^{159}Sm β^- decay 1987Wi14

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 157 (2012)	31-Dec-2010

Parent: ^{159}Sm: E=0; J$^\pi$=5/2$^-$; T$_{1/2}$=11.37 s *15*; Q(β^-)=3805 *65*; %β^- decay=100.0

Additional information 1.

^{159}Sm produced by thermal-neutron fission of ^{235}U (1986Ma12) and spontaneous fission of ^{252}Cf (1987Wi14). In both cases identification was by mass separation and the genetic relation to the ^{159}Eu daughter activity.

The γ data and decay scheme are from 1987Wi14.

1986Ma12: produced by thermal-neutron fission of ^{235}U with mass separation in TRISTAN; report half-life and 2 γ's (114, 190).

1987Gr12: same as 1987Wi14; report half-life.

1987Wi14: produced by spontaneous fission of ^{252}Cf with mass separation; report half-life and 16 γ's and all in scheme. Deduce Iβ^- and some multipolarities and mixing ratios.

1990An31: repeat half-life from 1987Wi14.

^{159}Eu Levels

E(level)†	J$^\pi$‡
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$^+$)
1051.79 *12*	(7/2$^-$)

† From least-squares fit to γ energies.

‡ From ^{159}Eu Adopted Levels and based on the (t,α) assignments of 1979Bu05, except that for the 1052 level, which is based on this decay. See the Adopted Levels for the band assignments.

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
(2.75×10^3 *7*)	1051.79	32.1	5.0	av Eβ=1103 *30*
(3.47×10^3 *7*)	333.61	2.3	6.5	av Eβ=1432 *30*
(3.55×10^3 *7*)	254.54	23	5.6	av Eβ=1468 *30*
(3.62×10^3 *7*)	189.80	21	5.6	av Eβ=1498 *30*
(3.63×10^3 *7*)	172.00	1.3	8.4^{1u}	av Eβ=1483 *30*
(3.73×10^3 *7*)	75.41	10	6.0	av Eβ=1550 *30*
(3.81×10^3 *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: calculated to give 100% feeding of the ground state, with Iβ^-(0)=Iβ^-(75). If Iβ^-(0)=0, the normalization factor would be≈0.51.

E_γ	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_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+..)=0.24 20 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+..)=0.066 21 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	α(K)=0.398 6; α(L)=0.0609 9; α(M)=0.01312 19; α(N+..)=0.00342 5 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+..)=0.024 6 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	α(K)=0.1662 24; α(L)=0.0244 4; α(M)=0.00524 8; α(N+..)=0.001374 20 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	α(K)=0.0896 13; α(L)=0.01285 19; α(M)=0.00276 4; α(N+..)=0.000728 11 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	α(K)=0.241 4; α(L)=0.0903 13; α(M)=0.0208 3; α(N+..)=0.00530 8 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	α(K)=0.0499 7; α(L)=0.00704 10; α(M)=0.001513 22; α(N+..)=0.000400 6 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	α(K)=0.0427 6; α(L)=0.00601 9; α(M)=0.001291 19; α(N+..)=0.000341 5 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	α(K)=0.0198 3; α(L)=0.00274 4; α(M)=0.000589 9; α(N+..)=0.0001563 22 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+..)=0.000437 22 α(N)=0.000375 16; α(O)=5.8×10^{-5} 5; α(P)=4.7×10^{-6} 16

$^{159}_{63}$Eu$_{96}$-2

γ(^{159}Eu) (continued)

E_γ	I_γ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult.	α#	Comments
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+..)=4.0×10^{-5} *9* 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+..)=3.3×10^{-5} *8* α(N)=2.8×10^{-5} *7*; α(O)=4.5×10^{-6} *11*; α(P)=4.3×10^{-7} *13*
879.8 *3*	5.0 *7*	1051.79	(7/2$^-$)	172.00	(9/2$^+$)	[E1]	1.38×10^{-3}	α(K)=0.001186 *17*; α(L)=0.0001544 *22*; α(M)=3.30×10^{-5} *5*; α(N+..)=8.85×10^{-6} *13* α(N)=7.54×10^{-6} *11*; α(O)=1.192×10^{-6} *17*; α(P)=1.183×10^{-7} *17*
976.6 *3*	5.7 *8*	1051.79	(7/2$^-$)	75.41	(7/2$^+$)	[E1]	1.13×10^{-3}	α(K)=0.000972 *14*; α(L)=0.0001260 *18*; α(M)=2.69×10^{-5} *4*; α(N+..)=7.22×10^{-6} *11* 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}	α(K)=0.000847 *12*; α(L)=0.0001095 *16*; α(M)=2.34×10^{-5} *4*; α(N+..)=6.27×10^{-6} *9* α(N)=5.34×10^{-6} *8*; α(O)=8.47×10^{-7} *12*; α(P)=8.48×10^{-8} *12*

† 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.

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Decay Scheme

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