}Cu β decay (30.9 s + 3.75 min) using branching fraction. Full separation of Iγ's associated with 30.9 s and 3.75 min β^- decays was not possible with the data available. Iγ's are listed here for only those γ's which can be assigned wholly or partly to the 3.75 min β^- decay.
[#] From the Adopted Gammas.
[@] Observed to decay with a single half-life of 3.75 min (1972Sw01,1975Ti01).

^{68}Cu β^- decay (3.75 min) 1975Ti01,1972Sw01 (continued)

$\gamma(^{68}Zn)$ (continued)

[&] Intensity deduced by evaluator based on equilibrium decay intensities for ^{68}Cu β^- decay (30.9 s + 3.75 min), branching fraction and assumptions on feeding.
[a] The 670.7γ is multiply placed by the authors as deexciting levels at 3010 and 3424, and the 1540.7γ is placed from a 3425 level; however, these placements are inconsistent with branching from these levels in (n,γ) and thus not adopted.
[b] For absolute intensity per 100 decays, multiply by 0.83 *15*.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{68}_{30}Zn_{38}$-3

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Decay Scheme

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