^{70}As ε decay 2002Li41,1968De16

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	G. Gürdal, E. A. Mccutchan	NDS 136, 1 (2016)	1-Jul-2016

Parent: ^{70}As: E=0.0; $J^\pi=4^+$; $T_{1/2}$=52.6 min *3*; Q(ε)=6220 *50*; %ε+%β^+ decay=100.0

2002Li41: source was produced via ^{70}Ge(p,n), E_p=16 MeV. Compton-suppressed HPGe detector and a planar Ge used for γ-ray detection. Measured Eγ, Iγ, $\gamma\gamma$ coin.

1992De54: mass separated source was produced in $^{56}Fe(^{16}O$,pn). Seven Ge(Li) detectors used for γ-ray detection. Measured $\gamma(\theta)$; deduced δ.

1968De16: source was produced via ^{70}Ge(d,2n); enriched target, chemical separation; Ge(Li) detectors used for γ-ray detection; measured $T_{1/2}$, Eγ, Iγ, $\gamma\gamma$ coin.

1963Bo14: source was produced via ^{70}Ge(d,2n); natural and enriched targets, chemical separation; NaI(Tl) detector and β spectrometer; measured Eγ, Iγ, $\gamma\gamma$ coincidences, β^+ spectrum.

Others: 1967Vi06, 1969Hi01.

α: Additional information 1.

^{70}Ge Levels

E(level)‡	J^π†	E(level)‡	J^π†	E(level)‡	J^π†	E(level)‡	J^π†
0.0	0^+	2451.30 *3*	3^+	3294.76 *8*	$3^+,4^+$	4243.11 *15*	
1039.495 *22*	2^+	2534.93 *4*	2^+	3371.64 *10*	(3,4)	4577.23 *16*	$(3,4^+)$
1215.57 *3*	0^+	2562.05 *3*	3^-	3488.234 *24*	$(3,4^+)$	4675.41 *21*	$(3,4^+)$
1707.628 *18*	2^+	2806.25 *3*	4^+	3570.51 *7*	$(2,3)^-$	5265.81 *14*	
2153.17 *3*	4^+	3046.43 *3*	3^+	3675.75 *7*	$3^+,4^+$	5370.07 *5*	
2156.73 *3*	2^+	3058.720 *24*	4^+	4101.45 *5*	(3^-)		

† From the Adopted Levels.

‡ From a least-squares fit to Eγ's by evaluators.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)†‡	Comments
(8.5×10^2 *5*)	5370.07		0.84 *6*	5.13 *7*	0.84 *6*	εK=0.8807 *2*; εL=0.10044 *13*; εM+=0.01886 *3*
(9.5×10^2 *5*)	5265.81		0.164 *19*	5.94 *7*	0.164 *19*	εK=0.8810 *2*; εL=0.10022 *10*; εM+=0.018813 *22*
(1.54×10^3 *5*)	4675.41	0.008 *3*	0.077 *11*	6.69 *8*	0.085 *12*	av Eβ=226 *22*; εK=0.80 *3*; εL=0.090 *4*; εM+=0.0169 *6*
(1.64×10^3 *5*)	4577.23	0.034 *10*	0.18 *3*	6.39 *8*	0.21 *3*	av Eβ=268 *22*; εK=0.74 *4*; εL=0.083 *4*; εM+=0.0156 *8*
(1.98×10^3 *5*)	4243.11	0.12 *3*	0.14 *3*	6.64 *11*	0.26 *5*	av Eβ=413 *22*; εK=0.48 *4*; εL=0.054 *5*; εM+=0.0101 *9*
(2.12×10^3 *5*)	4101.45	0.59 *7*	0.45 *6*	6.20 *7*	1.04 *9*	av Eβ=475 *23*; εK=0.38 *4*; εL=0.043 *4*; εM+=0.0080 *7*
(2.54×10^3 *5*)	3675.75	1.03 *14*	0.27 *4*	6.58 *8*	1.30 *18*	av Eβ=666 *23*; εK=0.183 *16*; εL=0.0206 *18*; εM+=0.0039 *4*
(2.65×10^3 *5*)	3570.51	0.35 *4*	0.075 *11*	7.17 *8*	0.43 *5*	av Eβ=713 *23*; εK=0.155 *13*; εL=0.0174 *15*; εM+=0.0033 *3*
(2.73×10^3 *5*)	3488.234	6.0 *4*	1.1 *1*	6.04 *6*	7.1 *4*	av Eβ=751 *23*; εK=0.136 *11*; εL=0.0153 *13*; εM+=0.00286 *24*
(2.85×10^3 *5*)	3371.64	0.17 *3*	0.026 *6*	7.70 *10*	0.20 *4*	av Eβ=804 *23*; εK=0.114 *9*; εL=0.0128 *10*; εM+=0.00240 *19*
(2.93×10^3 *5*)	3294.76	0.63 *12*	0.082 *17*	7.22 *10*	0.71 *14*	av Eβ=840 *23*; εK=0.102 *8*; εL=0.0114 *9*; εM+=0.00214 *17*
(3.16×10^3 *5*)	3058.720	35.6 *19*	3.2 *3*	5.69 *5*	38.8 *21*	av Eβ=949 *24*; εK=0.074 *5*; εL=0.0083 *6*;

Continued on next page (footnotes at end of table)

^{70}As ε decay 2002Li41,1968De16 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ ‡	Iε ‡	Log *ft*	I($\varepsilon+\beta^+$) †‡	Comments
						εM+=0.00155 *11*
(3.17×10^3 *5*)	3046.43	31.9 *19*	2.8 *3*	5.75 *5*	34.7 *21*	av Eβ=954 *24*; εK=0.072 *5*; εL=0.0081 *6*; εM+=0.00152 *11*
(3.41×10^3 *5*)	2806.25	1.2 *4*	0.079 *25*	7.37 *14*	1.3 *4*	av Eβ=1066 *24*; εK=0.054 *4*; εL=0.0060 *4*; εM+=0.00113 *7*
(3.66×10^3 *5*)	2562.05	1.6 *4*	0.078 *19*	7.44 *11*	1.7 *4*	av Eβ=1181 *24*; εK=0.0406 *23*; εL=0.0045 *3*; εM+=0.00085 *5*
(3.69×10^3 *5*)	2534.93	0.80 *16*	0.037 *8*	7.76 *10*	0.84 *17*	av Eβ=1194 *24*; εK=0.0394 *23*; εL=0.00441 *25*; εM+=0.00083 *5*
(3.77×10^3 *5*)	2451.30	5.66 *19*	0.241 *16*	6.97 *4*	5.90 *20*	av Eβ=1233 *24*; εK=0.0360 *20*; εL=0.00403 *22*; εM+=0.00076 *5*
(4.06×10^3 *5*)	2156.73	0.8 *3*	0.02 *1*	8.04 *17*	0.8 *3*	av Eβ=1372 *24*; εK=0.0268 *14*; εL=0.00300 *15*; εM+=0.00056 *3*
(4.07×10^3 # *5*)	2153.17	4.3 *15*	0.13 *5*	7.30 *16*	4.4 *15*	av Eβ=1374 *24*; εK=0.0267 *14*; εL=0.00299 *15*; εM+=0.00056 *3*

† From γ intensity imbalance.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

$\gamma(^{70}Ge)$

Iγ normalization: from ΣI(γ+ce) to g.s.=100, assuming that there is no direct feeding to the g.s. because of large spin change.

E_γ[†]	I_γ[†e]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	δ[ad]	α	Comments
176.04 4	3.5 2	1215.57	0^+	1039.495	2^+	E2		0.0894	α(K)=0.0790 11; α(L)=0.00902 13; α(M)=0.001337 19; α(N)=7.73×10^{-5} 11
239.90 10	0.25 7	3046.43	3^+	2806.25	4^+				
252.46 4	3.3 2	3058.720	4^+	2806.25	4^+	[M1+E2]		0.016 9	α(K)=0.014 8; α(L)=0.0015 9 δ: 1.28 27 or −0.15 11 (1992De54).
294.60 16	0.10 4	2451.30	3^+	2156.73	2^+				
297.88 8	0.66 10	2451.30	3^+	2153.17	4^+				
445.6 10	0.17 8	2153.17	4^+	1707.628	2^+				E_γ: The level scheme in 2002Li41 shows that 1707.6 keV level is populated by 449.15γ. Level energy difference requires 445.6γ decays into 1707.6 keV level.
450.4[‡] 5	0.16[‡] 8	2156.73	2^+	1707.628	2^+	E2		0.00327	α(K)=0.00291 5; α(L)=0.000308 5; α(M)=4.58×10^{-5} 7; α(N)=2.90×10^{-6} 5
492.09 5	1.31 9	1707.628	2^+	1215.57	0^+	E2		0.00247	α(K)=0.00220 3; α(L)=0.000232 4; α(M)=3.45×10^{-5} 5; α(N)=2.20×10^{-6} 3
496.74[#] 4	3.1 2	3058.720	4^+	2562.05	3^-				
595.11 4	22.9 13	3046.43	3^+	2451.30	3^+	[M1+E2]		0.00118 23	α(K)=0.00104 20; α(L)=0.00011 2 δ: 1.50 9 or −0.06 3 (1992De54).
607.34 4	5.3 3	3058.720	4^+	2451.30	3^+	M1(+E2)		0.00112 21	α(K)=0.00099 19; α(L)=0.00010 2 δ: δ≥12 or 0.19 8 (1992De54).
653.15 6	0.60 7	2806.25	4^+	2153.17	4^+				
668.21 4	26.9 16	1707.628	2^+	1039.495	2^+	M1+E2	−3.6 +11−6	9.80×10^{-4} 2	α(K)=0.000875 21; α(L)=9.08×10^{-5} 22; α(M)=1.35×10^{-5} 4; α(N)=8.74×10^{-7} 20 δ: −5.8 ≤ δ ≤ −0.7 (1992De54).
[x]685.50[b] 12									
743.62 4	27.0 19	2451.30	3^+	1707.628	2^+	M1(+E2)		5.78×10^{-4} 9	α(K)=0.000517 8; α(L)=5.28×10^{-5} 8; α(M)=7.89×10^{-6} 12; α(N)=5.20×10^{-7} 8 δ: −1.80 15 or −0.27 4 (1992De54).
760.2[&] 5	0.30 15	3294.76	$3^+,4^+$	2534.93	2^+				
827.24 10	0.45 5	2534.93	2^+	1707.628	2^+				
889.72 4	3.2 2	3046.43	3^+	2156.73	2^+	M1+E2		0.00044 4	α(K)=0.00039 4 δ: −1.18≤δ≤−0.50 (1992De54).
893.50 4	2.3 1	3046.43	3^+	2153.17	4^+	M1+E2		0.00043 4	α(K)=0.00038 4 δ: 4 +9−2 or 0.38 +33−19 (1992De54).
901.95 5	1.19 8	3058.720	4^+	2156.73	2^+				
905.61 2	13.6 8	3058.720	4^+	2153.17	4^+	[M1+E2]		0.00042 4	α(K)=0.00037 3 δ: 1.42 16 or −0.20 5 (1992De54).
941.10 4	2.1 1	2156.73	2^+	1215.57	0^+	E2		4.09×10^{-4}	α(K)=0.000366 6; α(L)=3.76×10^{-5} 6; α(M)=5.60×10^{-6} 8; α(N)=3.65×10^{-7} 6

γ(^{70}Ge) (continued)

E_γ[†]	I_γ[†e]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	δ[ad]	α	Comments
953.30 7	0.53 5	3488.234	(3,4^+)	2534.93	2^+				
1036.99[@] 4	3.0 2	3488.234	(3,4^+)	2451.30	3^+				
1039.49 4	100 6	1039.495	2^+	0.0	0^+	E2		3.23×10^{-4}	α(K)=0.000289 4; α(L)=2.96×10^{-5} 5; α(M)=4.41×10^{-6} 7; α(N)=2.88×10^{-7} 4
1098.54 4	5.1 3	2806.25	4^+	1707.628	2^+	E2		2.84×10^{-4}	α(K)=0.000254 4; α(L)=2.60×10^{-5} 4; α(M)=3.88×10^{-6} 6; α(N)=2.54×10^{-7} 4
1113.60 4	25.1 15	2153.17	4^+	1039.495	2^+	E2		2.77×10^{-4}	α(K)=0.000247 4; α(L)=2.52×10^{-5} 4; α(M)=3.76×10^{-6} 6; α(N)=2.46×10^{-7} 4
1117.28 4	3.4 2	2156.73	2^+	1039.495	2^+	E2(+M1)		0.00023 1	α(K)=0.00023 1 δ: −4.0 ≤δ ≤−0.7 (1992De54).
1196.66[@] 15	0.32 6	4243.11		3046.43	3^+				
1218.57 11	0.19 4	3371.64	(3,4)	2153.17	4^+				
1295.24[#] 6	0.59 6	4101.45	(3^-)	2806.25	4^+				
1331.58 7	0.47 4	3488.234	(3,4^+)	2156.73	2^+				
1335.28 10	0.38 4	3488.234	(3,4^+)	2153.17	4^+				
1338.76 4	11.0 7	3046.43	3^+	1707.628	2^+	M1+E2		0.00016 1	α(K)=0.00016 1 δ: δ≥26 or 0.24 4 (1992De54).
1350.90 6	0.57 6	3058.720	4^+	1707.628	2^+				
1411.86 4	10.6 6	2451.30	3^+	1039.495	2^+	M1+E2	−2.2 +5−3	2.18×10^{-4} 4	α(K)=0.0001463 22; α(L)=1.487×10^{-5} 22; α(M)=2.22×10^{-6} 4; α(N)=1.460×10^{-7} 22 δ: 4.8 9 or 0.48 5 (1992De54).
1417.24[#] 7	0.50 5	3570.51	$(2,3)^-$	2153.17	4^+				
1495.43 5	1.4 1	2534.93	2^+	1039.495	2^+	M1+E2	−0.75	2.15×10^{-4}	α(K)=0.0001274 18; α(L)=1.291×10^{-5} 18; α(M)=1.93×10^{-6} 3; α(N)=1.273×10^{-7} 18 δ: 0.02≤δ≤2.4 (1992De54).
[x]1507.80[c] 13	0.83 7								
1522.55 2	5.3 4	2562.05	3^-	1039.495	2^+	E1+M2	−0.11 10	3.42×10^{-4}	α(K)=6.7×10^{-5} 6; α(L)=6.8×10^{-6} 6; α(M)=1.01×10^{-6} 8; α(N)=6.6×10^{-8} 6
1523.2[‡] 7	1.1[‡] 2	3675.75	3^+,4^+	2153.17	4^+				δ: 3.4 +14−7 or −0.58 10 (1992De54).
1539.29[@] 20	0.18 5	4101.45	(3^-)	2562.05	3^-				
1587.17 12	0.39 5	3294.76	3^+,4^+	1707.628	2^+				
1707.61 2	21.3 6	1707.628	2^+	0.0	0^+	E2		2.87×10^{-4}	α(K)=0.0001011 15; α(L)=1.025×10^{-5} 15; α(M)=1.529×10^{-6} 22; α(N)=1.007×10^{-7} 15
1780.52 2	4.7 1	3488.234	(3,4^+)	1707.628	2^+				δ: δ≥11 or 0.21 6 (1992De54).
1881.67 5	0.84 5	5370.07		3488.234	(3,4^+)				
1944.21 16	0.15 2	4101.45	(3^-)	2156.73	2^+				
1948.35 11	0.35 3	4101.45	(3^-)	2153.17	4^+				
2006.87 3	3.4 1	3046.43	3^+	1039.495	2^+	M1+E2			δ: −11 +3−6 or 0.15 4 (1992De54).
2019.16 2	20.2 5	3058.720	4^+	1039.495	2^+	E2		4.02×10^{-4}	α(K)=7.38×10^{-5} 11; α(L)=7.46×10^{-6} 11; α(M)=1.114×10^{-6} 16; α(N)=7.35×10^{-8} 11
[x]2095.69 14	0.07 1								

^{70}As ε decay 2002Li41,1968De16 (continued)

$\gamma(^{70}$Ge) (continued)

E_γ[†]	I_γ[†e]	E_i(level)	J^π_i	E_f	J^π_f	Comments
2156.65 *6*	0.58 *3*	2156.73	2^+	0.0	0^+	
2219.34 *14*	0.20 *2*	5265.81		3046.43	3^+	
2255.16 *11*	0.17 *2*	3294.76	$3^+,4^+$	1039.495	2^+	
2325.42 *18*	0.18 *2*	5370.07		3046.43	3^+	E_γ: Authors of 2002Li41 stated that the placement of the transition was confirmed but level spacing requires 2323.6γ decays into 3046.4 keV level.
2331.59 *24*	0.05 *1*	3371.64	(3,4)	1039.495	2^+	
2419.88 *24*	0.12 *2*	4577.23	$(3,4^+)$	2156.73	2^+	
2424.41 *20*	0.14 *2*	4577.23	$(3,4^+)$	2153.17	4^+	
2448.82 *9*	0.36 *2*	3488.234	$(3,4^+)$	1039.495	2^+	δ: $\delta\geq5$ or 0.33 *13* (1992De54).
2521.8 *3*	0.034 *9*	4675.41	$(3,4^+)$	2153.17	4^+	
2531.7[@] *2*	0.03 *1*	3570.51	$(2,3)^-$	1039.495	2^+	
2636.20 *7*	0.48 *2*	3675.75	$3^+,4^+$	1039.495	2^+	
[x]2781.57[f] *25*	0.14 *2*					
2968.1 *3*	0.07 *1*	4675.41	$(3,4^+)$	1707.628	2^+	
[x]3123.59 *17*	0.14 *1*					

† From 2002Li41, unless stated otherwise. Intensity is normalized to $I_\gamma(1039.5\gamma)$=100.

‡ From coincidence data in 2002Li04.

Placement by 2002Li41.

@ New transition identified by 2002Li41.

& From 1968De16, not reported by 2002Li41.

[a] From Adopted Gammas. Values from 1992De54 are given as comments.

[b] Authors of 2002Li14 stated that 685.50γ is the double-escape peak of the 1707.61 keV γ-ray.

[c] Authors of 2002Li14 stated that 1707.61γ is the single-escape peak of the 2019.6 keV γ-ray.

[d] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.

[e] For absolute intensity per 100 decays, multiply by 0.82 *4*.

[f] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

^{70}As ε decay 2002Li41,1968De16

Decay Scheme

Intensities: I_γ per 100 parent decays