^{71}Se ε decay (4.74 min) 1980Te01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 188,1 (2023)	17-Jan-2023

Parent: ^{71}Se: E=0.0; J$^{\pi}$=(5/2$^-$); T$_{1/2}$=4.74 min *5*; Q(ε)=4747 *5*; %ε+%β^+ decay=100

^{71}Se-J$^{\pi}$,T$_{1/2}$: From ^{71}Se Adopted Levels.

^{71}Se-Q(ε): from 2021Wa16.

1980Te01: mass-separated source of ^{71}Se produced in ^{70}Ge(^{3}He,2n) reaction with 25 MeV ^{3}He beam from the AVF cyclotron of the Vrije Universiteit. Measured Eγ, Iγ, $\gamma\gamma$, using several Ge(Li) detectors in singles and coincidence modes. For singles measurement a Ge(Li) detector was surrounded by a large NaI(Tl) detector to achieve some level of Compton suppression. Internal conversion data were obtained for 143γ and 147γ using solenoidal magnetic spectrometer. Isotopic half-life was also measured by timing decay of γ rays with a Compton-suppressed Ge detector system. Comparisons with cluster-phonon model calculations.

Additional information 1.

1969Hu13: measured Eγ, Iγ, $\gamma\gamma$, isotopic half-life, eight γ rays reported.

Others:

2001To06 (also 2001Br44): measured Eβ, $\beta\gamma$ coin using Ge and plastic scintillators. Weighted average Q(ε)=4762 *35* (2001Br44). Deduced mass excess. The ^{71}Se source produced in ^{58}Ni(^{16}O,2pn) reaction at 65 MeV/nucleon.

1976Ro01: measured Eγ.

1974Ro14: measured Eγ, Iγ.

1973Sc17: measured Eβ, deduced Q value=4428 *125*.

1971Do01: measured Eγ, isotopic half-life.

1968At04: measured Eγ.

1957Be43: measured isotopic half-life.

1957At37: measured Eβ^+.

The decay scheme is considered as incomplete by evaluators due to a large gap between Q-value and the highest observed level.

^{71}As Levels

E(level)†	J$^{\pi}$#	T$_{1/2}$#	E(level)†	J$^{\pi}$#
0.0	5/2$^-$	65.30 h *7*	1284.81 *16*	
143.53 *7*	(1/2)$^-$	59 ns *10*	1412.76 *7*	1/2$^-$,3/2$^-$
147.46 *4*	(3/2)$^-$	0.85 ns *25*	1443.16 *7*	(3/2,5/2$^-$)
506.24 *9*	(3/2)$^-$		1463.26 *9*	(3/2,5/2$^-$)
828.67 *14*	(3/2)$^-$		1471.24 *12*	
870.32 *7*	(5/2)$^-$		1615.72‡ *9*	(3/2,5/2,7/2$^-$)
924.57 *7*	(7/2$^-$)	2.1 ps *17*	1751.74 *8*	(3/2,5/2$^-$)
977.89 *5*	(3/2$^-$,5/2$^-$)		1981.57 *5*	(3/2$^-$,5/2$^-$,7/2$^-$)
990.58 *7*	(3/2,5/2$^-$)		2369.95 *17*	(3/2,5/2,7/2)
1000.21 *20*	9/2$^+$	19.8 ns *3*	2429.24 *9*	(3/2$^-$,5/2$^-$)
1129.07 *21*	3/2$^+$,5/2$^+$	≤2.1 ps	2506.93 *13*	(3/2,5/2,7/2$^-$)
1242.65 *4*	(3/2$^-$,5/2$^-$)		3172.75 *10*	(3/2$^-$,5/2$^-$,7/2$^-$)

† From a least-squares fit to Eγ data, with uncertainty doubled for 1462.54γ and 3171.82γ. Normalized χ^2=2.1 as compared to critical χ^2=1.7 at 95% confidence level. Without the adjusted uncertainties, normalized χ^2=3.0.

‡ Value of 1616.7 given in the decay scheme of 1980Te01 is adopted here as 1615.72 based on a least-squares fit to Eγ data.

\# From the Adopted Levels.

^{71}Se ε decay (4.74 min) 1980Te01 (continued)

ε,β^+ radiations

E(decay)	E(level)	$I\beta^+$ ‡	$I\varepsilon$‡	Log *ft*	$I(\varepsilon+\beta^+)$†‡	Comments
(1574 *5*)	3172.75	0.04 *1*	0.32 *3*	5.09 *4*	0.36 *3*	av Eβ=239.6 *22*; εK=0.792 *3*; εL=0.0901 *3*; εM+=0.01720 *6*
(2240 *5*)	2506.93	0.12 *1*	0.07 *1*	6.05 *5*	0.19 *2*	av Eβ=529.8 *23*; εK=0.332 *3*; εL=0.0377 *4*; εM+=0.00719 *6*
(2318 *5*)	2429.24	0.25 *3*	0.12 *1*	5.84 *5*	0.37 *4*	av Eβ=564.5 *23*; εK=0.2922 *25*; εL=0.0331 *3*; εM+=0.00632 *6*
(2377 *5*)	2369.95	0.116 *15*	0.051 *6*	6.26 *6*	0.167 *21*	av Eβ=591.0 *23*; εK=0.2649 *22*; εL=0.03001 *25*; εM+=0.00573 *5*
(2765 *5*)	1981.57	1.08 *8*	0.210 *16*	5.77 *4*	1.29 *10*	av Eβ=767.1 *23*; εK=0.1431 *11*; εL=0.01619 *13*; εM+=0.003091 *24*
(2995 *5*)	1751.74	0.57 *5*	0.08 *1*	6.28 *5*	0.65 *6*	av Eβ=872.7 *23*; εK=0.1028 *8*; εL=0.01162 *8*; εM+=0.002218 *16*
(3131 *5*)	1615.72	0.29 *3*	0.030 *3*	6.70 *5*	0.32 *3*	av Eβ=935.6 *24*; εK=0.0855 *6*; εL=0.00967 *7*; εM+=0.001845 *13*
(3276 *5*)	1471.24	0.179 *16*	0.0157 *14*	7.04 *4*	0.195 *17*	av Eβ=1002.7 *24*; εK=0.0711 *5*; εL=0.00803 *5*; εM+=0.001533 *10*
(3284 *5*)	1463.26	0.55 *5*	0.048 *4*	6.56 *4*	0.60 *5*	av Eβ=1006.4 *24*; εK=0.0704 *5*; εL=0.00795 *5*; εM+=0.001517 *10*
(3304 *5*)	1443.16	1.40 *11*	0.118 *9*	6.17 *4*	1.52 *12*	av Eβ=1015.7 *24*; εK=0.0686 *5*; εL=0.00776 *5*; εM+=0.001480 *10*
(3334 *5*)	1412.76	0.36 *6*	0.029 *5*	6.78 *8*	0.39 *7*	av Eβ=1029.9 *24*; εK=0.0661 *4*; εL=0.00747 *5*; εM+=0.001426 *9*
(3462 *5*)	1284.81	0.138 *14*	0.0095 *10*	7.31 *5*	0.147 *15*	av Eβ=1089.7 *24*; εK=0.0568 *4*; εL=0.00641 *4*; εM+=0.001223 *8*
(3504 *5*)	1242.65	17.2 *13*	1.12 *9*	5.24 *4*	18.3 *14*	av Eβ=1109.4 *24*; εK=0.0540 *4*; εL=0.00610 *4*; εM+=0.001165 *7* E(decay): E(β^+)(max)=2455 *70* in coin with 1095γ (2001To06). E(decay): E(β^+)(max)=2473 *70* in coin with 1243γ (2001To06).
(3618 *5*)	1129.07	0.09 *3*	0.0054 *16*	7.59 *13*	0.10 *3*	av Eβ=1162.7 *24*; εK=0.0475 *3*; εL=0.00537 *3*; εM+=0.001025 *6*
(3747 *5*)	1000.21	0.093 *11*	0.0119 *14*	9.01^{1u} *5*	0.105 *12*	av Eβ=1243.5 *24*; εK=0.0995 *6*; εL=0.01130 *7*; εM+=0.002158 *12*
(3756 *5*)	990.58	2.42 *21*	0.118 *10*	6.28 *4*	2.54 *22*	av Eβ=1227.8 *24*; εK=0.04094 *22*; εL=0.004623 *25*; εM+=0.000882 *5*
(3769 *5*)	977.89	10.6 *9*	0.51 *4*	5.65 *4*	11.1 *9*	av Eβ=1233.8 *24*; εK=0.04040 *22*; εL=0.004562 *24*; εM+=0.000870 *5*
(3822 *5*)	924.57	0.65 *6*	0.029 *3*	6.90 *4*	0.68 *6*	av Eβ=1259.0 *24*; εK=0.03822 *20*; εL=0.004315 *23*; εM+=0.000823 *5*
(3877 *5*)	870.32	8.9 *7*	0.38 *3*	5.80 *4*	9.3 *7*	av Eβ=1284.6 *24*; εK=0.03616 *19*; εL=0.004082 *21*; εM+=0.000779 *4* E(decay): E(β^+)(max)=2875 *75* in coin with 723γ (2001To06). E(decay): E(β^+)(max)=2915 *75* in coin with 870γ (2001To06).
(3918 *5*)	828.67	0.70 *11*	0.029 *4*	6.93 *7*	0.73 *11*	av Eβ=1304.3 *24*; εK=0.03467 *18*; εL=0.003914 *20*; εM+=0.000747 *4*
(4241 *5*)	506.24	0.6 *3*	0.02 *1*	7.22 *22*	0.6 *3*	av Eβ=1457.2 *24*; εK=0.02551 *12*; εL=0.002879 *13*; εM+=0.0005492 *2*
(4600 *5*)	147.46	19.5 *18*	0.42 *4*	5.90 *4*	19.9 *18*	av Eβ=1628.3 *24*; εK=0.01874 *8*; εL=0.002114 *9*; εM+=0.0004032 *1* E(decay): E(β^+)(max)=3630 *90* in coin with 147.5γ (2001To06).
(4747 *5*)	0.0	30 *6*	0.59 *11*	5.79 *9*	31 *6*	av Eβ=1698.9 *24*; εK=0.01665 *7*; εL=0.001878 *8*; εM+=0.0003582 *1*

Continued on next page (footnotes at end of table)

^{71}Se ε decay (4.74 min) 1980Te01 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Comments
		E(decay): measured E(β^+)(maximum)=3406 *125* (1973Sc17). Other: 3.4 MeV *3* (1957At37).

† Deduced by evaluators from γ+ce intensity balance at each level, with uncertain γ-ray placements omitted in this analysis.
‡ Absolute intensity per 100 decays.

$\gamma(^{71}As)$

Iγ normalization: from Iγ(147.5γ)/Iβ^+=0.497 *35* (1969Hu13) deduced from measured Iγ(147.5γ) and I($\gamma^\pm$) radiation with 4.5% correction included by 1969Hu13 for annihilation in flight, and ε/β^+ theoretical ratios from 1971Go40. Note that ≈2.3 units of relative intensity (or ≈1% of absolute intensity) remains unplaced in the level scheme.

E_γ[†]	I_γ[†&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[a]	Comments
143.2 *3*	4.8 *6*	143.53	(1/2)$^-$	0.0	5/2$^-$	E2[@]	0.206 *4*	α(K)=0.181 *3*; α(L)=0.0219 *4*; α(M)=0.00331 *6*; α(N)=0.000232 *4* %Iγ=2.3 *3*
147.50 *22*	100 *2*	147.46	(3/2)$^-$	0.0	5/2$^-$	M1[@]	0.0317	α(K)=0.0282 *5*; α(L)=0.00303 *5*; α(M)=0.000462 *7*; α(N)=3.49×10^{-5} *5* %Iγ=48 *4*
358.8 *3*	3.7 *2*	506.24	(3/2)$^-$	147.46	(3/2)$^-$			%Iγ=1.76 *16*
362.2 *4*	1.0 *5*	506.24	(3/2)$^-$	143.53	(1/2)$^-$			%Iγ=0.48 *24*
484.2 *3*	1.2 *2*	990.58	(3/2,5/2$^-$)	506.24	(3/2)$^-$			%Iγ=0.57 *10*
681.29 *16*	1.4 *2*	828.67	(3/2)$^-$	147.46	(3/2)$^-$			%Iγ=0.67 *11*
685.00 *20*	0.13 *1*	828.67	(3/2)$^-$	143.53	(1/2)$^-$			%Iγ=0.062 *7*
722.90 *13*	5.5 *2*	870.32	(5/2)$^-$	147.46	(3/2)$^-$			%Iγ=2.61 *21*
726.70 *20*	0.25 *10*	870.32	(5/2)$^-$	143.53	(1/2)$^-$			%Iγ=0.12 *5*
773.76[b] *18*	0.22 *3*	1751.74	(3/2,5/2$^-$)	977.89	(3/2$^-$,5/2$^-$)			%Iγ=0.105 *16*
777.3[b] *4*	0.11 *3*	924.57	(7/2$^-$)	147.46	(3/2)$^-$			%Iγ=0.052 *15*
830.33 *9*	20.5 *3*	977.89	(3/2$^-$,5/2$^-$)	147.46	(3/2)$^-$			%Iγ=9.7 *7*
834.30 *20*	0.8 *2*	977.89	(3/2$^-$,5/2$^-$)	143.53	(1/2)$^-$			%Iγ=0.38 *10*
842.99 *9*	2.4 *1*	990.58	(3/2,5/2$^-$)	147.46	(3/2)$^-$			%Iγ=1.14 *10*
847.14 *10*	1.3 *1*	990.58	(3/2,5/2$^-$)	143.53	(1/2)$^-$			%Iγ=0.62 *7*
870.30 *8*	13.9 *1*	870.32	(5/2)$^-$	0.0	5/2$^-$			%Iγ=6.6 *5*
924.54 *8*	1.91 *5*	924.57	(7/2$^-$)	0.0	5/2$^-$			%Iγ=0.91 *7*
936.91 *7*	1.88 *3*	1443.16	(3/2,5/2$^-$)	506.24	(3/2)$^-$			%Iγ=0.89 *7*
957.00 *18*	0.33 *2*	1463.26	(3/2,5/2$^-$)	506.24	(3/2)$^-$			%Iγ=0.157 *15*
977.85 *6*	2.56 *3*	977.89	(3/2$^-$,5/2$^-$)	0.0	5/2$^-$			%Iγ=1.22 *9*
981.60 *20*	0.21 *6*	1129.07	3/2$^+$,5/2$^+$	147.46	(3/2)$^-$			%Iγ=0.10 *3*
990.67 *11*	0.44 *4*	990.58	(3/2,5/2$^-$)	0.0	5/2$^-$			%Iγ=0.209 *24*
1000.20 *20*	0.22 *2*	1000.21	9/2$^+$	0.0	5/2$^-$	(M2)	0.000793 *12*	α(K)=0.000707 *10*; α(L)=7.39×10^{-5} *11*; α(M)=1.128×10^{-5} *16* α(N)=8.61×10^{-7} *12* %Iγ=0.105 *12*
1003.42 *11*	0.56 *2*	1981.57	(3/2$^-$,5/2$^-$,7/2$^-$)	977.89	(3/2$^-$,5/2$^-$)			%Iγ=0.266 *21*
^{x}1057.1 *3*	0.17 *2*							%Iγ=0.081 *11*
1095.26 *5*	20.7 *3*	1242.65	(3/2$^-$,5/2$^-$)	147.46	(3/2)$^-$			%Iγ=9.8 *7*
1098.82 *12*	2.9 *3*	1242.65	(3/2$^-$,5/2$^-$)	143.53	(1/2)$^-$			%Iγ=1.38 *17* Additional information 2.

γ(^{71}As) (continued)

E_γ [†]	I_γ [†&]	E_i(level)	J^π_i	E_f	J^π_f	Comments
1137.34 15	0.31 2	1284.81		147.46	(3/2)$^-$	%Iγ=0.147 14
1186.46 14	0.32 2	2429.24	(3/2$^-$,5/2$^-$)	1242.65	(3/2$^-$,5/2$^-$)	%Iγ=0.152 15
1242.59 5	15.15 17	1242.65	(3/2$^-$,5/2$^-$)	0.0	5/2$^-$	%Iγ=7.2 5
1265.26 6	0.98 13	1412.76	1/2$^-$,3/2$^-$	147.46	(3/2)$^-$	%Iγ=0.47 7
1269.40 20	0.24 3	1412.76	1/2$^-$,3/2$^-$	143.53	(1/2)$^-$	%Iγ=0.114 17
1295.68 7	1.00 2	1443.16	(3/2,5/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.48 4
1300.3 4	0.15 3	1443.16	(3/2,5/2$^-$)	143.53	(1/2)$^-$	%Iγ=0.071 15
1315.92 10	0.43 2	1463.26	(3/2,5/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.204 18
1319.70 20	0.21 2	1463.26	(3/2,5/2$^-$)	143.53	(1/2)$^-$	%Iγ=0.100 12
1323.77 11	0.41 2	1471.24		147.46	(3/2)$^-$	%Iγ=0.195 17
[x]1394.70 25	0.16 4					%Iγ=0.076 20
[x]1402.90 25	0.11 4					%Iγ=0.052 19
1443.27 14	0.44 2	1443.16	(3/2,5/2$^-$)	0.0	5/2$^-$	%Iγ=0.209 18
1445.5 3	0.26 3	2369.95	(3/2,5/2,7/2)	924.57	(7/2$^-$)	%Iγ=0.124 17
[x]1456.20 24	0.11 3					%Iγ=0.052 15
1462.54[‡] 12	0.30 4	1463.26	(3/2,5/2$^-$)	0.0	5/2$^-$	%Iγ=0.143 22
1468.24 8	0.67 3	1615.72	(3/2,5/2,7/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.32 3
1499.56 19	0.09 2	2369.95	(3/2,5/2,7/2)	870.32	(5/2)$^-$	%Iγ=0.043 10
1504.58 11	0.22 2	2429.24	(3/2$^-$,5/2$^-$)	924.57	(7/2$^-$)	%Iγ=0.105 12
1528.82[b] 22	0.12 4	2506.93	(3/2,5/2,7/2$^-$)	977.89	(3/2$^-$,5/2$^-$)	%Iγ=0.057 20
1559.3[b] 3	0.07 4	2429.24	(3/2$^-$,5/2$^-$)	870.32	(5/2)$^-$	%Iγ=0.033 19
[x]1581.99 22	0.17 2					%Iγ=0.081 11
1604.19 7	0.98 5	1751.74	(3/2,5/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.47 4
1608.7 5	0.20 5	1751.74	(3/2,5/2$^-$)	143.53	(1/2)$^-$	%Iγ=0.095 25
1637.0[b] 4	0.04 1	2506.93	(3/2,5/2,7/2$^-$)	870.32	(5/2)$^-$	%Iγ=0.019 5
[x]1683.31 25	0.10 2					%Iγ=0.048 10
[x]1687.2 3	0.10 2					%Iγ=0.048 10
1701.1[b] 3	0.10 2	3172.75	(3/2$^-$,5/2$^-$,7/2$^-$)	1471.24		%Iγ=0.048 10
1729.68 12	0.26 2	3172.75	(3/2$^-$,5/2$^-$,7/2$^-$)	1443.16	(3/2,5/2$^-$)	%Iγ=0.124 13
1752.05 17	0.17 2	1751.74	(3/2,5/2$^-$)	0.0	5/2$^-$	%Iγ=0.081 11
1759.93 10	0.39 2	3172.75	(3/2$^-$,5/2$^-$,7/2$^-$)	1412.76	1/2$^-$,3/2$^-$	%Iγ=0.185 16
[x]1769.2 3	0.10 2					%Iγ=0.048 10
1834.09 6	1.61 3	1981.57	(3/2$^-$,5/2$^-$,7/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.77 6
[x]1926.4 3	0.19 2					%Iγ=0.090 12
1929.9[b] 3	0.12 2	3172.75	(3/2$^-$,5/2$^-$,7/2$^-$)	1242.65	(3/2$^-$,5/2$^-$)	%Iγ=0.057 10
1981.67 8	0.53 2	1981.57	(3/2$^-$,5/2$^-$,7/2$^-$)	0.0	5/2$^-$	%Iγ=0.252 20
2282.05 22	0.18 2	2429.24	(3/2$^-$,5/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.086 11
2286.5 4	0.06 3	2429.24	(3/2$^-$,5/2$^-$)	143.53	(1/2)$^-$	%Iγ=0.029 15
2359.30 14	0.26 2	2506.93	(3/2,5/2,7/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.124 13
[x]2380.7 3	0.08 2					%Iγ=0.038 10

$^{71}_{33}$As$_{38}$-5

γ(^{71}As) (continued)

E_γ[†]	I_γ[†&]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]2411.7 *4*	0.13 *2*					%Iγ=0.062 *11*
[x]2418.15 *23*	0.05 *1*					%Iγ=0.024 *5*
2429.36[b] *25*	0.10 *2*	2429.24	(3/2$^-$,5/2$^-$)	0.0	5/2$^-$	%Iγ=0.048 *10*
2507.22 *23*	0.14 *2*	2506.93	(3/2,5/2,7/2$^-$)	0.0	5/2$^-$	%Iγ=0.067 *11*
[x]2520.15 *20*	0.13 *2*					%Iγ=0.062 *11*
[x]2609.1 *5*	0.12 *4*					%Iγ=0.057 *20*
[x]2854.0 *4*	0.06 *1*					%Iγ=0.029 *5*
[x]2909.57 *23*	0.10 *2*					%Iγ=0.048 *10*
[x]2926.69 *20*	0.13 *2*					%Iγ=0.062 *11*
[x]3002.1 *4*	0.02 *1*					%Iγ=0.010 *5*
3023.5[b] *5*	0.03 *1*	3172.75	(3/2$^-$,5/2$^-$,7/2$^-$)	147.46	(3/2)$^-$	%Iγ=0.014 *5*
[x]3078.4 *6*	0.03 *1*					%Iγ=0.014 *5*
[x]3095.0 *4*	0.06 *1*					%Iγ=0.029 *5*
3171.82[‡] *22*	0.10 *1*	3172.75	(3/2$^-$,5/2$^-$,7/2$^-$)	0.0	5/2$^-$	%Iγ=0.048 *6*
[x]3189.65 *19*	0.14 *2*					%Iγ=0.067 *11*
[x]3246.0 *5*	0.03 *1*					%Iγ=0.014 *5*
[x]3359.0 *3*	0.02 *1*					%Iγ=0.010 *5*
[x]3457.8 *3*	0.03 *1*					%Iγ=0.014 *5*
[x]3590.2 *4*	0.04 *1*					%Iγ=0.019 *5*

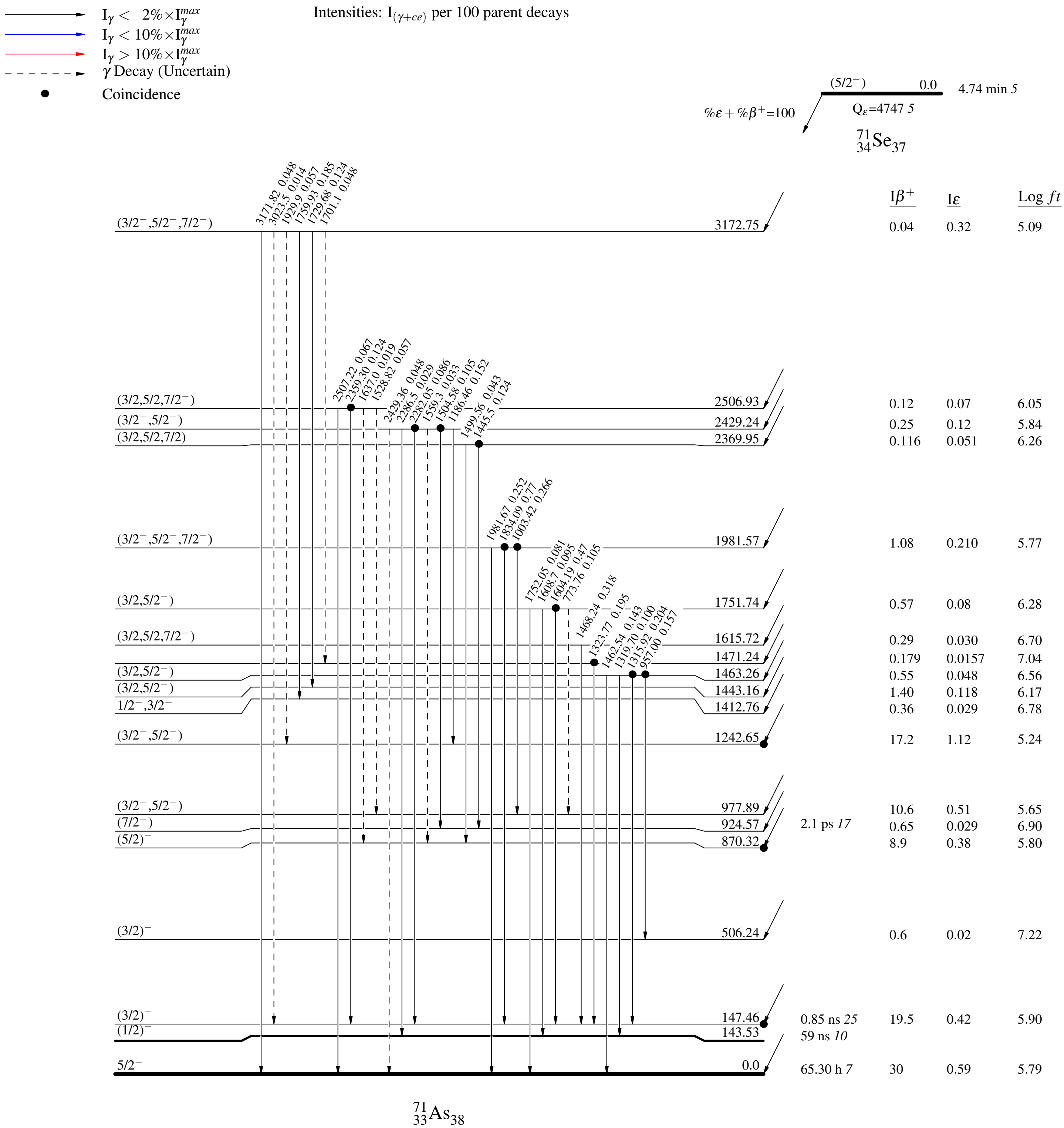
[†] From 1980Te01.
[‡] Uncertainty doubled for the purpose of least-squares adjustment procedure.
[#] From Adopted Gammas. Supporting arguments from this dataset are given under comments where available and Adopted values taken from this dataset are noted.
[@] Adopted value from ce spectrum, measured α(K)exp(143.2γ)/α(K)exp(147.5γ)=6 (1980Te01), which is consistent with E2 for 143.2γ and M1 147.5γ.
[&] For absolute intensity per 100 decays, multiply by 0.475 *34*.
[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] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{71}_{33}$As$_{38}$-6

^{71}Se ε decay (4.74 min) 1980Te01

Decay Scheme

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



^{71}Se ε decay (4.74 min) 1980Te01

Decay Scheme (continued)

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

Legend