^{159}Sm β^- decay (11.37 s) 1987Wi14

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	07-June-2023

Parent: ^{159}Sm: E=0.0; J$^\pi$=5/2$^-$; T$_{1/2}$=11.37 s *15*; Q(β^-)=3836 *7*; %β^- decay=100

^{159}Sm-J$^\pi$,T$_{1/2}$: From ^{159}Sm Adopted Levels. Configuration=ν5/2[523] (1987Wi14).

^{159}Sm-Q(β^-): From 2021Wa16.

1987Wi14 (also 1990An31,1987Gr12): ^{159}Sm produced and identified in SF decay of ^{252}Cf, followed by mass separation at the INEL-ISOL facility of the INEL, Idaho Falls. Measured Eγ, Iγ for 16 γ rays, x rays using Ge(Li) detectors.

1986Ma12: ^{159}Sm produced in ^{235}U(n,F) (1986Ma12), followed by mass separation at TRISTAN facility at Brookhaven National Laboratory. Measured half-life of the decay of ^{159}Sm and two γ rays of 114 and 190 keV.

The γ data and decay scheme are from 1987Wi14.

^{159}Eu Levels

E(level)†	J$^\pi$‡	Comments
0.0#	5/2$^+$	
75.41# *4*	7/2$^+$	
172.00# *6*	9/2$^+$	
189.80@ *5*	5/2$^-$	
254.54@ *5*	7/2$^-$	
333.61 *12*	3/2$^+$	Configuration=π3/2[411].
1051.79 *12*	7/2$^-$	J$^\pi$: γ rays to 5/2$^+$, 5/2$^-$, 7/2$^-$, and 9/2$^+$ levels and allowed-unhindered (au) β^- decay (log *ft*=5.0) from the parent, which is interpreted as the ν5/2,5/2[523] → π7/2,7/2[523] transition, which is the only available 'au' transition in this mass region.

† From least-squares fit to γ energies.

‡ From the Adopted Levels, based on assignments in (pol t,α). except that for the 1052 level, which is based on this decay.

Band(A): π5/2[413].

@ Band(B): π5/2[532].

β^- radiations

With a Q value of 3805 keV and levels reported only to 1052 keV, the scheme is not complete. The computed log*ft* values may be lower than might otherwise be expected. The effect of higher-energy levels would be to reduce these Iβ^- values and increase the log*ft* values.

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(2784 *7*)	1051.79	32.1	5.0	av Eβ=1103 *30*
(3502 *7*)	333.61	2.3	6.5	av Eβ=1432 *30*
(3582 *7*)	254.54	23	5.6	av Eβ=1468 *30*
(3646 *7*)	189.80	21	5.6	av Eβ=1498 *30*
(3664 *7*)	172.00	1.3	8.4^{1u}	av Eβ=1483 *30*
(3761 *7*)	75.41	10	6.0	av Eβ=1550 *30*
(3836 *7*)	0.0	10	6.0	av Eβ=1585 *30*

† From γ intensity balances. Value for ground-state branch is assumed to be equal to that to the 75 level. Since the scheme is incomplete, no uncertainties are given.

‡ Absolute intensity per 100 decays.

γ(^{159}Eu)

Iγ normalization: From 100% feeding of the ground state, with Iβ^-(0)=Iβ^-(75). If Iβ^-(0)=0, the normalization factor would be 0.51.

E$_\gamma$[†]	I$_\gamma$[†#]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.	δ	α[@]	Comments
64.76 *6*	2.5 *3*	254.54	7/2$^-$	189.80	5/2$^-$	[M1,E2]		10 *3*	α(K)=4.3 *12*; α(L)=4 *4*; α(M)=0.9 *8* α(N)=0.21 *18*; α(O)=0.029 *23*; α(P)=0.00042 *19* Mult.: from expected reduced M1 transition probabilities and a reasonable value for the intrinsic quadrupole moment, 1987Wi14 deduce that this transition is primarily M1 with only a few percent E2.
75.44 *4*	9.6 *6*	75.41	7/2$^+$	0.0	5/2$^+$	(M1+E2)	0.50 *18*	4.7 *4*	α(K)=3.28 *15*; α(L)=1.1 *4*; α(M)=0.25 *9* α(N)=0.057 *19*; α(O)=0.0081 *25*; α(P)=0.00035 *3* δ: 0.50 *18* (1987Wi14) from the constancy of the ratio of intrinsic M1 matrix element within the rotational band to its intrinsic quadrupole moment and δ(96).
82.58 *5*	1.7 *3*	254.54	7/2$^-$	172.00	9/2$^+$	[E1]		0.475 *7*	α(K)=0.398 *6*; α(L)=0.0609 *9*; α(M)=0.01312 *19* α(N)=0.00295 *5*; α(O)=0.000438 *7*; α(P)=3.23×10^{-5} *5*
96.65 *8*	1.8 *4*	172.00	9/2$^+$	75.41	7/2$^+$	(M1+E2)	0.48 *18*	2.17 *9*	α(K)=1.64 *6*; α(L)=0.41 *11*; α(M)=0.093 *25* α(N)=0.021 *6*; α(O)=0.0031 *7*; α(P)=0.000172 *12* δ: 0.48 *18* deduced (1987Wi14) from calculation of E2 portion from Alaga rules and Iγ(172).
114.42 *6*	7.9 *4*	189.80	5/2$^-$	75.41	7/2$^+$	[E1]		0.197 *3*	α(K)=0.1662 *24*; α(L)=0.0244 *4*; α(M)=0.00524 *8* α(N)=0.001181 *17*; α(O)=0.000179 *3*; α(P)=1.413×10^{-5} *20*
143.90 *12*	2.1 *3*	333.61	3/2$^+$	189.80	5/2$^-$	[E1]		0.1060 *15*	α(K)=0.0896 *13*; α(L)=0.01285 *19*; α(M)=0.00276 *4* α(N)=0.000625 *9*; α(O)=9.53×10^{-5} *14*; α(P)=7.86×10^{-6} *12*
172.09 *12*	3.4 *4*	172.00	9/2$^+$	0.0	5/2$^+$	[E2]		0.358 *5*	α(K)=0.241 *4*; α(L)=0.0903 *13*; α(M)=0.0208 *3* α(N)=0.00463 *7*; α(O)=0.000651 *10*; α(P)=1.99×10^{-5} *3*
179.09 *9*	12.5 *6*	254.54	7/2$^-$	75.41	7/2$^+$	[E1]		0.0588 *8*	α(K)=0.0499 *7*; α(L)=0.00704 *10*; α(M)=0.001513 *22* α(N)=0.000343 *5*; α(O)=5.26×10^{-5} *8*; α(P)=4.49×10^{-6} *7*
189.79 *9*	100	189.80	5/2$^-$	0.0	5/2$^+$	[E1]		0.0504 *7*	α(K)=0.0427 *6*; α(L)=0.00601 *9*; α(M)=0.001291 *19* α(N)=0.000293 *5*; α(O)=4.50×10^{-5} *7*; α(P)=3.88×10^{-6} *6*
254.43 *8*	21.2 *9*	254.54	7/2$^-$	0.0	5/2$^+$	[E1]		0.0233 *3*	α(K)=0.0198 *3*; α(L)=0.00274 *4*; α(M)=0.000589 *9* α(N)=0.0001337 *19*; α(O)=2.07×10^{-5} *3*; α(P)=1.85×10^{-6} *3*
333.20 *26*	2.5 *4*	333.61	3/2$^+$	0.0	5/2$^+$	[M1,E2]		0.054 *13*	α(K)=0.045 *12*; α(L)=0.0075 *4*; α(M)=0.00165 *6* α(N)=0.000375 *16*; α(O)=5.8×10^{-5} *5*; α(P)=4.7×10^{-6} *16*
797.2 *5*	13.2 *24*	1051.79	7/2$^-$	254.54	7/2$^-$	[M1,E2]	[‡]	0.0058 *16*	α(K)=0.0049 *14*; α(L)=0.00069 *16*; α(M)=0.00015 *4* α(N)=3.4×10^{-5} *8*; α(O)=5.4×10^{-6} *13*; α(P)=5.2×10^{-7} *16*
861.97 *14*	39.6 *24*	1051.79	7/2$^-$	189.80	5/2$^-$	[M1,E2]	[‡]	0.0048 *13*	α(K)=0.0041 *11*; α(L)=0.00057 *13*; α(M)=0.00012 *3* α(N)=2.8×10^{-5} *7*; α(O)=4.5×10^{-6} *11*; α(P)=4.3×10^{-7} *13*
879.78 *29*	5.0 *7*	1051.79	7/2$^-$	172.00	9/2$^+$	[E1]		1.38×10^{-3} *2*	α(K)=0.001186 *17*; α(L)=0.0001544 *22*; α(M)=3.30×10^{-5} *5* α(N)=7.54×10^{-6} *11*; α(O)=1.192×10^{-6} *17*; α(P)=1.183×10^{-7} *17*

γ(^{159}Eu) (continued)

E_γ [†]	I_γ [†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α [@]	Comments
976.65 *32*	5.7 *8*	1051.79	7/2$^-$	75.41	7/2$^+$	[E1]	1.13×10^{-3} *2*	α(K)=0.000972 *14*; α(L)=0.0001260 *18*; α(M)=2.69×10^{-5} *4* α(N)=6.15×10^{-6} *9*; α(O)=9.74×10^{-7} *14*; α(P)=9.72×10^{-8} *14*
1051.7 *3*	6.0 *14*	1051.79	7/2$^-$	0.0	5/2$^+$	[E1]	9.86×10^{-4} *14*	α(K)=0.000847 *12*; α(L)=0.0001095 *16*; α(M)=2.34×10^{-5} *4* α(N)=5.34×10^{-6} *8*; α(O)=8.47×10^{-7} *12*; α(P)=8.48×10^{-8} *12*

† From 1987Wi14.

‡ Authors argue that the M1 component is “asymptotically unhindered and intrinsically quite strong”, so the transition is predominantly M1 (1987Wi14).

\# For absolute intensity per 100 decays, multiply by 0.46.

@ 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.

$^{159}_{63}$Eu$_{96}$-3

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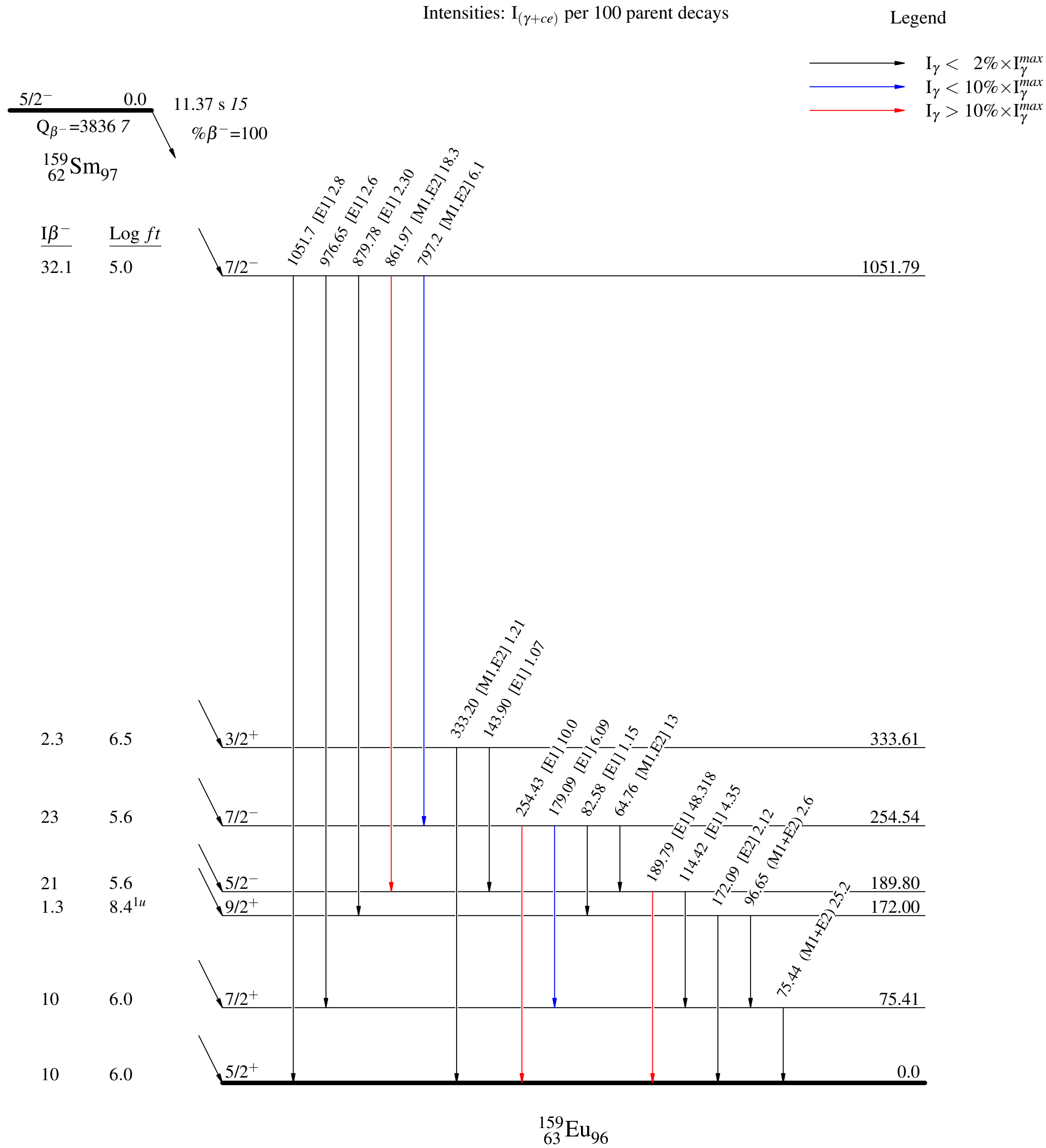
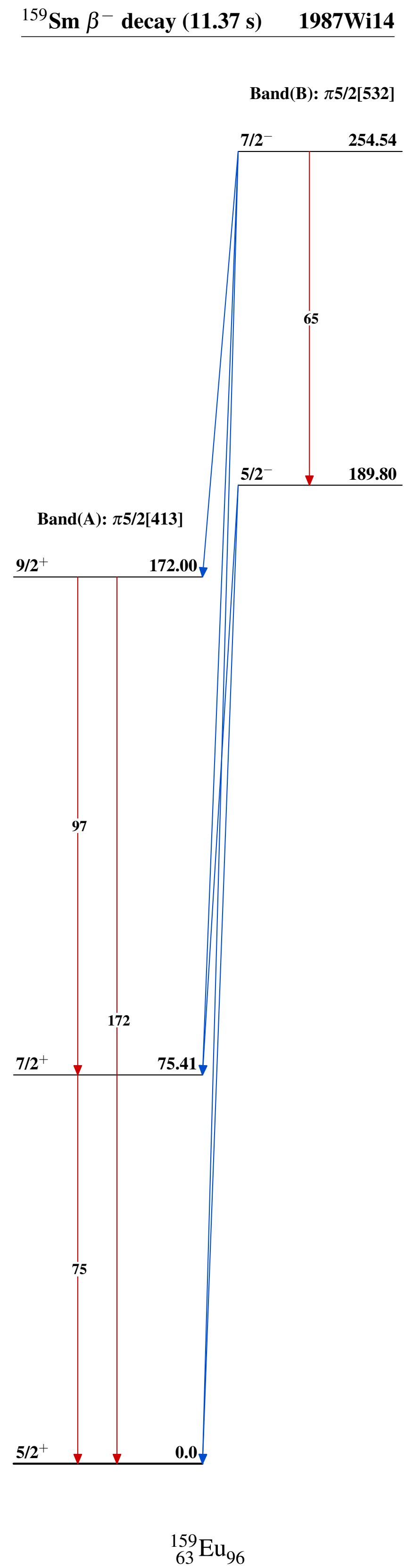
Decay Scheme

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




^{159}Sm β^- decay (11.37 s) 1987Wi14
Band(B): π5/2[532]
7/2$^-$ 254.54
65
5/2$^-$ 189.80
Band(A): π5/2[413]
9/2$^+$ 172.00
97
172
7/2$^+$ 75.41
75
5/2$^+$ 0.0
$^{159}_{63}Eu_{96}$