^{165}Ho(α,2nγ) 1980Ol05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

1980Ol05 (also 1981Io06): Eα=21-27 MeV. Metallic holmium targets. Measured Eγ, Iγ, γγ-coin, γ(θ), excitation functions using Ge(Li) detectors with Compton suppression system. Methodological and procedures of analysis of angular distribution data are presented in 1981Io06.

Others:

1970Wi09: Eα=21-27 MeV from Rosendorf U-120 cyclotron facility. Measured Eγ, Iγ, γγ-coin, γ(θ), excitation functions. A total of 56 γ rays reported from 62.9 to 486.1 keV, with 48 of these placed in four rotational bands: π1/2[411] (1/2 to 23/2), π1/2[541] (ΔJ=2, 9/2 to 25/2), π7/2[523] (7/2 to 25/2), and π7/2[404] (7/2 to 23/2). 1973Wi02 from the same group discuss systematics of rotational bands in this general mass region, in particular M1 and E2 γ transitions from 11/2$^+$, 15/2$^+$, 19/2$^+$ and 23/2$^+$ members of π1/2[411] band. 1972WiZH (two-page lab annual report from the same group as 1970Wi09) has a level scheme for π1/2[411] band up to 29/2, π1/2[541] band up to 29/2 and π1/2[541] band from 11/2 to 23/2.

1970No02: Eα=22-25 MeV from variable energy cyclotron at Osaka University. Measured Eγ, Iγ, conversion electrons using Ge(Li) detector for γ radiation and a magnetic spectrometer for conversion electrons. A total of 22 γ rays are reported (with energy uncertainties of 1-2 keV) placed in π1/2[411] band (1/2 to 23/2) and three transitions from 179,7/2$^+$; 293,7/2$^-$; and 322,5/2$^-$ levels, conversion electrons measured for 13 transitions and multipolarity assignments for a few of these, but no numerical data for conversion electron intensities or conversion coefficients provided in the paper. The γ-ray intensities in Table 1 seem to be for Eα=27 MeV.

All data here are from 1980Ol05 unless otherwise stated.

^{167}Tm Levels

E(level)[†]	J$^\pi$[‡]	Comments
0.0[#]	1/2$^+$	
10.419[#] 25	3/2$^+$	Additional information 1.
116.608[#] 9	5/2$^+$	
142.467[#] 13	7/2$^+$	
171.76[@] 5	1/2$^-$	
179.522[&] 12	7/2$^+$	
187.69[@] 3	5/2$^-$	
285.942[@] 13	9/2$^-$	
290.96[@] 4	3/2$^-$	
292.863[a] 14	7/2$^-$	
296.232[&] 14	9/2$^+$	
326.514[#] 15	9/2$^+$	
371.063[#] 13	11/2$^+$	
383.702[a] 17	9/2$^-$	
436.080[&] 14	11/2$^+$	
459.94[@] 3	7/2$^-$	
470.271[@] 15	13/2$^-$	
471.15[b] 3	3/2$^+$	
496.633[a] 20	11/2$^-$	
522.36[b] 4	5/2$^+$	
557.84?[c] 4	5/2$^+$	
597.495[&] 15	13/2$^+$	
602.12[b] 3	7/2$^+$	
622.100[#] 14	13/2$^+$	
631.818[a] 19	13/2$^-$	

Continued on next page (footnotes at end of table)

^{165}Ho(α,2nγ) 1980Ol05 (continued)

^{167}Tm Levels (continued)

E(level)[†]	J^{π}[‡]	E(level)[†]	J^{π}[‡]	E(level)[†]	J^{π}[‡]	E(level)[†]	J^{π}[‡]
657.85?[c] *4*	$7/2^+$	1008.54[d] *4*	$9/2^-$	1487.37[c] *7*	$17/2^+$	2098.08[d] *4*	$23/2^-$
689.197[#] *15*	$15/2^+$	1044.06[e] *3*	$11/2^-$	1524.95[d] *3*	$17/2^-$	2113.89[a] *5*	$27/2^-$
699.190[@] *25*	$11/2^-$	1086.580[#] *16*	$19/2^+$	1528.70[@] *3*	$25/2^-$	2135.93[f] *6*	$23/2^+$
709.22[b] *4*	$9/2^+$	1096.235[@] *19*	$21/2^-$	1550.04[#] *3*	$23/2^+$	2186.45[&] *4*	$27/2^+$
741.386[@] *17*	$17/2^-$	1096.48[c] *4*	$13/2^+$	1562.94[b] *3*	$19/2^+$	2279.76[@] *6*	$27/2^-$
779.016[&] *16*	$15/2^+$	1101.27[f] *3*	$13/2^+$	1606.80[a] *3*	$23/2^-$	2321.09?[b] *6*	$25/2^+$
780.50?[c] *5*	$9/2^+$	1105.34[d] *3*	$11/2^-$	1668.93[&] *3*	$23/2^+$	2381.91?[f] *13*	$25/2^+$
787.802[a] *21*	$15/2^-$	1160.962[a] *23*	$19/2^-$	1678.89[f] *4*	$19/2^+$	2394.45[a] *5*	$29/2^-$
840.27[b] *3*	$11/2^+$	1163.98[b] *4*	$15/2^+$	1691.25[d] *3*	$19/2^-$	2396.44[d] *7*	$25/2^-$
852.81[d] *4*	$3/2^-$	1194.816[&] *22*	$19/2^+$	1705.58[c] *5*	$19/2^+$	2440.47[#] *6*	$29/2^+$
882.15[d] *18*	$5/2^-$	1223.12[d] *4*	$13/2^-$	1808.674[@] *22*	$23/2^-$	2455.62[&] *9*	$29/2^+$
927.88[c] *3*	$11/2^+$	1276.77[f] *3*	$15/2^+$	1813.97[b] *3*	$21/2^+$	2573.32[d] *6*	$27/2^-$
929.74?[e] *6*	$9/2^-$	1281.47[c] *6*	$15/2^+$	1858.66[a] *4*	$25/2^-$	2593.47[@] *11*	$33/2^-$
935.27[d] *5*	$7/2^-$	1358.77[d] *4*	$15/2^-$	1901.27[f] *5*	$21/2^+$	2620.16[#] *7*	$31/2^+$
944.91[f] *3*	$11/2^+$	1372.760[b] *19*	$17/2^+$	1915.40[#] *4*	$25/2^+$	2670.64[a] *6*	$31/2^-$
965.771[a] *21*	$17/2^-$	1378.19[a] *3*	$21/2^-$	1916.63[d] *5*	$21/2^-$	2735.83[&] *9*	$31/2^+$
978.521[&] *17*	$17/2^+$	1381.00[@] *3*	$19/2^-$	1922.38[&] *4*	$25/2^+$	2799.07[@] *11*	$31/2^-$
993.612[#] *15*	$17/2^+$	1424.67[&] *3*	$21/2^+$	2022.26[b] *8*	$23/2^+$		
1001.239[b] *18*	$13/2^+$	1429.530[#] *17*	$21/2^+$	2030.79[@] *5*	$29/2^-$		
1007.633[@] *20*	$15/2^-$	1470.16[f] *4*	$17/2^+$	2065.46[#] *5*	$27/2^+$		

[†] From a least-squares fit of Eγ data, by keeping the energy of the 10.419 level fixed with its uncertainty. For five poorly-fitted γ rays (116.69γ from 117 level, 330.99γ from 657 level, 332.11γ from 1276 level, 372.96γ from 1161 level, and 639.89γ from 1381 level), uncertainties were increased as indicated in comments. With these adjustments, reduced χ^2=1.8 as compared to critical χ^2=1.3 at 95% confidence level. Without these adjustments, reduced χ^2 is 2.36.

[‡] From 1980Ol05, based on relative excitation functions, multipolarities of transitions, and fits of cascades of coincident γ rays into interconnected sets of rotational bands.

[#] Band(A): π1/2[411].

[@] Band(B): π1/2[541].

[&] Band(C): π7/2[404].

[a] Band(D): π7/2[523].

[b] Band(E): π3/2[411].

[c] Band(F): π5/2[402].

[d] Band(G): π3/2[532]+(1/2[541], K−2).

[e] Band(H): π9/2[514].

[f] Band(I): π7/2[404], K+2.

γ(^{167}Tm)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	δ[a]	α[c]	Comments
(10.419 *25*)		10.419	3/2+	0.0	1/2+	M1+E2	0.043 *+4−3*	648 *38*	E_γ,Mult.,δ,α: from the Adopted Gammas, where values were adopted from ^{167}Yb ε decay.
(25.83 *2*)	≈1.8	142.467	7/2+	116.608	5/2+				E_γ: from the Adopted Gammas. I_γ: deduced from Iγ(132.0γ) and adopted I(26γ):I(132γ)=1.6 *5*:100 *3* from 143 level.
(37.05 *2*)		179.522	7/2+	142.467	7/2+				E_γ: from the Adopted Gammas. Eγ=37.1 in level-scheme Fig. 5 of 1970Wi09.
(44.5)		371.063	11/2+	326.514	9/2+				
62.91 *1*	12.2 *13*	179.522	7/2+	116.608	5/2+	[M1]		11.74 *17*	Eγ=62.9 *3*, Iγ=17 *5* (1970Wi09). M1 in 1980Ol05.
(67.02 *5*)		689.197	15/2+	622.100	13/2+				E_γ: from the Adopted Gammas.
79.56 *9*	0.4 *1*	602.12	7/2+	522.36	5/2+				
x80.53 *3*	1.0 *1*								
85.10 *1*	11.0[&] *10*	371.063	11/2+	285.942	9/2−	D			A_2=−0.155 *28* Eγ=85.0 *2*, Iγ=7 *3* (1970Wi09). E1 in 1980Ol05.
x89.10 *15*	0.8 *1*								
90.84 *1*	22.0[&] *20*	383.702	9/2−	292.863	7/2−				A_2=+0.016 *4* M1 in 1980Ol05. Eγ=90.9 *1*, Iγ=21 *5* (1970Wi09).
x93.32 *20*	0.5 *1*								
98.25 *2*	3.3[&] *3*	285.942	9/2−	187.69	5/2−	[E2]		3.28 *5*	A_2=+0.070 *32*; A_4=−0.009 *44* E2 in 1980Ol05.
99.21 *1*	26.0[&] *20*	470.271	13/2−	371.063	11/2+	D			A_2=−0.218 *13*; A_2=−0.19 *6* (1970Wi09) Eγ=99.2 *1*, Iγ=25 *5* (1970Wi09). E1 in 1970Wi09 and 1980Ol05.
x100.37 *16*	0.5 *1*								
103.32 *5*	2.2 *3*	290.96	3/2−	187.69	5/2−				
105.14 *7*	5.2 *3*	292.863	7/2−	187.69	5/2−	[M1]		2.69 *4*	
106.18 *1*	94[&] *8*	116.608	5/2+	10.419	3/2+	(M1+E2)		2.53 *9*	A_2=−0.110 *5*; A_4=+0.008 *7*; A_2=−0.09 *7* (1970Wi09) Eγ=106.2 *1*, Iγ=100 (1970Wi09). M1 in 1980Ol05; M1,E2 in 1970Wi09.
107.13 *4*	2.0 *10*	709.22	9/2+	602.12	7/2+				
112.88 *4*	36.0[&] *30*	496.633	11/2−	383.702	9/2−	(M1+E2)	+0.16 *1*	2.19 *3*	A_2=0.000 *14*; A_4=+0.001 *2* dipole in 1980Ol05. Eγ=113.3 *1*, Iγ=126 *15* (1970Wi09).
113.34 *1*	83[&] *7*	292.863	7/2−	179.522	7/2+	D			A_2=−0.037 *17* E1 in 1980Ol05. Eγ=113.3 *1*, Iγ=126 *15* (1970Wi09, doublet).
114.32 *5*	3.1 *13*	1044.06	11/2−	929.74?	9/2−				

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	δ[a]	α[c]	Comments
116.69[e] *1*	11.8[e&] *12*	116.608	5/2+	0.0	1/2+	(E2)		1.721 *24*	A_2=+0.162 *6*; A_4=+0.001 *8*; A_2=+0.20 *1* (1970Wi09) E_γ: uncertainty increased to 0.05 keV in least-squares fit procedure. I_γ: deduced from Iγ(106.2γ) and adopted I(106γ):I(117γ)=100 *5*:12.5 *3* from 117 level. Eγ=116.6 *2*, Iγ=44 *15* (1970Wi09, doublet). E2 in 1980Ol05 and 1970Wi09.
116.69[e] *1*	33[e&] *4*	296.232	9/2+	179.522	7/2+	[M1]		1.99 *3*	I_γ: from difference between Iγ=45 *4* for both placements of 116.7γ and Iγ=11.8 *12* deduced for component placed from 116.7 level. M1 in 1980Ol05.
[x]118.40 *4*	1.0 *2*								
[x]120.11 *9*	0.6 *1*								
[x]121.06 *3*	1.7 *1*								
[x]124.59 *6*	0.4 *1*								
[x]128.60 *13*	1.2 *2*								
[x]130.21 *3*	1.7 *2*								
131.06[d] *4*	4.3[d] *15*	602.12	7/2+	471.15	3/2+				
131.06[d] *4*	4.3[d] *15*	840.27	11/2+	709.22	9/2+				
132.05 *2*	115[&] *6*	142.467	7/2+	10.419	3/2+	(E2)		1.096 *16*	A_2=+0.164 *2*; A_4=−0.033 *3*; A_2=+0.16 *1* (1970Wi09) Eγ=132.1 *1*, Iγ=120 *15* (1970Wi09). E2 in 1980Ol05 and 1970Wi09.
[x]133.15 *10*	2.5 *10*								
[x]133.81 *6*	1.6 *6*								
135.20 *1*	37.0[&] *20*	631.818	13/2−	496.633	11/2−	(M1+E2)	+0.13 *2*	1.306 *18*	A_2=−0.023 *8*; A_4=−0.004 *7*; A_2=−0.02 *8* (1970Wi09) Eγ=135.3 *2*, Iγ=38 *10* (1970Wi09). M1,E2 in 1970Wi09; M1 in 1980Ol05.
[x]137.72 *5*	0.9 *2*								
139.83 *1*	26.0[&] *12*	436.080	11/2+	296.232	9/2+	(M1+E2)	+0.46 *3*	1.140 *17*	A_2=+0.243 *7*; A_4=+0.031 *9*; A_2=+0.17 *1* (1970Wi09) Eγ=140.0 *2*, Iγ=29 *10* (1970Wi09). M1,E2 in 1970Wi09; M1 in 1980Ol05.
[x]141.44 *8*	1.6 *6*								
[x]142.41 *3*	3.7 *13*								
143.46 *1*	103[&] *4*	285.942	9/2−	142.467	7/2+	D			A_2=−0.206 *3*; A_2=−0.18 *3* (1970Wi09) Eγ=143.5 *1*, Iγ=125 *15* (1970Wi09). E1 in 1980Ol05 and 1970Wi09.
[x]144.70 *3*	2.5 *8*								
[x]148.48 *10*	0.6 *2*								
[x]154.58 *7*	0.8 *1*								

γ(^{167}Tm) (continued)

Eγ	Iγ[@]	Ei(level)	J^π_i	Ef	J^π_f	Mult.[a]	δ[a]	α[c]	Comments
156.03 *2*	32.5[&] *12*	787.802	15/2−	631.818	13/2−	(M1+E2)	+0.11 *2*	0.872 *12*	A_2=−0.026 *13*; A_4=−0.030 *17*; A_2=+0.03 *4* (1970Wi09) Negative A_4 is inconsistent with ΔJ=1 transition. Eγ=156.1 *1*, Iγ=37 *5* (1970Wi09). M1,E2 in 1970Wi09; M1 in 1980Ol05.
156.33[†]		1101.27	13/2+	944.91	11/2+				
[x]156.92 *26*	1.4 *2*								
160.98[†f]		1001.239	13/2+	840.27	11/2+				
161.25[†]	1.1 *5*	171.76	1/2−	10.419	3/2+				Iγ: deduced from Iγ(171.8γ) and adopted I(161γ):I(172γ)=94 *28*:100 *28* from 172 level.
161.40 *1*	17.6[&] *7*	597.495	13/2+	436.080	11/2+	(M1+E2)	+0.40 +*1*−*3*	0.760 *12*	A_2=+0.229 *18*; A_4=+0.016 *24*; A_2=0.26 *1* (1970Wi09) Eγ=161.5 *1*, Iγ=20 *5* (1970Wi09). M1,E2 in 1970Wi09; M1 in 1980Ol05.
162.82 *9*	2.1[&] *1*	1163.98	15/2+	1001.239	13/2+				
[x]165.51 *9*	0.9 *3*								
[x]166.34 *13*	0.7 *1*								
[x]167.45 *8*	1.0 *1*								
168.66 *4*	2.4 *2*	1096.48	13/2+	927.88	11/2+				
169.12[†f]		459.94	7/2−	290.96	3/2−				
171.76 *5*	1.1 *2*	171.76	1/2−	0.0	1/2+				E1 in 1980Ol05.
174.02[†f]		459.94	7/2−	285.942	9/2−				
174.25 *7*	1.6 *2*	290.96	3/2−	116.608	5/2+				
175.34 *6*	2.8[&] *2*	1276.77	15/2+	1101.27	13/2+				
176.26 *2*	25.5[&] *9*	292.863	7/2−	116.608	5/2+	D			A_2=−0.071 *13* E1 in 1980Ol05. Eγ=176.2 *3*, Iγ=40 *10* (1970Wi09).
177.27 *2*	25.8[&] *9*	187.69	5/2−	10.419	3/2+	D			A_2=−0.152 *11* γ(θ) for doublet. E1 in 1980Ol05.
177.95 *2*	23.3[&] *8*	965.771	17/2−	787.802	15/2−	(M1+E2)	+0.12 *1*	0.602 *9*	A_2=−0.058 *16*; A_4=+0.031 *25* Eγ=177.5 *4*, Iγ=43 *15* (1970Wi09). Dipole in 1980Ol05.
[x]179.14 *6*	1.7 *2*								
181.50 *2*	9.7[&] *4*	779.016	15/2+	597.495	13/2+	(M1+E2)	+0.45 *11*	0.537 *17*	A_2=+0.298 *53*; A_4=−0.032 *74* Eγ≈182, Iγ≈10 (1970Wi09). Dipole in 1980Ol05.
[x]182.84 *17*	2.0 *7*								
184.01 *15*	32.5[&] *15*	326.514	9/2+	142.467	7/2+	(M1+E2)	−0.12 +*11*−*18*	0.549 *17*	A_2=−0.280 *44*; A_4=−0.012 *74*; A_2=+0.11 *4* (1970Wi09) Note opposite signs for A_2 in 1980Ol05 and 1970Wi09. Eγ=184.3 *1*, Iγ=113 *15* (1970Wi09, doublet). M1,E2 in 1970Wi09; M1 in 1980Ol05.

γ(^{167}Tm) (continued)

Eγ	Iγ[@]	Ei(level)	J_i^π	E_f	J_f^π	Mult.[a]	δ[a]	α[c]	Comments
184.33 *4*	68.0[&] *20*	470.271	13/2⁻	285.942	9/2⁻	(E2)		0.342 *5*	A_2=+0.248 *9*; A_4=−0.01 *5*; A_2=0.11 *4* (1970Wi09) Eγ=184.3 *1*, Iγ=113 *15* (1970Wi09, doublet). M1,E2 in 1970Wi09 for doublet; E2 in 1980Ol05 for a single line.
185.11[f] *17*	3.3 *12*	1281.47	15/2⁺	1096.48	13/2⁺				
186.68 *11*	1.4 *5*	709.22	9/2⁺	522.36	5/2⁺				
190.14 *9*	0.9 *2*	1562.94	19/2⁺	1372.760	17/2⁺				
193.45 *7*	2.0[&] *1*	1470.16	17/2⁺	1276.77	15/2⁺				A_2=+0.082 *37*
195.20 *1*	16.0[&] *5*	1160.962	19/2⁻	965.771	17/2⁻	(M1+E2)	≈0.15[b]	0.464 *9*	A_2=−0.056 *15*; A_4=+0.001 *21* α(theory) with assumed 50% uncertainty for mixing ratio. M1 in 1980Ol05.
199.56 *2*	5.7[&] *3*	978.521	17/2⁺	779.016	15/2⁺	(M1+E2)	+0.46 *+7−9*	0.409 *12*	A_2=+0.277 *26*; A_4=−0.037 *33* Negative A_4 is inconsistent with ΔJ=1 transition. Eγ=199.0 *3*, Iγ=6 *3* (1970Wi09). Dipole in 1980Ol05.
203.75 *4*	4.0[&] *2*	496.633	11/2⁻	292.863	7/2⁻	(E2)		0.244 *4*	A_2=+0.297 *73*; A_4=−0.133 *97* E2 in 1980Ol05. Eγ=204.1 *3*, Iγ=4 *2* (1970Wi09).
[x]205.45 *9*	1.4 *2*								
206.18[f] *10*	1.3[&] *2*	1487.37	17/2⁺	1281.47	15/2⁺				
208.86[d] *7*	2.1[d] *6*	1372.760	17/2⁺	1163.98	15/2⁺				
208.86[d] *7*	2.1[d] *6*	1678.89	19/2⁺	1470.16	17/2⁺				
209.92 *2*	14.5[&] *4*	326.514	9/2⁺	116.608	5/2⁺	(E2)		0.221 *3*	A_2=+0.239 *58*; A_4=−0.105 *64* E2 in 1980Ol05. Eγ=209.9 *3*, Iγ=17 *5* (1970Wi09).
[x]212.60 *16*	0.7 *2*								
[x]213.44 *5*	1.7[&] *2*								
216.29 *4*	3.0[&] *4*	1194.816	19/2⁺	978.521	17/2⁺	(M1+E2)	≈0.46[b]	0.326 *23*	A_2=+0.326 *80*; A_4=−0.008 *96* α(K)≈0.267; α(L)≈0.0459; α(M)≈0.01039 α(N)≈0.00242; α(O)≈0.000337; α(P)≈1.599×10^{-5} α(theory) with assumed 50% uncertainty for mixing ratio. Dipole in 1980Ol05.
217.27 *2*	10.4[&] *4*	1378.19	21/2⁻	1160.962	19/2⁻	(M1+E2)	≈0.17[b]	0.344 *7*	A_2=−0.020 *34*; A_4=+0.064 *45* α(theory) with assumed 50% uncertainty for mixing ratio.
218.07[d] *17*	1.7[d] *6*	840.27	11/2⁺	622.100	13/2⁺				
218.07[df] *17*	1.7[d] *6*	1705.58	19/2⁺	1487.37	17/2⁺				
218.90 *2*	11.8[&] *3*	689.197	15/2⁺	470.271	13/2⁻	D			A_2=−0.177 *33*

$^{167}_{69}$Tm$_{98}$-6

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[a]	δ[a]	α[c]	Comments
									Eγ=218.8 4, Iγ=14 5 (1970Wi09). E1 in 1980Ol05.
222.50[df] 19	0.5[d] 2	780.50?	$9/2^+$	557.84?	$5/2^+$				
222.50[d] 19	0.5[d] 2	1901.27	$21/2^+$	1678.89	$19/2^+$				
[x]227.35 5	3.3 10								
228.61[e] 1	87[e&] 13	371.063	$11/2^+$	142.467	$7/2^+$	(E2)		0.1675 24	A_2=+0.205 7; A_4=−0.055 9; A_2=+0.21 5 (1970Wi09) γ(θ) for doublet. Eγ=228.7 1, Iγ=148 15 (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
228.61[e] 1	27[e&] 13	1606.80	$23/2^-$	1378.19	$21/2^-$				I_γ: total intensity for the doublet=114.0 30, other placement from 779 level. Intensity divided in the two placements by the evaluators based on the branching ratio: Iγ(229)/Iγ(446)=3.49 25 in ^{164}Dy(^{7}Li,4nγ) dataset, also recommended in the Adopted dataset.
228.92[†]		699.190	$11/2^-$	470.271	$13/2^-$				
229.85 4	2.8[&] 1	1424.67	$21/2^+$	1194.816	$19/2^+$	(M1+E2)	≈0.30[b]	0.287 13	A_2=+0.400 52; A_4=−0.110 60 α(theory) with assumed 50% uncertainty for mixing ratio. Negative A_4 is inconsistent with ΔJ=1 transition.
234.68 7	0.4 1	2135.93	$23/2^+$	1901.27	$21/2^+$				
[x]236.37 3	1.1 1								
238.13 4	1.2 1	840.27	$11/2^+$	602.12	$7/2^+$				
239.26 2	1.9 1	699.190	$11/2^-$	459.94	$7/2^-$				
[x]243.69 17	1.0 3								
244.27 3	1.2 4	1668.93	$23/2^+$	1424.67	$21/2^+$				
246.10 16	0.3 1	2381.91?	$25/2^+$	2135.93	$23/2^+$				
248.12 1	9.5[&] 4	631.818	$13/2^-$	383.702	$9/2^-$	(E2)		0.1288 18	A_2=+0.226 13; A_4=−0.045 18 Eγ=248.4 3, Iγ=13 5 (1970Wi09). E2 in 1980Ol05.
[x]249.44 5	0.8 1								
251.03[d] 1	20.5[d&] 20	622.100	$13/2^+$	371.063	$11/2^+$	(M1+E2)	−0.13 3	0.233 3	A_2=−0.320 15; A_4=+0.03 3 γ(θ) for doubly-placed γ. Eγ=251.2 2, Iγ=35 5 (1970Wi09). M1 in 1980Ol05.
251.03[d] 1	20.5[d&] 20	1813.97	$21/2^+$	1562.94	$19/2^+$	D			A_2=−0.320 15; A_4=+0.025 30 M1 in 1980Ol05.
251.84 2	4.4[&] 6	1858.66	$25/2^-$	1606.80	$23/2^-$				
253.43[d] 4	2.1[d&] 2	1358.77	$15/2^-$	1105.34	$11/2^-$				
253.43[d] 4	2.1[d&] 2	1922.38	$25/2^+$	1668.93	$23/2^+$	D			A_2=−0.110 87 γ(θ) for doublet.

$^{167}_{69}$Tm$_{98}$-7

^{165}Ho(α,2nγ) 1980Ol05 (continued)

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	α[c]	Comments
255.12 *6*	2.2 *3*	2113.89	27/2⁻	1858.66	25/2⁻			
256.57 *1*	20.1[&] *4*	436.080	11/2⁺	179.522	7/2⁺	(E2)	0.1158 *16*	A_2=+0.216 *2*; A_4=−0.050 *17* E2 in 1980Ol05. Eγ=256.5 *2*, Iγ=24 *5* (1970Wi09).
264.02 *8*	1.0 *1*	2186.45	27/2⁺	1922.38	25/2⁺			
[x]265.13 *18*	0.6 *1*							
266.40 *11*	1.0 *1*	1007.633	15/2⁻	741.386	17/2⁻			
269.17 *11*	1.7 *2*	2455.62	29/2⁺	2186.45	27/2⁺			
270.14[†]		927.88	11/2⁺	657.85?	7/2⁺			
271.12 *1*	80.0[&] *15*	741.386	17/2⁻	470.271	13/2⁻	(E2)	0.0975 *14*	A_2=+0.266 *10*; A_4=−0.074 *12*; A_2=+0.25 *5* (1970Wi09) Eγ=271.1 *1*, Iγ=97 *10* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
272.29 *8*	1.7 *5*	459.94	7/2⁻	187.69	5/2⁻			
[x]274.96 *6*	0.6 *1*							
275.57[†]		602.12	7/2⁺	326.514	9/2⁺			
276.22[d] *11*	0.7[d] *2*	1705.58	19/2⁺	1429.530	21/2⁺			
276.22[d] *11*	0.7[d] *2*	2670.64	31/2⁻	2394.45	29/2⁻			
279.96[†]		1808.674	23/2⁻	1528.70	25/2⁻			
280.21 *2*	2.5 *1*	2735.83	31/2⁺	2455.62	29/2⁺			
(280.55 *20*)	0.77 *25*	290.96	3/2⁻	10.419	3/2⁺			E_γ: from the Adopted Gammas. I_γ: from I(174γ) (1980Ol05) and I(281γ):I(174γ)=1.8 *5*:3.7 *4* (1976Sv01).
280.56[†]		2394.45	29/2⁻	2113.89	27/2⁻			
[x]283.58[#] *9*	1.2 *2*							
284.73[‡] *16*	0.8 *2*	1381.00	19/2⁻	1096.235	21/2⁻			
286.25 *17*	1.0 *3*	1372.760	17/2⁺	1086.580	19/2⁺			
287.70 *11*	0.7 *2*	1281.47	15/2⁺	993.612	17/2⁺			
290.94		290.96	3/2⁻	0.0	1/2⁺			I_γ: Iγ=7 *3* is expected for this placement based in I(174γ) and adopted I(291γ)/I(281γ)=9.3 *24*. E1 in 1980Ol05.
291.150 *10*	15.3[&] *10*	787.802	15/2⁻	496.633	11/2⁻	(E2)	0.0783 *11*	A_2=+0.226 *13*; A_4=−0.072 *17* γ(θ) for a multiplet of several γ rays near this energy, some of which were proposed from γγ-coin data only. Eγ=291.2 *2*, Iγ=19 *4* (1970Wi09). E2 in 1980Ol05.
292.07[†]		1001.239	13/2⁺	709.22	9/2⁺			
295.59 *1*	24.2[&] *4*	622.100	13/2⁺	326.514	9/2⁺	(E2)	0.0747 *11*	A_2=+0.243 *19*; A_4=−0.062 *8*; A_2=+0.25 *10* (1970Wi09) Eγ=295.2 *2*, Iγ=30 *5* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.

γ(^{167}Tm) (continued)

Eγ	Iγ[@]	Ei(level)	J^π_i	Ef	J^π_f	Mult.[a]	δ[a]	α[c]	Comments
301.26 *1*	28.3[&] *5*	597.495	13/2+	296.232	9/2+	(E2)		0.0705 *10*	A_2=+0.244 *11*; A_4=−0.063 *15*; A_2=+0.25 *10* Eγ=301.4 *2*, Iγ=37 *5* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
301.84[†]		1524.95	17/2−	1223.12	13/2−				
304.41 *1*	9.3[&] *2*	993.612	17/2+	689.197	15/2+	(M1+E2)	−0.23 +*16*−*17*	0.136 *7*	A_2=−0.410 *18*; A_4=−0.025 *36* Eγ=304.5 *2*, Iγ=13 *4* (1970Wi09). Dipole in 1980Ol05.
305.91 *27*	0.4 *1*	927.88	11/2+	622.100	13/2+				
308.46 *2*	3.0[&] *2*	1007.633	15/2−	699.190	11/2−	(Q)			A_2=+0.257 *56*; A_4=−0.039 *72*
312.11 *11*	0.8 *1*	1001.239	13/2+	689.197	15/2+				
[x]313.48 *14*	0.5 *1*								
315.79 *17*	0.4 *1*	1096.48	13/2+	780.50?	9/2+				
318.14 *1*	47.0[&] *20*	689.197	15/2+	371.063	11/2+	(E2)		0.0599 *9*	A_2=+0.256 *9*; A_4=−0.067 *10*; A_2=+0.22 *5* (1970Wi09) Eγ=318.1 *1*, Iγ=63 *10* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
[x]320.89 *8*	0.5 *1*								
323.34 *19*	0.6 *1*	1163.98	15/2+	840.27	11/2+				
330.99 *9*	0.7 *1*	657.85?	7/2+	326.514	9/2+				Eγ: uncertainty increased to 0.18 keV in least-squares fit procedure.
332.11 *6*	1.5 *2*	1276.77	15/2+	944.91	11/2+				Eγ: uncertainty increased to 0.10 keV in least-squares fit procedure.
332.36 *6*	2.2 *2*	1691.25	19/2−	1358.77	15/2−				
333.96 *1*	15.5[&] *15*	965.771	17/2−	631.818	13/2−	(E2)		0.0519 *7*	A_2=+0.270 *20*; A_4=−0.104 *49*; A_2=+0.35 *6* (1970Wi09) Eγ=333.7 *2*, Iγ=17 *5* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
338.01 *22*	0.7 *2*	709.22	9/2+	371.063	11/2+				
[x]339.63 *17*	0.8 *3*								
[x]341.29 *3*	0.5 *1*								
342.95[e] *1*	28.4[e&] *17*	779.016	15/2+	436.080	11/2+	(E2)		0.0480 *7*	A_2=+0.120 *20*; A_4=−0.044 *16*; A_2=+0.07 *5* (1970Wi09) γ(θ) for doublet. Eγ=343.1 *1*, Iγ=58 *8* (1970Wi09, doublet). (M1,E2) in 1970Wi09; E2 in 1980Ol05.
342.95[e] *1*	7.9[e&] *7*	1429.530	21/2+	1086.580	19/2+				Iγ: total intensity for the doublet=36.3 *15*, other placement from 779 level. Intensity divided in the two placements by the evaluators based on the branching ratio: Iγ(343)/Iγ(435)=0.61 *5* in ^{164}Dy(^{7}Li,4nγ) dataset, also recommended in the Adopted dataset.
343.37[†]		459.94	7/2−	116.608	5/2+				E1 in 1980Ol05.
345.20 *2*	7.4[&] *2*	1086.580	19/2+	741.386	17/2−	D			A_2=−0.225 *20* Tentative Eγ=345 in level-scheme Fig. 5 of 1970Wi09.

From ENSDF

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	α[c]	Comments
[x]350.71 *2*	3.3 *10*							
[x]352.93 *15*	1.4 *5*							
353.42 *15*	2.6 *9*	1281.47	15/2+	927.88	11/2+			
354.85 *1*	46.2[&] *15*	1096.235	21/2−	741.386	17/2−	(E2)	0.0435 *6*	A_2=+0.303 *18*; A_4=−0.101 *22* E2 in 1980Ol05.
356.40 *14*	1.2 *2*	978.521	17/2+	622.100	13/2+			
365.35 *3*	1.4[&] *1*	1915.40	25/2+	1550.04	23/2+			
368.99 *12*	1.5 *2*	1470.16	17/2+	1101.27	13/2+			
371.52[e] *1*	10.6[e&] *8*	993.612	17/2+	622.100	13/2+	(E2)	0.0382 *5*	A_2=+0.239 *21*; A_4=−0.071 *26* I_γ: total intensity for the doublet=23.6 *13*, other placement from 1372 level. Intensity divided in the two placements by the evaluators based on the branching ratio: Iγ(371.5)/Iγ(304.4)=1.14 *8* in ^{164}Dy(^{7}Li,4nγ) dataset, also recommended in the Adopted dataset. γ(θ) for doublet. Eγ=371.0 *4*, Iγ=20 *5* (1970Wi09). E2 in 1980Ol05.
371.52[e] *1*	13.0[e&] *15*	1372.760	17/2+	1001.239	13/2+	(E2)	0.0382 *5*	A_2=+0.239 *21*; A_4=−0.071 *26* E2 in 1980Ol05. γ(θ) for doublet.
372.70[†] *10*		699.190	11/2−	326.514	9/2+			
372.96 *5*	23.7[&] *6*	1160.962	19/2−	787.802	15/2−	(E2)	0.0377 *5*	A_2=+0.149 *13*; A_4=−0.042 *16* E_γ: uncertainty increased to 0.10 keV in least-squares fit procedure.
373.42 *12*	4.4 *14*	1381.00	19/2−	1007.633	15/2−			
375.02[†]		2440.47	29/2+	2065.46	27/2+			
379.15[d] *2*	4.9[d&] *3*	1001.239	13/2+	622.100	13/2+			A_2=+0.18 *4* γ(θ) for triply-placed γ. M1 in 1980Ol05.
379.15[d] *2*	4.9[d&] *3*	1372.760	17/2+	993.612	17/2+			
379.15[d] *2*	4.9[d&] *3*	1808.674	23/2−	1429.530	21/2+			
379.84[†]		522.36	5/2+	142.467	7/2+			M1 in 1980Ol05.
381.01 *1*	23.5[&] *5*	978.521	17/2+	597.495	13/2+	(E2)	0.0355 *5*	A_2=+0.254 *12*; A_4=−0.058 *14*; A_2=+0.34 *6* (1970Wi09) Eγ=380.8 *3*, Iγ=34 *5* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
382.41 *30*	0.6 *3*	709.22	9/2+	326.514	9/2+			
384.44[†f]		1813.97	21/2+	1429.530	21/2+			
385.50 *2*	5.4[&] *3*	1007.633	15/2−	622.100	13/2+	D		A_2=−0.219 *35*
386.67[†]		1915.40	25/2+	1528.70	25/2−			
387.26 *5*	3.2[&] *2*	1381.00	19/2−	993.612	17/2+	D		A_2=−0.179 *79*

$^{167}_{69}$Tm$_{98}$-10

γ(^{167}Tm) (continued)

Eγ	Iγ[@]	Ei(level)	J^π_i	Ef	J^π_f	Mult.[a]	α[c]	Comments
390.61 *12*	0.9 *2*	1487.37	17/2+	1096.48	13/2+			
391.72 *5*	2.0 *2*	1916.63	21/2−	1524.95	17/2−			
397.38 *1*	27.0[&] *5*	1086.580	19/2+	689.197	15/2+	(E2)	0.0316 *5*	A_2=+0.234 *15*; A_4=−0.048 *14*; A_2=+0.19 *5* (1970Wi09) Eγ=397.4 *1*, Iγ=34 *5* (1970Wi09). E2 in 1970Wi09 and 1980Ol05.
398.65 *13*	1.2 *3*	1562.94	19/2+	1163.98	15/2+			
400.56[#] *15*	0.6 *2*	1487.37	17/2+	1086.580	19/2+			
402.07 *5*	1.2 *2*	1678.89	19/2+	1276.77	15/2+			
405.69[d] *4*	1.5[d] *4*	522.36	5/2+	116.608	5/2+			M1 in 1980Ol05.
405.69[d] *4*	1.5[d] *4*	2321.09?	25/2+	1915.40	25/2+			
406.84 *4*	4.0[&] *3*	2098.08	23/2−	1691.25	19/2−			A_2=+0.189 *62*; A_4=−0.044 *80*
407.27[†f]		1096.48	13/2+	689.197	15/2+			
412.39 *2*	13.0[&] *3*	1378.19	21/2−	965.771	17/2−	(E2)	0.0285 *4*	A_2=+0.168 *15*; A_4=−0.070 *20*
413.39 *12*	2.2 *3*	699.190	11/2−	285.942	9/2−			M1 in 1980Ol05.
(415.50 *20*)		557.84?	5/2+	142.467	7/2+			Eγ: from the Adopted Gammas, doublet.
415.79 *2*	19.7[&] *4*	1194.816	19/2+	779.016	15/2+	(E2)	0.0279 *4*	A_2=+0.264 *10*; A_4=−0.074 *28*
[x]418.31 *3*	0.4 *1*							
[x]421.82 *3*	0.5 *1*							
424.05 *5*	0.9 *1*	1705.58	19/2+	1281.47	15/2+			
427.66 *3*	3.0[&] *1*	1808.674	23/2−	1381.00	19/2−	(E2)	0.0258 *4*	A_2=+0.179 *90*; A_4=−0.047 *93*
[x]428.44 *3*	0.9 *4*							
431.11[d] *4*	1.9[d] *2*	1424.67	21/2+	993.612	17/2+			
431.11[d] *4*	1.9[d] *2*	1901.27	21/2+	1470.16	17/2+			
432.47 *2*	20.3[&] *5*	1528.70	25/2−	1096.235	21/2−	(E2)	0.0251 *4*	A_2=+0.255 *22*; A_4=−0.118 *33*
435.94 *2*	13.0[&] *4*	1429.530	21/2+	993.612	17/2+	(E2)	0.0245 *4*	A_2=+0.323 *35*; A_4=−0.067 *45*
[x]439.59 *4*	0.8 *1*							
441.22[d] *3*	2.7[d&] *2*	557.84?	5/2+	116.608	5/2+			A_2=−0.056 *71* M1 in 1980Ol05. γ(θ) for doublet.
441.22[d] *3*	2.7[d&] *2*	1813.97	21/2+	1372.760	17/2+			
[x]443.70 *3*	1.2 *1*							
445.82 *4*	7.6 *36*	1606.80	23/2−	1160.962	19/2−			
446.11 *5*	10.3[&] *47*	1424.67	21/2+	978.521	17/2+	(E2)	0.0231 *3*	A_2=+0.284 *40*; A_4=−0.070 *50*
450.81 *21*	0.4 *1*	1429.530	21/2+	978.521	17/2+			
[x]451.57 *12*	0.6 *2*							
[x]453.38 *8*	2.2 *4*							
453.77[†]		1550.04	23/2+	1096.235	21/2−			A_2=−0.24 *4*

From ENSDF

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	α[c]	Comments
453.97 *4*	4.1[&] *2*	780.50?	9/2+	326.514	9/2+	D		A_2=−0.242 *38*
[x]456.20 *7*	0.9 *3*							
457.05 *6*	1.7[&] *2*	2135.93	23/2+	1678.89	19/2+			
459.63[d] *19*	1.4[d] *1*	602.12	7/2+	142.467	7/2+			
459.63[d] *19*	1.4[d] *1*	2022.26	23/2+	1562.94	19/2+			
460.77 *3*	3.1[&] *3*	471.15	3/2+	10.419	3/2+			M1 in 1980Ol05.
463.44 *3*	12.3[&] *3*	1550.04	23/2+	1086.580	19/2+	(E2)	0.0209 *3*	A_2=+0.306 *27*; A_4=−0.116 *36*
[x]464.63 *13*	0.6 *2*							
469.26 *4*	2.4 *6*	840.27	11/2+	371.063	11/2+			M1 in 1980Ol05.
471.01 *7*	2.1 *5*	2279.76	27/2−	1808.674	23/2−			
471.26		471.15	3/2+	0.0	1/2+			
472.17 *8*	1.7 *4*	2022.26	23/2+	1550.04	23/2+			
474.09 *3*	9.6 *13*	1668.93	23/2+	1194.816	19/2+			
474.38[†]		1096.48	13/2+	622.100	13/2+			
474.77[†]		1163.98	15/2+	689.197	15/2+			
475.25[d] *6*	4.0[d] *6*	935.27	7/2−	459.94	7/2−			
475.25[d] *6*	4.0[d] *6*	2573.32	27/2−	2098.08	23/2−			
476.35 *9*	2.2 *4*	1562.94	19/2+	1086.580	19/2+			
479.88 *6*	5.0 *6*	2396.44	25/2−	1916.63	21/2−			
480.50[d] *17*	3.6[d] *7*	1858.66	25/2−	1378.19	21/2−			
480.50[d] *17*	3.6[d] *7*	2381.91?	25/2+	1901.27	21/2+			
[x]482.12 *33*	0.7 *2*							
484.08[#] *11*	1.0 *3*	1678.89	19/2+	1194.816	19/2+			
485.39 *12*	2.3 *4*	602.12	7/2+	116.608	5/2+			
485.98 *13*	4.3 *4*	1915.40	25/2+	1429.530	21/2+			
[x]486.48 *5*	2.2 *7*							Eγ=486.1 *5*, Iγ=7 *3* (1970Wi09).
491.02 *26*	1.5[&] *2*	1915.40	25/2+	1424.67	21/2+			
491.70[†]		1470.16	17/2+	978.521	17/2+			
492.89 *6*	1.5[&] *2*	1922.38	25/2+	1429.530	21/2+			
[x]495.70 *11*	0.6 *2*							
497.71[d] *4*	4.2[d&] *3*	1276.77	15/2+	779.016	15/2+			
497.71[d] *4*	4.2[d&] *3*	1922.38	25/2+	1424.67	21/2+	(E2)	0.01733 *24*	A_2=+0.337 *49*; A_4=−0.050 *55* γ(θ) for doublet.
502.09 *4*	5.5[&] *4*	2030.79	29/2−	1528.70	25/2−	(E2)	0.01695 *24*	A_2=+0.364 *68*; A_4=−0.119 *90*
503.84[#] *13*	0.7 *2*	1101.27	13/2+	597.495	13/2+			
507.14[d] *4*	3.2[d] *2*	2113.89	27/2−	1606.80	23/2−			

$^{167}_{69}$Tm$_{98}$-12

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Comments
507.14[df] 4	3.2[d] 2	2321.09?	25/2+	1813.97	21/2+	
508.81[‡] 14	1.1 2	944.91	11/2+	436.080	11/2+	
[x]510.25[‡] 13	1.3 2					
[x]511.65 8	2.8 2					
513.66 5	1.8 2	840.27	11/2+	326.514	9/2+	
515.42[d] 4	6.0[d] 10	657.85?	7/2+	142.467	7/2+	
515.42[d] 4	6.0[d] 10	2065.46	27/2+	1550.04	23/2+	
517.34[†]		1524.95	17/2−	1007.633	15/2−	
517.53 3	3.3 6	2186.45	27/2+	1668.93	23/2+	
518.17[†f]		2440.47	29/2+	1922.38	25/2+	
519.31[†]		2799.07	31/2−	2279.76	27/2−	
[x]523.39 25	0.6 2					
523.93[†]		1223.12	13/2−	699.190	11/2−	
525.07 5	2.2 3	2440.47	29/2+	1915.40	25/2+	
533.18 12	1.7[&] 2	2455.62	29/2+	1922.38	25/2+	
535.61[†]		1916.63	21/2−	1381.00	19/2−	
535.79 3	4.5[&] 4	2394.45	29/2−	1858.66	25/2−	
536.72[†]		2065.46	27/2+	1528.70	25/2−	
537.39 3	3.9[&] 3	1007.633	15/2−	470.271	13/2−	M1 in 1980Ol05.
(541.28 25)		657.85?	7/2+	116.608	5/2+	E_γ: from the Adopted Gammas, doublet.
541.87 7	1.2 3	1163.98	15/2+	622.100	13/2+	M1 in 1980Ol05.
542.51 15	1.2 3	2573.32	27/2−	2030.79	29/2−	
547.42[d] 3	2.7[d&] 3	557.84?	5/2+	10.419	3/2+	
547.42[d] 3	2.7[d&] 3	1044.06	11/2−	496.633	11/2−	
549.50 19	0.8 2	2735.83	31/2+	2186.45	27/2+	
554.66 7	1.4[&] 2	2620.16	31/2+	2065.46	27/2+	
556.74[d] 5	2.8[d] 4	927.88	11/2+	371.063	11/2+	M1 in 1980Ol05.
556.74[d] 5	2.8[d] 4	2670.64	31/2−	2113.89	27/2−	M1 in 1980Ol05.
[x]560.23 7	0.8 1					
562.68 10	1.0 1	2593.47	33/2−	2030.79	29/2−	
566.83 11	0.6 1	709.22	9/2+	142.467	7/2+	
569.35[d] 6	1.6[d] 2	1562.94	19/2+	993.612	17/2+	
569.35[d] 6	1.6[d] 2	2098.08	23/2−	1528.70	25/2−	
[x]570.90 3	2.9[&] 4					
[x]577.10 8	0.6 1					
587.45 15	0.5 1	2396.44	25/2−	1808.674	23/2−	M1 in 1980Ol05.

$^{167}_{69}$Tm$_{98}$-13

γ(^{167}Tm) (continued)

E_γ	I_γ [@]	E_i(level)	J_i^π	E_f	J_f^π	Comments
589.47 *12*	1.4 *2*	2620.16	31/2$^+$	2030.79	29/2$^-$	
[x]591.45 *8*	1.8 *2*					
592.27[†]		1281.47	15/2$^+$	689.197	15/2$^+$	
[x]593.21 *18*	1.0 *2*					
595.05 *3*	3.6 *2*	1691.25	19/2$^-$	1096.235	21/2$^-$	
[x]597.16 *16*	0.4 *1*					
[x]600.14 *4*	2.6 *2*					
601.48 *5*	1.7 *2*	927.88	11/2$^+$	326.514	9/2$^+$	
[x]615.95 *11*	0.7 *2*					
617.33 *4*	4.0 *4*	1358.77	15/2$^-$	741.386	17/2$^-$	
619.04 *7*	1.1 *2*	1705.58	19/2$^+$	1086.580	19/2$^+$	
[x]621.69 *6*	0.5 *1*					
630.14 *3*	3.0 *2*	1001.239	13/2$^+$	371.063	11/2$^+$	M1 in 1980Ol05.
635.07 *3*	2.8 *2*	1105.34	11/2$^-$	470.271	13/2$^-$	
636.95 *20*	1.3 *5*	929.74?	9/2$^-$	292.863	7/2$^-$	
639.89 *4*	6.2 *3*	1381.00	19/2$^-$	741.386	17/2$^-$	E_γ: uncertainty increased to 0.10 keV in least-squares fit procedure. M1 in 1980Ol05.
[x]640.89 *10*	1.2 *2*					
648.43 *11*	1.1 *2*	944.91	11/2$^+$	296.232	9/2$^+$	
649.38 *4*	2.2 *7*	935.27	7/2$^-$	285.942	9/2$^-$	M1 in 1980Ol05.
[x]652.54 *14*	0.5 *1*					
[x]654.65[#] *20*	0.4 *1*					
659.18[#] *24*	0.5 *1*	1281.47	15/2$^+$	622.100	13/2$^+$	
660.36 *5*	2.0 *2*	1044.06	11/2$^-$	383.702	9/2$^-$	M1 in 1980Ol05.
665.13[d] *3*	2.1[d] *1*	852.81	3/2$^-$	187.69	5/2$^-$	
665.13[d] *3*	2.1[d] *1*	1101.27	13/2$^+$	436.080	11/2$^+$	
[x]670.69 *5*	0.5 *1*					
679.43 *7*	2.0 *2*	1276.77	15/2$^+$	597.495	13/2$^+$	
680.86 *16*	0.8 *2*	852.81	3/2$^-$	171.76	1/2$^-$	
683.54 *4*	2.1 *2*	1372.760	17/2$^+$	689.197	15/2$^+$	
[x]688.83 *4*	1.7 *2*					
691.20[†]		1470.16	17/2$^+$	779.016	15/2$^+$	
[x]691.60[#] *5*	2.7 *2*					
[x]693.24[#] *5*	4.4 *3*					
694.46 *17*	3.5 *3*	882.15	5/2$^-$	187.69	5/2$^-$	M1 in 1980Ol05.
700.36[#] *7*	1.7 *2*	1678.89	19/2$^+$	978.521	17/2$^+$	
706.35[#] *15*	0.8 *2*	1901.27	21/2$^+$	1194.816	19/2$^+$	
711.34[†][f]		2135.93	23/2$^+$	1424.67	21/2$^+$	

$^{167}_{69}Tm_{98}$-14

γ(^{167}Tm) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Comments
712.41 *3*	4.6 *2*	1808.674	23/2⁻	1096.235	21/2⁻	
[x]719.56 *4*	1.8 *2*					
722.60 *3*	2.7 *2*	1008.54	9/2⁻	285.942	9/2⁻	(E2) in 1980Ol05.
725.34 *4*	1.8 *3*	1096.48	13/2⁺	371.063	11/2⁺	
727.63 *11*	0.7 *2*	1813.97	21/2⁺	1086.580	19/2⁺	
[x]735.62 *34*	0.3 *1*					
[x]737.47 *17*	0.4 *1*					
747.50 *9*	0.4 *1*	935.27	7/2⁻	187.69	5/2⁻	
751.21[d] *10*	2.3[d] *3*	1044.06	11/2⁻	292.863	7/2⁻	(E2) in 1980Ol05.
751.21[d] *10*	2.3[d] *3*	2279.76	27/2⁻	1528.70	25/2⁻	
752.85 *3*	5.5 *4*	1223.12	13/2⁻	470.271	13/2⁻	
[x]757.57 *32*	0.6 *2*					
[x]759.29 *18*	0.5 *2*					
[x]763.62 *35*	0.3 *1*					
765.42 *3*	2.3 *2*	944.91	11/2⁺	179.522	7/2⁺	E2 in 1980Ol05.
768.28 *22*	0.5 *1*	2799.07	31/2⁻	2030.79	29/2⁻	
[x]774.88 *18*	2.3 *2*					
783.57 *3*	5.8 *2*	1524.95	17/2⁻	741.386	17/2⁻	
[x]786.54 *9*	0.6 *2*					
798.46 *10*	0.7 *1*	1487.37	17/2⁺	689.197	15/2⁺	
805.07 *4*	2.5 *2*	1101.27	13/2⁺	296.232	9/2⁺	
819.41[†]		1105.34	11/2⁻	285.942	9/2⁻	
[x]819.70 *10*	1.1 *2*					
820.44[†]		1916.63	21/2⁻	1096.235	21/2⁻	
[x]826.01 *6*	1.3 *2*					
[x]829.52 *13*	0.4 *1*					
[x]835.54 *21*	0.3 *1*					
840.70 *6*	1.9 *2*	1276.77	15/2⁺	436.080	11/2⁺	
[x]861.28 *20*	0.5 *1*					
[x]863.08 *12*	1.0 *2*					
867.36 *26*	0.4 *1*	2396.44	25/2⁻	1528.70	25/2⁻	
[x]869.44 *15*	0.7 *1*					
872.62 *8*	1.6 *2*	1470.16	17/2⁺	597.495	13/2⁺	
[x]874.92 *12*	2.1 *2*					
[x]877.13 *13*	1.1 *2*					
[x]880.62 *14*	0.6 *1*					
[x]884.12 *9*	1.2 *1*					
[x]886.45 *31*	0.3 *1*					
888.37 *12*	1.5 *2*	1358.77	15/2⁻	470.271	13/2⁻	
[x]891.03 *10*	0.9 *1*					

$^{167}_{69}$Tm$_{98}$-15

γ(^{167}Tm) (continued)

E_γ	I_γ @	E_i(level)	J_i^π	E_f	J_f^π
^{x}895.64$^{\#}$ *22*	0.4 *1*				
^{x}900.32 *21*	0.6 *1*				
^{x}903.14 *14*	0.5 *1*				
^{x}908.77 *11*	0.4 *1*				
^{x}911.93$^{\#}$ *13*	0.5 *1*				
^{x}912.89 *31*	0.4 *1*				
^{x}914.25 *13*	0.6 *2*				
^{x}931.11 *18*	0.5 *1*				
^{x}932.94 *37*	0.4 *1*				
^{x}934.36 *19*	0.6 *2*				
^{x}937.04 *12*	0.7 *2*				
^{x}937.91 *32*	1.0 *4*				
^{x}940.19 *26*	0.4 *1*				
^{x}947.19 *26*	0.4 *1*				
950.11 *21*	1.6 *1*	1691.25	19/2$^-$	741.386	17/2$^-$
^{x}954.48 *29*	0.3 *1*				
^{x}968.15 *27*	0.4 *1*				
^{x}970.55 *17*	0.4 *1*				
^{x}973.18 *16*	0.5 *1*				
^{x}982.24 *8*	1.9 *2*				
^{x}988.54 *11*	1.4 *2*				
^{x}990.50 *18*	0.9 *2*				
1001.70 *23*	0.6 *1*	2098.08	23/2$^-$	1096.235	21/2$^-$
^{x}1004.43 *32*	0.3 *1*				
^{x}1007.52 *27*	0.6 *1*				
^{x}1009.69 *11*	1.3 *2*				
^{x}1014.74$^{\#}$ *24*	0.6 *1*				
1016.62 *29*	0.6 *1*	1705.58	19/2$^+$	689.197	15/2$^+$
^{x}1018.33 *24*	0.6 *1*				
^{x}1024.69 *15*	1.1 *2*				
^{x}1027.01 *30*	0.4 *1*				
^{x}1033.49 *15*	0.5 *1*				
^{x}1037.73 *13*	0.7 *1*				
1044.60†		2573.32	27/2$^-$	1528.70	25/2$^-$
^{x}1047.36 *12*	0.8 *1*				

E_γ	I_γ @	E_i(level)
^{x}1050.37 *38*	0.4 *1*	
^{x}1051.34 *19*	0.6 *2*	
^{x}1053.95 *23*	0.4 *1*	
^{x}1061.21 *22*	0.6 *1*	
^{x}1068.89 *15*	0.5 *1*	
^{x}1074.09 *32*	0.5 *1*	
^{x}1077.36 *17*	0.9 *3*	
^{x}1079.34‡ *29*	0.7 *2*	
^{x}1080.77 *16*	0.6 *1*	
^{x}1090.62 *64*	0.6 *1*	
^{x}1099.89 *30*	0.7 *1*	
^{x}1101.75$^{\#}$ *18*	0.9 *1*	
^{x}1103.06 *41*	0.7 *1*	
^{x}1108.91 *17*	0.5 *1*	
^{x}1111.66 *18*	0.6 *1*	
^{x}1118.11 *37*	0.5 *1*	
^{x}1126.96 *33*	0.6 *1*	
^{x}1128.36 *20*	0.9 *2*	
^{x}1134.23 *15*	0.8 *1*	
^{x}1138.87 *29*	0.4 *1*	
^{x}1140.14$^{\#}$ *25*	0.7 *1*	
^{x}1152.05 *17*	0.9 *1*	
^{x}1162.89 *27*	0.9 *2*	
^{x}1170.15 *29*	0.5 *1*	
^{x}1177.95 *26*	0.5 *1*	
^{x}1180.26 *22*	0.6 *2*	
^{x}1183.39 *23*	0.5 *1*	
^{x}1189.77 *29*	0.3 *1*	
^{x}1195.57 *23*	0.5 *1*	
^{x}1214.28 *15*	0.8 *2*	
^{x}1232.56 *49*	0.4 *1*	
^{x}1235.69 *14*	1.2 *2*	
^{x}1238.48 *42*	0.4 *1*	
^{x}1240.85 *30*	0.6 *2*	

† From $\gamma\gamma$-coin only with no energy uncertainty given in 1980Ol05.
‡ This γ observed at E(α)=25 MeV only.

$^{167}_{69}$Tm$_{98}$-16

γ(^{167}Tm) (continued)

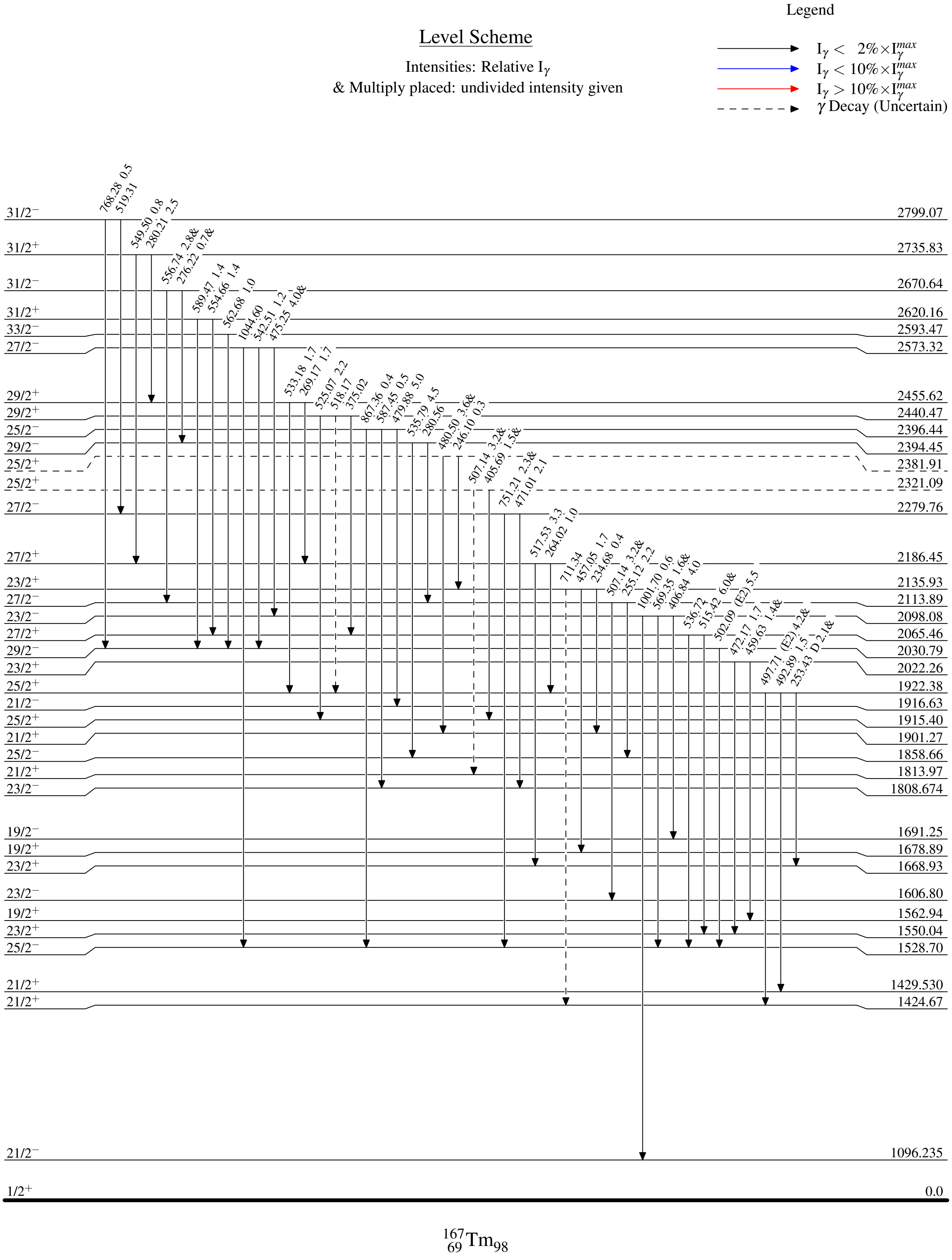
[#] This γ observed at E(α)=23 MeV only.
[@] For E(α)=27 MeV and θ=90°, relative to I(106γ, 90°)=100 (1980Ol05), except as noted.
[&] Average intensities over all angles (relative to I(106γ, 90°)=100) (1980Ol05).
[a] From γ(θ) (1980Ol05,1981Io06); stretched Q (E2) assignments were based on positive A_2 and evidence of negative A_4, and ΔJ=1, dipole (M1) or dipole+quadrupole (M1+E2) assignments on rotational−band structure and negative A_2 values. When δ(Q/D) are significantly large (>0.1 or so), mult=(M1+E2) assigned in contrast to (E1+M2) from RUL, assuming that the states have half−lives shorter than typical γγ-coin resolving time of 50 ns or so. Some of the mixing ratios are from γ-branching ratios, as noted, deduced by 1980Ol05.
[b] Estimated by 1980Ol05 from γ-branching ratios.
[c] 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.
[d] Multiply placed with undivided intensity.
[e] Multiply placed with intensity suitably divided.
[f] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{165}Ho(α,2nγ) 1980Ol05

Level Scheme

Intensities: Relative I_γ

& Multiply placed: undivided intensity given



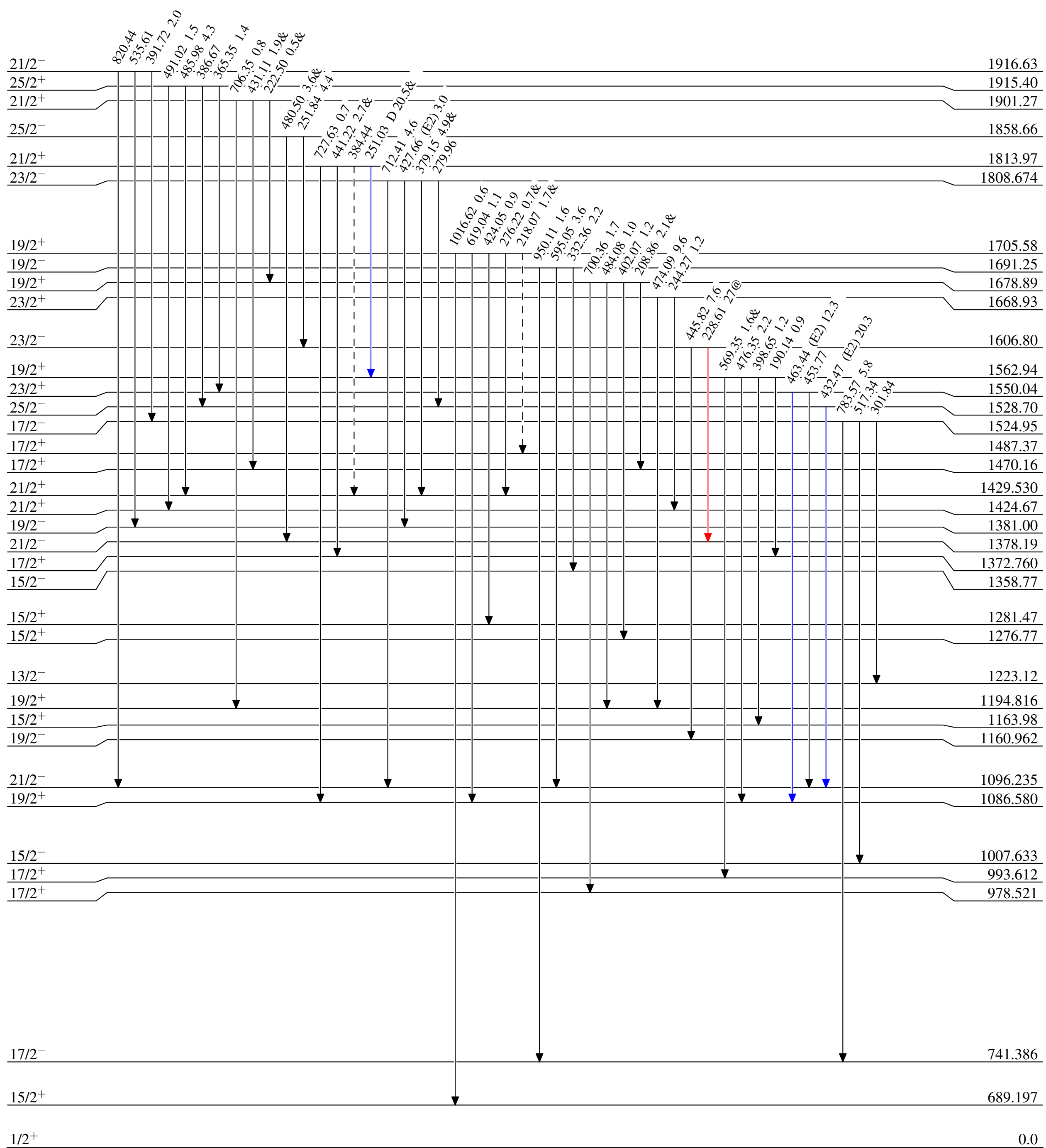
^{165}Ho(α,2nγ) 1980Ol05

Level Scheme (continued)

Intensities: Relative I_γ
& 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)



$^{167}_{69}Tm_{98}$

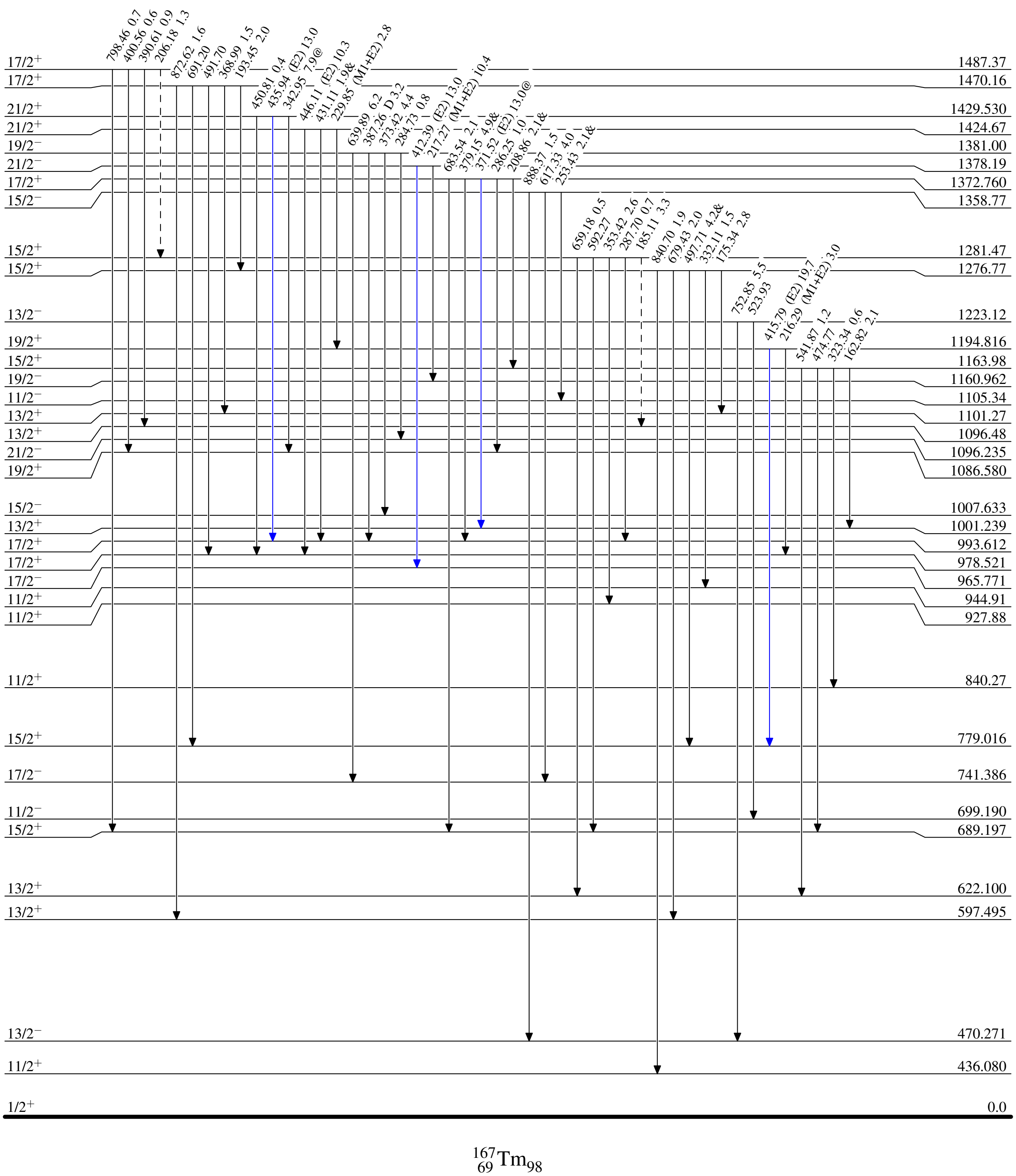
^{165}Ho(α,2nγ) 1980Ol05

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

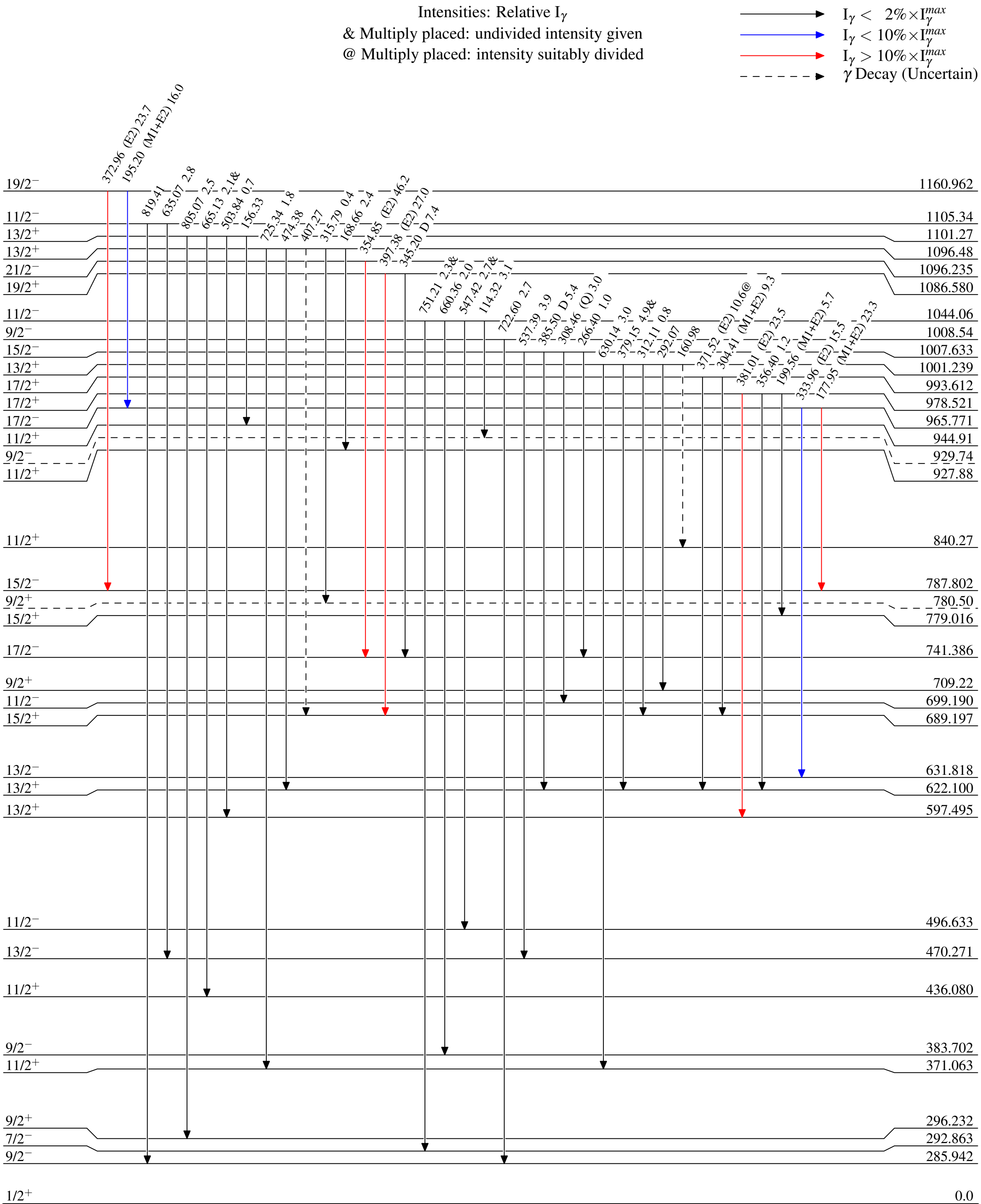
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



^{165}Ho(α,2nγ) 1980Ol05

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



$^{167}_{69}Tm_{98}$

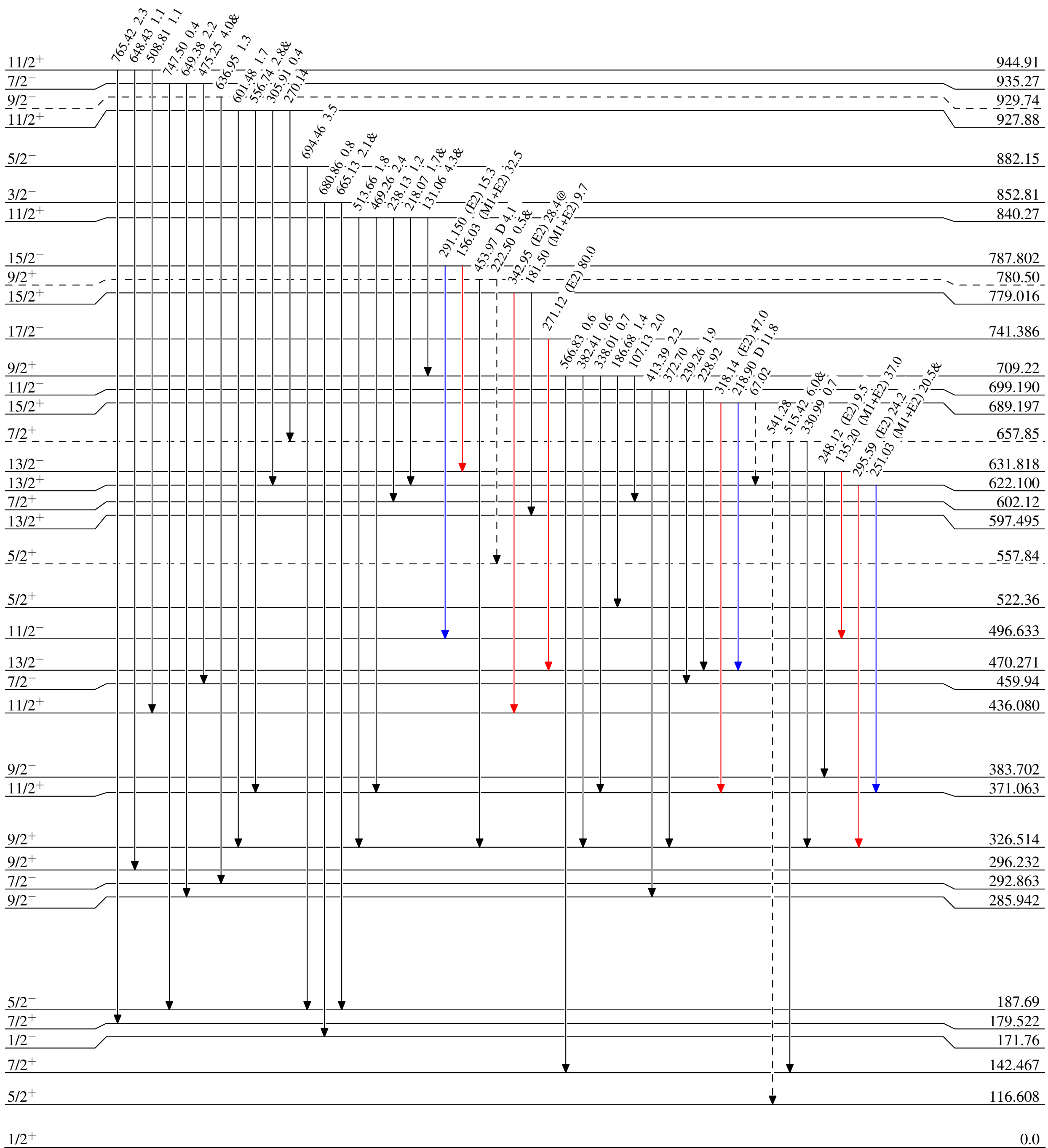
^{165}Ho(α,2nγ) 1980Ol05

Level Scheme (continued)

Intensities: Relative I_γ
& 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)



$^{167}_{69}Tm_{98}$

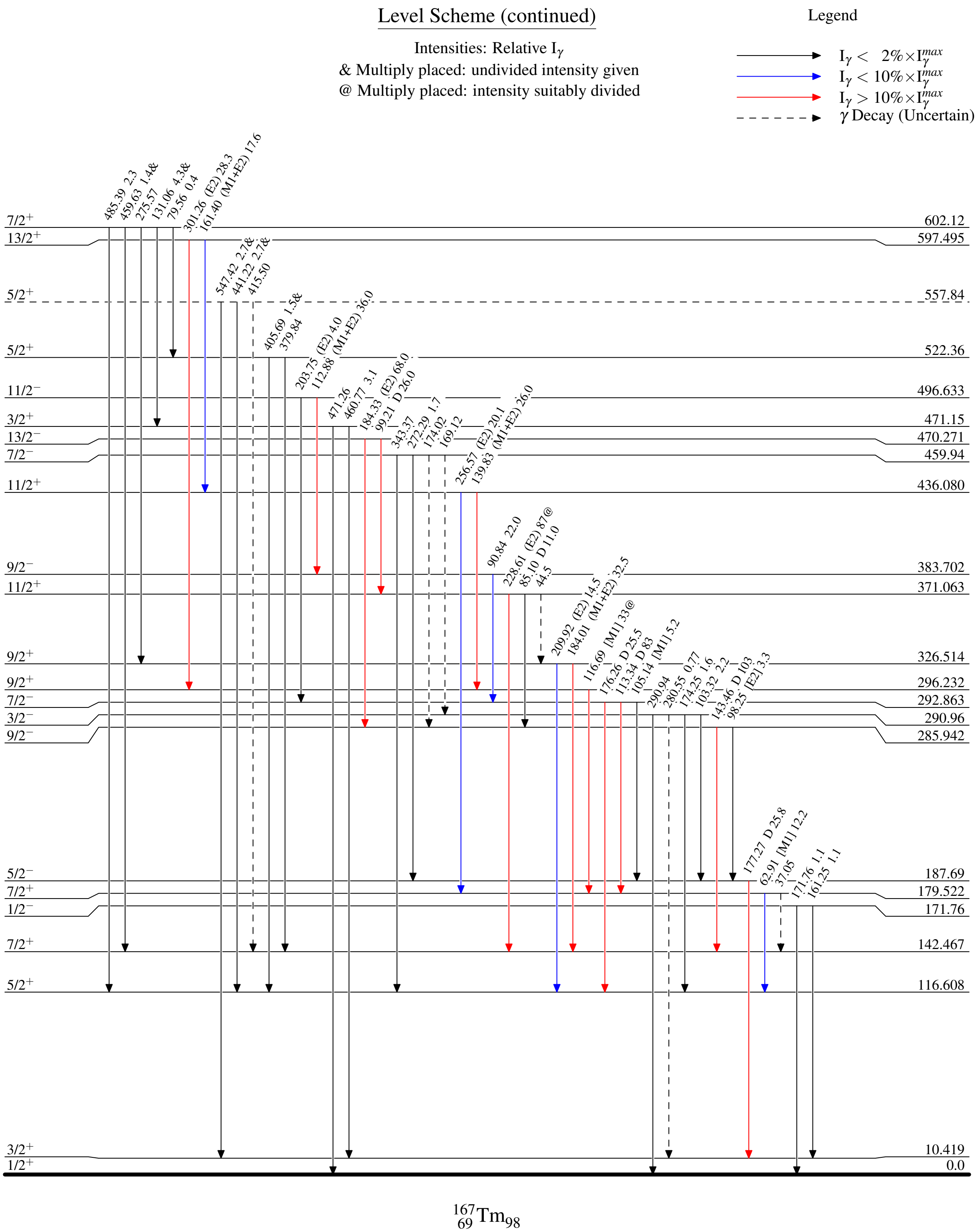
^{165}Ho(α,2nγ) 1980Ol05

Level Scheme (continued)

Intensities: Relative I_γ

& Multiply placed: undivided intensity given

@ Multiply placed: intensity suitably divided



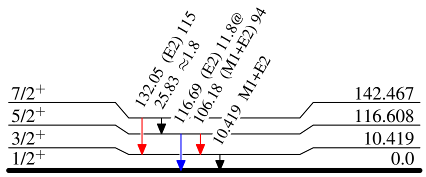
^{165}Ho(α,2nγ) 1980Ol05

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

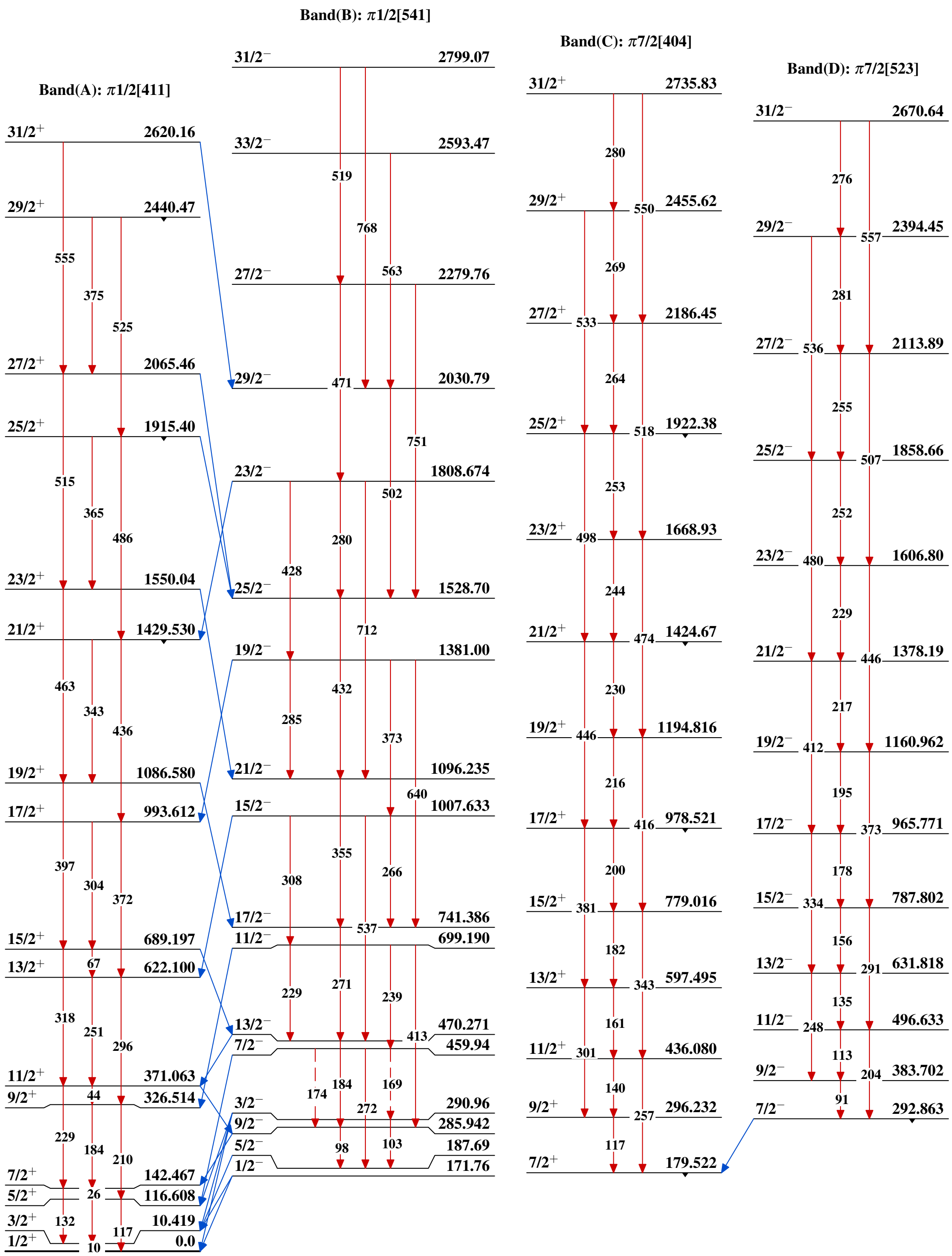
Legend

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



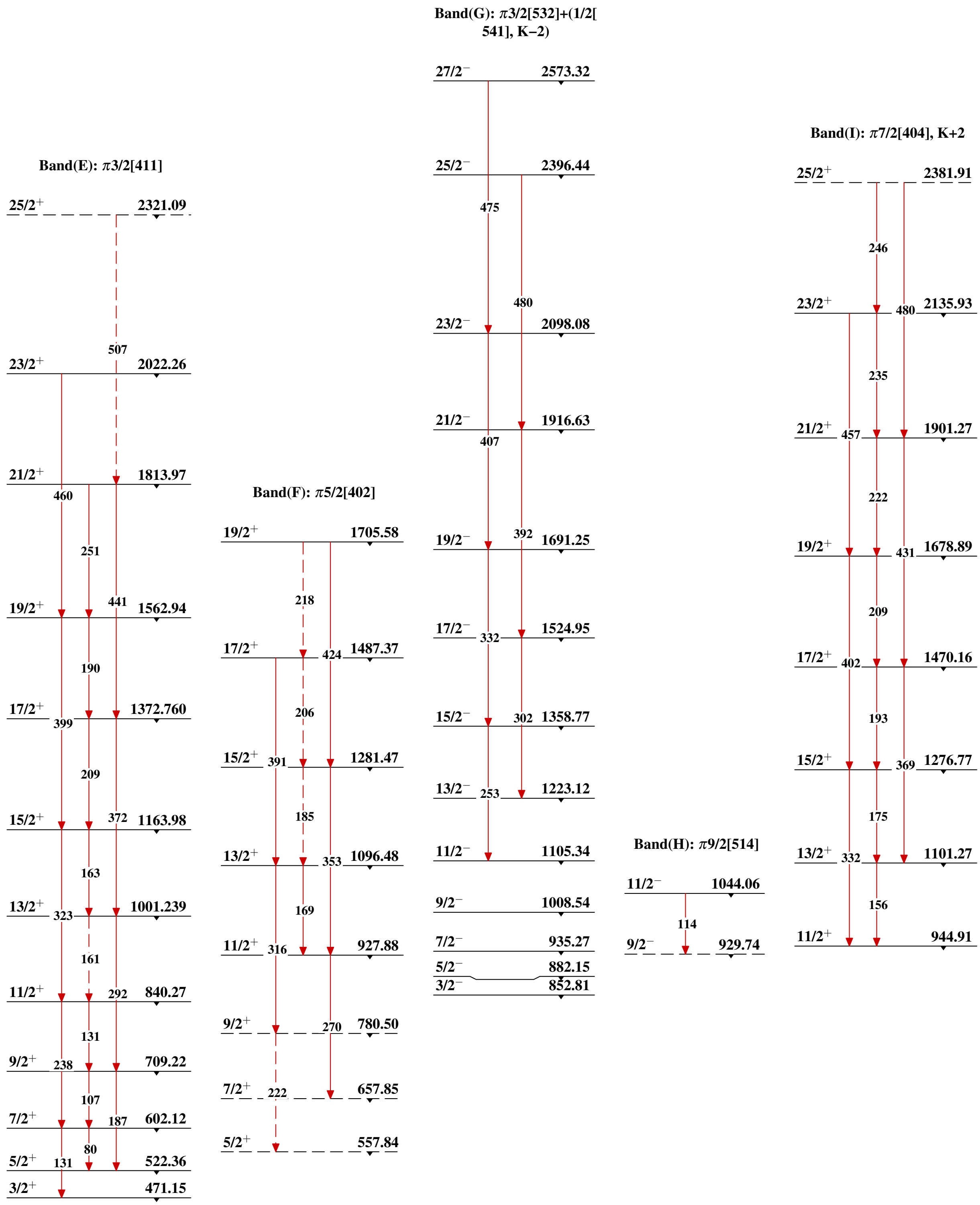
$^{167}_{69}Tm_{98}$

^{165}Ho(α,2nγ) 1980Ol05



$^{167}_{69}Tm_{98}$

^{165}Ho(α,2nγ) 1980Ol05 (continued)



$^{167}_{69}Tm_{98}$