^{78}Ga β^- decay (5.09 s) 1980Le22,1993Ch05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Ameenah R. Farhan, Balraj Singh	NDS 110, 1917 (2009)	30-Jun-2009

Parent: ^{78}Ga: E=0.0; J^π=(3$^+$); $T_{1/2}$=5.09 s *5*; Q(β^-)=8156 *4*; %β^- decay=100.0

^{78}Ga-Q(β^-): from 2009AuZZ. Other: 8156 *5* (2003Au03).

1980Le22: measured γ, $\gamma\gamma$, $T_{1/2}$.

1993Ch05: measured $\beta\gamma\gamma$(t), fast timing technique.

Others: 1977Al17, 1977GaZK, 1972MaWL.

The decay scheme and gammas are from the detailed study of 1980Le22. Only 10 levels have been reported by 1993Ch05.

Data are from 1980Le22 unless otherwise stated.

Total decay energy of 8238 keV *310* calculated (by RADLIST code) from level scheme is consistent with the expected value of 8156 keV *5*.

^{78}Ge Levels

E(level)†	J^π‡	$T_{1/2}$#	E(level)†	J^π‡	$T_{1/2}$#	E(level)†	J^π‡
0.0	0$^+$		2319.40 *23*	(2,3,4)	43 ps *5*	3389.89 *22*	(2$^+$,3,4$^+$)
619.35 *12*	2$^+$	15.9 ps *28*	2438.71 *19*	(2$^+$)	<7 ps	3687.9 *3*	(4$^+$)
1186.51 *12*	2$^+$	12 ps *6*	2665.69 *17*	(2,3,4$^+$)	4.2 ps *28*	4083.8 *5*	(2,3,4$^+$)
1546.6 *4*	0$^+$	25 ps *10*	2706.02 *19*	(2$^+$)		4270.13 *23*	(2,3,4$^+$)
1570.19 *19*	4$^+$	<3.5 ps	2857.12 *19*	(2,3,4$^+$)		4279.4 *4*	(2,3,4$^+$)
1644.54 *15*	(2,3,4$^+$)	15 ps *6*	2952.9 *3*	(4$^+$)	9 ps *4*	5078.2 *10*	(2,3,4$^+$)
1842.73 *22*	2$^+$		3120.59 *20*	(2,3,4$^+$)	<2.8 ps		

† From least-squares fit to Eγ's.

‡ From 'Adopted Levels'.

From $\beta\gamma\gamma$(t) (1993Ch05).

β^- radiations

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(3078 *4*)	5078.2	1.4 *3*	5.68 *10*	av Eβ=1316.1 *25*
(3877 *4*)	4279.4	2.8 *4*	5.81 *7*	av Eβ=1699.3 *25*
(3886 *4*)	4270.13	3.2 *5*	5.76 *7*	av Eβ=1703.8 *25*
(4072 *4*)	4083.8	5.2 *7*	5.64 *6*	av Eβ=1793.6 *25*
(4468 *4*)	3687.9	1.9 *4*	6.26 *10*	av Eβ=1984.9 *25*
(4766 *4*)	3389.89	3.0 *5*	6.18 *8*	av Eβ=2129.1 *25*
(5035 *4*)	3120.59	13.2 *11*	5.65 *4*	av Eβ=2259.6 *25*
(5203 *4*)	2952.9	2.8 *8*	6.38 *13*	av Eβ=2340.9 *25*
(5299 *4*)	2857.12	4.6 *6*	6.20 *6*	av Eβ=2387.3 *25*
(5450 *4*)	2706.02	4.3 *7*	6.29 *7*	av Eβ=2460.6 *25*
(5490 *4*)	2665.69	13.4 *10*	5.81 *4*	av Eβ=2480.2 *25*
(5717 *4*)	2438.71	4.7 *6*	6.34 *6*	av Eβ=2590.3 *25*
(5837 *4*)	2319.40	6.3 *4*	6.26 *3*	av Eβ=2648.3 *25*
(6313 *4*)	1842.73	2.9 *6*	6.75 *9*	av Eβ=2879.7 *25*
(6511 *4*)	1644.54	4.3 *12*	6.64 *13*	av Eβ=2976.0 *25*
(6586 *4*)	1570.19	6.0 *9*	6.52 *7*	av Eβ=3012.1 *25*
(6609‡ *4*)	1546.6	1.00 *24*	7.30 *11*	av Eβ=3023.6 *25* Iβ^-: log *ft* is too low to Be consistent with ΔJ=3 β transition. The intensity balance can probably be accounted for by unobserved γ rays.
(6969 *4*)	1186.51	7.1 *18*	6.56 *11*	av Eβ=3198.5 *25*
(7537 *4*)	619.35	12 *5*	6.49 *19*	av Eβ=3474.1 *25*

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^{78}Ga β^- decay (5.09 s) 1980Le22,1993Ch05 (continued)

β^- radiations (continued)

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.

$\gamma(^{78}Ge)$

Iγ normalization: from I(γ+ce)=100 for γ's to g.s. with the assumption of No β^- feeding to g.s..

E_γ	I_γ#	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α@	Comments
345.76[a] *26*	6.8 *10*	2665.69	(2,3,4$^+$)	2319.40	(2,3,4)			
458.00 *15*	7.6 *4*	1644.54	(2,3,4$^+$)	1186.51	2$^+$			
532.7 *4*	0.31 *9*	3389.89	(2$^+$,3,4$^+$)	2857.12	(2,3,4$^+$)			
567.06 *16*	23.7 *12*	1186.51	2$^+$	619.35	2$^+$	(E2)	1.60×10^{-3}	α(K)=0.001431 *20*; α(L)=0.0001496 *21*; α(M)=2.23×10^{-5} *4*; α(N+..)=1.428×10^{-6} *20* α(N)=1.428×10^{-6} *20*
619.40 *16*	100 *5*	619.35	2$^+$	0.0	0$^+$	(E2)	1.24×10^{-3}	α(K)=0.001106 *16*; α(L)=0.0001152 *17*; α(M)=1.717×10^{-5} *24*; α(N+..)=1.104×10^{-6} *16* α(N)=1.104×10^{-6} *16*
674.86 *17*	8.2 *4*	2319.40	(2,3,4)	1644.54	(2,3,4$^+$)			
862.8† *15*	1.1† *5*	2706.02	(2$^+$)	1842.73	2$^+$			
891.3†[a] *16*	0.44† *25*	2438.71	(2$^+$)	1546.6	0$^+$			
927.2 *3*	1.3 *3*	1546.6	0$^+$	619.35	2$^+$	(E2)	4.24×10^{-4}	α(K)=0.000379 *6*; α(L)=3.90×10^{-5} *6*; α(M)=5.81×10^{-6} *9*; α(N+..)=3.79×10^{-7} *6* α(N)=3.79×10^{-7} *6*
950.77 *17*	9.8 *5*	1570.19	4$^+$	619.35	2$^+$	(E2)	3.99×10^{-4}	α(K)=0.000357 *5*; α(L)=3.66×10^{-5} *6*; α(M)=5.46×10^{-6} *8*; α(N+..)=3.56×10^{-7} *5* α(N)=3.56×10^{-7} *5*
962.5[a] *15*	1.0 *5*	4083.8	(2,3,4$^+$)	3120.59	(2,3,4$^+$)			
1021.2 *4*	1.6 *4*	2665.69	(2,3,4$^+$)	1644.54	(2,3,4$^+$)			
1025.11 *17*	16.1 *9*	1644.54	(2,3,4$^+$)	619.35	2$^+$			
1061.9 *4*	0.88 *26*	2706.02	(2$^+$)	1644.54	(2,3,4$^+$)			
1186.42 *16*	26.1 *12*	1186.51	2$^+$	0.0	0$^+$	(E2)	2.46×10^{-4}	α(K)=0.000214 *3*; α(L)=2.18×10^{-5} *3*; α(M)=3.26×10^{-6} *5*; α(N+..)=6.94×10^{-6} *10* α(N)=2.14×10^{-7} *3*; α(IPF)=6.73×10^{-6} *10*
1212.41 *24*	2.6 *4*	2857.12	(2,3,4$^+$)	1644.54	(2,3,4$^+$)			
1223.36 *18*	6.0 *5*	1842.73	2$^+$	619.35	2$^+$			
1251.96 *20*	2.4 *3*	2438.71	(2$^+$)	1186.51	2$^+$			
1308.4 *3*	0.46 *23*	2952.9	(4$^+$)	1644.54	(2,3,4$^+$)			
1382.6 *9*	0.9 *8*	2952.9	(4$^+$)	1570.19	4$^+$			
1475.5 *4*	1.8 *7*	3120.59	(2,3,4$^+$)	1644.54	(2,3,4$^+$)			
1479.13 *18*	10.7 *7*	2665.69	(2,3,4$^+$)	1186.51	2$^+$			
1519.32 *24*	2.07 *32*	2706.02	(2$^+$)	1186.51	2$^+$			

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^{78}Ga β^- decay (5.09 s) 1980Le22,1993Ch05 (continued)

$\gamma(^{78}Ge)$ (continued)

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π
1564.2 *3*	1.56 *24*	4270.13	(2,3,4$^+$)	2706.02	(2$^+$)
1573.4 *3*	1.35 *25*	4279.4	(2,3,4$^+$)	2706.02	(2$^+$)
1604.38 *23*	2.08 *30*	4270.13	(2,3,4$^+$)	2665.69	(2,3,4$^+$)
1670.67 *23*	2.1 *3*	2857.12	(2,3,4$^+$)	1186.51	2$^+$
[x]1675.2 *3*	1.10 *23*				
1745.4 *4*	0.94 *22*	3389.89	(2$^+$,3,4$^+$)	1644.54	(2,3,4$^+$)
1819.59[&] *21*	3.7[&] *6*	2438.71	(2$^+$)	619.35	2$^+$
1819.59[&] *21*	1.0[&†] *4*	3389.89	(2$^+$,3,4$^+$)	1570.19	4$^+$
1934.10 *21*	12.1 *8*	3120.59	(2,3,4$^+$)	1186.51	2$^+$
2043.1 *4*	1.7 *3*	3687.9	(4$^+$)	1644.54	(2,3,4$^+$)
2046.32 *25*	7.2 *7*	2665.69	(2,3,4$^+$)	619.35	2$^+$
2237.9 *4*	1.6 *4*	2857.12	(2,3,4$^+$)	619.35	2$^+$
2241.0 *6*	1.1 *3*	4083.8	(2,3,4$^+$)	1842.73	2$^+$
2333.3 *4*	2.3 *4*	2952.9	(4$^+$)	619.35	2$^+$
[x]2358.3 *5*	1.34 *30*				
2501.4[&] *3*	3.3[&] *6*	3120.59	(2,3,4$^+$)	619.35	2$^+$
2501.4[&] *3*	0.8[&†] *4*	3687.9	(4$^+$)	1186.51	2$^+$
2706.2 *4*	4.4 *5*	2706.02	(2$^+$)	0.0	0$^+$
2771.2 *6*	1.7 *4*	3389.89	(2$^+$,3,4$^+$)	619.35	2$^+$
3083.0 *15*	0.51 *31*	4270.13	(2,3,4$^+$)	1186.51	2$^+$
3092.8 *7*	2.3 *4*	4279.4	(2,3,4$^+$)	1186.51	2$^+$
3464.3 *8*	5.7 *7*	4083.8	(2,3,4$^+$)	619.35	2$^+$
3508.4[†] *16*	0.12[†] *8*	5078.2	(2,3,4$^+$)	1570.19	4$^+$
4458.5 *12*	1.7 *3*	5078.2	(2,3,4$^+$)	619.35	2$^+$

[†] From $\gamma\gamma$.
[‡] From B(E2) values and systematic trends In this region (1993Ch05).
[#] For absolute intensity per 100 decays, multiply by 0.77 *3*.
[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[&] Multiply placed with intensity suitably divided.
[a] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence

(3^+) 0.0 — 5.09 s 5
Q_{β^-}=8156 4 — $\%\beta^-$=100.0
$^{78}_{31}Ga_{47}$

Iβ⁻	Log *ft*		
1.4	5.68	(2,3,4⁺)	5078.2
2.8	5.81	(2,3,4⁺)	4279.4
3.2	5.76	(2,3,4⁺)	4270.13
5.2	5.64	(2,3,4⁺)	4083.8
1.9	6.26	(4⁺)	3687.9
3.0	6.18	(2⁺,3,4⁺)	3389.89
13.2	5.65	(2,3,4⁺)	3120.59
2.8	6.38	(4⁺)	2952.9
4.6	6.20	(2,3,4⁺)	2857.12
4.3	6.29	(2⁺)	2706.02
13.4	5.81	(2,3,4⁺)	2665.69
4.7	6.34	(2⁺)	2438.71
6.3	6.26	(2,3,4)	2319.40
2.9	6.75	2⁺	1842.73
4.3	6.64	(2,3,4⁺)	1644.54
6.0	6.52	4⁺	1570.19
1.00	7.30	0⁺	1546.6
7.1	6.56	2⁺	1186.51
12	6.49	2⁺	619.35
		0⁺	0.0

5078.2	<2.8 ps
2952.9	9 ps *4*
2857.12	
2706.02	
2665.69	4.2 ps *28*
2438.71	<7 ps
2319.40	43 ps *5*
1842.73	
1644.54	15 ps *6*
1570.19	<3.5 ps
1546.6	25 ps *10*
1186.51	12 ps *6*
619.35	15.9 ps *28*

4458.5 1.31; 3508.4 0.09; 3092.8 1.8; 1573.4 1.04; 3083.0 0.39; 1604.38 1.60; 1564.2 1.20; 3464.3 4.4; 2241.0 0.85; 962.5 0.8; 2501.4 0.6@; 2043.1 1.31; 2771.2 1.3; 1819.59 0.8@; 1745.4 0.72; 532.7 0.24; 2501.4 2.5@; 1934.10 9.3; 1475.5 1.4; 2333.3 1.8; 1382.6 0.7; 1308.4 0.35; 2237.9 1.2; 1670.67 1.62; 1212.41 2.0; 2706.2 3.4; 1519.32 1.6; 1061.9 0.68; 862.8 0.8; 2046.32 5.5; 1479.13 8.2; 1021.2 1.2; 345.76 3.2; 1819.59 2.8@; 1251.96 1.85; 891.3 0.34; 674.86 6.3; 1223.36 4.6; 1025.11 12.4; 458.00 5.9; 980.77 (E2) 7.5; 927.2 (E2) 1.00; 1186.42 (E2) 20.1; 567.06 (E2) 18.3; 619.40 (E2) 77

$^{78}_{32}Ge_{46}$-4