^{65}Ge ε decay 1973Jo12

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 111, 2425 (2010)	1-Aug-2009

Parent: ^{65}Ge: E=0; $J^\pi=(3/2)^-$; $T_{1/2}$=30.9 s *5*; Q(ε)=6.24×10^3 *10*; %ε+%β^+ decay=100.0

1987Vi01: measured β^-delayed p′s, Eγ and Iγ from ^{64}Zn(p,γ).

1973Jo12: measured Eγ, Iγ; deduced decay scheme; Ge(Li)′s detectors.

1974Ro16: measured Eγ, Iγ; deduced decay scheme.

1976Ha29,1981Ha44: measured p-x-ray, p-γ, γ-x-ray and β+γ coincidences and β^-delayed γ′s.

1975Ro25: measured delayed $\gamma\gamma$ coincidences, deduced $T_{1/2}$; NaI′s.

A $T_{1/2}$=1.5 min ^{65}Ge activity reported in 1958Po79 and associated with γ-rays at 0.67 and 1.72 MeV has been searched for but not observed (1973Jo12,1974Ro16).

^{65}Ga Levels

E(level)[†]	J^π[@]	$T_{1/2}$	Comments
0	3/2$^-$		I(ε+β^+)=0 *14* from the normalization used here; it is estimated to be<10% (1973Jo12). Other:<30% from measured growth of ^{65}Ga daughter activity (1974Ro16).
62.0 *2*	(1/2)$^-$	<1.2 ns	$T_{1/2}$: from measurement of delayed 62γ-$\gamma^\pm$ coincidence (1975Ro25).
190.8 *2*	5/2$^-$		
649.7 *2*	1/2$^-$,3/2$^-$		
809.2 *2*	1/2$^-$,3/2$^-$		
1075.8 *2*	7/2		
1662.8 *6*	1/2$^-$,3/2$^-$		
1879.3 *2*			
1902?[#] *2*			
2046.3?[#] *4*			
2161.7? *4*			
2929.4? *7*			
3085.1?[#] *4*			
3197.0?[#] *7*			
3279.3?[#] *7*			
5065 *5*			
5117[‡] *5*			
5192 *10*			
5240[‡] *5*			
5299[‡] *5*			
5339[‡] *5*			
5354[‡] *10*			
5384[‡] *5*			
5393[‡] *10*			
5437[‡] *5*			
5468[‡] *5*			
5480[‡] *5*			
5508[‡] *5*			
5553 *5*			
5563 *10*			
5597 *5*			
5643 *5*			
5656 *5*			
5678 *5*			
5709 *5*			
5758 *10*			

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^{65}Ge ε decay 1973Jo12 (continued)

^{65}Ga Levels (continued)

E(level)[†]	E(level)[†]	E(level)[†]
5799 *5*	5868 *5*	5927 *10*
5844 *5*	5900 *5*	5940 *10*
		5993 *10*

[†] From a least-squares fit to Eγ data, except where noted. Levels at 5065 and above are from 1987Vi01; their energy is determined from β^-delayed protons and a proton binding energy for ^{65}Ga=3943 keV *1*. The energy uncertainty was estimated by the evaluators from the uncertainties in these two quantities.

[‡] Level populated in ^{64}Zn(p,γ) (1987Vi01).

[#] Not seen in ^{64}Zn(p,γ) (1987Vi01).

[@] From Adopted Levels.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ [†‡]	Iε[‡]	Log *ft*	I(ε+β^+)[‡]	Comments
(2.5×10^2 *10*)	5993		1.2×10^{-4} *5*	5.8 *6*	1.2×10^{-4} *5*	εK=0.876 *6*; εL=0.104 *5*; εM+=0.0191 *11*
(3.0×10^2 *10*)	5940		2.4×10^{-4} *10*	5.7 *5*	2.4×10^{-4} *10*	εK=0.878 *4*; εL=0.103 *3*; εM+=0.0188 *6*
(3.1×10^2 *10*)	5927		8×10^{-5} *4*	6.2 *5*	8×10^{-5} *4*	εK=0.878 *4*; εL=0.103 *3*; εM+=0.0188 *6*
(3.4×10^2 *10*)	5900		1.3×10^{-4} *5*	6.1 *4*	1.3×10^{-4} *5*	εK=0.879 *3*; εL=0.1025 *21*; εM+=0.0187 *5*
(3.7×10^2 *10*)	5868		4.5×10^{-4} *7*	5.6 *3*	4.5×10^{-4} *7*	εK=0.8793 *21*; εL=0.1021 *17*; εM+=0.0186 *4*
(4.0×10^2 *10*)	5844		4.5×10^{-4} *7*	5.7 *3*	4.5×10^{-4} *7*	εK=0.8796 *18*; εL=0.1018 *15*; εM+=0.0186 *3*
(4.4×10^2 *10*)	5799		6.7×10^{-4} *10*	5.59 *24*	6.7×10^{-4} *10*	εK=0.8801 *14*; εL=0.1014 *12*; εM+=0.01848 *24*
(4.8×10^2 *10*)	5758		1.5×10^{-4} *5*	6.3 *3*	1.5×10^{-4} *5*	εK=0.8805 *11*; εL=0.1011 *9*; εM+=0.01841 *19*
(5.3×10^2 *10*)	5709		3.0×10^{-4} *5*	6.10 *20*	3.0×10^{-4} *5*	εK=0.8809; εL=0.1008 *8*; εM+=0.01835 *15*
(5.6×10^2 *10*)	5678		5.2×10^{-4} *7*	5.92 *19*	5.2×10^{-4} *7*	εK=0.8811; εL=0.1006 *7*; εM+=0.01831 *14*
(5.8×10^2 *10*)	5656		5.7×10^{-4} *7*	5.91 *18*	5.7×10^{-4} *7*	εK=0.8812; εL=0.1005 *6*; εM+=0.01829 *12*
(6.0×10^2 *10*)	5643		4.5×10^{-4} *7*	6.03 *18*	4.5×10^{-4} *7*	εK=0.8813; εL=0.1004 *6*; εM+=0.01827 *12*
(6.4×10^2 *10*)	5597		2.7×10^{-4} *5*	6.32 *17*	2.7×10^{-4} *5*	εK=0.8815; εL=0.1002 *5*; εM+=0.01823 *10*
(6.8×10^2 *10*)	5563		1.0×10^{-4} *5*	6.8 *3*	1.0×10^{-4} *5*	εK=0.8817; εL=0.1001 *5*; εM+=0.01821 *9*
(6.9×10^2 *10*)	5553		2.7×10^{-4} *5*	6.38 *16*	2.7×10^{-4} *5*	εK=0.8817; εL=0.1001 *4*; εM+=0.01820 *9*
(7.3×10^2 *10*)	5508		6.6×10^{-4} *10*	6.05 *15*	6.6×10^{-4} *10*	εK=0.8819; εL=0.0999 *4*; εM+=0.01817 *8*
(7.6×10^2 *10*)	5480		2.0×10^{-4} *5*	6.60 *17*	2.0×10^{-4} *5*	εK=0.8820; εL=0.0998 *4*; εM+=0.01815 *7*
(7.7×10^2 *10*)	5468		1.2×10^{-4} *5*	6.83 *22*	1.2×10^{-4} *5*	εK=0.8820; εL=0.0998 *4*; εM+=0.01815 *7*
(8.0×10^2 *10*)	5437		2.4×10^{-4} *5*	6.57 *15*	2.4×10^{-4} *5*	εK=0.8821; εL=0.0997 *3*; εM+=0.01813 *6*
(8.5×10^2 *10*)	5393		7×10^{-5} *3*	7.15 *22*	7×10^{-5} *3*	εK=0.8823; εL=0.0996 *3*; εM+=0.01811 *6*
(8.6×10^2 *10*)	5384		6.0×10^{-4} *10*	6.22 *14*	6.0×10^{-4} *10*	εK=0.8823; εL=0.09960 *25*; εM+=0.01810 *6*
(8.9×10^2 *10*)	5354		2.0×10^{-4} *10*	6.73 *25*	2.0×10^{-4} *10*	εK=0.8824; εL=0.09954 *24*; εM+=0.01809 *5*
(9.0×10^2 *10*)	5339		3.4×10^{-4} *10*	6.52 *17*	3.4×10^{-4} *10*	εK=0.8824; εL=0.09951 *23*; εM+=0.01808 *5*
(9.4×10^2 *10*)	5299		5.0×10^{-4} *10*	6.39 *14*	5.0×10^{-4} *10*	εK=0.8825; εL=0.09943 *21*; εM+=0.01807 *5*
(1.00×10^3 *10*)	5240		1.14×10^{-3} *15*	6.08 *11*	1.14×10^{-3} *15*	εK=0.8826; εL=0.09933 *18*; εM+=0.01805 *4*
(1.05×10^3 *10*)	5192		1.7×10^{-4} *10*	6.9 *3*	1.7×10^{-4} *10*	εK=0.8827; εL=0.09926 *18*; εM+=0.01803 *4*
(1.12×10^3 *10*)	5117		8.4×10^{-4} *10*	6.32 *10*	8.4×10^{-4} *10*	εK=0.8827 *25*; εL=0.0991 *5*; εM+=0.01801 *8*
(1.18×10^3 *10*)	5065		0.00013 *5*	7.17 *19*	1.3×10^{-4} *5*	av Eβ=70 *44*; εK=0.882 *6*; εL=0.0990 *8*; εM+=0.01798 *15*
(4.36×10^3 *10*)	1879.3	6.6 *10*	0.137 *25*	5.29 *9*	6.7 *10*	av Eβ=1513 *48*; εK=0.0180 *17*; εL=0.00200

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^{65}Ge ε decay 1973Jo12 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ †‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)‡	Comments
						19; εM+=0.00036 *4*
(4.58×10^3 *10*)	1662.8	0.68 *13*	0.0117 *25*	6.40 *10*	0.69 *13*	av Eβ=1617 *48*; εK=0.0150 *14*; εL=0.00166 *15*; εM+=0.00030 *3*
(5.43×10^3 *10*)	809.2	22 *3*	0.20 *3*	5.32 *8*	22 *3*	av Eβ=2028 *49*; εK=0.0080 *6*; εL=0.00088 *7*; εM+=0.000160 *12*
(5.59×10^3 *10*)	649.7	35 *5*	0.28 *5*	5.19 *8*	35 *5*	av Eβ=2105 *49*; εK=0.0072 *5*; εL=0.00079 *6*; εM+=0.000144 *10*
(6.05×10^3 *10*)	190.8	4.4 *10*	0.027 *7*	6.28 *11*	4.4 *10*	av Eβ=2328 *49*; εK=0.0054 *4*; εL=0.00060 *4*; εM+=0.000109 *7*
(6.18×10^3 *10*)	62.0	30 *8*	0.17 *5*	5.50 *13*	30 *8*	av Eβ=2390 *49*; εK=0.0050 *3*; εL=0.00056 *4*; εM+=0.000101 *6*

† From γ intensity balance at each level for E(level)<2000; from %β^+p for E(level)=5065 and above, normalized to Iγ(650)=33.0% (1987Vi01).
‡ Absolute intensity per 100 decays.

$\gamma(^{65}Ga)$

Iγ normalization: Based on I$\gamma(\gamma^{\pm})$/Iγ(650)=6.0 *5* (1973Jo12) and theoretical ε/β^+ ratios.

E_γ †	I_γ ‡&	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	δ@	α a	Comments
62.0 *2*	81 *15*	62.0	(1/2)$^-$	0	3/2$^-$	[M1]		0.266	α(K)=0.233; α(L)=0.0248 E$_\gamma$: from 1974Ro16. Eγ=62.1 *5* reported in 1973Jo12.
190.8 *2*	31.3 *19*	190.8	5/2$^-$	0	3/2$^-$	M1+E2	−0.7 *3*	0.029 *10*	α(K)=0.026 *9*; α(L)=0.028 *10*
459.1 *5*	6.0 *8*	649.7	1/2$^-$,3/2$^-$	190.8	5/2$^-$				
587.7 *2*	8.0 *12*	649.7	1/2$^-$,3/2$^-$	62.0	(1/2)$^-$				
618.7 *4*	4.6 *7*	809.2	1/2$^-$,3/2$^-$	190.8	5/2$^-$				
649.7 *2*	100	649.7	1/2$^-$,3/2$^-$	0	3/2$^-$				
[x]753.0[c] *3*	3.9 *6*								E$_\gamma$: reported in 1974Ro16 as a possible γ ray associated with ^{65}Ge ε decay. Not reported in 1973Jo12. I$_\gamma$: from 1974Ro16.
809.1 *2*	65 *4*	809.2	1/2$^-$,3/2$^-$	0	3/2$^-$				
826.8[c] *15*	1.1 *4*	1902?		1075.8	7/2				
884.9 *3*	1.0 *4*	1075.8	7/2	190.8	5/2$^-$	D+Q	−0.23 *4*		
970.7[c] *15*	0.7 *3*	2046.3?		1075.8	7/2				
1070.2 *3*	2.8 *3*	1879.3		809.2	1/2$^-$,3/2$^-$				
1075.9 *3*	2.5 *3*	1075.8	7/2	0	3/2$^-$	Q+O			
1150.7[c] *15*	0.4 *2*	3197.0?		2046.3?					
1183.6[c] *3*	1.4 *3*	3085.1?		1902?					
1205.7[c] *4*	3.7 *4*	3085.1?		1879.3					
1229.8 *3*	6.7 *9*	1879.3		649.7	1/2$^-$,3/2$^-$				Eγ,Iγ: from 1974Ro16. Not reported in 1973Jo12.
1237.1[c] *3*	3.8 *3*	2046.3?		809.2	1/2$^-$,3/2$^-$				This γ has been assigned to the decays of 1299 and 1880 levels in the

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^{65}Ge ε decay 1973Jo12 (continued)

$\gamma(^{65}Ga)$ (continued)

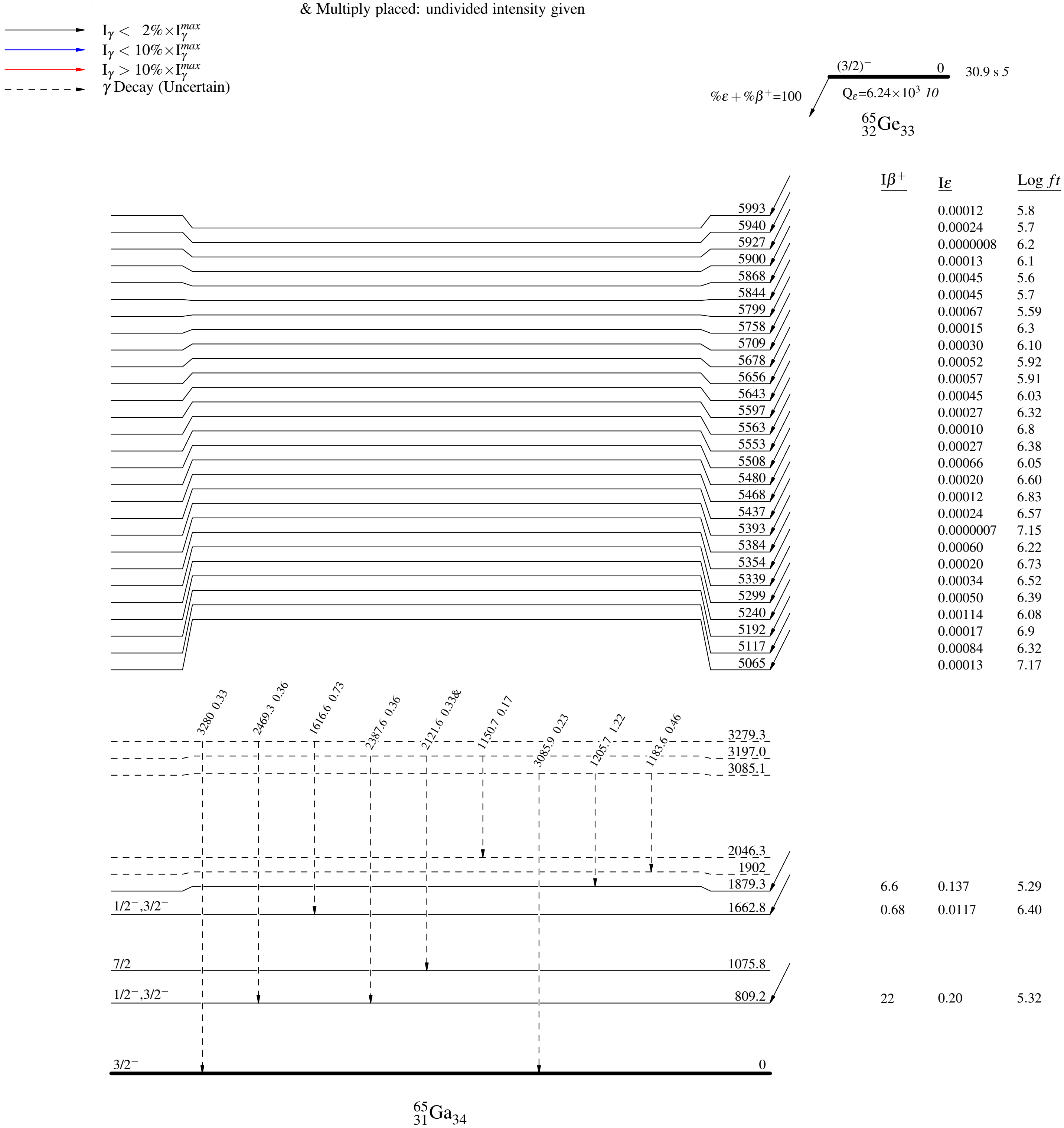
E_γ [†]	I_γ [‡&]	E_i(level)	J_i^π	E_f	J_f^π	Comments
						$^{64}Zn(p,\gamma)$ data of 1987Vi01.
1511.9[c] *10*	1.0 *2*	2161.7?		649.7	1/2$^-$,3/2$^-$	
1600.8 *5*	2.1 *3*	1662.8	1/2$^-$,3/2$^-$	62.0	(1/2)$^-$	
1616.6[c] *5*	2.2 *3*	3279.3?		1662.8	1/2$^-$,3/2$^-$	
1688.5 *5*	6.7 *6*	1879.3		190.8	5/2$^-$	I_γ: 10.9 *15* from 1974Ro16.
1816.3 *15*	1.2 *3*	1879.3		62.0	(1/2)$^-$	
1879.2 *5*	2.9 *7*	1879.3		0	3/2$^-$	I_γ: in disagreement with $I\gamma$=10.9 *15* from 1974Ro16.
1902[c] *2*	1.2 *3*	1902?		0	3/2$^-$	
2099.6[c] *4*	4.5 *3*	2161.7?		62.0	(1/2)$^-$	
2121.6[bc] *10*	1.0[b] *3*	2929.4?		809.2	1/2$^-$,3/2$^-$	
2121.6[bc] *10*	1.0[b] *3*	3197.0?		1075.8	7/2	
2162.6[c] *12*	1.6 *3*	2161.7?		0	3/2$^-$	
[x]2219 *2*	0.7 *4*					
2279.5[c] *5*	1.0 *3*	2929.4?		649.7	1/2$^-$,3/2$^-$	
2387.6[c] *10*	1.1 *5*	3197.0?		809.2	1/2$^-$,3/2$^-$	
[x]2448.0 *4*	4.2 *5*					
2469.3[c] *15*	1.0 *2*	3279.3?		809.2	1/2$^-$,3/2$^-$	
[x]2703.5 *15*	0.6 *3*					
[x]2717.2 *15*	1.0 *3*					
[x]2968.5 *12*	1.5 *2*					
3085.9[c] *15*	0.7 *3*	3085.1?		0	3/2$^-$	
3280[c] *2*	0.9 *2*	3279.3?		0	3/2$^-$	

[†] From 1973Jo12, except as noted.
[‡] From 1973Jo12. $I\gamma$'s from 1974Ro16, where measured, are in good agreement with 1973Jo12 values, except as noted.
[#] From adopted γ's.
[@] From adopted γ's.
[&] For absolute intensity per 100 decays, multiply by 0.33 *4*.
[a] 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.
[b] Multiply placed with undivided intensity.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{65}Ge ε decay 1973Jo12

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given



^{65}Ge ε decay 1973Jo12

Decay Scheme (continued)