^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. K. Basu, A. A. Sonzogni	NDS 114, 435 (2013)	1-Apr-2013

Others: 1962Bi16, 1966El05, 1967Pr08, 1968Gr32, 1969Ra10, 1973PrZI, 1976Ba18.

1976Ba18: contains data in tabular form from 1966Sm03, 1969Ra10, 1966El05, 1962Bi16, 1967Pr08, and 1973PrZI and, gives extensive references.

1968Gr32: give Eγ, Iγ from 1963Gr18, 1966Sm03, 1969Ra10. E_{ce}, I_{ce} from 1962Bi16, 1963Gr18, 1966El05 and 1967Pr08.

1966Sm03: investigated the γ rays resulting from thermal-neutron capture in ^{149}Sm with a bent-crystal spectrometer in the energy range of 40 keV to 2.4 MeV. The source consisted of 350 mg of Sm oxide enriched to 83% in ^{149}Sm. This sample absorbed ≈100% of the thermal neutron flux initially but as the ^{149}Sm (σ=64000 barns) was converted to ^{150}Sm, the neutron transmission increased. α study of this effect allowed the calculation of intensity in units of photons per 100 neutron captures. γ rays in ^{150}Sm, ^{151}Sm, and ^{152}Sm were identified by comparing plots of intensity versus integrated neutron flux. In this manner 217 γ rays were identified with thermal neutron capture in ^{149}Sm. Quoted energies and intensities were obtained from averages of 5 to 10 independent determinations. Errors are probable errors reflecting a 60% confidence limit and include both a statistical uncertainty and an estimated systematic error. The bent crystal γ-ray data were combined by the authors with the conversion-electron data of 1962Bi16 and 1963Gr18 to obtain K-conversion coefficients. $\gamma\gamma$ coincidence and angular-correlation data were taken. α decay scheme was proposed by 1966Sm03 based up to the 1642-keV level on the γ-ray work of that author and the calculated K-conversion coefficients. The decay scheme is extended up to 2020 keV by comparison with the work of 1965Gu03, 1964Ke03 and 1963Gr18.

1963Gr18: studied the primary and secondary gammas in the γ-ray spectrum emitted in neutron capture in ^{149}Sm. Assuming that all γ rays with Eγ>(S(n)−2) MeV are primary transitions in ^{150}Sm, authors obtain S(n)=7985.5 keV *4*, to be compared with 7986.7 keV *4* from the Adopted Levels. Primary γ rays listed below are taken from this source.

1969Re11: studied the directional anisotropy of capture γ rays from aligned ^{149}Sm nuclei. J^π were assigned by combining these data with α(exp) data.

^{150}Sm Levels

Levels below 3 MeV are from 1966Sm03, unless otherwise noted. Levels above 3 MeV are those seen by 1964Ke03 in the (d,p) reaction to which primary γ rays may be assigned from the (n,γ) E=thermal results of 1963Gr18.

E(level)[†]	J^π[‡]	Comments
0.0	0^+	
333.99 *4*	2^+	
740.50 *5*	0^+	
773.35 *5*	4^+[#]	
1046.17 *5*	2^+	
1071.38 *5*	3^-	
1165.71 *6*	1^-	J^π: from directional anisotropy of capture γ rays from aligned nuclei and α(exp) measurements.
1193.84 *5*	2^+	J^π: from γ-deexcitation pattern.
1255.52 *5*	0^+	E(level): this level was reported in studies of β decay to ^{150}Sm and was adopted by 1963Gr18 who observed transitions which could be assigned to it.
1278.90 *5*	6^+	J^π: from Adopted Levels. 1969Re11 find that $\gamma(\theta)$ for the 505-keV γ ray from this state is consistent with a 6^+ to 4^+ E2.
1357.65 *5*	5^-	J^π: from E1 transitions to 4^+ and 6^+ levels.
1417.32 *5*	2^+	E(level): this level was observed in β decay studies of ^{150}Sm and was adopted by 1976Ba18. All transitions assigned to this level were observed by 1966Sm03. J^π: from E1 transitions to 3^- and 1^- states.
1449.17 *5*	4^+[#]	
1504.60 *5*	3^+[#]	
1642.63 *5*	4^+[#]	
1658.37 *7*	$2^{(-)}$	

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

^{150}Sm Levels (continued)

E(level)[†]	J$^\pi$[‡]	Comments
1672.73? *5*	(4$^+$)	
1684.14 *6*	3$^-$[#]	
1713.97? *10*	1	E(level): level suggested in ^{150}Pm β^- decay. J$^\pi$: based on multipolarity of the 1380.3-keV transition to the 333.96-keV, 2$^+$, level and photon branching to 0$^+$ and 1$^-$ levels.
1760.08 *5*	(3$^-$)	
1764.76? *9*	7$^-$	Level observed in ^{149}Sm(d,p) and ^{152}Sm(p,t) reactions.
1794.30 *6*	2$^+$	
1819.34 *6*	4$^+$	
1821.87 *6*	(4)$^+$	
1822.53 *11*	(4,5)$^-$	E(level): from 1963Gr18 and 1969Re11. J$^\pi$: 1969Re11 assign 3$^+$,4$^+$ to this level through $\gamma(\theta)$ studies. Accepted values are from γ-deexcitation (1976Ba18).
1927.29? *10*	(2$^+$)	Primary γ to level of this energy seen in (n,γ) res but not in (n,γ) E=th. However, 510- and 761-keV γ's observed by 1966Sm03 can be placed here on basis of energy fit.
1950.94 *6*	3$^-$	
1970.42 *6*	4$^+$[#]	
2020.24? *10*	5$^+$	
2024.58 *6*	4$^+$[#]	
2035.4? *3*	5$^-$	E(level): the statement that the 2035 level is populated in (n,γ)therm is only as valid as is the assumption that the 1261.99 *3* γ ray in ε decay and the 1263.2 *6* γ ray in (n,γ)therm are the same.
2062.81 *6*	(3)$^+$[#]	
2095.35 *10*	(5$^+$)	1969Re11 report primary γ ray feeding a level of this energy. J$^\pi$: 1969Re11 determine J^π=5$^+$ from directional anisotropy of primary γ-ray feeding level.
2117.15 *9*	4$^+$	
2152.62 *9*	4$^+$[#]	
2190.9 *3*	4$^+$[#]	
2191.11 *7*	(4$^+$)	E(level): adopted value.
2227? *5*		Level seen in (p,t) and (d,d′) reactions; 1963Gr18 report 2227-keV 5 γ ray.
2250?[@] *6*	(3$^+$,4$^+$)	
2265?[@] *7*	4$^{(+)}$	J$^\pi$: from $\gamma(\theta)$ aligned (1969Re11).
2295?[@] *7*	3$^+$,4$^+$	
2337?[@] *9*		
2378?[@] *5*	(3$^+$)	
2461?[@] *5*	3$^+$	J$^\pi$: assigned 3$^+$ in anisotropy studies by 1969Re11.
2472?[@]		
2502?[@] *6*	(3)$^+$[#]	
2575?[@] *6*	3$^+$,4$^+$	
2589?[@] *8*	3$^+$,4$^+$	
2612?[@] *8*		
2657?[@] *6*	(3,5)	J$^\pi$: 1969Re11 assigned (3,5) on basis of directional anisotropy studies. There was doubt as to the π assignment.
2673?[@] *8*		E(level): adopted value.
2712?[@] *6*		
2731?[@] *9*		
2755?[@] *6*		
2812.9?[@] *3*	(1$^-$,2)	
2861?[@] *7*		
2910.5 *21*		Adopted level. 1963Gr18 report a 5075-keV γ ray which could be the primary γ ray to this level.
2937?		Adopted level. Possible primary γ ray (1969Ra10). 1963Gr18 see a 2949-keV γ ray which gives

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

^{150}Sm Levels (continued)

E(level)†	J$^{\pi}$‡	Comments
		2949 keV for the energy of what is probably the same level.
2996? *6*		Adopted level. Possible primary γ ray (1969Ra10).
3031? *6*		From presence of primary γ ray (1963Gr18).
3050.1? *8*		Adopted level. Primary γ ray (1963Gr18).
3080.5? *15*		Adopted level. Primary γ ray (1963Gr18).
3125? *5*		
3183? *5*		
3226? *7*		
3244? *7*		
3276? *7*		
3326? *6*		
3390? *7*		
3449? *7*		
3490? *6*		
3528? *6*		
3567? *6*		
3591? *6*		
3648 *6*		
3700? *6*		
3731? *6*		
3754? *6*		
3791? *4*		
3839? *6*		
3877? *6*		
3908? *6*		
3944? *6*		
3971? *6*		
4001? *6*		
7986.6 *4*	4$^-$	E(level): from Adopted Levels. 1963Gr18 get S(n)=7983 keV *4*. J$^{\pi}$: from 1954Ro25. Capture of polarized neutrons by polarized ^{149}Sm nuclei. 1984MuZY indicate that thermal neutron capture in ^{149}Sm is predominantly due to a 4$^-$ resonance.

† Listed energies are least-squares-fitted values with input from all photon transitions between levels while holding the energy of the capturing state constant.
‡ From Adopted Levels, except as noted.
# Confirmed by 1969Re11. See general comment.
@ 1963Gr18 see primary γ ray to this level.

γ(^{150}Sm)

γ rays below 2350 keV are from 1966Sm03, unless otherwise noted. γ rays above 2350 keV are taken from 1963Gr18. From 1764.77-keV level and up, some γ rays seen by 1966Sm03 have been placed in the decay scheme by the evaluator on the basis of energy fit.

The γ rays placed from level 7986 are a partial list of those reported in the literature and consist of transitions reported by both 1963Gr18 and 1969Ra10. Above 5616 keV γ rays reported by both 1963Gr18 and 1969Re04 are listed. Eγ have been taken from 1963Gr18 and Iγ from 1969Ra10 or 1969Re04. The multipolarities are deduced from α(K)exp based on Iγ of 1969Ra10 or 1969Re04 and Ice(K) data of 1966El05 or 1970Pa20. 1969Re11 also give multipolarities based on α(exp) of 1966El05 but reanalyed. The chosen multipolarities are consistent with both sources.

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

E_γ	I_γ[c]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
x70.64 3	0.0044 22						
x72.15 3	0.0012 8						
x74.93 3	0.0032 10						
78.76 1	0.022 11	1357.65	5⁻	1278.90	6⁺	E1	
x85.74 4	0.0025 9						
x89.69 2	0.0035 9						
x92.75 2	0.0015 5						
x93.65 2	0.0075 10						
x98.95 1	0.025 4					E1	
x99.35 1	0.0034 10						
x105.83 1	0.0056 20						
x109.19 1	0.009 3						
x116.36 2	0.0030 10						
117.58[g] 2	0.0010 5	1760.08	(3⁻)	1642.63	4⁺		
x124.09 2	0.0033 11						
x128.98 3	0.0010 5						
x131.00 2	0.0010 5						
135.16 2	0.0017 6	1819.34	4⁺	1684.14	3⁻		
x135.76 3	0.0021 7						
138.05[&] 4	0.0011 5	1642.63	4⁺	1504.60	3⁺		
x144.56 3	0.0074 18						
147.73 4	0.0018 9	1193.84	2⁺	1046.17	2⁺	M1+E2[#]	
x150.61 4	0.0016 5						
151.06[g] 4	0.0008 4	1970.42	4⁺	1819.34	4⁺		
151.64[g] 4	0.0008 4	1794.30	2⁺	1642.63	4⁺		
153.78[&] 4	0.0012 6	1658.37	2⁽⁻⁾	1504.60	3⁺		
x158.89 1	0.0025 8						
161.84[g] 3	0.015 5	1417.32	2⁺	1255.52	0⁺	(E2)	
x165.20 4	0.0012 4						
x165.73 2	0.014 5						
168.24[g] 4	0.0066 20	1672.73?	(4⁺)	1504.60	3⁺		
170.23[g] 2	0.0051 8	1449.17	4⁺	1278.90	6⁺	E1,E2	
x176.51 5	0.0011 5						
x178.78 2	0.0045 8						
179.26[g] 5	0.0017 9	1821.87	(4)⁺	1642.63	4⁺		
x180.78 3	0.0017 6						
x182.03 2	0.011 3						
x185.04 5	0.0009 5						
x185.65 5	0.0009 5						
x188.46 2	0.0029 8						
x192.65 2	0.0037 11						
193.46 2	0.0073 18	1642.63	4⁺	1449.17	4⁺	(E2+E0)	
x194.82 2	0.0017 3						
x196.02 8	0.0015 4						
x197.88 6	0.0009 3						
x198.50 5	0.0011 4						
x199.20 2	0.0013 2						
x200.88 3	0.0007 3						
x202.13 2	0.0032 8						
x202.48 8	0.0014 7						
x203.41 2	0.0044 5						
x204.71 2	0.022 3					(E2+E0)	
205.21[g] 2	0.027 4	2024.58	4⁺	1819.34	4⁺	M1	Mult.: adopted value.
x205.63 6	0.0034 6						
x207.01 2	0.0029 6						

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

Eγ	Iγ[c]	E$_i$(level)	J^π_i	E$_f$	J^π_f	Mult.[†]	Comments
209.36 *2*	0.0048 *12*	1255.52	0+	1046.17	2+	not E1	
x210.63 *5*	0.0013 *4*						
x213.21 *2*	0.0026 *7*						
x215.97 *2*	0.0007 *3*						
x217.72 *2*	0.0019 *5*						
x218.49 *2*	0.0024 *3*						
x221.09 *3*	0.0024 *3*						
223.51[d] *2*	0.0087 *17*	1417.32	2+	1193.84	2+	(E2+E0)	
223.51[dg] *2*	0.0087 *17*	1672.73?	(4+)	1449.17	4+	(E2+E0)	
x224.12 *3*	0.0045 *9*						
225.34 *2*	0.0041 *8*	1642.63	4+	1417.32	2+		
x226.52 *8*	0.0012 *6*						
x229.28 *2*	0.0023 *4*						
240.03[g] *3*	0.0030 *6*	2191.11	(4+)	1950.94	3−		Eγ: placement from 1969Re11.
x242.21 *2*	0.030 *3*						
x245.59 *3*	0.0038 *7*						
x248.30 *3*	0.0025 *4*						
251.56 *3*	0.23 *2*	1417.32	2+	1165.71	1−	E1	
255.34[e] *3*	0.021[e] *3*	1449.17	4+	1193.84	2+	(E2)	
255.34[eg] *3*	0.021[e] *3*	1760.08	(3−)	1504.60	3+		
x258.35 *4*	0.0023 *5*						
x260.17 *3*	0.0022 *10*						
x264.75 *5*	0.0040 *20*						
268.51[g] *3*	0.0067 *7*	2062.81	(3)+	1794.30	2+		
272.82[f] *3*	0.043[f] *16*	1046.17	2+	773.35	4+		Iγ: from Iγ(272)/Iγ(712)=0.014 *5* in β− decay and Iγ(712)=3.07 *21*. Mult.: 1966Sm03 attribute E2 and E1+M2 character to this apparent doublet. The E2 assignment would be in agreement with a transition from the 1046 level, while the E1+M2 assignment would be appropriate for a transition from the 2095 level.
272.82[fg] *3*	0.055[f] *19*	2095.35	(5+)	1822.53	(4,5)−		Iγ: from Iγ=0.098 *10* for the doubly-placed 272.8γ and Iγ=0.043 *16* for the placement from the 1046 level.
x275.84 *3*	0.016 *2*						
x277.67 *4*	0.0020 *10*						
x283.93 *4*	0.016 *2*						
285.01 *3*	0.12 *1*	1642.63	4+	1357.65	5−	E1(+M2)	
286.28[d] *3*	0.017 *6*	1357.65	5−	1071.38	3−		Iγ: multiplet in (n,γ) and ε. Iγ deduced by 1976Ba18 from E1,E2 mixture in (n,γ) data. Iγ(peak)=0.031 *3*.
286.28[dg] *3*	0.014 *7*	1970.42	4+	1684.14	3−		Iγ: multiplet in (n,γ) and ε. Iγ deduced by 1976Ba18 from E1,E2 mixture in (n,γ) data. Iγ(peak)=0.031 *3*.
x293.84 *6*	0.0057 *12*						
x294.88 *5*	0.015 *2*						
x295.39 *4*	0.0061 *20*						
298.06 *3*	0.50 *5*	1071.38	3−	773.35	4+	E1	
305.68 *3*	0.104 *10*	1046.17	2+	740.50	0+	E2	
x308.05 *4*	0.014 *2*						
308.05 *4*	0.014 *2*	1950.94	3−	1642.63	4+		Observed by 1966Sm03, placed in decay scheme by 1969Re11.
x309.20 *4*	0.013 *2*						
310.73[f] *4*	0.046[f] *12*	1504.60	3+	1193.84	2+		Iγ: from Iγ(310)/Iγ(1170) in ^{150}Eu ε decay

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

E_γ	I_γ[c]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
							(36.9 y) and Iγ(1170) in 1966Sm03. Iγ(peak)=0.066 *7*.
310.74[fg] *4*	0.020[f] *14*	1760.08	(3⁻)	1449.17	4⁺		I_γ: see comment under 310.73γ. Iγ(310.74)=Iγ(peak)−Iγ(310.73) \.
[x]319.70 *5*	0.0061 *12*						
333.94 *4*	61 *3*	333.99	2⁺	0.0	0⁺	E2	Mult.: assumed E2 by 1966Sm03 (α(K)=0.0325) for normalization of electron and photon data. Mult=E2 from K/L (1967Pr08).
[x]340.32 *4*	0.0040 *20*						
345.93 *4*	0.50 *5*	1417.32	2⁺	1071.38	3⁻	E1	
[x]349.75 *7*	0.0075 *15*						
[x]352.53 *4*	0.0044 *11*						
[x]356.25 *9*	0.0033 *16*						
[x]358.97 *4*	0.0053 *11*						
[x]360.70 *14*	0.0069 *23*						
[x]364.40 *7*	0.0070 *15*						
[x]369.09 *7*	0.0089 *17*						
371.14 *5*	0.089 *9*	1417.32	2⁺	1046.17	2⁺	(E2+E0)	
372.75 *5*	0.26 *3*	1821.87	(4)⁺	1449.17	4⁺		
377.74 *5*	0.060 *6*	1449.17	4⁺	1071.38	3⁻		
381.92[g] *5*	0.070 *7*	2024.58	4⁺	1642.63	4⁺		
[x]384.12 *6*	0.0056 *8*						
[x]392.45 *10*	0.0088 *17*						
393.92[g] *5*	0.019 *4*	1672.73?	(4⁺)	1278.90	6⁺		
[x]396.17 *5*	0.019 *4*						
[x]399.97 *10*	0.020 *10*						
402.97 *5*	0.89 *9*	1449.17	4⁺	1046.17	2⁺	E2[‡]	
406.49 *5*	0.41 *4*	740.50	0⁺	333.99	2⁺	E2	
[x]409.34 *8*	0.019 *5*						
[x]410.32 *6*	0.031 *5*					(E2+E0)	
420.48 *9*	0.016 *5*	1193.84	2⁺	773.35	4⁺	(E2)	
425.10 *7*	0.020 *3*	1165.71	1⁻	740.50	0⁺		
439.39 *7*	35.7 *16*	773.35	4⁺	333.99	2⁺	E2[‡]	
448.68 *6*	0.15 *3*	1642.63	4⁺	1193.84	2⁺		
453.40 *6*	0.050 *10*	1193.84	2⁺	740.50	0⁺	(E2)	Mult.: α(K)exp allows E1 or E2 but E1 is ruled out by decay scheme.
458.17 *6*	0.21 *4*	1504.60	3⁺	1046.17	2⁺	E2	I_γ: Iγ(458) is larger in (n,γ) than in ε decay (or β⁻).
461.59 *6*	0.12 *4*	1819.34	4⁺	1357.65	5⁻	E1	
464.09 *8*	0.42 *7*	1821.87	(4)⁺	1357.65	5⁻	E1	α(K)exp=0.0042 *8*
[x]468.13 *11*	0.031 *6*						
[x]470.83 *12*	0.010 *2*						
474.46[g] *7*	0.015 *3*	2117.15	4⁺	1642.63	4⁺	(E2+M1+E0)	Mult.: from α(K)exp calculated from ce(K) of 1966El05 and I(γ) of 1966Sm03.
[x]476.94[g] *7*	0.048 *6*						
[x]480.61 *14*	0.012 *3*						
485.86[g] *7*	0.81 *8*	1764.76?	7⁻	1278.90	6⁺	(E1)	
492.33[g] *21*	0.017 *3*	1658.37	2⁽⁻⁾	1165.71	1⁻		
[x]495.74 *10*	0.017 *8*						
505.44 *8*	6.6 *5*	1278.90	6⁺	773.35	4⁺	E2	
510.01[eg] *9*	0.15[e] *3*	1927.29?	(2⁺)	1417.32	2⁺		
510.01[eg] *9*	0.15[e] *3*	2152.62	4⁺	1642.63	4⁺		Observed by 1966Sm03 and 1969Re11; the latter suggest this assignment.
510.01[eg] *15*	0.15[e] *3*	2191.11	(4⁺)	1684.14	3⁻		

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

$E_γ$	$I_γ$[c]	E_i(level)	$J_i^π$	E_f	$J_f^π$	Mult.[†]	$I_{(γ+ce)}$[c]	Comments
514.9	≤0.08	1255.52	0+	740.50	0+	E0	0.0066 *7*	$I_{(γ+ce)}$: α(K)exp+α(L)exp given, calculated from α(K)exp (1966El05) and εL/εK (1956Ch21).
515.65[eg] *8*	0.29[e] *4*	1794.30	2+	1278.90	6+			
515.65[eg] *8*	0.29[e] *4*	2020.24?	5+	1504.60	3+	E2		Mult.: adopted value.
519.96 *8*	0.22 *3*	2024.58	4+	1504.60	3+	E2+M1		
[x]523.85 *19*	0.015 *4*							
[x]529.33 *20*	0.023 *4*							
[x]538.84 *16*	0.100 *15*					(E1)		
542.95 *9*	0.17 *3*	1821.87	(4)+	1278.90	6+	(E2)		Mult.: adopted value.
548.59[g] *11*	0.040 *5*	1713.97?	1	1165.71	1−			Assigned to 1713.27-keV level on basis of ^{150}Pm β− decay data. But, an inconsistency of branching results from this placement: Iγ(548γ)/Iγ(1379γ)=0.013 *5* from β−, 0.083 *8* from (n,γ) thermal.
[x]554.42 *11*	0.065 *13*							
558.13[g] *9*	0.23 *3*	2062.81	(3)+	1504.60	3+	(E2+M1)		
565.91[g] *14*	0.016 *5*	1760.08	(3−)	1193.84	2+			
571.21 *10*	0.27 *3*	1642.63	4+	1071.38	3−	(E1)[‡]		
576.02 *12*	0.030 *6*	2024.58	4+	1449.17	4+	(E2+E0)		
[x]581.34 *13*	0.075 *14*							
584.24 *10*	6.0 *5*	1357.65	5−	773.35	4+	E1[‡]		
590.85[g] *10*	0.13 *2*	2095.35	(5+)	1504.60	3+			
596.34 *18*	0.029 *5*	1642.63	4+	1046.17	2+			
600.43 *25*	0.031 *5*	1794.30	2+	1193.84	2+			
607.16 *13*	0.067 *14*	2024.58	4+	1417.32	2+	(E2)		Mult.: adopted value.
[x]614.92 *11*	0.23 *4*							
626.67 *22*	0.070 *10*	1672.73?	(4+)	1046.17	2+			
[x]628.56 *14*	0.086 *12*							
[x]632.85 *18*	0.022 *7*							
638.45 *12*	0.055 *11*	1684.14	3−	1046.17	2+			
647.81[g] *13*	0.079 *25*	2152.62	4+	1504.60	3+	(E2)		Observed by 1966Sm03, placement suggested by 1966Re11 on basis of energy fit. Mult.: from 1973PrZI.
[x]657.77 *17*	0.044 *6*							
667.31[fg] *13*	≤0.024[f]	1713.97?	1	1046.17	2+			Assigned to 1713.27-keV level on basis of ^{150}Pm β− decay data. From Iγ(667)/Iγ(1379)=0.050 *10* in β− decay one expects Iγ(667)≤0.024 from decay of this level.
667.31[f] *13*	0.16[f] *3*	2024.58	4+	1357.65	5−			$I_γ$: from total Iγ(667)=0.17 *2*, Iγ(667)≤0.024 from 1713 level.
675.77 *14*	1.99 *20*	1449.17	4+	773.35	4+	E2+E0+M1		
688.30 *14*	0.038 *6*	1760.08	(3−)	1071.38	3−	(E2)		Mult.: from ce(K) data of 1966El05.
[x]696.73 *14*	0.044 *7*							
712.23 *15*	3.07 *21*	1046.17	2+	333.99	2+	E2+E0+M1		
722.65 *18*	0.049 *8*	1794.30	2+	1071.38	3−			
731.31 *16*	0.69 *7*	1504.60	3+	773.35	4+	E2[‡]		
737.47 *17*	6.6 *5*	1071.38	3−	333.99	2+	E1		
740.6 *1*		740.50	0+	0.0	0+	E0	0.0070 *5*	$I_{(γ+ce)}$: α(K)exp+α(L)exp given, calculated from α(K)exp (1966El05) and L/K (1956Ch21).

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

E_γ	I_γ[c]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
749.31 *17*	1.08 *11*	1819.34	4^+	1071.38	3^-	E1	
756.2 *3*	0.17 *5*	2035.4?	5^-	1278.90	6^+	(E1)	Placed in decay scheme by 1973MeZX in ε decay. Mult.: from Adopted Levels.
761.2[g] *3*	0.18 *5*	1927.29?	(2^+)	1165.71	1^-	(E1)[#]	
773.97 *24*	0.10 *3*	1819.34	4^+	1046.17	2^+		E_γ: 1969Re11 assign a 773 γ ray to level 2191 but the branching ratios for Iγ(773)/Iγ(749) in ε decay and (n,γ)thermal indicate there is little or no intensity left for a second placement of Iγ(773).
[x]780.6 *4*	0.06 *3*						
795.30[g] *19*	0.068 *10*	2152.62	4^+	1357.65	5^-		Observed by 1966Sm03, placement suggested by 1966Re11 on basis of energy fit.
816.19[g] *23*	0.13 *2*	2095.35	(5^+)	1278.90	6^+	E2+M1	
[x]825.8 *3*	0.103 *15*						
831.28[d] *24*	0.77 *12*	1165.71	1^-	333.99	2^+	E1[#]	
831.28[dg] *24*	0.77 *12*	2024.58	4^+	1193.84	2^+	E2	
836.5[g] *5*	0.27 *4*	2191.11	(4^+)	1357.65	5^-	E2	E_γ: placement from ^{150}Eu ε decay (36.9 y).
[x]840.9 *5*	0.056 *8*						
[x]854.00 *25*	0.050 *13*						
859.28 *20*	1.03 *10*	1193.84	2^+	333.99	2^+	E2+M1(+E0)[‡]	
869.21[f] *20*	1.04[f] *11*	1642.63	4^+	773.35	4^+	E2+E0(+M1)[‡]	
869.21[fg] *20*	0.26[f] *17*	2062.81	$(3)^+$	1193.84	2^+		
[x]877.8 *4*	0.076 *13*						
899.6[fg] *3*	0.08[f] *6*	1672.73?	(4^+)	773.35	4^+		
899.60[f] *28*	0.21[f] *4*	1970.42	4^+	1071.38	3^-	E1	
910.73 *25*	0.51 *6*	1684.14	3^-	773.35	4^+	E1	
921.2 *3*	0.32 *4*	1255.52	0^+	333.99	2^+	E2	
[x]937.9 *3*	0.44 *7*					E1	
[x]945.2 *4*	0.29 *4*						
[x]955.4 *7*	0.053 *8*						
[x]968.9 *3*	0.21 *3*						
[x]985.0 *10*	0.034 *6*						
997.1[g] *3*	0.17 *2*	2190.9	4^+	1193.84	2^+	E2	Observed by 1966Sm03, placement suggested by 1969Re11.
1016.3[dg] *5*	0.50 *7*	2062.81	$(3)^+$	1046.17	2^+	E2	
[x]1022.9 *6*	0.16 *4*					(E1+M2)	
1047.9[e] *4*	0.25[e] *4*	1046.17	2^+	0.0	0^+	(E1),(E2)	I_γ: the total intensity reported by 1966Sm03 for this multiply placed γ ray is 1.77 *18*. For this level one can estimate Iγ=0.25 *4* from Iγ(1047γ)/Iγ(712γ)=0.081 in β^- decay and Iγ(712γ)=3.07 *21* (n,γ) thermal.
1047.9[dg] *4*	≤0.20	1819.34	4^+	773.35	4^+		I_γ: the total intensity reported by 1966Sm03 for this multiply placed γ ray is 1.77 *18*. For this level one can estimate Iγ≤0.20 from Iγ(1047γ)/Iγ(1485γ) in ε decay and Iγ(1485γ)≤0.42 (estimated by evaluator).
1047.9[dg] *4*	≤0.5	1822.53	$(4,5)^-$	773.35	4^+	E1	Mult.: 1966Sm03 suspect this to be a doublet with E1 and E2 components. E1 agrees with the conversion electron data of ^{150}Eu ε decay (36.9 y).

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

E_γ	I_γ [c]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [†]	$I_{(\gamma+ce)}$ [c]	Comments
								I_γ: the total intensity reported by 1966Sm03 for this multiply placed γ ray is 1.77 *18*. For this level one can estimate Iγ≤0.5 from Iγ(1047γ)/Iγ(751γ) in ε decay and Iγ(751γ)<0.2 (estimated by evaluator).
1047.9[dg] *4*	≤0.08	2117.15	4^+	1071.38	3^-			I_γ: the total intensity reported by 1966Sm03 for this multiply placed γ ray is 1.77 *18*. For this level one can estimate Iγ≤0.08 from Iγ(1047γ)/Iγ(1343γ) in ε decay and Iγ(1485γ)≤0.2 (estimated by evaluator).
[x]1064.0 *7*	0.095 *15*							
1082.6 *4*	0.22 *3*	1417.32	2^+	333.99	2^+	(E2+E0)		I_γ: a wt av of Iγ(1083γ)/Iγ(251γ) from ε and β^- decays is 0.95 *7*. From Iγ(251γ)=0.23 *2* in (n,γ) thermal one expects Iγ(1083γ) from level 1417 to be 0.22 *3*. The measured Iγ(1083γ) is 0.35 *4* so that there is an excess of 0.35 *4*–0.22 *3*=0.13 *5* for possible placement elsewhere.
[x]1092.4 *8*	0.106 *20*							
[x]1108.5 *4*	0.064 *10*							
[x]1114.8 *13*	0.058 *10*							
1122.3[g] *4*	0.40 *4*	2191.11	(4^+)	1071.38	3^-			E_γ: placement from ^{150}Eu ε decay (36.9 y).
[x]1151.3 *13*	0.099 *12*							
1165.1 *13*	0.89 *18*	1165.71	1^-	0.0	0^+	E1		
1170.2 *10*	2.1 *4*	1504.60	3^+	333.99	2^+	E2(+M1)		
1176.6 *13*	0.65 *13*	1950.94	3^-	773.35	4^+	E1[#]		Observed by 1966Sm03, placed in decay scheme by 1969Re11.
1193.1 *7*	1.21 *12*	1193.84	2^+	0.0	0^+	E2		
1196.1[g] *11*	0.24 *5*	1970.42	4^+	773.35	4^+	(E2+E0+M1)		
[x]1222.1 *8*	0.098 *20*							
1246.5[g] *6*	0.56 *6*	2020.24?	5^+	773.35	4^+	E2		
1256.3 *3*	≤0.2	1255.52	0^+	0.0	0^+	E0	0.00042 *8*	$I_{(\gamma+ce)}$: α(K)exp+α(L)exp given, calculated from α(K)exp (1966El05) and εL/εK (1956Ch21). E_γ: E0 transition to ground state reported by 1963Gr18. Energy and intensity are from 1976Ba18.
1263.2 *6*	≤0.81	2035.4?	5^-	773.35	4^+	E1		Placed in decay scheme by 1973MeZX in ε decay. The branching ratio Iγ(756)/Iγ(1262) is 0.246 *16* in ε decay and 0.21 *7* in (n,γ)thermal, leaving open the possibility that excess 1262γ may exist in (n,γ)thermal for placement elsewhere.
[x]1294.7 *9*	0.29 *3*					(E2+M1)		
1308.1 *9*	0.50 *5*	1642.63	4^+	333.99	2^+	E2[‡]		
1323.6[g] *7*	0.95 *10*	2095.35	(5^+)	773.35	4^+	(E2)		
1347.9[g] *5*	1.17 *12*	1684.14	3^-	333.99	2^+	E1[‡]		

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

Eγ	Iγ[c]	Ei(level)	Jπi	Ef	Jπf	Mult.[†]	Comments
1380.3[dg] 8	0.48 5	1713.97?	1	333.99	2+	(E2)	Assigned to 1713.27-keV level on basis of ^{150}Pm β⁻ decay data.
1380.3[dg] 8	0.48 5	2152.62	4+	773.35	4+	(E2)	Observed by 1966Sm03, placement suggested by 1966Re11 on basis of energy fit.
[x]1389.7 10	0.11 2						
[x]1431.5 10	0.11						
[x]1451.0 8	0.23 3					(E2)	
1489.3 8	0.42 5	1819.34	4+	333.99	2+	E2	Eγ: Eγ(adopted) taken from E decay is 1485.49 3. This, and some of the other γ rays which are shown as originating at the 1819-keV level, could energetically be assigned to the 1821- or the 1822-keV level instead. 1966Sm03 assigned the 1489-keV transition to the 1821-keV level but 1977Si12 assigned it to the 1819-keV level. Mult.: 1966Sm03 suggest (E2)(M1) on basis of α(K)exp while 1973MeZX give E2 on basis of α(K)exp and α(L)exp data.
[x]1498 4	0.2						
[x]1505.4	≤0.04						
[x]1513 4	0.2						
[x]1536 4	0.2						
[x]1552.8 8	0.24 3						
[x]1597.5 13	0.25 5					(E2),(M1)	
[x]1618 4	0.2						
1634.1[g] 19	0.17 4	1970.42	4+	333.99	2+	E2	Mult.: ^{150}Eu ε decay (36.9 y) ce data support an E2 assignment.
[x]1673.7 14	0.39 4					(E2)	
[x]1705.7 16	0.36 5					(E2)	
[x]1737 5	0.15 5						
1798 4	0.21 4	1794.30	2+	0.0	0+		
[x]1812 5	0.2						
[x]1826 4	0.37 4						
[x]1843 4	0.3						
[x]1859 4	0.34 3						
[x]1866 5	0.07						
[x]1877 4	0.2						
[x]1891 4	0.40 4						
[x]1913 4	0.3						
[x]1927 4	0.45 5						
[x]1937 5	0.12						
[x]1961 4	0.34 4						
[x]2039 9	0.26 4						
[x]2058 4	0.4						
[x]2080 11	0.24 4						
[x]2120 5	0.42 7						
[x]2162 7	0.18 3						
[x]2185	0.30						
2227[@g] 5	0.12	2227?		0.0	0+		
[x]2280 13	0.19 5						
[x]2331 14	0.25 4						
[x]2367	0.5						
[x]2402 5	0.11						
[x]2443 5	0.07						
[x]2497 5	0.09						
[x]2507 5	0.09						
[x]2528 5	0.10						

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^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

E_γ	I_γ[c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
^{x}2554 *5*	0.08						
^{x}2577 *5*	0.10						
^{x}2613 *5*	0.11						
^{x}2654 *5*	0.09						
^{x}2727 *5*	0.06						
^{x}2748 *5*	0.07						
^{x}2806 *5*	0.06						
^{x}2967 *5*	0.07						
^{x}3173 *5*	0.11						
^{x}3202 *6*	0.07						
^{x}3220 *6*	0.09						
^{x}3296 *6*	0.10						
^{x}3432 *6*	0.07						
^{x}3473 *6*	0.09						
^{x}3530 *6*	0.05						
^{x}3567 *6*	0.08						
^{x}3605 *6*	0.05						
^{x}3632 *6*	0.05						
^{x}3682 *6*	0.08						
^{x}3744 *6*	0.06						
^{x}3903 *6*	0.04						
^{x}3941 *6*	0.06						
^{x}3970 *6*	0.05						
3986 *6*	0.06 *3*	7986.6	4^-	4001?		E1	α(K)exp=0.09×10^{-3} *5*
4016 *6*	0.04 *2*	7986.6	4^-	3971?		not E1	α(K)exp=0.23×10^{-3} *12*
4043 *6*	0.08 *4*	7986.6	4^-	3944?		(E1)	α(K)exp=0.06×10^{-3} *4*
4079 *6*	0.030 *15*	7986.6	4^-	3908?		not E1	α(K)exp=0.22×10^{-3} *12*
4110 *6*	0.04 *2*	7986.6	4^-	3877?		E1	α(K)exp=0.09×10^{-3} *5*
^{x}4134 *6*	0.04 *2*						
4148 *6*	0.02	7986.6	4^-	3839?			I_γ: from 1963Gr18.
4183 *6*	0.030 *15*	7986.6	4^-	3791?		not E1	α(K)exp=0.18×10^{-3} *13*
4209 *6*	0.030 *15*	7986.6	4^-	3754?		not E1	α(K)exp=0.22×10^{-3} *15*
4233 *6*	0.10 *5*	7986.6	4^-			(E1)	
4256 *6*	0.050 *25*	7986.6	4^-	3731?			α(K)exp=0.16×10^{-3} *9*
4287 *6*	0.02 *1*	7986.6	4^-	3700?		(E1)	α(K)exp=0.09×10^{-3} *7*
4339 *6*	0.050 *25*	7986.6	4^-	3648			α(K)exp=0.20×10^{-3} *20*
4396 *6*	0.15 *8*	7986.6	4^-	3591?		(E1)	
4420 *6*	0.06 *3*	7986.6	4^-	3567?			α(K)exp=0.13×10^{-3} *7*
4459 *6*	0.06 *3*	7986.6	4^-	3528?		(E1)	α(K)exp=0.08×10^{-3} *5*
^{x}4479 *6*	0.17 *9*						
4497 *6*	0.06 *3*	7986.6	4^-	3490?		(E1)	α(K)exp=0.09×10^{-3} *5*
4538 *7*	0.09 *5*	7986.6	4^-	3449?			α(K)exp=0.06×10^{-3} *3*
4597 *7*	0.070 *35*	7986.6	4^-	3390?		(E1)	α(K)exp=0.060×10^{-3} *35*
4661 *6*	0.06 *3*	7986.6	4^-	3326?		M1,(E2)	α(K)exp=0.12×10^{-3} *6*
4804 *5*	0.39 *20*	7986.6	4^-	3183?			α(K)exp=0.04×10^{-3} *2*; α(L)exp=0.008×10^{-3} *5*
4862 *5*	0.11 *6*	7986.6	4^-	3125?			α(K)exp=0.04×10^{-3} *2*
4956 *6*	0.02 *1*	7986.6	4^-	3031?			α(K)exp=0.35×10^{-3} *19*
4991 *6*	0.030 *15*	7986.6	4^-	2996?			α(K)exp=0.21×10^{-3} *12*
5232 *6*	0.030 *15*	7986.6	4^-	2755?			α(K)exp=0.08×10^{-3} *6*
5275 *6*	0.11 *6*	7986.6	4^-	2712?			α(K)exp=0.07×10^{-3} *4*
5314 *8*	0.04 *2*	7986.6	4^-	2673?		E1	α(K)exp=0.05×10^{-3} *3*
5330 *6*	0.02 *1*	7986.6	4^-	2657?	(3,5)	E1[b]	α(K)exp=0.073×10^{-3} *20*
5398 *8*	0.030 *15*	7986.6	4^-	2589?	$3^+,4^+$		α(K)exp=0.10×10^{-3} *5*
5412 *6*	0.07 *4*	7986.6	4^-	2575?	$3^+,4^+$		α(K)exp=0.06×10^{-3} *3*
5485 *6*	0.10[a] *1*	7986.6	4^-	2502?	$(3)^+$	E1	α(K)exp=0.056×10^{-3} *8*
5526 *5*	0.38[a] *5*	7986.6	4^-	2461?	3^+	E1	α(K)exp=0.050×10^{-3} *8*

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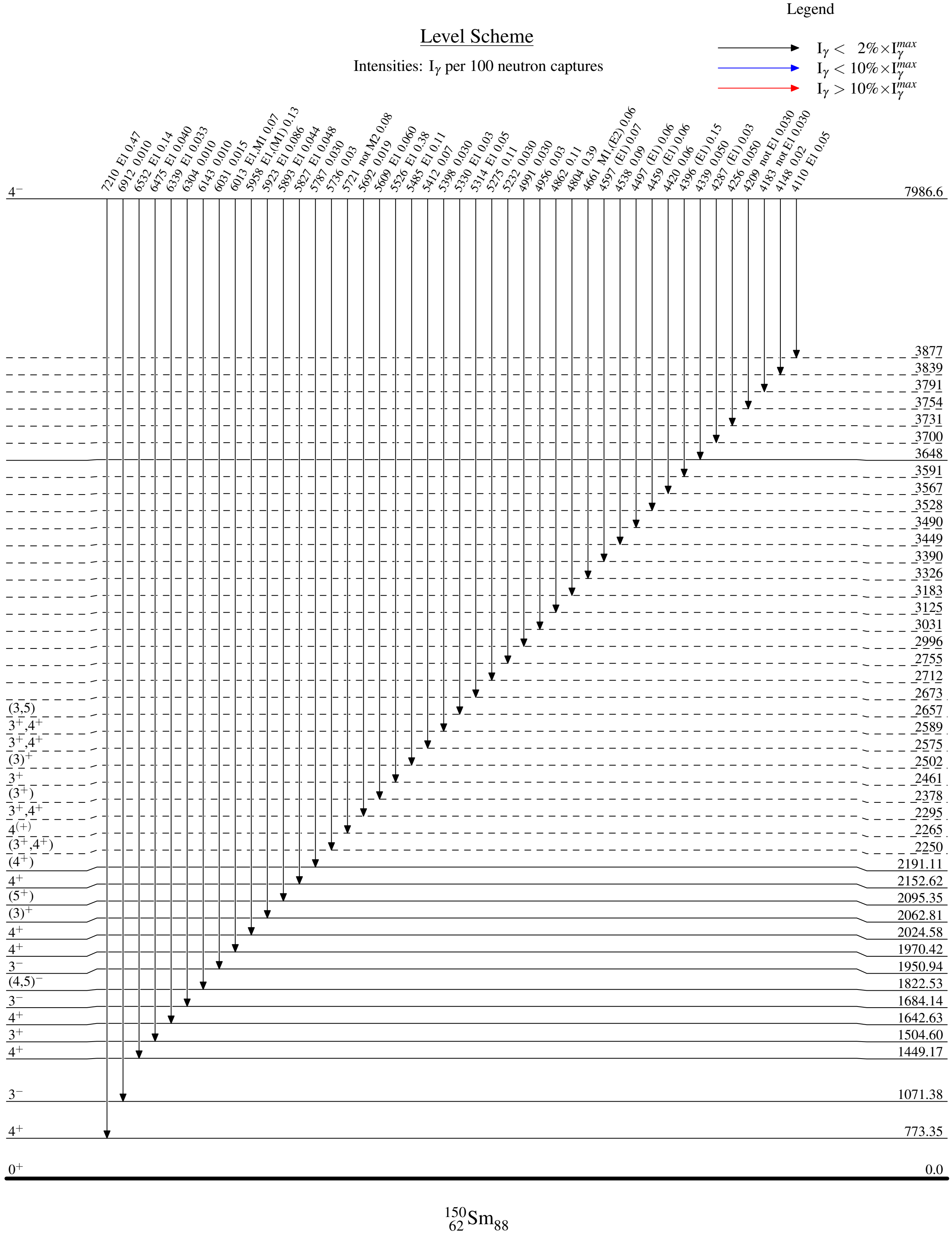
^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11 (continued)

γ(^{150}Sm) (continued)

E_γ	I_γ[c]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
5609 *5*	0.060[a] *8*	7986.6	4⁻	2378?	(3⁺)	E1	α(K)exp=0.058×10⁻³ *11*
5692 *7*	0.019[a] *3*	7986.6	4⁻	2295?	3⁺,4⁺		
5721 *7*	0.07[a] *2*	7986.6	4⁻	2265?	4⁽⁺⁾	not M2	α(K)exp=0.08×10⁻³ *3*
5736 *6*	0.02 *1*	7986.6	4⁻	2250?	(3⁺,4⁺)		I_γ: Iγ=0.02 *1* with Ice(K)=0.03 *3* (1966El05) gives a meaningless value for α(K)exp.
5787 *6*	0.030[a] *6*	7986.6	4⁻	2191.11	(4⁺)		α(K)exp=0.13×10⁻³ *10*
5827 *6*	0.048 *6*	7986.6	4⁻	2152.62	4⁺	E1	
5893 *7*	0.044[a] *8*	7986.6	4⁻	2095.35	(5⁺)	E1	α(K)exp=0.027×10⁻³ *12*
5923 *7*	0.086[a] *15*	7986.6	4⁻	2062.81	(3)⁺	E1	α(K)exp=0.048×10⁻³ *11*
5958 *5*	0.12[a] *2*	7986.6	4⁻	2024.58	4⁺	E1,(M1)	α(K)exp=0.063×10⁻³ *13*
6013 *6*	0.06[a] *1*	7986.6	4⁻	1970.42	4⁺	E1,M1	α(K)exp=0.067×10⁻³ *24*
6031 *6*	0.015[a] *5*	7986.6	4⁻	1950.94	3⁻		α(K)exp=0.21×10⁻³ *11*
6143 *7*	0.010[a] *4*	7986.6	4⁻	1822.53	(4,5)⁻		
6304 *7*	0.010[a] *3*	7986.6	4⁻	1684.14	3⁻		
6339 *6*	0.033[a] *5*	7986.6	4⁻	1642.63	4⁺	E1	α(K)exp=0.04×10⁻³ *3*; α(L)exp=0.006×10⁻³ *3* α(K)exp,α(L)exp: Calculated from Iγ=0.033 *5* (1969Re04) and I_{ce}(K)=0.0013×10⁻³ *9*, I_{ce}(L)=0.0002×10⁻³ *1* (1970Pa20).
6475 *6*	0.040[a] *6*	7986.6	4⁻	1504.60	3⁺	E1	α(K)exp=0.035×10⁻³ *14*
6532 *5*	0.13[a] *1*	7986.6	4⁻	1449.17	4⁺	E1	α(K)exp=0.040×10⁻³ *6*; α(L)exp=0.008×10⁻³ *5* α(L)exp: Calculated from icel=0.0010×10⁻³ *7*(1970Pa20).
6912 *7*	0.010 *3*	7986.6	4⁻	1071.38	3⁻		
7210 *4*	0.47 *7*	7986.6	4⁻	773.35	4⁺	E1[b]	α(K)exp=0.038×10⁻³ *2* I_γ: from 1963Gr18.

† Based on γγ(θ) and α(K) data by 1966Sm03, normalized to the assumption that the 333.94-keV γ ray is a pure E2 transition (see general comment in level listing). Above 5 MeV, multipolarities are from 1969Re11 on basis of capture γ-ray anisotropy and/or α′s calc from data of 1966El05 and 1963Gr18.
‡ Confirmed by 1969Re11. See general comment.
# From 1973PrZI.
@ From 1963Gr18.
& Isotopic assignment is questionable.
a From 1969Re04.
b From 1969Re11, from α(K)exp values.
c Intensity per 100 neutron captures.
d Multiply placed.
e Multiply placed with undivided intensity.
f Multiply placed with intensity suitably divided.
g Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

$^{149}Sm(n,\gamma)$ E=thermal 1966Sm03,1963Gr18,1969Re11



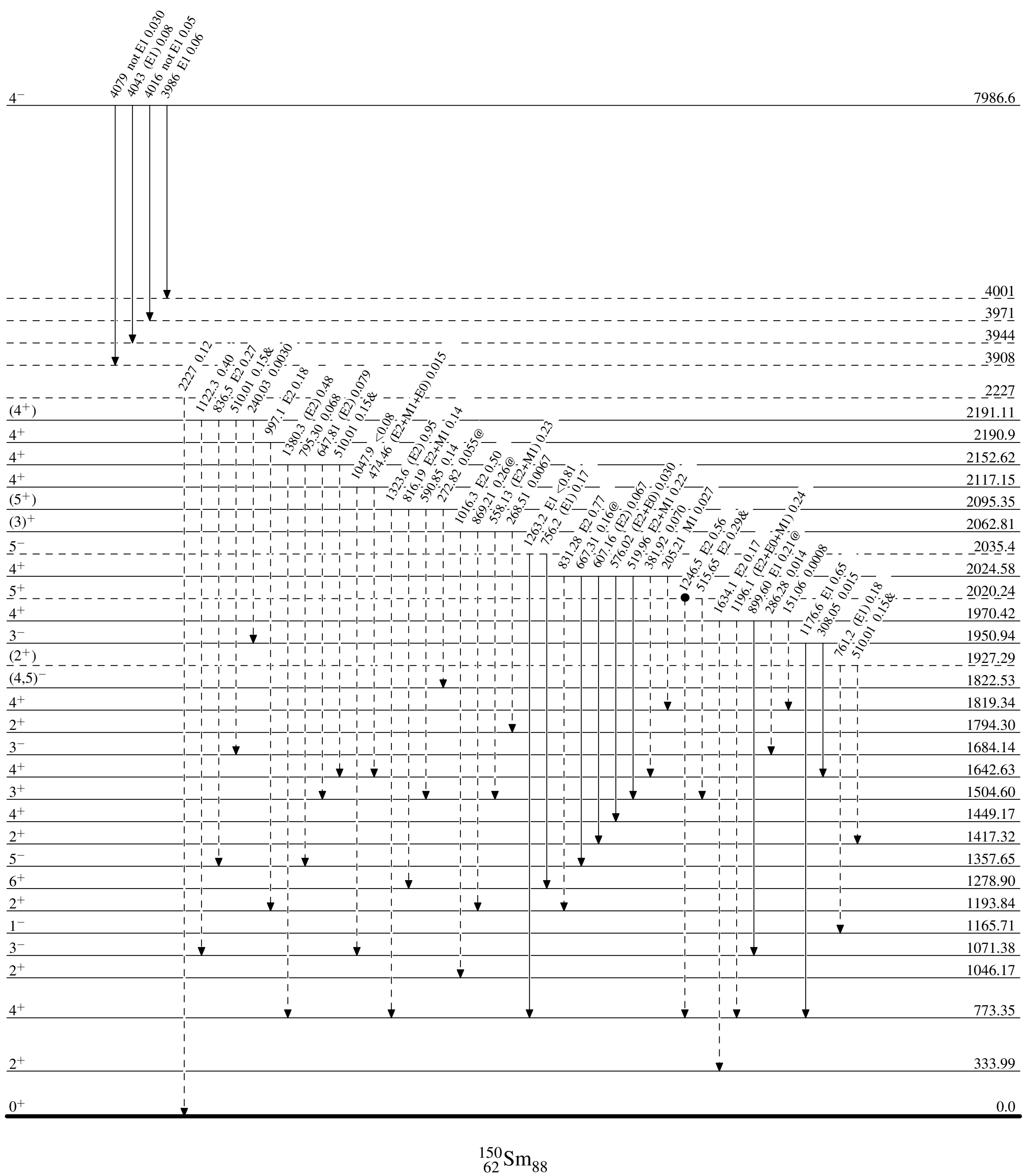
^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11

Level Scheme (continued)

Intensities: I_γ per 100 neutron captures
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence

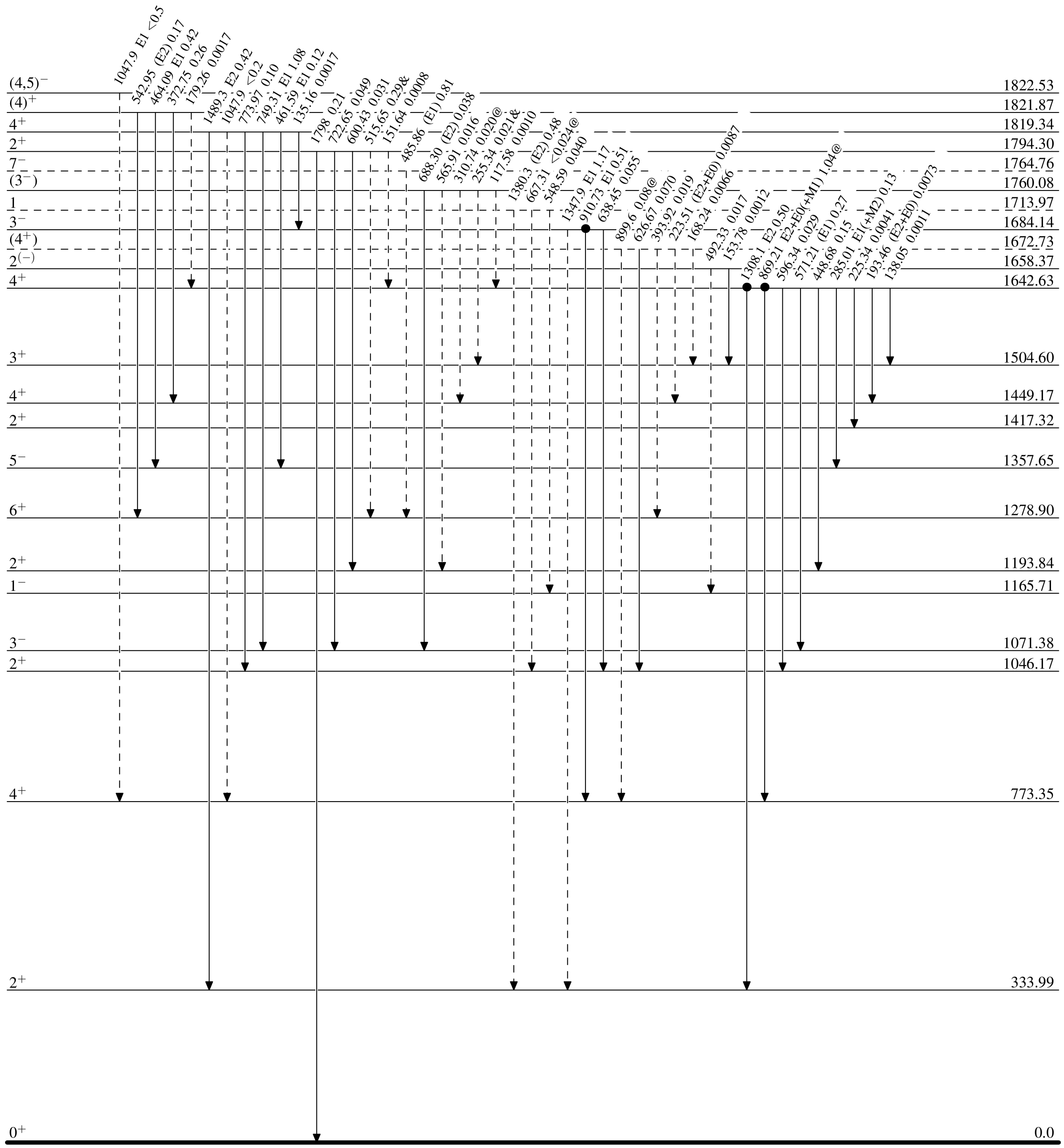


^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11

Level Scheme (continued)

Intensities: I_γ per 100 neutron captures
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
Coincidence



^{149}Sm(n,γ) E=thermal 1966Sm03,1963Gr18,1969Re11

Level Scheme (continued)

Intensities: I_γ per 100 neutron captures
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided