^{147}Sm(α,p4nγ) 1988Er02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Yu. Khazov, A. Rodionov and G. Shulyak	NDS 136, 163 (2016)	14-Jul-2016

Also ^{144}Sm(α,d).

1988Er02,1980Er04: ^{147}Sm(α,p4nγ), E=76 MeV; ^{147}Sm(p,2nγ), E=19 MeV; measured Eγ, Iγ, $\gamma(\theta)$, $\gamma\gamma$ coin, ce. ^{146}Eu; deduced levels, J^π, mult., configurations. Model calculations.

1988La18,1988GeZZ: ^{144}Sm(α,d), E=218 MeV; measured Ed, σ(Ed,θ) at θ=3°−4°. ^{146}Eu; deduced levels, J^π, configuration. Synchrocyclotron, proportional chambers, ΔE detector, DWBA analysis.

The level scheme is from 1988Er02. Possible configurations are from 1988Er02.

^{146}Eu Levels

E(level)[†]	J^{π}[#]	$T_{1/2}$	Comments
0.0[@]	4⁻		
14.52[@] *9*	5⁻		
289.31[@] *10*	6⁻		
316.48[&] *9*	5⁻		
372.66[&] *10*	6⁻		
647.53[&] *11*	7⁻		
666.33[a] *12*	9⁺		E(level): also measured in (α,d) reaction.
802.32[c] *15*	8⁺		
1235.22[c] *16*	9⁺		
1698.63[d] *16*	10⁺		
1768.62[b] *16*	11⁻	4.5 ns *7*	$T_{1/2}$: from $\gamma\gamma$(t) in ^{147}Sm(p,2n) of 1988Er02.
1882.79[b] *21*	(9)⁻		
1978.01[b] *22*	(10)⁻		
2026.92[b] *19*	12⁻		E(level): also measured in (α,d) reaction.
2105.54[e] *23*	11⁺		
2540.0[f] *4*	12⁺		
2665.8[f] *4*	13⁺		
2951.3[f] *4*	(14⁺)		
3200[‡]			
3400[‡]			
3470.8[f] *6*	(15⁺)		
4130[‡]			

[†] From a least-squares fit to Eγ′s.
[‡] Measured in (α,d) reaction only.
[#] From 'Adopted Levels'.
[@] Possible configuration=$\pi d^{-1}_{5/2}\times\nu f_{7/2}$ (1988Er02).
[&] Possible configuration=$\pi g^{-1}_{7/2}\times\nu f_{7/2}$ (1988Er02).
[a] Possible configuration=$\pi h_{11/2}\times\nu f_{7/2}$ (1988Er02).
[b] possible configuration=$\pi h_{11/2}\times\nu f_{7/2}\times 3^-$ (1988Er02).
[c] Possible configuration=$\pi d^{-1}_{5/2}\times\nu i^{*}_{13/2}$ (1988Er02).
[d] Possible configuration=$\pi g^{-1}_{7/2}\times\nu i^{*}_{13/2}$ (1988Er02).
[e] Possible configuration=$9^+\times(\pi^{-2})_{2+}$ (1988Er02).
[f] Possible configuration= $9^+\times(\pi d^{-1}_{5/2}\times g^{-1}_{7/2})_{6+}$ (1988Er02).

γ(^{146}Eu)

E_γ †	I_γ ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult. #	α &	$I_{(\gamma+ce)}$	Comments
14.5 *1*	3 *1*	14.52	5⁻	0.0	4⁻	M1	83.9 *21*		α(exp)=75 *25* α(L)=65.8 *17*; α(M)=14.3 *4* α(N)=3.26 *9*; α(O)=0.515 *13*; α(P)=0.0504 *13* α: value from I(γ+ce) balance (1988Er02).
(18.8)		666.33	9⁺	647.53	7⁻	[M2]	7.27×10^3	115 *25*	ce(L)/(γ+ce)=0.763 *8*; ce(M)/(γ+ce)=0.187 *4* ce(N)/(γ+ce)=0.0431 *9*; ce(O)/(γ+ce)=0.00643 *13*; ce(P)/(γ+ce)=0.000463 *10* α(L)=5.55×10^3 *8*; α(M)=1359 *19* α(N)=313 *5*; α(O)=46.8 *7*; α(P)=3.37 *5* $I_{(\gamma+ce)}$: from balance of I(γ+ce) at 666 and 647.5 levels (1988Er02).
56.2 *1*	0.23 *3*	372.66	6⁻	316.48	5⁻				
70.0 *1*	25 *3*	1768.62	11⁻	1698.63	10⁺	E1	≤1.5		α≤1.5 α(K)=0.615 *9*; α(L)=0.0970 *15*; α(M)=0.0209 *3* α(N)=0.00468 *7*; α(O)=0.000690 *10*; α(P)=4.88×10^{-5} *7* α: from I(γ+ce) balance (1988Er02). A_2=−0.20 *10*, A_4=+0.00 *20*.
83.2 *2*	≤0.2	372.66	6⁻	289.31	6⁻				
95.2@ *2*	4.0 *3*	1978.01	(10)⁻	1882.79	(9)⁻				
125.8 *1*	41 *4*	2665.8	13⁺	2540.0	12⁺	M1	0.959		α(K)=0.812 *12*; α(L)=0.1158 *17*; α(M)=0.0250 *4* α(N)=0.00573 *9*; α(O)=0.000909 *13*; α(P)=8.98×10^{-5} *13* α: 0.4<α_{tot}<1.1 from I(γ+ce) balance (1988Er02). A_2=−0.15 *2*, A_4=−0.05 *3*.
136.0 *1*	34 *3*	802.32	8⁺	666.33	9⁺	M1	0.770		α(K)exp=0.63 *6* α(K)=0.651 *10*; α(L)=0.0928 *14*; α(M)=0.0201 *3* α(N)=0.00459 *7*; α(O)=0.000728 *11*; α(P)=7.20×10^{-5} *11* A_2=−0.15 *3*, A_4=−0.01 *4*.
209.4@ *2*	1.4 *1*	1978.01	(10)⁻	1768.62	11⁻	M1	0.232		α(K)exp=0.19 *6* α(K)=0.197 *3*; α(L)=0.0278 *4*; α(M)=0.00599 *9* α(N)=0.001373 *20*; α(O)=0.000218 *4*; α(P)=2.16×10^{-5} *3* A_2=−0.24 *18*, A_4=+0.06 *25*.
258.3 *1*	61 *6*	2026.92	12⁻	1768.62	11⁻	M1	0.1312		α(K)exp=0.14 *6* α(K)=0.1113 *16*; α(L)=0.01563 *22*; α(M)=0.00337 *5* α(N)=0.000773 *11*; α(O)=0.0001227 *18*; α(P)=1.222×10^{-5} *18* A_2=−0.21 *2*, A_4=−0.01 *2*.
274.76 *5*	170 *16*	289.31	6⁻	14.52	5⁻	M1	0.1112		α(K)exp=0.095 *9* α(K)=0.0943 *14*; α(L)=0.01323 *19*; α(M)=0.00285 *4* α(N)=0.000653 *10*; α(O)=0.0001038 *15*; α(P)=1.035×10^{-5} *15* α: for doublet line. E_γ: doublet with 274.8γ, Iγ=32 *16* from 647.5 keV level. A_2=−0.040 *2*, A_4=+0.001 *2*.
274.89 *7*	32 *16*	647.53	7⁻	372.66	6⁻	M1	0.1110		α(K)exp=0.095 *9*

$^{146}_{63}$Eu$_{83}$-2

γ(^{146}Eu) (continued)

Eγ†	Iγ‡	Ei(level)	J^π_i	Ef	J^π_f	Mult.#	α&	Comments
								α(K)=0.0942 *14*; α(L)=0.01321 *19*; α(M)=0.00285 *4* α(N)=0.000653 *10*; α(O)=0.0001037 *15*; α(P)=1.034×10^{-5} *15* α: for doublet line. Eγ: doublet with 274.76γ, Iγ=170 *16* from 289.3 keV level. A_2=−0.040 *2*, A_4=+0.001 *2*.
285.5 *1*	60 *6*	2951.3	(14$^+$)	2665.8	13$^+$	D+Q		A_2=−0.07 *2*, A_4=−0.00 *3*.
293.7 *1*	3.9 *2*	666.33	9$^+$	372.66	6$^-$	E3	0.254	α(K)exp=0.15 *3*; K/L=1.8 *4* α(K)=0.1502 *21*; α(L)=0.0798 *12*; α(M)=0.0188 *3* α(N)=0.00420 *6*; α(O)=0.000590 *9*; α(P)=1.482×10^{-5} *21* A_2=−0.04 *6*, A_4=−0.06 *8*.
316.5 *1*	2.3 *2*	316.48	5$^-$	0.0	4$^-$	M1	0.0763	α(K)exp=0.066 *8* α(K)=0.0648 *9*; α(L)=0.00905 *13*; α(M)=0.00195 *3* α(N)=0.000447 *7*; α(O)=7.10×10^{-5} *10*; α(P)=7.09×10^{-6} *10* A_2=−0.05 *1*, A_4=−0.01 *1*.
358.2 *1*	36 *18*	372.66	6$^-$	14.52	5$^-$	M1	0.0551	α(K)exp=0.048 *5* α(K)=0.0468 *7*; α(L)=0.00651 *10*; α(M)=0.001403 *20* α(N)=0.000321 *5*; α(O)=5.11×10^{-5} *8*; α(P)=5.11×10^{-6} *8* α: for doublet line. Eγ: doublet with 358.2γ, Iγ=75 *18* from 647.5 keV level. A_2=−0.039 *3*, A_4=+0.001 *4*.
358.2 *1*	75 *18*	647.53	7$^-$	289.31	6$^-$	M1	0.0551	α(K)exp=0.048 *5* α(K)=0.0468 *7*; α(L)=0.00651 *10*; α(M)=0.001403 *20* α(N)=0.000321 *5*; α(O)=5.11×10^{-5} *8*; α(P)=5.11×10^{-6} *8* α: for doublet line. Eγ: doublet with 358.2γ, Iγ=36 *18* from 372.7 keV level. A_2=−0.039 *3*, A_4=+0.001 *4*.
377.0 *1*	100	666.33	9$^+$	289.31	6$^-$	E3	0.0994	K/L=2.5 *2* α(K)=0.0668 *10*; α(L)=0.0252 *4*; α(M)=0.00584 *9* α(N)=0.001312 *19*; α(O)=0.000188 *3*; α(P)=6.89×10^{-6} *10* A_2=+0.00 *1*, A_4=−0.00 *1*.
432.9 *1*	48 *9*	1235.22	9$^+$	802.32	8$^+$	M1	0.0337	α(K)exp=0.029 *4* α(K)=0.0287 *4*; α(L)=0.00396 *6*; α(M)=0.000854 *12* α(N)=0.000196 *3*; α(O)=3.11×10^{-5} *5*; α(P)=3.12×10^{-6} *5* A_2=−0.13 *3*, A_4=+0.04 *3*.
434.5 *3*	57 *9*	2540.0	12$^+$	2105.54	11$^+$	D+Q		A_2=+0.03 *3*, A_4=+0.04 *4*.
463.4 *1*	35 *4*	1698.63	10$^+$	1235.22	9$^+$	M1	0.0283	α(K)exp=0.025 *7* α(K)=0.0241 *4*; α(L)=0.00332 *5*; α(M)=0.000715 *10* α(N)=0.0001639 *23*; α(O)=2.61×10^{-5} *4*; α(P)=2.62×10^{-6} *4* A_2=−0.09 *4*, A_4=−0.01 *5*.
513 *1*	15 *5*	2540.0	12$^+$	2026.92	12$^-$			
519.5 *4*	30 *8*	3470.8	(15$^+$)	2951.3	(14$^+$)	D+Q		A_2=−0.10 *10*, A_4=+0.10 *12*.
639 *1*	10 *5*	2665.8	13$^+$	2026.92	12$^-$			
966.3 *3*	6 *1*	1768.62	11$^-$	802.32	8$^+$	(E3)	0.00610	α(K)=0.00500 *7*; α(L)=0.000854 *12*; α(M)=0.000188 *3* α(N)=4.28×10^{-5} *6*; α(O)=6.61×10^{-6} *10*; α(P)=5.41×10^{-7} *8*

γ(^{146}Eu) (continued)

E_γ †	I_γ ‡	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	α&	Comments
								A_2=+0.51 *21*, A_4=+0.13 *20*. Mult.: from isomeric transition rates (1988Er02).
1032.3 *2*	20 *2*	1698.63	10$^+$	666.33	9$^+$	M1	0.00394	α(K)exp=0.0038 *9* α(K)=0.00336 *5*; α(L)=0.000451 *7*; α(M)=9.68×10^{-5} *14* α(N)=2.22×10^{-5} *4*; α(O)=3.53×10^{-6} *5*; α(P)=3.60×10^{-7} *5* A_2=+0.20 *8*, A_4=0.05 *10*.
1080.5@ *2*	3.7 *3*	1882.79	(9)$^-$	802.32	8$^+$	E1	9.38×10^{-4}	α(K)exp=0.00097 *25* α(K)=0.000806 *12*; α(L)=0.0001041 *15*; α(M)=2.22×10^{-5} *4* α(N)=5.08×10^{-6} *8*; α(O)=8.05×10^{-7} *12*; α(P)=8.07×10^{-8} *12* A_2=−0.27 *14*, A_4=−0.19 *20*.
1102.3 *2*	30 *3*	1768.62	11$^-$	666.33	9$^+$	(E3+M2)	0.0063 *19*	α(K)=0.0053 *17*; α(L)=0.00079 *20*; α(M)=0.00017 *5* α(N)=3.9×10^{-5} *10*; α(O)=6.2×10^{-6} *16*; α(P)=5.9×10^{-7} *20*; α(IPF)=5.7×10^{-8} *3* A_2=−0.10 *6*, A_4=−0.16 *8*. Mult.: from isomeric transition rates (1988Er02).
1216.1@ *5*	2.8 *4*	1882.79	(9)$^-$	666.33	9$^+$	E1	7.90×10^{-4}	α(K)exp<0.001 α(K)=0.000651 *10*; α(L)=8.37×10^{-5} *12*; α(M)=1.79×10^{-5} *3* α(N)=4.08×10^{-6} *6*; α(O)=6.48×10^{-7} *9*; α(P)=6.53×10^{-8} *10*; α(IPF)=3.24×10^{-5} *5*
1439.2 *2*	59 *6*	2105.54	11$^+$	666.33	9$^+$	E2	1.31×10^{-3}	α(K)=0.001074 *15*; α(L)=0.0001454 *21*; α(M)=3.12×10^{-5} *5* α(N)=7.14×10^{-6} *10*; α(O)=1.129×10^{-6} *16*; α(P)=1.107×10^{-7} *16*; α(IPF)=5.52×10^{-5} *8* Mult.: ΔJ=2, stretched Q(E2) from A_2=+0.28 *4*, A_4=−0.08 *5*.

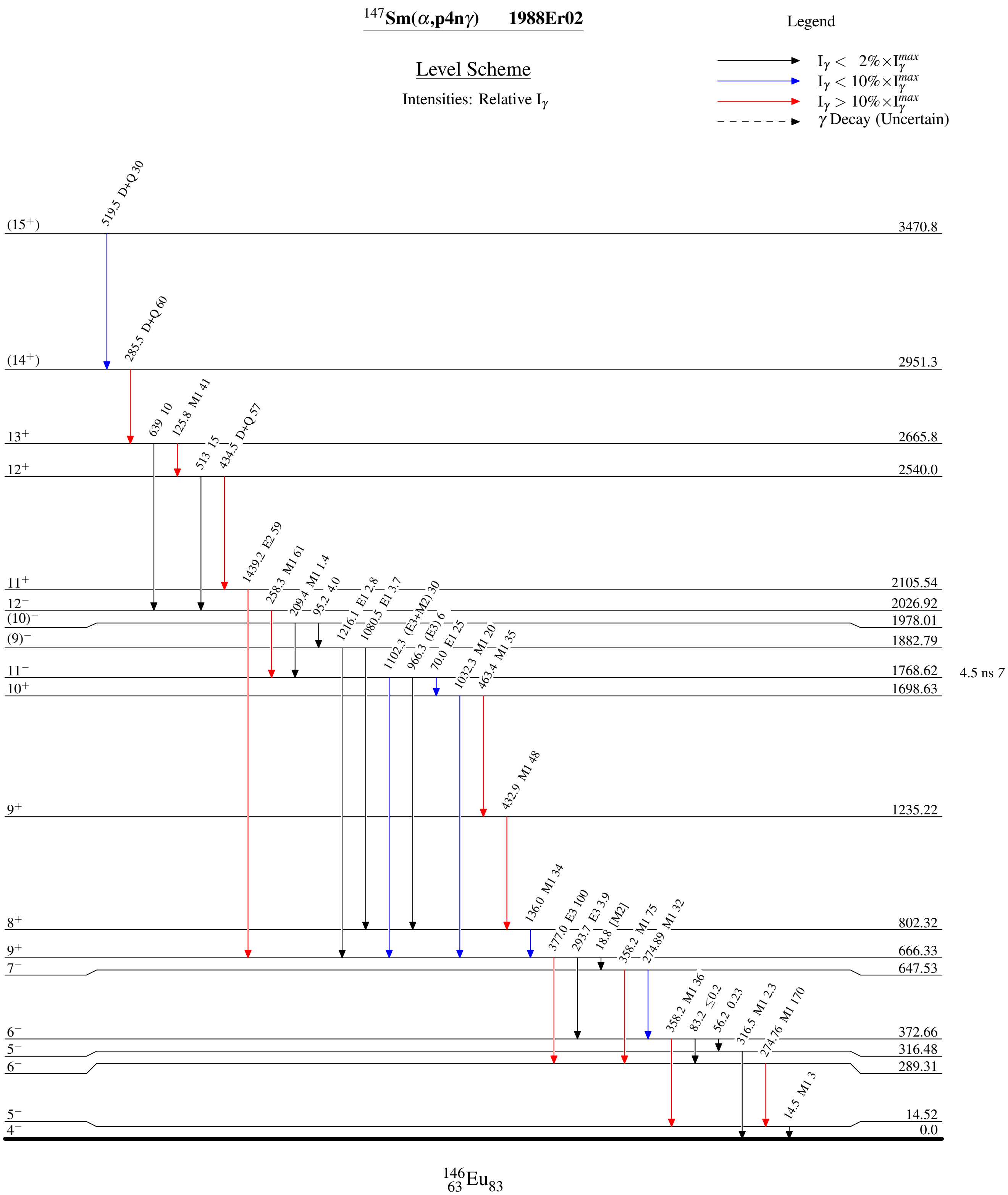
† From 1988Er02.

‡ From 1988Er02. $I\gamma$'s are normalized to $I\gamma$(377, E3, 9$^+$→6$^-$)=100 corresponding to 230 decays of 9$^+$ isomer (1988Er02).

From α(exp), $\gamma(\theta)$ from (p,2n) of 1988Er02 and RUL; α's were normalized to α(K)(377γ, E3)=0.0668 (from BrIcc).

@ From ^{147}Sm(p,2n) reaction (1988Er02).

& Additional information 1.


^{147}Sm(α,p4nγ) 1988Er02
Level Scheme
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
γ Decay (Uncertain)
(15+) 3470.8
(14+) 2951.3
13+ 2665.8
12+ 2540.0
11+ 2105.54
12− 2026.92
(10)− 1978.01
(9)− 1882.79
11− 1768.62 4.5 ns 7
10+ 1698.63
9+ 1235.22
8+ 802.32
9+ 666.33
7− 647.53
6− 372.66
5− 316.48
6− 289.31
5− 14.52
4− 0.0
519.5 D+Q 30
285.5 D+Q 60
639 10
125.8 M1 41
513 15
434.5 D+Q 57
1439.2 E2 59
258.3 M1 61
209.4 M1 1.4
95.2 4.0
1216.1 E1 2.8
1080.5 E1 3.7
1102.3 (E3+M2) 30
966.3 (E3) 6
70.0 E1 25
1032.3 M1 20
463.4 M1 35
432.9 M1 48
136.0 M1 34
377.0 E3 100
293.7 E3 3.9
18.8 [M2]
358.2 M1 75
274.89 M1 32
358.2 M1 36
83.2 ≤0.2
56.2 0.23
316.5 M1 2.3
274.76 M1 170
14.5 M1 3
$^{146}_{63}$Eu$_{83}$