^{68}As ε decay (151.6 s) 1977Pa13

History

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

Parent: ^{68}As: E=0.0; $J^\pi=3^+$; $T_{1/2}$=151.6 s *8*; Q(ε)=8084 *3*; %ε+%β^+ decay=100.0

1977Pa13: ^{68}As from ^{58}Ni(^{12}C,pn) at 32,42 MeV. Measured Eγ, Iγ, Eβ^+, $\gamma\gamma$ and $\beta^+\gamma$ coincidences, and $T_{1/2}$ using a Ge(Li) detector (FWHM=2.5 keV at 1.3 MeV) and a NE102 plastic scintillator. See also 1976PaZY.

1971Pa32: ^{68}As from ^{70}Ge(p,3n) at 40 MeV. Measured Eγ, Iγ, $\gamma\gamma$ and $T_{1/2}$ with Ge(Li) (FWHM=2.5 keV at 1.3 MeV), LEPS and NaI(Tl) detectors.

α: Additional information 1.

α: Additional information 2.

α: Additional information 3.

^{68}Ge Levels

E(level)†	J^π‡	E(level)†	J^π‡	E(level)†	J^π‡	E(level)†	J^π‡
0.0	0^+	2457.7 *7*	2^+	3087.8 *5*	$2^{(+)}$	3809.7 *10*	2^+
1016.23 *22*	2^+	2649.4 *10*	3^-	3288.0 *7*	$2^{(+)}$	4238.9 *10*	(2^+)
1754.8 *4*	0^+	2830.9 *4*	4^+	3400.8 *4*	$2^{(+)}$	4567.9 *10*	(2^+)
1778.15 *23*	2^+	2947.9 *5*	2^+	3417.9 *5*		4878.5 *14*	
2268.6 *4*	4^+	3023.6 *5*	2^+	3475.1 *10*			
2429.5 *3*	3^+	3041.5 *3*	(4^+)	3522.5 *10*	2^+		

† From a least squares fit to Eγ by evaluator.

‡ From Adopted Levels.

ε,β^+ radiations

E(decay)#	E(level)	Iβ^+ †@	Iε†@	Log *ft*	I($\varepsilon+\beta^+$)‡@	Comments
(3206 *3*)	4878.5	0.14 *7*	0.012 *6*	6.82 *24*	0.15 *8*	av Eβ=969.2 *16*; εK=0.0695 *3*; εL=0.00779 *4*; εM+=0.001460 *7*
(3516 *3*)	4567.9	0.4 *1*	0.02 *1*	6.64 *11*	0.4 *1*	av Eβ=1114.2 *15*; εK=0.04755 *18*; εL=0.005329 *20*; εM+=0.000999 *4*
(3845 *3*)	4238.9	0.14 *8*	0.006 *3*	7.30 *24*	0.15 *8*	av Eβ=1269.1 *15*; εK=0.03323 *11*; εL=0.003723 *13*; εM+=0.0006975 *2*
(4274 *3*)	3809.7	1.2 *1*	0.030 *3*	6.67 *4*	1.2 *1*	av Eβ=1472.7 *15*; εK=0.02199 *7*; εL=0.002463 *7*; εM+=0.0004614 *1* Eβ^+=3010 *140* (1977Pa13).
(4562 *3*)	3522.5	1.4 *1*	0.027 *2*	6.77 *4*	1.4 *1*	av Eβ=1609.8 *16*; εK=0.01717 *5*; εL=0.001922 *5*; εM+=0.0003600 *1* Eβ^+=3510 *110* (1977Pa13).
(4609 *3*)	3475.1	4.9 *8*	0.094 *15*	6.24 *7*	5.0 *8*	av Eβ=1632.5 *16*; εK=0.01651 *5*; εL=0.001848 *5*; εM+=0.0003462 *9*
(4666 *3*)	3417.9	2.7 *1*	0.048 *2*	6.540 *17*	2.7 *1*	av Eβ=1659.9 *15*; εK=0.01576 *4*; εL=0.001764 *5*; εM+=0.0003305 *9*
(4683 *3*)	3400.8	6.2 *3*	0.11 *1*	6.181 *21*	6.3 *3*	av Eβ=1668.1 *15*; εK=0.01555 *4*; εL=0.001740 *5*; εM+=0.0003259 *8* Eβ^+=3580 *80* (1977Pa13), weighted average of 3495 *167* and 3605 *86*.
(4796 *3*)	3288.0	1.1 *1*	0.018 *2*	7.00 *4*	1.1 *1*	av Eβ=1722.2 *15*; εK=0.01422 *4*; εL=0.001592 *4*; εM+=0.0002981 *8*
(4996 *3*)	3087.8	3.0 *2*	0.042 *3*	6.66 *3*	3.0 *2*	av Eβ=1818.4 *15*; εK=0.01222 *3*; εL=0.001367 *3*; εM+=0.0002561 *6*
(5043 *3*)	3041.5	15.1 *6*	0.205 *8*	5.979 *18*	15.3 *6*	av Eβ=1840.6 *15*; εK=0.01181 *3*; εL=0.001321 *3*;

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^{68}As ε decay (151.6 s) 1977Pa13 (continued)

ε,β+ radiations (continued)

E(decay)#	E(level)	Iβ+ †@	Iε†@	Log *ft*	I(ε+β+)‡@	Comments
						εM+=0.0002475 *6* Eβ+=3950 *70* (1977Pa13), weighted average of 3855 *204*, 3885 *280*, 3929 *108*, and 3998 *92*.
(5060 *3*)	3023.6	3.9 *3*	0.053 *4*	6.57 *4*	4.0 *3*	av Eβ=1849.3 *15*; εK=0.01166 *3*; εL=0.001304 *3*; εM+=0.0002443 *6* Eβ+=3680 *180* (1977Pa13), weighted average of 3645 *242* and 3720 *279*.
(5136 *3*)	2947.9	0.92 *8*	0.012 *1*	7.24 *4*	0.93 *8*	av Eβ=1885.7 *15*; εK=0.011037 *24*; εL=0.001235 *3*; εM+=0.0002313 *5*
(5253 *3*)	2830.9	3.30 *22*	0.038 *3*	6.74 *3*	3.34 *22*	av Eβ=1942.1 *15*; εK=0.010164 *22*; εL=0.0011370 *2*; εM+=0.0002130 *5*
(5435 *3*)	2649.4	0.90 *11*	0.0093 *11*	7.39 *6*	0.91 *11*	av Eβ=2029.8 *16*; εK=0.008983 *19*; εL=0.0010048 *2*; εM+=0.0001882 *4*
(5626 *3*)	2457.7	3.5 *8*	0.031 *7*	6.89 *10*	3.5 *8*	av Eβ=2122.6 *15*; εK=0.007926 *16*; εL=0.0008865 *1*; εM+=0.0001661 *4*
(5655 *3*)	2429.5	36.0 *20*	0.320 *18*	5.885 *24*	36.3 *20*	av Eβ=2136.2 *15*; εK=0.007785 *15*; εL=0.0008707 *1*; εM+=0.0001631 *4*
(5815 *3*)	2268.6	3.1 *4*	0.025 *3*	7.02 *6*	3.1 *4*	av Eβ=2214.2 *15*; εK=0.007041 *13*; εL=0.0007874 *1*; εM+=0.0001475 *3*
(6306 *3*)	1778.15	7 *3*	0.04 *2*	6.86 *19*	7 *3*	av Eβ=2452.6 *15*; εK=0.005285 *9*; εL=0.0005909 *1*; εM+=0.00011068
(6329 *3*)	1754.8	<0.2	<0.001	>8.4	<0.2	av Eβ=2464.0 *15*; εK=0.005217 *9*; εL=0.0005833 *1*; εM+=0.00010925
(7068 *3*)	1016.23	4.0 *22*	0.016 *9*	7.38 *24*	4.0 *22*	av Eβ=2824.5 *15*; εK=0.003554 *6*; εL=0.0003973 *6*; εM+=7.440×10^{-5} *11*

† From I(ε+β+) and theoretical β+/ε ratios.
‡ From I(γ+ce) imbalance at each level and assuming no direct feeding of the g.s.
# Experimental values from β+γ coincidence β+ endpoint energy measurements (1977Pa13) are given in the comments.
@ Absolute intensity per 100 decays.

γ(^{68}Ge)

Iγ normalization: From total I(γ+c.e.)(g.s.)=100% (direct ε feeding to the ground state is not expected (ΔJ=3)). Systematics of log *ft* values for ΔJ=3 with no parity change give a lower limit of 13 (1973Ra10). Based on this limit, the ε branch to the g.s. would have an intensity less than 2×10^{-5}%.

Eγ †	Iγ †&	Ei(level)	J_i^π	Ef	J_f^π	Mult.‡	δ‡	α	Comments
(190.3 *10*)	1.5 *2*	2457.7	2^+	2268.6	4^+	[E2]		0.0669 *17*	α(K)=0.0592 *15*; α(L)=0.00669 *17*; α(M)=0.000992 *25*; α(N+..)=5.81×10^{-5} *14* Eγ,Iγ: from the Adopted Gammas and Iγ(702γ)=0.9 *1*.
(403.8 *10*)	0.056 *8*	2830.9	4^+	2429.5	3^+				Eγ,Iγ: from the Adopted Gammas and Iγ(1053γ)=2.3 *2*.
(564.0 *10*)	0.156 *19*	2830.9	4^+	2268.6	4^+				Eγ,Iγ: from the Adopted Gammas and Iγ(1053γ)=2.3 *2*.
612.0 *3*	12.5 *7*	3041.5	(4^+)	2429.5	3^+	M1+E2	+0.24 *4*	0.000906 *15*	α=0.000906 *15*; α(K)=0.000810 *13*;

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^{68}As ε decay (151.6 s) 1977Pa13 (continued)

γ(^{68}Ge) (continued)

E_γ †	I_γ †&	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	δ‡	α	Comments
									α(L)=8.31×10^{-5} *14*; α(M)=1.242×10^{-5} *21*; α(N+..)=8.16×10^{-7}
651.2 *3*	41.2 *21*	2429.5	3$^+$	1778.15	2$^+$	M1+E2	+0.06 *2*	0.000772 *11*	α=0.000772 *11*; α(K)=0.000690 *10*; α(L)=7.07×10^{-5} *10*; α(M)=1.056×10^{-5} *15*; α(N+..)=6.96×10^{-7}
702.9 *10*	0.9 *1*	2457.7	2$^+$	1754.8	0$^+$	[E2]		0.000869 *13*	α=0.000869 *13*; α(K)=0.000776 *12*; α(L)=8.04×10^{-5} *12*; α(M)=1.199×10^{-5} *18*; α(N+..)=7.75×10^{-7}
738.4 *5*	3.9 *3*	1754.8	0$^+$	1016.23	2$^+$	E2		0.000760 *11*	α=0.000760 *11*; α(K)=0.000679 *10*; α(L)=7.03×10^{-5} *10*; α(M)=1.048×10^{-5} *15*; α(N+..)=6.78×10^{-7}
761.8 *3*	43.3 *23*	1778.15	2$^+$	1016.23	2$^+$	M1+E2	−0.15 *3*	0.000552 *8*	α=0.000552 *8*; α(K)=0.000493 *7*; α(L)=5.04×10^{-5} *8*; α(M)=7.53×10^{-6} *11*; α(N+..)=4.97×10^{-7} *7*
(871.2 *2*)	0.069 *6*	2649.4	3$^-$	1778.15	2$^+$	[E1]		0.000201 *3*	α=0.000201 *3*; α(K)=0.000180 *3*; α(L)=1.82×10^{-5} *3*; α(M)=2.72×10^{-6} *4*; α(N+..)=1.781×10^{-7} *25*
									E_γ,I_γ: from the Adopted Gammas and Iγ(1633γ)=1.3 *1*.
988.3 *5*	1.3 *1*	3417.9		2429.5	3$^+$				
1016.1 *3*	100	1016.23	2$^+$	0.0	0$^+$	E2		0.000341 *5*	α=0.000341 *5*; α(K)=0.000304 *5*; α(L)=3.12×10^{-5} *5*; α(M)=4.66×10^{-6} *7*; α(N+..)=3.04×10^{-7} *5*
1052.7 *5*	2.3 *2*	2830.9	4$^+$	1778.15	2$^+$	E2		0.000314 *5*	α=0.000314 *5*; α(K)=0.000280 *4*; α(L)=2.87×10^{-5} *4*; α(M)=4.28×10^{-6} *6*; α(N+..)=2.80×10^{-7} *4*
1169.7 *5*	1.2 *1*	2947.9	2$^+$	1778.15	2$^+$				
1245.1 *10*	0.6 *1*	3023.6	2$^+$	1778.15	2$^+$				
1252.4 *3*	5.8 *4*	2268.6	4$^+$	1016.23	2$^+$	E2		0.000230 *4*	α=0.000230 *4*; α(K)=0.000190 *3*; α(L)=1.94×10^{-5} *3*; α(M)=2.89×10^{-6} *4*; α(N+..)=1.79×10^{-5} *3*
1263.4 *3*	6.6 *4*	3041.5	(4$^+$)	1778.15	2$^+$				
1309.6 *10*	0.7 *1*	3087.8	2$^{(+)}$	1778.15	2$^+$				
1332.8 *5*	1.5 *1*	3087.8	2$^{(+)}$	1754.8	0$^+$				
1413.3 *5*	19.6 *10*	2429.5	3$^+$	1016.23	2$^+$	M1+E2	+0.16 *8*	0.000200 *3*	α=0.000200 *3*; α(K)=0.0001396 *20*; α(L)=1.415×10^{-5} *20*; α(M)=2.11×10^{-6} *3* α(N+..)=4.42×10^{-5} *7*
(1441.0 *10*)	0.69 *13*	2457.7	2$^+$	1016.23	2$^+$				E_γ,I_γ: from the Adopted Gammas and Iγ(702γ)=0.9 *1*.
1622.5 *5*	5.4 *3*	3400.8	2$^{(+)}$	1778.15	2$^+$				
1633.2 *10*	1.3 *1*	2649.4	3$^-$	1016.23	2$^+$	E1+M2	+0.09 *3*	0.000423 *6*	α=0.000423 *6*; α(K)=5.91×10^{-5} *13*; α(L)=5.96×10^{-6} *13*;

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^{68}As ε decay (151.6 s) 1977Pa13 (continued)

γ(^{68}Ge) (continued)

E_γ [†]	I_γ [†&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α	Comments
								α(M)=8.89×10^{-7} *19*; α(N+..)=0.000357 *6*
1639.9 *7*	2.2 *1*	3417.9		1778.15	2$^+$			
1645.9 *10*	1.3 *1*	3400.8	2$^{(+)}$	1754.8	0$^+$			
1778.1 *3*	25.8 *15*	1778.15	2$^+$	0.0	0$^+$	E2	0.000310 *5*	α=0.000310 *5*; α(K)=9.35×10^{-5} *13*; α(L)=9.48×10^{-6} *14*; α(M)=1.414×10^{-6} *20* α(N+..)=0.000205 *3*
1814.7 *5*	1.8 *2*	2830.9	4$^+$	1016.23	2$^+$	E2	0.000323 *5*	α=0.000323 *5*; α(K)=9.00×10^{-5} *13*; α(L)=9.11×10^{-6} *13*; α(M)=1.360×10^{-6} *19* α(N+..)=0.000222 *4*
2007.4 *5*	4.6 *4*	3023.6	2$^+$	1016.23	2$^+$			
2025.3 *10*	0.7 *1*	3041.5	(4$^+$)	1016.23	2$^+$			
2071.8 *10*	0.4 *1*	3087.8	2$^{(+)}$	1016.23	2$^+$			
2229.0 *10*	0.2 *1*	4878.5		2649.4	3$^-$			
2271.3 *10*	1.0 *1*	3288.0	2$^{(+)}$	1016.23	2$^+$			
2384.6 *10*	1.2 *1*	3400.8	2$^{(+)}$	1016.23	2$^+$			
2457.6 *10*	1.3[#] *10*	2457.7	2$^+$	0.0	0$^+$	[E2]	0.000591 *9*	α=0.000591 *9*; α(K)=5.21×10^{-5} *8*; α(L)=5.26×10^{-6} *8*; α(M)=7.84×10^{-7} *11*; α(N+..)=0.000533 *8*
2458.8 *10*	6.5[#] *10*	3475.1		1016.23	2$^+$			
2506.2 *10*	1.8 *1*	3522.5	2$^+$	1016.23	2$^+$			
2793.4 *10*	1.6 *1*	3809.7	2$^+$	1016.23	2$^+$			
[x]3058[@] *3*	1.1[@] *2*							
3088.3 *10*	1.3 *1*	3087.8	2$^{(+)}$	0.0	0$^+$			
3222.6 *10*	0.2 *1*	4238.9	(2$^+$)	1016.23	2$^+$			
3288.4 *10*	0.4 *1*	3288.0	2$^{(+)}$	0.0	0$^+$			
3401.3 *10*	0.3 *1*	3400.8	2$^{(+)}$	0.0	0$^+$			
3551.6 *10*	0.5 *1*	4567.9	(2$^+$)	1016.23	2$^+$			

[†] From 1977Pa13, except where noted otherwise. Iγ normalized to Iγ(1016γ)=100.
[‡] From Adopted Gammas.
[#] Doublet components derived from γγ data (1977Pa13).
[@] Reported only by 1971Pa32.
[&] For absolute intensity per 100 decays, multiply by 0.774 *11*.
[x] γ ray not placed in level scheme.

^{68}As ε decay (151.6 s) 1977Pa13

Decay Scheme

Intensities: I_γ per 100 parent decays