^{154}Eu IT decay (46.3 min) 1975Ca22,1976Ch08,1976Zo01

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 200,2 (2025)	22-Aug-2022

Parent: ^{154}Eu: E=145.3 *3*; $J^{\pi}=8^{-}$; $T_{1/2}$=46.3 min *4*; %IT decay=100

Additional information 1.

Experimental methods:

1975Ca22: Produced by (p,n) on enriched (99.996%) ^{154}Sm with E(p)=11 MeV. Measured γ singles and $\gamma\gamma$ coincidences with Ge detectors.

1976Ch08: Produced by (p,n) on enriched (99.996%) ^{154}Sm with E(p)=12.5 MeV followed by chemical separation. Measured γ's with Ge detectors and ce in magnetic spectrometer.

1976Zo01: Produced by (p,n), (d,2n), (d,α), and (d,p); some followed by chemical separations. Measured γ singles and $\gamma\gamma$ coincidences with Ge detectors. Si(Li) detector used in search for the isomeric transition.

^{154}Eu Levels

Although the observed γ rays are similar, the decay schemes of 1975Ca22, 1976Ch08, and 1976Zo01 are quite different. The scheme adopted here is that of the evaluator and is based on the level structure from the ^{153}Eu(n,γ) study of 1987Ba52. The scheme adopted in previous ENSDF evaluations (1979Ha02 and 1987He20) was similar to that of 1976Zo01, which relied on certain data from the (n,γ) study of 1977St14. This study differs in important ways from that of 1987Ba52.

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	Comments
0.0	3^{-}	8.592 y *5*	
68.17 *1*	2^{+}	2.2 μs *1*	$T_{1/2}$: 4.1 μs *4* (1975Ca22).
99.950 *15*	3^{+}	<2 ns	
100.88 *1*	4^{+}	54 ns *3*	$T_{1/2}$: 50 ns *10* (1975Ca22).
127.46 *6*	4^{+}	<10 ns	
129.660 *23*	4^{-}	<2 ns	
136.8 *3*	5^{+}		
145.3 *3*	8^{-}	46.3 min *4*	$T_{1/2}$: 48.2 m *17* (1975Ca22), 45.8 m *3* (1976Ch08), 46.8 m *6* (1976Zo01).

† Computed from these γ energies, unless otherwise noted; for more precise values, see the Adopted Levels.

‡ From ^{154}Eu Adopted Levels, where the band assignments are also discussed.

Adopted values. In comments: from ^{154}Eu (46.0 min) decay only.

γ(^{154}Eu)

Iγ normalization: Normalized to give 100% feeding of ground state by 68.17γ and 100.88γ.

The γ transition which deexcites the isomeric level has not been observed; and two other unobserved γ transitions are proposed to provide feeding of the 127 and 129 levels.

E_γ[†]	I_γ[‡&]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[@]	$I_{(\gamma+ce)}$[&]	Comments
(0.91)		100.88	4^+	99.950	3^+	[M1,E2]			114 *28*	E_γ: Existence of transition proposed by 1987Ba52. $I_{(\gamma+ce)}$: Deduced by evaluator from intensity balances at 99 and 100 levels; 1987Ba52 suggest Iγ(1+α) ≈ 80.
(7.1)		136.8	5^+	129.660	4^-	[E1]			7 *3*	$I_{(\gamma+ce)}$: Chosen to give intensity balance at 129 level.
(8.6)		145.3	8^-	136.8	5^+	[E3]			320 *70*	E_γ: From level energies observed in ^{153}Eu(d,p) (1987Ba52). From the inability to observe L-subshell conversion lines in this isomer decay, 1976Ch08 deduce Eγ < 13 keV. α: If mult=E3, α(8.6 keV)>5.6x10^7, but the E_γ value lies within 1 keV of 2 of the L-shell binding energies. Also, there is a large energy dependence in the theoretical α values in this energy region. Thus, the evaluator regards the α value for this transition as highly uncertain. $I_{(\gamma+ce)}$: Chosen to give intensity balance.
(9.3)		136.8	5^+	127.46	4^+	[M1,E2]		7×10^4 *7*	35 *12*	ce(L)/(γ+ce)=0.8 *5*; ce(M)/(γ+ce)=0.18 *23* ce(N)/(γ+ce)=0.04 *5*; ce(O)/(γ+ce)=0.005 *7*; ce(P)/(γ+ce)=4 α(L)=6×10^4 *5*; α(M)=1.3×10^4 *13* α(N)=2.8×10^3 *28*; α(O)=4×10^2 *4*; α(P)=0.32 *13* $I_{(\gamma+ce)}$: Chosen to give intensity balance at 127 level.
27.51 *5*	2.4 *8*	127.46	4^+	99.950	3^+	M1+E2	0.032 *9*	13.1 *4*		α(L)=10.30 *35*; α(M)=2.24 *8* α(N)=0.511 *18*; α(O)=0.0801 *24*; α(P)=0.00752 *11*
28.78 *2*	2.9 *12*	129.660	4^-	100.88	4^+	E1		1.502 *21*		α(L)=1.180 *17*; α(M)=0.257 *4* α(N)=0.0563 *8*; α(O)=0.00762 *11*; α(P)=0.000404 *6*
31.78 *1*	15 *3*	99.950	3^+	68.17	2^+	M1+E2	0.030 *3*	8.43 *13*		α(L)=6.61 *10*; α(M)=1.433 *23* α(N)=0.327 *5*; α(O)=0.0515 *8*; α(P)=0.00491 *7*
32.61	0.22 *3*	100.88	4^+	68.17	2^+	E2		269 *4*		α(L)=208.2 *29*; α(M)=48.7 *7* α(N)=10.73 *15*; α(O)=1.418 *20*; α(P)=0.000822 *12* I_γ: Deduced from Iγ(32.6)/Iγ(100.8) in (n,γ) (1987Ba52). This value gives Iγ(1+α)=59, compared to Iγ(1+α) ≈ 36 from Ice data of (1976Ch08).
35.802	34 *8*	136.8	5^+	100.88	4^+	M1+E2	0.09 *2*	7.1 *6*		α(L)=5.5 *5*; α(M)=1.21 *12* α(N)=0.275 *26*; α(O)=0.0421 *34*; α(P)=0.00343 *5*
68.17 *1*	100	68.17	2^+	0.0	3^-	E1		0.793 *11*		α(K)=0.660 *9*; α(L)=0.1046 *15*; α(M)=0.02256 *32* α(N)=0.00505 *7*; α(O)=0.000742 *10*; α(P)=5.22×10^{-5} *7*

$\gamma(^{154}$Eu) (continued)

E_γ[†]	I_γ[‡&]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[@]	Comments
100.88 *1*	72 *5*	100.88	4^+	0.0	3^-	E1	0.277 *4*	α(K)=0.2331 *33*; α(L)=0.0347 *5*; α(M)=0.00747 *10* α(N)=0.001680 *24*; α(O)=0.0002524 *35*; α(P)=1.948×10^{-5} *27* I_γ: Average of three reported values.

† From 1976Zo01. These values have the smallest uncertainties, so a weighted average of these values with those of 1975Ca22 and 1976Ch08 would give essentially the same values. For most γ's, more precise energies are given in the Adopted γ Radiations.

‡ From 1976Ch08, unless otherwise noted. The evaluator has increased the uncertainties by factors of 2.0 above 30 keV and 4.0 below 30 keV to allow for the large discrepancy between the values from 1975Ca22, 1976Ch08, and 1976Zo01. The discrepancies among the reported data are illustrated by the fact that, for the three γ's below 34 keV, the reported uncertainties are about 10%, but the values vary by factors of 2 or more.

\# Assignments and values are from Adopted γ Radiations.

@ Additional information 2.

& For absolute intensity per 100 decays, multiply by 0.369 *9*.

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Decay Scheme

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

%IT=100