^{230}Th(n,γ) E=th 1987Wh01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jagdish K. Tuli, and Edgardo Browne	NDS 185, 560 (2022)	31-Aug-2022

1987Wh01: measured secondary gammas from (n,γ) E=th using curved-crystal spectrometer GAMS1 and GAMS2/3 at ILL, Grenoble with FWHM=20 eV at 100 keV, and 210 eV at 500 keV. Eγ calibrated relative to Th Kα_1 x ray=93.3483 keV. Measured conversion electrons using BILL β-ray magnetic spectrometer at ILL, Grenoble, with a momentum resolution of 5×10^{-4}. Primary γ rays from (n,γ) E=th and E(n)=2 keV were measured using a three-crystal pair spectrometer (one Ge detector and two NaI(Tl) detectors) at Grenoble with FWHM=5.5 keV at Eγ=4.5 MeV.

See ^{230}Th(n,γ) E=th:Primary γ dataset for relative intensity data for primary γ rays.

^{231}Th Levels

E(level)[†]	J$^\pi$[b]	Comments
0.0[c]	5/2$^+$[#]	
41.952[c] 2	7/2$^+$[#]	
96.129[c] 3	9/2$^+$[#]	
185.715[d] 2	5/2$^-$[#]	
205.310[d] 2	(7/2$^-$)[#]	J$^\pi$: 7/2$^-$ in 1987Wh01.
221.398[e] 2	3/2$^+$[#]	
236.954[d] 31	9/2$^-$[#]	
240.881[e] 2	5/2$^+$[#]	
247.583[f] 2	1/2$^+$[#]	
272.180[f] 2	3/2$^+$[#]	
275.425[e] 2	7/2$^+$[#]	
301.744[f] 2	5/2$^+$[#]	
317.082[l] 2	5/2$^+$[@]	
324.913[e] 7	(9/2)$^+$	J$^\pi$: 9/2$^+$ in 1987Wh01.
348.7[‡]	1/2$^+$,3/2$^+$[a]	
351.511[f] 6	7/2$^+$	
377.577[l] 8	(7/2)$^+$	J$^\pi$: 7/2$^+$ in 1987Wh01.
380.0[‡] 3	1/2$^+$,3/2$^+$[a]	
387.827[j] 2	7/2$^-$[#]	
501.1[‡] 5		
510.897?[k] 10	(7/2)$^+$	J$^\pi$: 7/2$^+$ in 1987Wh01.
536.7[‡] 7		
554.651[g] 2	(1/2)$^-$[#]	J$^\pi$: 1/2$^-$ in 1987Wh01.
590.838[m] 2	3/2$^-$[#]	
593.617[g] 2	(3/2)$^-$[#]	J$^\pi$: 3/2$^-$ in 1987Wh01.
595.974[g] 2	5/2$^-$	
619.638[r] 4	3/2$^-$[&]	
623.937?[s] 18	5/2$^-$[&]	
629.342[m] 2	(5/2)$^-$	J$^\pi$: 5/2$^-$ in 1987Wh01.
634.044?[s] 13	(7/2$^-$)[&]	J$^\pi$: 7/2$^-$ in 1987Wh01.
655.981?[m] 25	7/2$^-$[#]	
684.490[h] 2	(5/2)$^-$[&]	J$^\pi$: 5/2$^-$ in 1987Wh01.
687.631[q] 3	1/2$^+$	
693.46[‡] 17		
709.099[q] 4	3/2$^+$	

Continued on next page (footnotes at end of table)

^{230}Th(n,γ) E=th 1987Wh01 (continued)

^{231}Th Levels (continued)

E(level)[†]	J$^\pi$[b]	Comments
713.753[o] 2	3/2$^-$[@]	
720.298[o] 5	(7/2)$^-$[@]	J$^\pi$: 7/2$^-$ in 1987Wh01.
735.263[q] 6	(5/2)$^+$	J$^\pi$: 5/2$^+$ in 1987Wh01.
793.026[n] 4	1/2$^+$	
808.507[n] 8	3/2$^+$	
820.544[p] 7	1/2$^+$[@]	
833.168[o] 4	(1/2)$^-$[@]	J$^\pi$: 1/2$^-$ in 1987Wh01.
839.304[p] 8	3/2$^+$[@]	
846.3[‡] 4	(1/2$^+$,3/2$^+$)	
867.03 4	5/2$^-$,7/2$^-$	
875.549[i] 4	(3/2)$^-$	J$^\pi$: 3/2$^-$ in 1987Wh01.
889.998[n] 12	5/2$^+$	J$^\pi$: 7/2$^+$ in 1987Wh01.
899.2[‡] 6		
914.904[i] 40	(5/2)$^-$	J$^\pi$: 5/2$^-$ in 1987Wh01.
936.305 10	(5/2)$^-$	J$^\pi$: 5/2$^-$ in 1987Wh01.
942.2[‡] 9		
960.807[t] 11	3/2$^+$	
1004.236 20	3/2$^+$	
1020.728 5	3/2$^-$	
1033.0[‡] 3	(1/2$^+$)[a]	
1056.30 3	(3/2$^+$)	J$^\pi$: 3/2$^+$ in 1987Wh01.
1066.19 2	(5/2,7/2)$^+$	J$^\pi$: (5/2)$^+$ in 1987Wh01.
1074.35 2	(3/2)$^-$	J$^\pi$: 3/2$^-$ in 1987Wh01.
1081.33 2	1/2$^-$,3/2$^-$	
1086.812 10	5/2$^+$	
1094.22[‡] 23	1/2$^-$,3/2$^-$[a]	
1102.25 1	3/2$^-$	
1133.81 8	(1/2$^+$,3/2$^+$)	J$^\pi$: (1/2$^+$,3/2$^+$,5/2$^+$) in 1987Wh01.
1155.5[‡] 4		
1159.750 7	(3/2)$^-$	J$^\pi$: 1/2$^-$,3/2$^-$ in 1987Wh01.
1173.00 2	3/2$^-$	
1193.2[‡] 8		
1200.38[‡] 17	1/2,3/2[a]	
1213.83[‡] 21		
1219.02[‡] 24	(1/2$^+$,3/2$^+$)[a]	
1251.43[‡] 17		
1274.5[‡] 4	1/2$^-$,3/2$^-$[a]	
(5118.13 20)	1/2$^+$	E(level): S(n)(^{231}Th)=5118.02 20 (2021Wa16).

[†] From least-squares fit to Eγ data.
[‡] No secondary γ rays are known from this level. Also, this level is reported only in (n,γ),E=th or E=2 keV:ARC.
[#] From well-established Nilsson configuration (1987Wh01).
[@] From probable Nilsson configuration (1987Wh01).
[&] From possible Nilsson configuration (1987Wh01).
[a] From 1987Wh01, based on γ-ray deexcitation and γ-ray intensities in average resonance capture.
[b] From Adopted Levels, unless otherwise specified.
[c] Band(A): ν5/2[633]. Well-established configuration (1987Wh01).

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^{230}Th(n,γ) E=th 1987Wh01 (continued)

^{231}Th Levels (continued)

[d] Band(B): ν5/2[752]. Well-established configuration (1987Wh01).
[e] Band(C): ν3/2[631]. Well-established configuration (1987Wh01).
[f] Band(D): ν1/2[631]. Well-established configuration (1987Wh01).
[g] Band(E): ν1/2[501]. Well-established configuration for $1/2^-$ and $3/2^-$, probable for $5/2^-$ member (1987Wh01).
[h] Band(F): ν5/2[503]. Speculative configuration (1987Wh01).
[i] Band(G): ν3/2[501]. Plausible configuration (1987Wh01).
[j] Band(H): ν7/2[743]. Well-established configuration (1987Wh01).
[k] Band(I): ν7/2[624]. Plausible configuration (1987Wh01).
[l] Band(J): ν5/2[622]. Probable configuration (1987Wh01).
[m] Band(K): ν3/2[761]. Well-established configuration for $3/2^-$, probable for $5/2^-$ member (1987Wh01).
[n] Band(L): ν1/2[640] + ν1/2[631]$\otimes 0^+$. Plausible configuration (1987Wh01); 5/2[631] listed for 793 level in Table IV seems a misprint.
[o] Band(M): ν1/2[770]. Plausible configuration (1987Wh01).
[p] Band(N): ν1/2[631]$\otimes 0^+$. Probable configuration (1987Wh01).
[q] Band(n): ν1/2[631]$\otimes 0^+$ + ν5/2[633]$\otimes 2^+$. Probable configuration for $1/2^+$ and $3/2^+$, plausible for $5/2^+$ (1987Wh01).
[r] Band(O): ν3/2[631]$\otimes 0^-$. Speculative configuration (1987Wh01).
[s] Band(P): ν5/2[752]$\otimes 0^+$. Speculative configuration (1987Wh01).
[t] Band(Q): ν3/2[631]$\otimes 0^+$ Plausible configuration (1987Wh01).

γ(^{231}Th)

Iγ normalization: 1987Wh01 give Iγ for the secondary γ rays as per 100 n captures, based on the absolute intensities of γ rays in ^{231}Th β^- decay, with 15% systematic calibration error added in quadrature by the authors to the statistical uncertainties. The Iγ for the primary γ rays in thermal neutron capture are given by 1987Wh01 as relative intensities, listed in a separate dataset: ^{230}Th(n,γ) E=th:Primary γ.
All data are from 1987Wh01, unless otherwise stated.

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
[x]47.356 *6*	0.15 *4*								
[x]47.807 *7*	0.17 *5*								
[x]53.674 *7*	0.15 *4*								
[x]55.417 *6*	0.14 *4*								
[x]57.984 *4*	0.26 *7*								
[x]59.323 *4*	0.39 *10*								
[x]66.26 *3*	0.063 *21*								
[x]67.263 *6*	0.082 *13*								
76.198 *4*	0.128 *19*	317.082	5/2$^+$	240.881	5/2$^+$				
80.347 *2*	0.20 *3*	301.744	5/2$^+$	221.398	3/2$^+$				
[x]89.443 *1*	1.29 *24*								
[x]95.713 *8*	0.21 *3*								
[x]106.183 *7*	0.25 *4*								
[x]107.591 *4*	0.116 *21*								
[x]112.393 *12*	0.080 *12*								
143.764 *2*	3.2 *5*	185.715	5/2$^-$	41.952	7/2$^+$	(E1)[‡]		0.207 *3*	Mult.: E1 in 1987Wh01.
[x]145.961 *25*	0.066 *13*								
[x]147.599 *3*	0.032 *6*								
[x]148.693 *12*	0.083 *13*					(M1)		6.01 *9*	α(L1)exp=1.8 *3* α(K)=4.80 *7*; α(L)=0.915 *13*; α(M)=0.220 *3* α(N)=0.0587 *9*; α(O)=0.01390 *20*; α(P)=0.00270 *4*; α(Q)=0.000256 *4* Mult.: M1 in 1987Wh01, but α(L1)(theory)=0.813.
[x]160.604 *13*	0.028 *5*								
163.358 *2*	0.41 *6*	205.310	(7/2$^-$)	41.952	7/2$^+$	(E1)[‡]		0.1525 *22*	Mult.: E1,E2 in 1987Wh01.
179.297 *2*	0.27 *4*	275.425	7/2$^+$	96.129	9/2$^+$	M1(+E2)	0.25 *25*	3.4 *4*	α(L1)exp=0.48 *7*; α(L2)exp=0.17 *3*; α(M1)exp=0.127 *19* α(K)=2.7 *4*; α(L)=0.540 *11*; α(M)=0.131 *5* α(N)=0.0350 *13*; α(O)=0.00825 *24*; α(P)=0.001585 *23*; α(Q)=0.000142 *19* I_γ: γ not seen in α decay.
182.500 *8*	0.078 *16*	387.827	7/2$^-$	205.310	(7/2$^-$)				
185.712 *1*	18.0 *27*	185.715	5/2$^-$	0.0	5/2$^+$	E1		0.1124 *16*	α(K)exp=0.066 *12*; α(L1)exp=0.011 *2*; α(L2)exp=0.005 *1*; α(L3)exp=0.002 *1*; α(M1)exp=0.001 *1*
198.928 *2*	1.8 *3*	240.881	5/2$^+$	41.952	7/2$^+$	(M1)		2.64 *4*	α(K)exp=2.7 *4*; α(L1)exp=0.36 *5*; α(L2)exp=0.036 *5*;

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γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(M1)exp=0.083 *13* α(K)=2.11 *3*; α(L)=0.400 *6*; α(M)=0.0962 *14* α(N)=0.0257 *4*; α(O)=0.00608 *9*; α(P)=0.001180 *17*; α(Q)=0.0001119 *16* Mult.: M1 in 1987Wh01.
[x]200.292 *19*	0.046 *9*								
202.111 *3*	0.21 *3*	387.827	7/2$^-$	185.715	5/2$^-$	M1		2.53 *4*	α(K)exp=2.2 *3*; α(L1)exp=0.33 *5* α(K)=2.02 *3*; α(L)=0.383 *6*; α(M)=0.0920 *13* α(N)=0.0245 *4*; α(O)=0.00581 *9*; α(P)=0.001128 *16*; α(Q)=0.0001070 *15*
[x]203.566 *9*	0.066 *13*								
205.309 *2*	0.35 *5*	205.310	(7/2$^-$)	0.0	5/2$^+$	(E1)[‡]		0.0887 *13*	Mult.: E1,E2 in 1987Wh01.
[x]211.608 *3*	0.136 *21*					M1		2.22 *3*	α(K)exp=1.8 *3*; α(L1)exp=0.39 *6* α(K)=1.777 *25*; α(L)=0.336 *5*; α(M)=0.0809 *12* α(N)=0.0216 *3*; α(O)=0.00511 *8*; α(P)=0.000991 *14*; α(Q)=9.40×10^{-5} *14*
[x]215.638 *6*	0.085 *13*					M1		2.11 *3*	α(K)exp=1.64 *25* α(K)=1.686 *24*; α(L)=0.319 *5*; α(M)=0.0767 *11* α(N)=0.0204 *3*; α(O)=0.00484 *7*; α(P)=0.000940 *14*; α(Q)=8.92×10^{-5} *13*
221.399 *1*	9.6 *15*	221.398	3/2$^+$	0.0	5/2$^+$	(M1)[‡]		1.96 *3*	Mult.: M1 in 1987Wh01.
228.785 *6*	0.086 *13*	324.913	(9/2)$^+$	96.129	9/2$^+$	M1		1.79 *3*	α(K)exp=1.45 *22* α(K)=1.429 *20*; α(L)=0.270 *4*; α(M)=0.0649 *9* α(N)=0.01731 *25*; α(O)=0.00410 *6*; α(P)=0.000796 *12*; α(Q)=7.55×10^{-5} *11*
230.243 *11*	0.034 *7*	272.180	3/2$^+$	41.952	7/2$^+$				
233.469 *3*	0.68 *10*	275.425	7/2$^+$	41.952	7/2$^+$	M1		1.688 *24*	α(K)exp=1.32 *20*; α(L1)exp=0.18 *3*; α(M1)exp=0.051 *8*; α(N1)exp=0.031 *5* α(K)=1.350 *19*; α(L)=0.255 *4*; α(M)=0.0613 *9* α(N)=0.01636 *23*; α(O)=0.00387 *6*; α(P)=0.000752 *11*; α(Q)=7.13×10^{-5} *10*
239.548 *4*	0.40 *6*	833.168	(1/2)$^-$	593.617	(3/2)$^-$	M1		1.571 *22*	α(K)exp=1.53 *23*; α(L1)exp=0.28 *4*; α(M1)exp=0.101 *15*; α(N1)exp=0.057 α(K)=1.257 *18*; α(L)=0.237 *4*; α(M)=0.0571 *8* α(N)=0.01522 *22*; α(O)=0.00360 *5*; α(P)=0.000699 *10*; α(Q)=6.63×10^{-5} *10*
240.875 *3*	2.6 *4*	240.881	5/2$^+$	0.0	5/2$^+$	M1(+E2)	0.3 *3*	1.45 *22*	α(K)exp=1.24 *19*; α(L1)exp=0.21 *3*; α(L2)exp=0.041 *6*; α(M1)exp=0.058 *9*; α(N1)exp=0.011 *2*
244.451 *10*	0.048 *10*	595.974	5/2$^-$	351.511	7/2$^+$	(E1)[‡]		0.0591 *8*	Mult.: E1,E2 in 1987Wh01.
247.586 *3*	0.140 *21*	247.583	1/2$^+$	0.0	5/2$^+$	E2		0.312 *5*	α(L2)exp=0.30 *5*; α(L3)exp=0.071 *11* α(K)=0.1063 *15*; α(L)=0.1507 *22*; α(M)=0.0408 *6* α(N)=0.01093 *16*; α(O)=0.00246 *4*; α(P)=0.000419 *6*; α(Q)=7.17×10^{-6} *10*
[x]248.586 *9*	0.047 *9*					M1		1.417 *20*	α(K)exp=1.4 *3*

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^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(K)=1.134 *16*; α(L)=0.214 *3*; α(M)=0.0514 *8* α(N)=0.01372 *20*; α(O)=0.00325 *5*; α(P)=0.000630 *9*; α(Q)=5.98×10^{-5} *9*
255.365 *11*	0.031 *6*	351.511	7/2$^+$	96.129	9/2$^+$	M1		1.315 *19*	α(K)exp=1.21 *25*; α(L1)exp=0.24 *5* α(K)=1.052 *15*; α(L)=0.199 *3*; α(M)=0.0477 *7* α(N)=0.01273 *18*; α(O)=0.00301 *5*; α(P)=0.000585 *9*; α(Q)=5.55×10^{-5} *8*
255.903 *10*	0.031 *6*	875.549	(3/2)$^-$	619.638	3/2$^-$				
259.790 *4*	0.140 *21*	301.744	5/2$^+$	41.952	7/2$^+$	M1+E2	0.65 *10*	0.96 *7*	α(K)exp=0.71 *11*; α(L1)exp=0.19 *3* α(K)=0.73 *6*; α(L)=0.170 *5*; α(M)=0.0419 *10* α(N)=0.0112 *3*; α(O)=0.00262 *7*; α(P)=0.000494 *16*; α(Q)=3.9×10^{-5} *3*
272.181 *2*	0.62 *9*	272.180	3/2$^+$	0.0	5/2$^+$	M1+E2	0.64 *10*	0.85 *6*	α(K)exp=0.60 *9*; α(L1)exp=0.120 *18*; α(L2)exp=0.013 *2*; α(M1)exp=0.038 *6* α(K)=0.65 *6*; α(L)=0.148 *5*; α(M)=0.0364 *10* α(N)=0.00972 *25*; α(O)=0.00228 *7*; α(P)=0.000431 *15*; α(Q)=3.5×10^{-5} *3*
275.129 *2*	0.65 *10*	317.082	5/2$^+$	41.952	7/2$^+$	M1+E2	0.6 *1*	0.84 *6*	α(K)exp=0.60 *9*; α(L1)exp=0.159 *24*; α(M1)exp=0.028 *4* E_γ: other: 275.132 in Table II of 1987Wh01.
275.428 *4*	0.17 *3*	275.425	7/2$^+$	0.0	5/2$^+$	M1(+E2)	0.25 *25*	1.02 *12*	α(K)exp=0.73 *11*; α(L1)exp=1.23 *19* α(K)=0.81 *11*; α(L)=0.157 *9*; α(M)=0.0379 *18* α(N)=0.0101 *5*; α(O)=0.00239 *13*; α(P)=0.00046 *3*; α(Q)=4.3×10^{-5} *6* δ: based on α(K)exp, α(L1)exp=1.23 is probably a typographical error.
278.524 *14*	0.028 *6*	833.168	(1/2)$^-$	554.651	(1/2)$^-$				
281.441 *9*	0.088 *14*	377.577	(7/2)$^+$	96.129	9/2$^+$	M1		1.005 *14*	α(K)exp=0.74 *12* α(K)=0.804 *12*; α(L)=0.1515 *22*; α(M)=0.0364 *5* α(N)=0.00970 *14*; α(O)=0.00230 *4*; α(P)=0.000446 *7*; α(Q)=4.23×10^{-5} *6*
282.471 *2*	2.2 *3*	554.651	(1/2)$^-$	272.180	3/2$^+$	E1		0.0425 *6*	α(K)exp=0.034 *5*; α(L1)exp=0.011 *2* α(K)=0.0340 *5*; α(L)=0.00644 *9*; α(M)=0.001545 *22* α(N)=0.000409 *6*; α(O)=9.50×10^{-5} *14*; α(P)=1.768×10^{-5} *25*; α(Q)=1.341×10^{-6} *19*
284.659 *13*	0.028 *6*	839.304	3/2$^+$	554.651	(1/2)$^-$				
289.092 *10*	0.030 *6*	590.838	3/2$^-$	301.744	5/2$^+$				
[x]295.037 *15*	0.031 *6*								
301.741 *3*	0.39 *6*	301.744	5/2$^+$	0.0	5/2$^+$	M1		0.829 *12*	α(K)exp=0.71 *11*; α(L1)exp=0.17 *3*; α(L2)exp=0.070 *11*; α(M1)exp=0.077 *12* α(K)=0.664 *10*; α(L)=0.1249 *18*; α(M)=0.0300 *5* α(N)=0.00800 *12*; α(O)=0.00189 *3*; α(P)=0.000367 *6*; α(Q)=3.49×10^{-5} *5*
302.540 *7*	0.053 *11*	619.638	3/2$^-$	317.082	5/2$^+$	(E1)[‡]		0.0365 *5*	Mult.: E1,E2 in 1987Wh01.

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γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
307.063 *2*	1.63 *25*	554.651	(1/2)$^-$	247.583	1/2$^+$	(E1)		0.0353 *5*	α(K)exp=0.045 *7* α(K)=0.0283 *4*; α(L)=0.00530 *8*; α(M)=0.001269 *18* α(N)=0.000336 *5*; α(O)=7.81×10^{-5} *11*; α(P)=1.459×10^{-5} *21*; α(Q)=1.126×10^{-6} *16* Mult.: E1 in 1987Wh01.
309.557 *12*	0.039 *8*	351.511	7/2$^+$	41.952	7/2$^+$	(E2)[‡]		0.1534 *22*	Mult.: E1,E2 in 1987Wh01.
[x]311.897 *7*	0.052 *11*								
317.062 *12*	0.030 *6*	317.082	5/2$^+$	0.0	5/2$^+$	M1		0.723 *10*	α(K)exp=0.71 *14* α(K)=0.579 *9*; α(L)=0.1089 *16*; α(M)=0.0261 *4* α(N)=0.00697 *10*; α(O)=0.001651 *24*; α(P)=0.000320 *5*; α(Q)=3.04×10^{-5} *5*
317.886 *22*	0.015 *3*	619.638	3/2$^-$	301.744	5/2$^+$				
[x]318.672 *4*	0.110 *17*					E2+M1		0.43 *29*	α(K)exp=0.23 *4* α(K)=0.32 *26*; α(L)=0.082 *26*; α(M)=0.0204 *55* α(N)=0.0054 *15*; α(O)=0.00127 *37*; α(P)=2.36×10^{-4} *80*; α(Q)=1.7×10^{-5} *13*
320.899 *4*	0.105 *16*	875.549	(3/2)$^-$	554.651	(1/2)$^-$	M1+E2	0.9 *2*	0.45 *7*	α(K)exp=0.34 *5* α(K)=0.34 *6*; α(L)=0.083 *7*; α(M)=0.0205 *13* α(N)=0.0055 *4*; α(O)=0.00128 *9*; α(P)=0.000240 *19*; α(Q)=1.8×10^{-5} *3* Mult.: M1(+E2) in 1987Wh01.
[x]321.435 *4*	0.099 *15*					(E1,E2)[‡]		0.09 *6*	
323.794 *2*	0.27 *4*	595.974	5/2$^-$	272.180	3/2$^+$	(E1)[‡]		0.0314 *5*	Mult.: E1,E2 in 1987Wh01.
325.925 *3*	0.17 *3*	713.753	3/2$^-$	387.827	7/2$^-$				
[x]332.479 *7*	0.047 *9*					(E1,E2)[‡]			
336.240 *10*	0.041 *8*	1020.728	3/2$^-$	684.490	(5/2)$^-$	M1+E2	0.63 *25*	0.47 *8*	α(K)exp=0.37 *7* α(K)=0.37 *7*; α(L)=0.079 *8*; α(M)=0.0194 *16* α(N)=0.0052 *5*; α(O)=0.00122 *11*; α(P)=0.000231 *23*; α(Q)=1.9×10^{-5} *4* Mult.: M1 in 1987Wh01.
[x]337.569 *9*	0.042 *9*					(M1)		0.609 *9*	α(K)exp=0.98 *20* α(K)=0.488 *7*; α(L)=0.0916 *13*; α(M)=0.0220 *3* α(N)=0.00586 *9*; α(O)=0.001389 *20*; α(P)=0.000269 *4*; α(Q)=2.56×10^{-5} *4* α(K)exp exceeds α(K)(theory) for M1, could be mixed with E0.
342.702 *17*	0.025 *5*	936.305	(5/2)$^-$	593.617	(3/2)$^-$	(M1)		0.584 *8*	α(K)exp=0.80 *16* α(K)=0.468 *7*; α(L)=0.0879 *13*; α(M)=0.0211 *3* α(N)=0.00562 *8*; α(O)=0.001332 *19*; α(P)=0.000258 *4*; α(Q)=2.45×10^{-5} *4* Mult.: M1 in 1987Wh01. α(K)exp exceeds α(K)(theory) for M1, could be mixed with E0.
[x]343.247 *3*	0.25 *4*					E2+M1	1.67 *22*	0.24 *3*	α(K)exp=0.164 *25*

$^{231}_{90}$Th$_{141}$-7

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(K)=0.164 *24*; α(L)=0.054 *3*; α(M)=0.0139 *6* α(N)=0.00370 *16*; α(O)=0.00085 *4*; α(P)=0.000156 *9*; α(Q)=8.9×10^{-6} *13*
[x]346.015 *4*	0.21 *3*					(E1,E2)[‡]		0.07 *5*	
351.512 *23*	0.025 *5*	351.511	7/2$^+$	0.0	5/2$^+$	(M1)		0.545 *8*	α(K)exp=0.96 *19* α(K)=0.437 *7*; α(L)=0.0819 *12*; α(M)=0.0197 *3* α(N)=0.00524 *8*; α(O)=0.001242 *18*; α(P)=0.000241 *4*; α(Q)=2.29×10^{-5} *4* Mult.: M1 in 1987Wh01. α(K)exp exceeds α(K)(theory) for M1, could be mixed with E0.
[x]354.721 *20*	0.025 *5*								
[x]360.982 *22*	0.037 *7*					(M1)[#]		0.507 *7*	
368.934 *2*	0.77 *12*	554.651	(1/2)$^-$	185.715	5/2$^-$	E2		0.0927 *13*	α(K)exp=0.050 *8*; α(L1)exp=0.020 *3*; α(L2)exp=0.030 *5* α(K)=0.0484 *7*; α(L)=0.0326 *5*; α(M)=0.00865 *13* α(N)=0.00232 *4*; α(O)=0.000526 *8*; α(P)=9.18×10^{-5} *13*; α(Q)=2.85×10^{-6} *4*
372.221 *2*	0.64 *10*	593.617	(3/2)$^-$	221.398	3/2$^+$	E1		0.0232 *3*	α(K)exp=0.020 *3* α(K)=0.0187 *3*; α(L)=0.00342 *5*; α(M)=0.000816 *12* α(N)=0.000216 *3*; α(O)=5.04×10^{-5} *7*; α(P)=9.48×10^{-6} *14*; α(Q)=7.59×10^{-7} *11*
[x]372.855 *11*	0.080 *13*					(E1,E2)[‡]		0.06 *4*	
374.590 *9*	0.063 *13*	595.974	5/2$^-$	221.398	3/2$^+$	(E1)[‡]		0.0229 *3*	Mult.: E1,E2 in 1987Wh01.
[x]381.934 *24*	0.045 *10*					M1		0.435 *6*	α(K)exp=0.30 *7* α(K)=0.348 *5*; α(L)=0.0653 *10*; α(M)=0.01566 *22* α(N)=0.00418 *6*; α(O)=0.000989 *14*; α(P)=0.000192 *3*; α(Q)=1.82×10^{-5} *3*
385.532 *3*	0.25 *4*	590.838	3/2$^-$	205.310	(7/2$^-$)	(E2)[‡]		0.0822 *12*	Mult.: E1,E2 in 1987Wh01.
388.482 *9*	0.083 *13*	1102.25	3/2$^-$	713.753	3/2$^-$				
390.662 *4*	0.17 *3*	595.974	5/2$^-$	205.310	(7/2$^-$)	M1+E2	1.2 *3*	0.21 *5*	α(K)exp=0.157 *24*; α(L1)exp=0.062 *6* α(K)=0.160 *41*; α(L)=0.041 *5*; α(M)=0.0102 *11* α(N)=0.0027 *3*; α(O)=0.00063 *8*; α(P)=0.000118 *16*; α(Q)=8.5×10^{-6} *21*
[x]391.619 *13*	0.048 *10*					(M1)		0.406 *6*	α(K)exp=0.52 *10* α(K)=0.326 *5*; α(L)=0.0609 *9*; α(M)=0.01462 *21* α(N)=0.00390 *6*; α(O)=0.000923 *13*; α(P)=0.000179 *3*; α(Q)=1.700×10^{-5} *24* Mult.: M1 in 1987Wh01. α(K)exp exceeds α(K)(theory) for M1, could be mixed with E0.
392.038 *13*	0.048 *10*	709.099	3/2$^+$	317.082	5/2$^+$				
398.242 *10*	0.073 *15*	619.638	3/2$^-$	221.398	3/2$^+$	(E1)[‡]		0.0201 *3*	Mult.: E1,E2 in 1987Wh01.
405.121 *3*	1.00 *15*	590.838	3/2$^-$	185.715	5/2$^-$	E2+M1	1.4 *2*	0.173 *22*	α(K)exp=0.139 *5*; α(L1)exp=0.025 *2*; α(L2)exp=0.011 *1*; α(L3)exp=0.002 *1*

$^{231}_{90}$Th$_{141}$-8

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(K)=0.127 *19*; α(L)=0.0343 *24*; α(M)=0.0086 *6* α(N)=0.00230 *14*; α(O)=0.00053 *4*; α(P)=9.9×10^{-5} *8*; α(Q)=6.8×10^{-6} *10*
407.899 *2*	1.56 *24*	593.617	(3/2)$^-$	185.715	5/2$^-$	E2		0.0708 *10*	α(K)exp=0.038 *2*; α(L1)exp=0.007 *1*; α(L2)exp=0.007 *1* α(K)=0.0398 *6*; α(L)=0.0229 *4*; α(M)=0.00603 *9* α(N)=0.001614 *23*; α(O)=0.000367 *6*; α(P)=6.46×10^{-5} *9*; α(Q)=2.29×10^{-6} *4*
410.252 *10*	0.079 *16*	595.974	5/2$^-$	185.715	5/2$^-$	(M1)		0.358 *5*	α(K)exp=0.321 *23* α(K)=0.287 *4*; α(L)=0.0537 *8*; α(M)=0.01288 *18* α(N)=0.00343 *5*; α(O)=0.000813 *12*; α(P)=0.0001577 *22*; α(Q)=1.497×10^{-5} *21* Mult.: M1 in 1987Wh01.
415.460 *8*	0.081 *13*	687.631	1/2$^+$	272.180	3/2$^+$	(M1)		0.346 *5*	α(K)exp=0.310 *20*; α(L1)exp=0.087 *9* α(K)=0.277 *4*; α(L)=0.0518 *8*; α(M)=0.01244 *18* α(N)=0.00332 *5*; α(O)=0.000785 *11*; α(P)=0.0001524 *22*; α(Q)=1.446×10^{-5} *21* Mult.: M1 in 1987Wh01.
[x]417.201 *7*	0.112 *18*					E2+M1	3.7 *8*	0.086 *11*	α(K)exp=0.054 *9* α(K)=0.054 *9*; α(L)=0.0232 *12*; α(M)=0.0060 *3* α(N)=0.00161 *8*; α(O)=0.000369 *8*; α(P)=6.6×10^{-5} *4*; α(Q)=3.0×10^{-6} *5* Mult.: E2 in 1987Wh01, α(K)(exp) gives δ(E2/M1)=3.7 *8*.
417.793 *14*	0.054 *12*	1102.25	3/2$^-$	684.490	(5/2)$^-$	M1		0.341 *5*	α(K)exp=0.29 *3* α(K)=0.273 *4*; α(L)=0.0511 *8*; α(M)=0.01225 *18* α(N)=0.00327 *5*; α(O)=0.000773 *11*; α(P)=0.0001501 *21*; α(Q)=1.424×10^{-5} *20*
418.62[d] *4*	0.012[d] *2*	623.937?	5/2$^-$	205.310	(7/2$^-$)				
418.62[d] *4*	0.012[d] *2*	720.298	(7/2)$^-$	301.744	5/2$^+$				
419.031[e] *16*	0.052 *11*	655.981?	7/2$^-$	236.954	9/2$^-$	(M1)		0.338 *5*	α(K)exp=0.30 *3* α(K)=0.271 *4*; α(L)=0.0507 *7*; α(M)=0.01215 *17* α(N)=0.00324 *5*; α(O)=0.000767 *11*; α(P)=0.0001489 *21*; α(Q)=1.413×10^{-5} *20* Mult.: M1 in 1987Wh01.
424.032 *4*	0.36 *6*	629.342	(5/2)$^-$	205.310	(7/2$^-$)	M1+E2	0.9 *1*	0.209 *16*	α(K)exp=0.175 *10*; α(L1)exp=0.080 *12* α(K)=0.162 *14*; α(L)=0.0361 *18*; α(M)=0.0089 *4* α(N)=0.00236 *11*; α(O)=0.00055 *3*; α(P)=0.000105 *6*; α(Q)=8.5×10^{-6} *7*
[x]424.43 *3*	0.043 *9*					M1		0.326 *5*	α(K)exp=0.31 *5* α(K)=0.262 *4*; α(L)=0.0489 *7*; α(M)=0.01174 *17* α(N)=0.00313 *5*; α(O)=0.000741 *11*; α(P)=0.0001438 *21*; α(Q)=1.365×10^{-5} *20*
427.110 *7*	0.105 *16*	1020.728	3/2$^-$	593.617	(3/2)$^-$	M1		0.321 *5*	α(K)exp=0.28 *4*; α(L1)exp=0.026 *6*

$^{231}_{90}$Th$_{141}$-9

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(K)=0.257 *4*; α(L)=0.0481 *7*; α(M)=0.01154 *17* α(N)=0.00308 *5*; α(O)=0.000728 *11*; α(P)=0.0001413 *20*; α(Q)=1.341×10^{-5} *19*
428.71 *4*	0.023 *5*	634.044?	(7/2$^-$)	205.310	(7/2$^-$)	M1+E0(+E2)			α(K)exp=0.66 *4*; α(L1)exp=0.19 *3* Mult.: M1+E0 in 1987Wh01.
433.517 *8*	0.135 *22*	735.263	(5/2)$^+$	301.744	5/2$^+$	(E2)[‡]		0.0605 *9*	Mult.: E1,E2 in 1987Wh01.
433.927 *4*	0.19 *3*	619.638	3/2$^-$	185.715	5/2$^-$	(M1)		0.308 *4*	α(K)exp=0.219 *13*; α(L1)exp=0.029 *5* α(K)=0.247 *4*; α(L)=0.0461 *7*; α(M)=0.01105 *16* α(N)=0.00295 *5*; α(O)=0.000697 *10*; α(P)=0.0001353 *19*; α(Q)=1.285×10^{-5} *18* Mult.: M1 in 1987Wh01.
436.917 *4*	0.28 *4*	709.099	3/2$^+$	272.180	3/2$^+$	M1+E0(+E2)			α(K)exp=0.340 *17*; α(L1)exp=0.056 *3*; α(M1)exp=0.017 *1* Mult.: M1(+E0) in 1987Wh01.
438.22 *2*	<0.025	623.937?	5/2$^-$	185.715	5/2$^-$	E0(+M1)			α(K)exp>1.5; α(L1)exp>0.4; α(L2)exp>0.1 Mult.: M1+E0 in 1987Wh01.
[x]439.427 *11*	0.073 *15*					M1+E2	1.30 *25*	0.147 *25*	α(K)exp=0.110 *18*; α(L1)exp=0.04 *3* α(K)=0.110 *22*; α(L)=0.028 *3*; α(M)=0.0069 *7* α(N)=0.00184 *17*; α(O)=0.00043 *4*; α(P)=8.0×10^{-5} *9*; α(Q)=5.8×10^{-6} *11*
440.044 *7*	0.121 *19*	687.631	1/2$^+$	247.583	1/2$^+$	E0+M1			α(K)exp=0.379 *18*; α(L1)exp=0.061 *8*; α(M1)exp=0.032 *4*
441.64 *4*	0.035 *7*	713.753	3/2$^-$	272.180	3/2$^+$				
443.626 *2*	0.94 *14*	629.342	(5/2)$^-$	185.715	5/2$^-$	M1(+E2)	0.4 *4*	0.26 *6*	α(K)exp=0.20 *3*; α(L1)exp=0.034 *5*; α(L2)exp=0.009 *11*; α(M1)exp=0.006 *1* α(K)=0.20 *5*; α(L)=0.040 *7*; α(M)=0.0096 *15* α(N)=0.0026 *4*; α(O)=0.00060 *10*; α(P)=0.000117 *20*; α(Q)=1.1×10^{-5} *3*
444.892 *14*	0.076 *16*	720.298	(7/2)$^-$	275.425	7/2$^+$	(E1)[‡]		0.01599 *23*	Mult.: E1,E2 in 1987Wh01.
445.996 *7*	0.137 *21*	1159.750	(3/2)$^-$	713.753	3/2$^-$	E2+M1	1.17 *20*	0.150 *21*	α(K)exp=0.116 *18* α(K)=0.114 *18*; α(L)=0.0275 *24*; α(M)=0.0068 *6* α(N)=0.00182 *15*; α(O)=0.00042 *4*; α(P)=8.0×10^{-5} *7*; α(Q)=6.0×10^{-6} *9* Mult.: E2(+M1) in 1987Wh01.
448.339 *18*	0.02 *1*	634.044?	(7/2$^-$)	185.715	5/2$^-$				
[x]450.680 *4*	0.30 *5*					M1+E2	0.32 *9*	0.257 *12*	α(K)exp=0.205 *10*; α(L1)exp=0.025 *2* α(K)=0.205 *11*; α(L)=0.0392 *14*; α(M)=0.0094 *4* α(N)=0.00252 *9*; α(O)=0.000595 *21*; α(P)=0.000115 *5*; α(Q)=1.07×10^{-5} *6*
[x]453.50 *6*	0.07 *2*					M1+E0(+E2)			α(K)exp=0.23 *6*; α(L1)exp=0.16 *4*; α(L2)exp=0.070 *20*; α(L3)exp=0.019 *7*; α(M1)exp=0.13 *4* Mult.: M1+E0 in 1987Wh01.
[x]454.19 *7*	0.046 *11*					M1+E2		0.16 *11*	α(K)exp=0.10 *3*

$^{231}_{90}Th_{141}$-10

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(K)=0.125 *93*; α(L)=0.028 *13*; α(M)=0.0070 *28* α(N)=0.00186 *75*; α(O)=4.4×10^{-4} *18*; α(P)=8.2×10^{-5} *38*; α(Q)=6.6×10^{-6} *48*
456.990[e] *11*	0.110 *19*	808.507	3/2$^+$	351.511	7/2$^+$	(E2)		0.0531 *8*	α(K)exp=0.051 *6*; α(L1)exp=0.013 *4* α(K)=0.0320 *5*; α(L)=0.01561 *22*; α(M)=0.00408 *6* α(N)=0.001091 *16*; α(O)=0.000249 *4*; α(P)=4.42×10^{-5} *7*; α(Q)=1.79×10^{-6} *3*
459.22 *8*	0.046 *13*	1173.00	3/2$^-$	713.753	3/2$^-$	M1(+E2)	<0.8	0.264 *4*	Mult.: E2(+M1) in 1987Wh01. Level scheme requires E2. α(K)exp=0.19 *5* α(K)=0.212 *3*; α(L)=0.0395 *6*; α(M)=0.00947 *14* α(N)=0.00252 *4*; α(O)=0.000598 *9*; α(P)=0.0001160 *17*; α(Q)=1.101×10^{-5} *16* δ(E2/M1)<0.8 from α(K)exp.
[x]460.753 *3*	0.54 *8*					M1		0.262 *4*	Mult.: M1 in 1987Wh01. α(K)exp=0.23 *4*; α(L1)exp=0.031 *3*; α(L2)exp=0.009 *1*; α(M1)exp=0.011 *1* α(K)=0.210 *3*; α(L)=0.0391 *6*; α(M)=0.00938 *14* α(N)=0.00250 *4*; α(O)=0.000592 *9*; α(P)=0.0001150 *16*; α(Q)=1.091×10^{-5} *16*
[x]461.571 *7*	0.17 *3*					M1		0.260 *4*	α(K)exp=0.209 *12*; α(L1)exp=0.031 *3*; α(L2)exp=0.018 *7* α(K)=0.209 *3*; α(L)=0.0389 *6*; α(M)=0.00934 *13* α(N)=0.00249 *4*; α(O)=0.000590 *9*; α(P)=0.0001144 *16*; α(Q)=1.086×10^{-5} *16*
463.085 *12*	0.101 *22*	735.263	(5/2)$^+$	272.180	3/2$^+$	M1+E2	1.2 *2*	0.136 *19*	α(K)exp=0.102 *16* α(K)=0.103 *16*; α(L)=0.0246 *22*; α(M)=0.0061 *5* α(N)=0.00163 *13*; α(O)=0.00038 *4*; α(P)=7.1×10^{-5} *7*; α(Q)=5.4×10^{-6} *9*
466.227 *3*	0.54 *8*	687.631	1/2$^+$	221.398	3/2$^+$	M1		0.253 *4*	α(K)exp=0.18 *3*; α(L1)exp=0.037 *6*; α(M1)exp=0.014 *12* α(K)=0.203 *3*; α(L)=0.0379 *6*; α(M)=0.00909 *13* α(N)=0.00242 *4*; α(O)=0.000574 *8*; α(P)=0.0001113 *16*; α(Q)=1.057×10^{-5} *15*
[x]467.172 *20*	0.072 *18*					M1+E2	0.78 *15*	0.176 *20*	α(K)exp=0.137 *17* α(K)=0.137 *17*; α(L)=0.0289 *23*; α(M)=0.0071 *5* α(N)=0.00188 *4*; α(O)=0.00044 *4*; α(P)=8.4×10^{-5} *7*; α(Q)=7.2×10^{-6} *9*
468.209[d] *19*	0.074[d] *16*	709.099	3/2$^+$	240.881	5/2$^+$	M1(+E2)		0.15 *10*	α(K)exp=0.13 *3* α(K)=0.116 *86*; α(L)=0.026 *12*; α(M)=0.0064 *27* α(N)=0.00170 *70*; α(O)=4.0×10^{-4} *17*; α(P)=7.5×10^{-5} *35*; α(Q)=6.1×10^{-6} *44*
468.209[d] *19*	0.074[d] *16*	1102.25	3/2$^-$	634.044?	(7/2$^-$)	[E2]		0.0500 *7*	Mult.: M1(+E2) in 1987Wh01.
468.944 *10*	0.132 *21*	510.897?	(7/2)$^+$	41.952	7/2$^+$	M1+E2	0.7 *2*	0.18 *3*	α(K)exp=0.144 *23* α(K)=0.144 *22*; α(L)=0.030 *3*; α(M)=0.0072 *7*

$^{231}_{90}Th_{141}$-11

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(N)=0.00193 *18*; α(O)=0.00045 *5*; α(P)=8.7×10^{-5} *9*; α(Q)=7.5×10^{-6} *12* Mult.: M1(+E2) in 1987Wh01.
470.25[e] *3*	0.037 *9*	655.981?	7/2$^-$	185.715	5/2$^-$	M1		0.248 *4*	α(K)exp=0.23 *3* α(K)=0.199 *3*; α(L)=0.0370 *6*; α(M)=0.00888 *13* α(N)=0.00237 *4*; α(O)=0.000560 *8*; α(P)=0.0001088 *16*; α(Q)=1.033×10^{-5} *15*
[x]475.62 *7*	0.11 *3*					E2+M1	1.7 *4*	0.097 *22*	α(K)exp=0.070 *20* α(K)=0.072 *19*; α(L)=0.019 *3*; α(M)=0.0049 *6* α(N)=0.00130 *16*; α(O)=0.00030 *4*; α(P)=5.6×10^{-5} *8*; α(Q)=3.8×10^{-6} *10*
479.19[d] *5*	0.12[d] *2*	684.490	(5/2)$^-$	205.310	(7/2$^-$)	E2+M1	3.0 *8*	0.066 *14*	α(K)exp=0.045 *11* α(K)=0.045 *12*; α(L)=0.0156 *16*; α(M)=0.0040 *4* α(N)=0.000106 *10*; α(O)=0.000245 *23*; α(P)=4.4×10^{-5} *5*; α(Q)=2.4×10^{-6} *6* Mult.: E2 in 1987Wh01.
479.19[d] *5*	0.12[d] *2*	867.03	5/2$^-$,7/2$^-$	387.827	7/2$^-$	(E2)[‡]		0.0472 *7*	Mult.: E2 in 1987Wh01.
[x]479.45 *7*	0.10 *3*								
482.62 *5*	0.026 *6*	1102.25	3/2$^-$	619.638	3/2$^-$				
483.507 *17*	0.060 *13*	1074.35	(3/2)$^-$	590.838	3/2$^-$	E2+M1	1.4 *3*	0.108 *21*	α(K)exp=0.079 *20* α(K)=0.081 *18*; α(L)=0.0202 *25*; α(M)=0.0050 *6* α(N)=0.00134 *15*; α(O)=0.00031 *4*; α(P)=5.8×10^{-5} *8*; α(Q)=4.3×10^{-6} *10*
[x]485.256 *4*	0.25 *4*					M1		0.227 *3*	α(K)exp=0.21 *3*; α(L1)exp=0.061 *10* α(K)=0.183 *3*; α(L)=0.0340 *5*; α(M)=0.00815 *12* α(N)=0.00217 *3*; α(O)=0.000515 *8*; α(P)=9.99×10^{-5} *14*; α(Q)=9.48×10^{-6} *14*
[x]486.79 *3*	0.053 *12*								
487.689[d] *23*	0.057[d] *12*	709.099	3/2$^+$	221.398	3/2$^+$	(E2)[‡]		0.0453 *5*	Mult.: E1,E2 in 1987Wh01.
487.689[d] *23*	0.057[d] *12*	735.263	(5/2)$^+$	247.583	1/2$^+$	(E2)[‡]		0.0453 *6*	Mult.: E1,E2 in 1987Wh01.
487.689[d] *23*	0.057[d] *12*	1081.33	1/2$^-$,3/2$^-$	593.617	(3/2)$^-$	(E2)[‡]		0.0453 *6*	Mult.: E1,E2 in 1987Wh01.
488.55 *5*	0.023 *5*	1173.00	3/2$^-$	684.490	(5/2)$^-$				
[x]489.43 *4*	0.053 *11*					(M1+E2)[#]		0.134 *89*	
490.51 *2*	0.057 *12*	1081.33	1/2$^-$,3/2$^-$	590.838	3/2$^-$	M1		0.221 *3*	α(K)exp=0.200 *20* α(K)=0.1774 *25*; α(L)=0.0330 *5*; α(M)=0.00792 *11* α(N)=0.00211 *3*; α(O)=0.000500 *7*; α(P)=9.70×10^{-5} *14*; α(Q)=9.21×10^{-6} *13*
491.284 *4*	0.34 *5*	793.026	1/2$^+$	301.744	5/2$^+$	(E2)		0.0445 *6*	α(K)exp=0.036 *6* α(K)=0.0279 *4*; α(L)=0.01234 *18*; α(M)=0.00321 *5* α(N)=0.000858 *12*; α(O)=0.000196 *3*; α(P)=3.50×10^{-5} *5*;

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(Q)=1.540×10^{-6} *22* Mult.: E2 in 1987Wh01.
493.177 *25*	0.050 *10*	1086.812	5/2$^+$	593.617	(3/2)$^-$	(E1)[‡]		0.01297 *18*	Mult.: E1,E2 in 1987Wh01.
498.775 *2*	1.25 *19*	684.490	(5/2)$^-$	185.715	5/2$^-$	M1		0.211 *3*	α(K)exp=0.17 *3*; α(L1)exp=0.031 *5* α(K)=0.1696 *24*; α(L)=0.0316 *5*; α(M)=0.00757 *11* α(N)=0.00202 *3*; α(O)=0.000478 *7*; α(P)=9.27×10^{-5} *13*; α(Q)=8.81×10^{-6} *13*
503.44 *6*	0.045 *11*	820.544	1/2$^+$	317.082	5/2$^+$				
506.74 *7*	0.045 *10*	808.507	3/2$^+$	301.744	5/2$^+$				
[x]514.32 *3*	0.096 *16*					M1+E0(+E2)			α(K)exp=0.52 *3*; α(L1)exp=0.240 *20* Mult.: M1+E0 in 1987Wh01.
514.991 *7*	0.47 *7*	720.298	(7/2)$^-$	205.310	(7/2$^-$)	M1+E2	1.0 *2*	0.117 *17*	α(K)exp=0.098 *8*; α(L1)exp=0.039 *3* α(K)=0.091 *15*; α(L)=0.0198 *21*; α(M)=0.0048 *5* α(N)=0.00129 *13*; α(O)=0.00030 *3*; α(P)=5.8×10^{-5} *6*; α(Q)=4.7×10^{-6} *8* δ: from α(K)exp.
520.847 *14*	0.102 *16*	793.026	1/2$^+$	272.180	3/2$^+$	E2+M1	1.5 *3*	0.085 *16*	α(K)exp=0.067 *12* α(K)=0.064 *13*; α(L)=0.0157 *19*; α(M)=0.0039 *5* α(N)=0.00104 *12*; α(O)=0.00024 *3*; α(P)=4.6×10^{-5} *6*; α(Q)=3.4×10^{-6} *7*
522.218 *16*	0.089 *14*	839.304	3/2$^+$	317.082	5/2$^+$	(M1)		0.187 *3*	α(K)exp=0.220 *20*; α(L1)exp=0.031 *3* α(K)=0.1500 *21*; α(L)=0.0279 *4*; α(M)=0.00668 *10* α(N)=0.001782 *25*; α(O)=0.000422 *6*; α(P)=8.19×10^{-5} *12*; α(Q)=7.78×10^{-6} *11* Mult.: M1 in 1987Wh01.
[x]523.90 *5*	0.037 *9*								
526.68 *5*	0.033 *8*	1081.33	1/2$^-$,3/2$^-$	554.651	(1/2)$^-$	(M1)		0.183 *3*	α(K)exp=0.20 *3* α(K)=0.1466 *21*; α(L)=0.0272 *4*; α(M)=0.00653 *10* α(N)=0.001741 *25*; α(O)=0.000412 *6*; α(P)=8.00×10^{-5} *12*; α(Q)=7.60×10^{-6} *11* Mult.: M1 in 1987Wh01.
528.038 *3*	0.70 *11*	713.753	3/2$^-$	185.715	5/2$^-$	M1		0.181 *3*	α(K)exp=0.161 *25*; α(L1)exp=0.029 *4* α(K)=0.1456 *21*; α(L)=0.0271 *4*; α(M)=0.00649 *9* α(N)=0.001729 *25*; α(O)=0.000409 *6*; α(P)=7.95×10^{-5} *12*; α(Q)=7.55×10^{-6} *11*
[x]533.82 *3*	0.031 *7*					(M1)		0.1761 *25*	α(K)exp=0.229 *25* α(K)=0.1414 *20*; α(L)=0.0263 *4*; α(M)=0.00630 *9* α(N)=0.001679 *24*; α(O)=0.000398 *6*; α(P)=7.71×10^{-5} *11*; α(Q)=7.33×10^{-6} *11*
534.562 *15*	0.072 *15*	720.298	(7/2)$^-$	185.715	5/2$^-$	M1		0.1755 *25*	α(K)exp=0.130 *10*; α(L1)exp=0.03 *4* α(K)=0.1409 *20*; α(L)=0.0262 *4*; α(M)=0.00627 *9* α(N)=0.001673 *24*; α(O)=0.000396 *6*; α(P)=7.69×10^{-5} *11*; α(Q)=7.30×10^{-6} *11*

$^{231}_{90}Th_{141}$-13

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
[x]535.36 *8*	0.05 *1*					(M1)		0.1748 *25*	α(K)exp=0.20 *4*; α(L1)exp=0.04 *8* α(K)=0.1403 *20*; α(L)=0.0261 *4*; α(M)=0.00625 *9* α(N)=0.001666 *24*; α(O)=0.000394 *6*; α(P)=7.66×10^{-5} *11*; α(Q)=7.27×10^{-6} *11* Additional information 1.
536.336 *17*	0.076 *16*	808.507	3/2$^+$	272.180	3/2$^+$	M1+E0(+E2)			α(K)exp=1.24 *25*; α(L1)exp=0.18 *4* Mult.: M1+E0 in 1987Wh01.
[x]537.307 *8*	0.28 *4*					M1+E2	1.0 *2*	0.103 *15*	α(K)exp=0.080 *13* α(K)=0.080 *13*; α(L)=0.0174 *18*; α(M)=0.0043 *5* α(N)=0.00114 *11*; α(O)=0.00027 *3*; α(P)=5.1×10^{-5} *6*; α(Q)=4.2×10^{-6} *7*
[x]539.27 *5*	0.028 *7*								
[x]541.11 *8*	0.022 *4*								
543.66 *3*	0.033 *7*	1173.00	3/2$^-$	629.342	(5/2)$^-$	(M1)		0.1677 *24*	α(K)exp=0.190 *20* α(K)=0.1347 *19*; α(L)=0.0250 *4*; α(M)=0.00599 *9* α(N)=0.001598 *23*; α(O)=0.000378 *6*; α(P)=7.34×10^{-5} *11*; α(Q)=6.98×10^{-6} *10* Mult.: α(K)exp is larger by ≈26% as compared to α(K) for M1. M1 in 1987Wh01.
545.420 *16*	<0.025	793.026	1/2$^+$	247.583	1/2$^+$	E0(+M1)			α(K)exp>1.6; α(L1)exp>0.4 Mult.: M1+E0 in 1987Wh01.
548.454 *15*	0.083 *13*	936.305	(5/2)$^-$	387.827	7/2$^-$	E2+M1	1.5 *3*	0.074 *14*	α(K)exp=0.058 *12* α(K)=0.056 *12*; α(L)=0.0136 *17*; α(M)=0.0034 *4* α(N)=0.00090 *10*; α(O)=0.000210 *24*; α(P)=3.9×10^{-5} *5*; α(Q)=2.9×10^{-6} *6*
[x]549.02 *5*	0.041 *9*								
[x]552.34 *4*	0.024 *5*					M1+E0(+E2)			α(K)exp=0.54 *4*; α(L1)exp=0.21 *3* Mult.: M1+E0 in 1987Wh01.
[x]554.23 *5*	0.022 *4*								
[x]555.53 *5*	0.013 *3*								
[x]556.76 *7*	0.063 *13*					M1+E2	1.0 *2*	0.095 *14*	α(K)exp=0.075 *10* α(K)=0.074 *12*; α(L)=0.0159 *17*; α(M)=0.0039 *4* α(N)=1.04×10^{-3} *11*; α(O)=2.44×10^{-4} *25*; α(P)=4.6×10^{-5} *5*; α(Q)=3.9×10^{-6} *6* Additional information 2.
560.875 *21*	0.058 *12*	808.507	3/2$^+$	247.583	1/2$^+$				
567.108 *19*	0.096 *16*	839.304	3/2$^+$	272.180	3/2$^+$	M1+E0			α(K)exp=0.78 *13*; α(L1)exp=0.17 *3*; α(L2)exp=0.033 *10*
[x]567.570 *16*	0.17 *3*					M1+E2	0.65 *20*	0.115 *16*	α(K)exp=0.091 *14*; α(L1)exp=0.019 *4* α(K)=0.091 *13*; α(L)=0.0180 *19*; α(M)=0.0044 *5* α(N)=0.00116 *12*; α(O)=0.00027 *3*; α(P)=5.3×10^{-5} *3*; α(Q)=4.7×10^{-6} *7* Additional information 3.
[x]570.4 *1*	0.03 *2*					M1		0.1475 *21*	α(K)exp=0.22 *9*

$^{231}_{90}$Th$_{141}$-14

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[c]	Comments
								α(K)=0.1185 *17*; α(L)=0.0220 *3*; α(M)=0.00527 *8* α(N)=0.001404 *20*; α(O)=0.000332 *5*; α(P)=6.45×10^{-5} *9*; α(Q)=6.13×10^{-6} *9* α(K)exp exceeds α(K)theory for M1.
572.964 *7*	0.24 *4*	820.544	1/2$^+$	247.583	1/2$^+$	M1+E0		α(K)exp=0.45 *7*; α(L1)exp=0.080 *8*
585.607 *13*	0.111 *18*	833.168	(1/2)$^-$	247.583	1/2$^+$			
587.155 *17*	0.081 *14*	808.507	3/2$^+$	221.398	3/2$^+$	M1	0.1366 *19*	α(K)exp=0.110 *11*; α(L1)exp=0.039 *5* α(K)=0.1097 *16*; α(L)=0.0203 *3*; α(M)=0.00487 *7* α(N)=0.001299 *19*; α(O)=0.000308 *5*; α(P)=5.97×10^{-5} *9*; α(Q)=5.67×10^{-6} *8*
[x]593.86 *3*	0.054 *12*					M1	0.1325 *19*	α(K)exp=0.15 *3* α(K)=0.1064 *15*; α(L)=0.0197 *3*; α(M)=0.00473 *7* α(N)=0.001260 *18*; α(O)=0.000298 *5*; α(P)=5.79×10^{-5} *9*; α(Q)=5.50×10^{-6} *8* α(K)exp exceeds α(K)theory for M1.
[x]596.40 *11*	0.011 *10*							
599.20 *4*	0.050 *11*	820.544	1/2$^+$	221.398	3/2$^+$			
[x]604.467 *24*	0.073 *16*							
611.80 *2*	0.093 *15*	833.168	(1/2)$^-$	221.398	3/2$^+$			
[x]612.50 *10*	0.043 *11*							
[x]613.84 *7*	0.033 *8*					M1	0.1213 *17*	α(K)exp=0.103 *15* α(K)=0.0975 *14*; α(L)=0.0180 *3*; α(M)=0.00432 *6* α(N)=0.001152 *17*; α(O)=0.000273 *4*; α(P)=5.30×10^{-5} *8*; α(Q)=5.04×10^{-6} *7*
614.563 *14*	0.132 *21*	889.998	5/2$^+$	275.425	7/2$^+$	M1	0.1209 *17*	α(K)exp=0.105 *6* α(K)=0.0972 *14*; α(L)=0.0180 *3*; α(M)=0.00431 *6* α(N)=0.001149 *16*; α(O)=0.000272 *4*; α(P)=5.28×10^{-5} *8*; α(Q)=5.02×10^{-6} *7*
617.87 *4*	0.047 *10*	839.304	3/2$^+$	221.398	3/2$^+$	M1+E0		α(K)exp=0.220 *20* α(K)exp is larger by a factor of ≈2 compared to α(K)theory=0.096 for pure M1.
619.27 *13*	0.068 *2*	936.305	(5/2)$^-$	317.082	5/2$^+$			
[x]619.67 *4*	0.046 *10*					(M1)	0.1183 *17*	α(K)exp=0.150 *20* α(K)=0.0950 *14*; α(L)=0.01759 *25*; α(M)=0.00421 *6* α(N)=0.001123 *16*; α(O)=0.000266 *4*; α(P)=5.16×10^{-5} *8*; α(Q)=4.91×10^{-6} *7* Additional information 4.
[x]621.45 *5*	0.037 *8*							
626.64 *4*	0.055 *12*	1004.236	3/2$^+$	377.577	(7/2)$^+$			
[x]628.394 *25*	0.084 *14*					M1	0.1140 *16*	α(K)exp=0.082 *8* α(K)=0.0916 *13*; α(L)=0.01694 *24*; α(M)=0.00406 *6* α(N)=0.001082 *16*; α(O)=0.000256 *4*; α(P)=4.97×10^{-5} *7*; α(Q)=4.73×10^{-6} *7*

$^{231}_{90}Th_{141}$-15

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
									α(Q)=4.73×10^{-6} *7*
629.368 *15*	0.090 *14*	629.342	(5/2)$^-$	0.0	5/2$^+$				
630.00 *6*	0.061 *13*	867.03	5/2$^-$,7/2$^-$	236.954	9/2$^-$	E2		0.0253 *4*	α(K)exp=0.016 *3* α(K)=0.01751 *25*; α(L)=0.00583 *9*; α(M)=0.001485 *21* α(N)=0.000397 *6*; α(O)=9.15×10^{-5} *13*; α(P)=1.664×10^{-5} *24*; α(Q)=9.27×10^{-7} *13*
[x]632.41 *7*	0.022 *4*					M1		0.1121 *16*	α(K)exp=0.10 *8* α(K)=0.0901 *13*; α(L)=0.01666 *24*; α(M)=0.00399 *6* α(N)=0.001064 *15*; α(O)=0.000252 *4*; α(P)=4.89×10^{-5} *7*; α(Q)=4.65×10^{-6} *7*
643.85 *7*	0.037 *9*	960.807	3/2$^+$	317.082	5/2$^+$				
[x]646.422 *17*	0.16 *3*								
[x]647.528 *5*	0.64 *10*					M1		0.1052 *15*	α(K)exp=0.078 *12*; α(L1)exp=0.013 *2* α(K)=0.0846 *12*; α(L)=0.01563 *22*; α(M)=0.00375 *6* α(N)=0.000998 *14*; α(O)=0.000236 *4*; α(P)=4.59×10^{-5} *7*; α(Q)=4.37×10^{-6} *7*
649.142 *23*	0.102 *16*	889.998	5/2$^+$	240.881	5/2$^+$	(M1)		0.1046 *15*	α(K)exp=0.068 *6* α(K)=0.0840 *12*; α(L)=0.01553 *22*; α(M)=0.00372 *6* α(N)=0.000992 *14*; α(O)=0.000235 *4*; α(P)=4.56×10^{-5} *7*; α(Q)=4.34×10^{-6} *6* Mult.: M1 in 1987Wh01.
[x]655.25 *4*	0.052 *12*					E2+M1	1.5 *3*	0.047 *8*	α(K)exp=0.036 *7* α(K)=0.037 *7*; α(L)=0.0083 *11*; α(M)=0.00203 *24* α(N)=5.8×10^{-4} *12*; α(O)=1.4×10^{-4} *12*; α(P)=2.6×10^{-5} *6*; α(Q)=2.2×10^{-6} *7*
658.97 *6*	0.040 *9*	960.807	3/2$^+$	301.744	5/2$^+$	M1+E2	1.0 *3*	0.062 *14*	α(K)exp=0.050 *9* α(K)=0.048 *11*; α(L)=0.0100 *17*; α(M)=0.0024 *4* α(N)=0.00065 *11*; α(O)=0.000153 *25*; α(P)=2.9×10^{-5} *5*; α(Q)=2.5×10^{-6} *6*
[x]662.55 *7*	0.043 *11*								
[x]664.95 *12*	0.032 *8*					E2+M1	1.2 *4*	0.054 *16*	α(K)exp=0.043 *12* α(K)=0.042 *13*; α(L)=0.0089 *20*; α(M)=0.0022 *5* α(N)=6.3×10^{-4} *30*; α(O)=1.49×10^{-4} *71*; α(P)=2.9×10^{-5} *15*; α(Q)=2.5×10^{-6} *17*
[x]667.185 *12*	0.27 *4*					E2		0.0224 *3*	α(K)exp=0.013 *1* α(K)=0.01577 *22*; α(L)=0.00496 *7*; α(M)=0.001258 *18* α(N)=0.000336 *5*; α(O)=7.76×10^{-5} *11*; α(P)=1.418×10^{-5} *20*; α(Q)=8.28×10^{-7} *12*
668.56 *10*	0.054 *12*	889.998	5/2$^+$	221.398	3/2$^+$	E2+M1	1.2 *3*	0.053 *11*	α(K)exp=0.043 *12* α(K)=0.041 *9*; α(L)=0.0088 *14*; α(M)=0.0021 *4* α(N)=0.00057 *9*; α(O)=0.000134 *20*; α(P)=2.6×10^{-5} *4*; α(Q)=2.1×10^{-6} *5*

$^{231}_{90}Th_{141}$-16

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
[x]672.75 *12*	0.028 *8*					M1		0.0951 *13*	α(K)exp=0.081 *24* α(K)=0.0764 *11*; α(L)=0.01411 *20*; α(M)=0.00338 *5* α(N)=0.000901 *13*; α(O)=0.000213 *3*; α(P)=4.14×10^{-5} *6*; α(Q)=3.94×10^{-6} *6*
673.96 *13*	0.05 *2*	914.904	(5/2)$^-$	240.881	5/2$^+$				
678.1 *3*	0.032 *10*	914.904	(5/2)$^-$	236.954	9/2$^-$				
681.37 *7*	0.096 *16*	867.03	5/2$^-$,7/2$^-$	185.715	5/2$^-$	(M1+E2)		0.057 *36*	α(K)exp=0.04 *4* α(K)=0.045 *30*; α(L)=0.0092 *45*; α(M)=0.0022 *11* α(N)=5.9×10^{-4} *28*; α(O)=1.40×10^{-4} *67*; α(P)=2.7×10^{-5} *14*; α(Q)=2.3×10^{-6} *15* Mult.: E2+M1 in 1987Wh01.
[x]684.131 *13*	0.23 *4*					E2+M1	1.3 *1*	0.047 *3*	α(K)exp=0.037 *2* α(K)=0.0366 *23*; α(L)=0.0079 *4*; α(M)=0.00194 *9* α(N)=5.2×10^{-4} *2*; α(O)=1.21×10^{-4} *6*; α(P)=2.3×10^{-5} *1*; α(Q)=1.9×10^{-6} *1*
687.658 *7*	0.67 *10*	687.631	1/2$^+$	0.0	5/2$^+$	(E2)		0.0210 *3*	α(K)exp=0.019 *1* α(K)=0.01492 *21*; α(L)=0.00456 *7*; α(M)=0.001155 *17* α(N)=0.000308 *5*; α(O)=7.13×10^{-5} *10*; α(P)=1.305×10^{-5} *19*; α(Q)=7.80×10^{-7} *11* Mult.: E2 in 1987Wh01.
688.611[d] *24*	0.17[d] *3*	960.807	3/2$^+$	272.180	3/2$^+$	E2+M1	1.1 *2*	0.052 *7*	α(K)exp=0.040 *5* α(K)=0.041 *6*; α(L)=0.0085 *9*; α(M)=0.00207 *21* α(N)=0.00055 *6*; α(O)=0.000130 *13*; α(P)=2.5×10^{-5} *3*; α(Q)=2.1×10^{-6} *3*
688.611[d] *24*	0.17[d] *3*	1066.19	(5/2,7/2)$^+$	377.577	(7/2)$^+$	E2+M1	1.1 *2*	0.052 *7*	α(K)exp=0.040 *5* α(K)=0.041 *6*; α(L)=0.0085 *9*; α(M)=0.00207 *21* α(N)=0.00055 *6*; α(O)=0.000130 *13*; α(P)=2.5×10^{-5} *3*; α(Q)=2.1×10^{-6} *3* Mult.: M1+E2 in 1987Wh01.
[x]689.932 *8*	0.49 *8*					(M1)		0.0889 *13*	α(K)exp=0.086 *4*; α(L1)exp=0.010 *2* α(K)=0.0715 *10*; α(L)=0.01319 *19*; α(M)=0.00316 *5* α(N)=0.000842 *12*; α(O)=0.000199 *3*; α(P)=3.87×10^{-5} *6*; α(Q)=3.69×10^{-6} *6* Additional information 5.
[x]696.01 *4*	0.066 *15*								
[x]696.85 *6*	0.043 *10*								
[x]705.53 *17*	0.032 *10*								
[x]707.1 *3*	0.054 *13*								
709.220 *14*	0.56 *9*	1086.812	5/2$^+$	377.577	(7/2)$^+$	E2+M1	0.8 *2*	0.058 *8*	α(K)exp=0.046 *3* α(K)=0.046 *7*; α(L)=0.0091 *11*; α(M)=0.00220 *24* α(N)=0.00059 *7*; α(O)=0.000139 *16*; α(P)=2.7×10^{-5} *3*; α(Q)=2.4×10^{-6} *4*

$^{231}_{90}$Th$_{141}$-17

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[@]	α[c]	Comments
713.234 *16*	0.20 *3*	960.807	3/2$^+$	247.583	1/2$^+$	M1+E2	0.6 *1*	0.065 *5*	α(K)exp=0.052 *4* α(K)=0.052 *4*; α(L)=0.0100 *6*; α(M)=0.00240 *13* α(N)=0.00064 *4*; α(O)=0.000151 *8*; α(P)=2.92×10^{-5} *16*; α(Q)=2.67×10^{-6} *18* Mult.: M1(+E2) in 1987Wh01.
[x]717.99 *4*	0.084 *15*					(M1)[#]		0.0800 *11*	
719.74 *12*	0.037 *9*	960.807	3/2$^+$	240.881	5/2$^+$				
[x]726.19 *3*	0.091 *16*								
729.19 *5*	0.082 *13*	914.904	(5/2)$^-$	185.715	5/2$^-$	(M1(+E2))[‡]		0.048 *29*	Mult.: M1(+E2) in 1987Wh01.
[x]736.73 *17*	0.032 *8*								
739.409 *25*	0.139 *23*	960.807	3/2$^+$	221.398	3/2$^+$	M1+E0(+E2)			α(K)exp=0.132 *10* Mult.: E1+E0 in 1987Wh01.
749.14 *5*	0.095 *15*	1066.19	(5/2,7/2)$^+$	317.082	5/2$^+$	(M1)		0.0715 *10*	α(K)exp=0.082 *7* α(K)=0.0575 *8*; α(L)=0.01059 *15*; α(M)=0.00254 *4* α(N)=0.000676 *10*; α(O)=0.0001600 *23*; α(P)=3.11×10^{-5} *5*; α(Q)=2.96×10^{-6} *5* Mult.: M1 in 1987Wh01.
750.621 *16*	0.23 *4*	936.305	(5/2)$^-$	185.715	5/2$^-$	M1		0.0711 *10*	α(K)exp=0.063 *5* α(K)=0.0572 *8*; α(L)=0.01053 *15*; α(M)=0.00252 *4* α(N)=0.000672 *10*; α(O)=0.0001592 *23*; α(P)=3.09×10^{-5} *5*; α(Q)=2.94×10^{-6} *5*
[x]755.23 *10*	0.075 *16*					(M1)		0.0700 *10*	α(K)exp=0.094 *21* α(K)=0.0563 *8*; α(L)=0.01036 *15*; α(M)=0.00248 *4* α(N)=0.000661 *10*; α(O)=0.0001566 *22*; α(P)=3.04×10^{-5} *5*; α(Q)=2.90×10^{-6} *4* Additional information 6.
757.28 *18*	0.048 *11*	1074.35	(3/2)$^-$	317.082	5/2$^+$				
[x]758.38 *4*	0.097 *16*					M1		0.0692 *10*	α(K)exp=0.060 *10* α(K)=0.0557 *8*; α(L)=0.01025 *15*; α(M)=0.00245 *4* α(N)=0.000654 *10*; α(O)=0.0001549 *22*; α(P)=3.01×10^{-5} *5*; α(Q)=2.87×10^{-6} *4*
763.363 *24*	0.16 *3*	1004.236	3/2$^+$	240.881	5/2$^+$	M1		0.0680 *10*	α(K)exp=0.056 *8* α(K)=0.0547 *8*; α(L)=0.01007 *15*; α(M)=0.00241 *4* α(N)=0.000643 *9*; α(O)=0.0001522 *22*; α(P)=2.96×10^{-5} *5*; α(Q)=2.82×10^{-6} *4*
766.6 *3*	0.043 *11*	808.507	3/2$^+$	41.952	7/2$^+$				
[x]768.43 *18*	0.047 *11*								
[x]771.60 *9*	0.069 *15*								
773.18 *13*	0.047 *11*	1020.728	3/2$^-$	247.583	1/2$^+$				
775.04 *13*	0.052 *15*	960.807	3/2$^+$	185.715	5/2$^-$				
[x]783.56 *8*	0.098 *16*								
784.05 *9*	0.106 *20*	1056.30	(3/2$^+$)	272.180	3/2$^+$				

$^{231}_{90}Th_{141}$-18

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[c]	Comments
785.08[d] *8*	0.104[d] *17*	1086.812	5/2+	301.744	5/2+			
785.08[d] *8*	0.104[d] *17*	1102.25	3/2−	317.082	5/2+			
785.08[d] *8*	0.104[d] *17*	1173.00	3/2−	387.827	7/2−			
[x]787.13 *7*	0.077 *17*							
793.04 *3*	0.115 *23*	793.026	1/2+	0.0	5/2+			
797.56 *13*	0.063 *14*	839.304	3/2+	41.952	7/2+			
799.38 *5*	0.093 *16*	1020.728	3/2−	221.398	3/2+			
[x]803.49 *6*	0.103 *17*							
[x]807.65 *4*	0.18 *3*							
808.38 *9*	0.10 *3*	808.507	3/2+	0.0	5/2+			
808.74 *9*	0.093 *16*	1056.30	(3/2+)	247.583	1/2+			
811.408 *15*	0.38 *6*	1086.812	5/2+	275.425	7/2+	E2	0.01501 *21*	α(K)exp=0.014 *2* α(K)=0.01107 *16*; α(L)=0.00295 *5*; α(M)=0.000738 *11* α(N)=0.000197 *3*; α(O)=4.57×10^{-5} *7*; α(P)=8.46×10^{-6} *12*; α(Q)=5.65×10^{-7} *8*
814.64 *4*	0.148 *24*	1086.812	5/2+	272.180	3/2+	(E2)[‡]	0.01489 *21*	Mult.: E1,E2 in 1987Wh01.
816.70[e] *9*	0.070 *15*	1133.81	(1/2+,3/2+)	317.082	5/2+			Eγ: poor fit, Eγ=817.16 *8* from level-energy difference.
820.43 *7*	0.089 *15*	820.544	1/2+	0.0	5/2+			
[x]827.05 *4*	0.141 *22*					M1	0.0551 *8*	α(K)exp=0.043 *7* α(K)=0.0443 *7*; α(L)=0.00814 *12*; α(M)=0.00195 *3* α(N)=0.000519 *8*; α(O)=0.0001229 *18*; α(P)=2.39×10^{-5} *4*; α(Q)=2.28×10^{-6} *4*
834.92[d] *5*	0.138[d] *22*	1020.728	3/2−	185.715	5/2−	(M1)[‡]	0.0537 *8*	α(K)exp=0.042 *7* α(K)=0.0432 *6*; α(L)=0.00793 *12*; α(M)=0.00190 *3* α(N)=0.000506 *7*; α(O)=0.0001199 *17*; α(P)=2.33×10^{-5} *4*; α(Q)=2.22×10^{-6} *4* Mult.: M1 in 1987Wh01.
834.92[d] *5*	0.138[d] *22*	1056.30	(3/2+)	221.398	3/2+	(M1)[‡]	0.0537 *8*	Mult.: M1 in 1987Wh01.
[x]836.56 *8*	0.096 *16*							
839.36 *5*	0.139 *22*	839.304	3/2+	0.0	5/2+	(E2)[‡]	0.01403 *20*	Mult.: E1,E2 in 1987Wh01.
[x]841.24 *16*	0.041 *10*							
844.55 *18*	0.042 *10*	1066.19	(5/2,7/2)+	221.398	3/2+			
[x]855.01 *13*	0.079 *17*					M1+E0(+E2)		α(K)exp=0.14 *3* Mult.: M1+E0 in 1987Wh01.
861.86[d] *24*	0.042[d] *10*	1102.25	3/2−	240.881	5/2+			
861.86[d] *24*	0.042[d] *10*	1133.81	(1/2+,3/2+)	272.180	3/2+			
[x]870.00 *11*	0.089 *14*							
875.54 *7*	0.126 *21*	875.549	(3/2)−	0.0	5/2+			
886.15 *25*	0.059 *14*	1133.81	(1/2+,3/2+)	247.583	1/2+			Eγ: 866.15 in Table I of 1987Wh01 seems a misprint.
888.49 *19*	0.068 *15*	1074.35	(3/2)−	185.715	5/2−			
[x]905.12 *9*	0.124 *21*							

$^{231}_{90}Th_{141}$-19

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[c]	Comments
[x]911.87 *11*	0.063 *15*					M1	0.0426 *6*	α(K)exp=0.054 *13* α(K)=0.0343 *5*; α(L)=0.00628 *9*; α(M)=0.001502 *21* α(N)=0.000400 *6*; α(O)=9.48×10^{-5} *14*; α(P)=1.84×10^{-5} *3*; α(Q)=1.757×10^{-6} *25*
914.91 *7*	0.148 *24*	914.904	(5/2)$^-$	0.0	5/2$^+$			
918.92[d] *11*	0.098[d] *16*	960.807	3/2$^+$	41.952	7/2$^+$	(E2)[‡]	0.01175 *17*	Mult.: E1,E2 in 1987Wh01.
918.92[d] *11*	0.098[d] *16*	1159.750	(3/2)$^-$	240.881	5/2$^+$	(E1)[‡]	0.00401 *6*	Mult.: E1,E2 in 1987Wh01.
[x]921.19 *24*	0.091 *17*							
[x]927.9						M1	0.0406 *6*	α(K)exp=0.030 *7* α(K)=0.0327 *5*; α(L)=0.00599 *9*; α(M)=0.001434 *20* α(N)=0.000382 *6*; α(O)=9.05×10^{-5} *13*; α(P)=1.758×10^{-5} *25*; α(Q)=1.678×10^{-6} *24*
[x]930.55 *14*	0.101 *18*					M1	0.0403 *6*	α(K)exp=0.032 *6* α(K)=0.0325 *5*; α(L)=0.00595 *9*; α(M)=0.001423 *20* α(N)=0.000379 *6*; α(O)=8.98×10^{-5} *13*; α(P)=1.744×10^{-5} *25*; α(Q)=1.665×10^{-6} *24*
936.17 *6*	0.23 *4*	936.305	(5/2)$^-$	0.0	5/2$^+$			
[x]938.72 *10*	0.16 *3*							
[x]950.11 *15*	0.110 *22*							
[x]952.79 *6*	0.26 *4*					(M1)	0.0379 *5*	α(K)exp=0.042 *7* α(K)=0.0305 *5*; α(L)=0.00559 *8*; α(M)=0.001336 *19* α(N)=0.000356 *5*; α(O)=8.44×10^{-5} *12*; α(P)=1.638×10^{-5} *23*; α(Q)=1.565×10^{-6} *22* Additional information 7.
[x]971.86 *20*	0.14 *4*							
974.15 *16*	0.059 *18*	1159.750	(3/2)$^-$	185.715	5/2$^-$			
[x]982.44 *7*	0.44 *8*							
[x]983.46 *6*	0.35 *7*							
[x]1012.83 *13*	0.29 *6*							
1014.33 *4*	0.41 *8*	1056.30	(3/2$^+$)	41.952	7/2$^+$	(E2)[‡]	0.00972 *14*	α(K)exp=0.005 *1* α(K)=0.00744 *11*; α(L)=0.001715 *24*; α(M)=0.000422 *6* α(N)=0.0001126 *16*; α(O)=2.63×10^{-5} *4*; α(P)=4.94×10^{-6} *7*; α(Q)=3.70×10^{-7} *6* Mult.: E2,E1 in 1987Wh01.
[x]1019.96 *22*	0.108 *20*							
1024.91 *25*	0.069 *23*	1066.19	(5/2,7/2)$^+$	41.952	7/2$^+$			
[x]1029.17 *18*	0.092 *19*							
[x]1035.23 *8*	0.16 *3*							
[x]1039.91 *20*	0.073 *21*							
1066.07 *15*	0.077 *25*	1066.19	(5/2,7/2)$^+$	0.0	5/2$^+$			
[x]1084.86 *14*	0.14 *3*							
[x]1091.26 *10*	0.20 *4*							

^{230}Th(n,γ) E=th 1987Wh01 (continued)

γ(^{231}Th) (continued)

E_γ	I_γ[ab]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
[x]1116.44 *10*	0.17 *4*						
[x]1144.43 *20*	0.098 *23*						
[x]1186.82 *12*	0.38 *7*						
[x]1220.5 *4*	0.14 *3*						
3843.6[&] *4*		(5118.13)	1/2+	1274.5	1/2−,3/2−	E1	
3866.66[&] *17*		(5118.13)	1/2+	1251.43			
3899.07[&] *24*		(5118.13)	1/2+	1219.02	(1/2+,3/2+)	(M1)	
3904.26[&] *21*		(5118.13)	1/2+	1213.83			
3917.71[&] *17*		(5118.13)	1/2+	1200.38	1/2,3/2	D	
3924.9[&] *8*		(5118.13)	1/2+	1193.2			
3946.19 *24*		(5118.13)	1/2+	1173.00	3/2−	D	
3958.49 *12*		(5118.13)	1/2+	1159.750	(3/2)−	E1	
3962.6[&] *4*		(5118.13)	1/2+	1155.5			
3981.82 *17*		(5118.13)	1/2+	1133.81	(1/2+,3/2+)	(M1)	E_γ: based on γ-ray placement, level-energy difference is 3984.32 *22*. See also comment for this γ in the Adopted dataset, where recommended Eγ=3984.31 *9*.
4023.87[&] *23*		(5118.13)	1/2+	1094.22	1/2−,3/2−	E1	
4062.44 *13*		(5118.13)	1/2+	1056.30	(3/2+)		E_γ: γ-ray placement requires Eγ=4061.79 *4*.
4085.1[&] *3*		(5118.13)	1/2+	1033.0	(1/2+)		
4096.72 *13*		(5118.13)	1/2+	1020.728	3/2−	E1	E_γ: γ-ray placement requires Eγ=4097.32 *3*.
4113.98 *13*		(5118.13)	1/2+	1004.236	3/2+	(M1)	
4157.42 *17*		(5118.13)	1/2+	960.807	3/2+		
4175.9[&] *9*		(5118.13)	1/2+	942.2			
4182.51[&] *19*		(5118.13)	1/2+	936.305	(5/2)−		
4218.9[&] *6*		(5118.13)	1/2+	899.2			
4242.45 *15*		(5118.13)	1/2+	875.549	(3/2)−	D	
4271.7 *4*		(5118.13)	1/2+	846.3	(1/2+,3/2+)		
4278.73 *17*		(5118.13)	1/2+	839.304	3/2+	(M1)	
4284.91 *12*		(5118.13)	1/2+	833.168	(1/2)−	D	
4297.14 *21*		(5118.13)	1/2+	820.544	1/2+		
4404.39 *11*		(5118.13)	1/2+	713.753	3/2−	E1	
4424.61[&] *17*		(5118.13)	1/2+	693.46			
4462.2 *3*		(5118.13)	1/2+	655.981?	7/2−		
4498.5 *3*		(5118.13)	1/2+	619.638	3/2−	E1	
4523.95 *25*		(5118.13)	1/2+	593.617	(3/2)−	E1	
4527.09 *11*		(5118.13)	1/2+	590.838	3/2−	E1	
4563.45 *9*		(5118.13)	1/2+	554.651	(1/2)−	E1	
4581.4[&] *7*		(5118.13)	1/2+	536.7			
4616.9[&] *5*		(5118.13)	1/2+	501.1			
4738.1[&] *3*		(5118.13)	1/2+	380.0	1/2+,3/2+	M1	

$^{231}_{90}Th_{141}$-21

$\gamma(^{231}Th)$ (continued)

E_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]
4769.8[&] *5*	(5118.13)	$1/2^+$	348.7	$1/2^+,3/2^+$	M1
4845.92 *6*	(5118.13)	$1/2^+$	272.180	$3/2^+$	M1
4870.1 *3*	(5118.13)	$1/2^+$	247.583	$1/2^+$	M1
4896.82 *21*	(5118.13)	$1/2^+$	221.398	$3/2^+$	M1
5117.69 *17*	(5118.13)	$1/2^+$	0.0	$5/2^+$	

[†] As given by 1987Wh01, based on their ce data as measured with magnetic spectrometer. Although the authors assign pure M1 or E2 for most of the transitions, evaluators have placed some of these in parentheses when the measured α(K)exp does not overlap the theoretical values. For multipolarities of primary γ rays from average resonance capture, see 1987Wh01 (they were deduced from average reduced intensities). In cases where upper limit on α(K)exp for secondary γ rays excludes all multipolarities other than E1 or E2, they are shown as (E1) or (E2), based on ΔJ^π requirements. Multipolarities shown as E0(+M1+E2) indicate that the α(exp) require M1, E2 or M1+E2 admixtures.

[‡] Possible multipolarities deduced from upper limit for conversion electron intensity (1987Wh01). In cases where upper limit on α(K)exp for secondary γ rays excludes all multipolarities other than E1 or E2, these are shown as (E1) or (E2), based on ΔJ^π involved. 1987Wh01 do not list conversion coefficients in Table II.

[#] Multipolarity given in 1987Wh01, but no conversion data available.

[@] Deduced by evaluators from conversion electron data in 1987Wh01.

[&] Primary γ populates a level from which no secondary γ rays are known.

[a] Values given by 1987Wh01 are per 100 neutron captures for secondary γ rays. 1987Wh01 provide relative intensities for primary γ rays, which are listed in a separate dataset: ^{230}Th(n,γ) E=th:Primary γ.

[b] Intensity per 100 neutron captures.

[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] Placement of transition in the level scheme is uncertain.

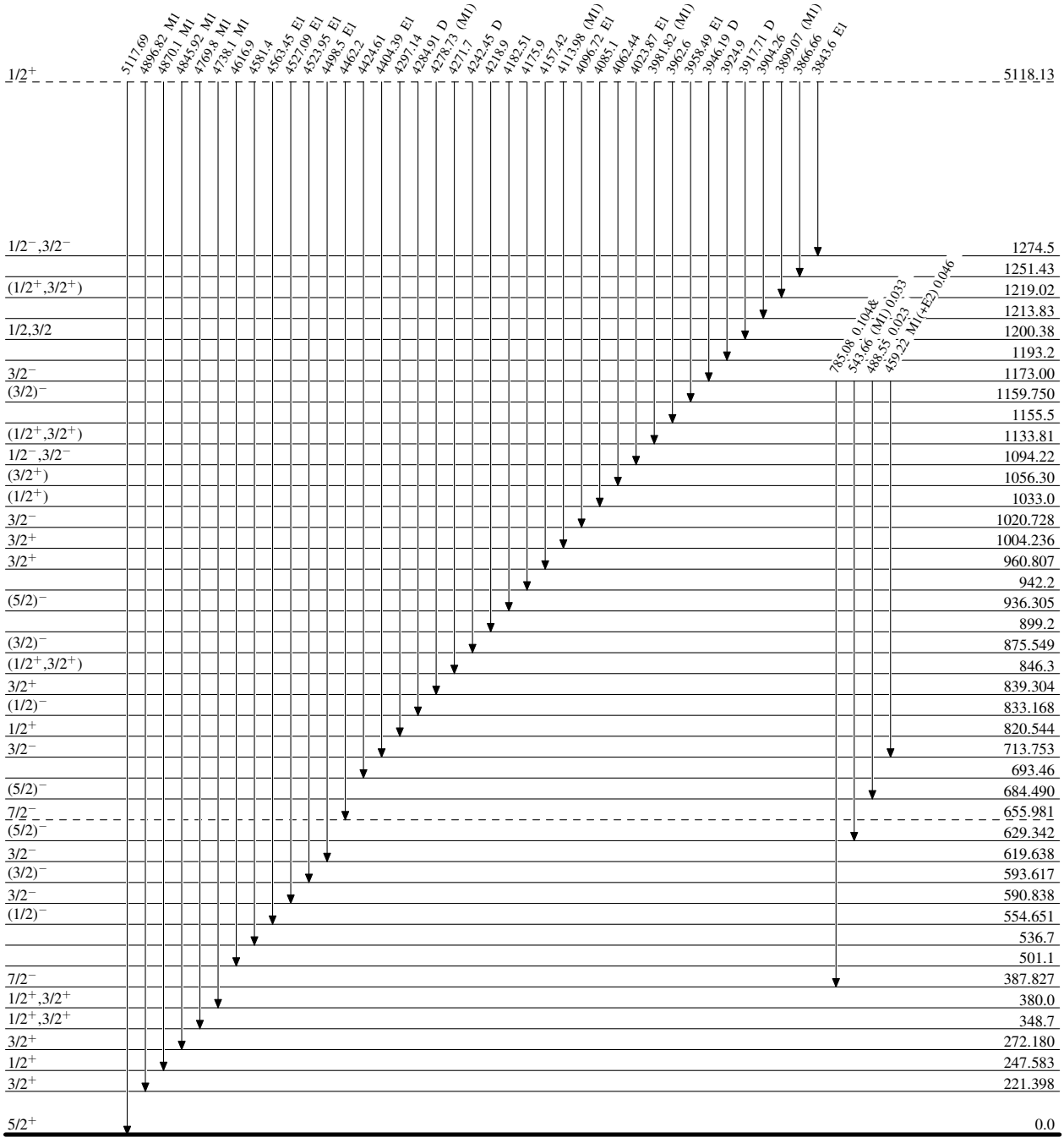
[x] γ ray not placed in level scheme.

^{230}Th(n,γ) E=th 1987Wh01

Level Scheme

Intensities: Per 100 n-captures for secondary γ rays.
& Multiply placed: undivided intensity given

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

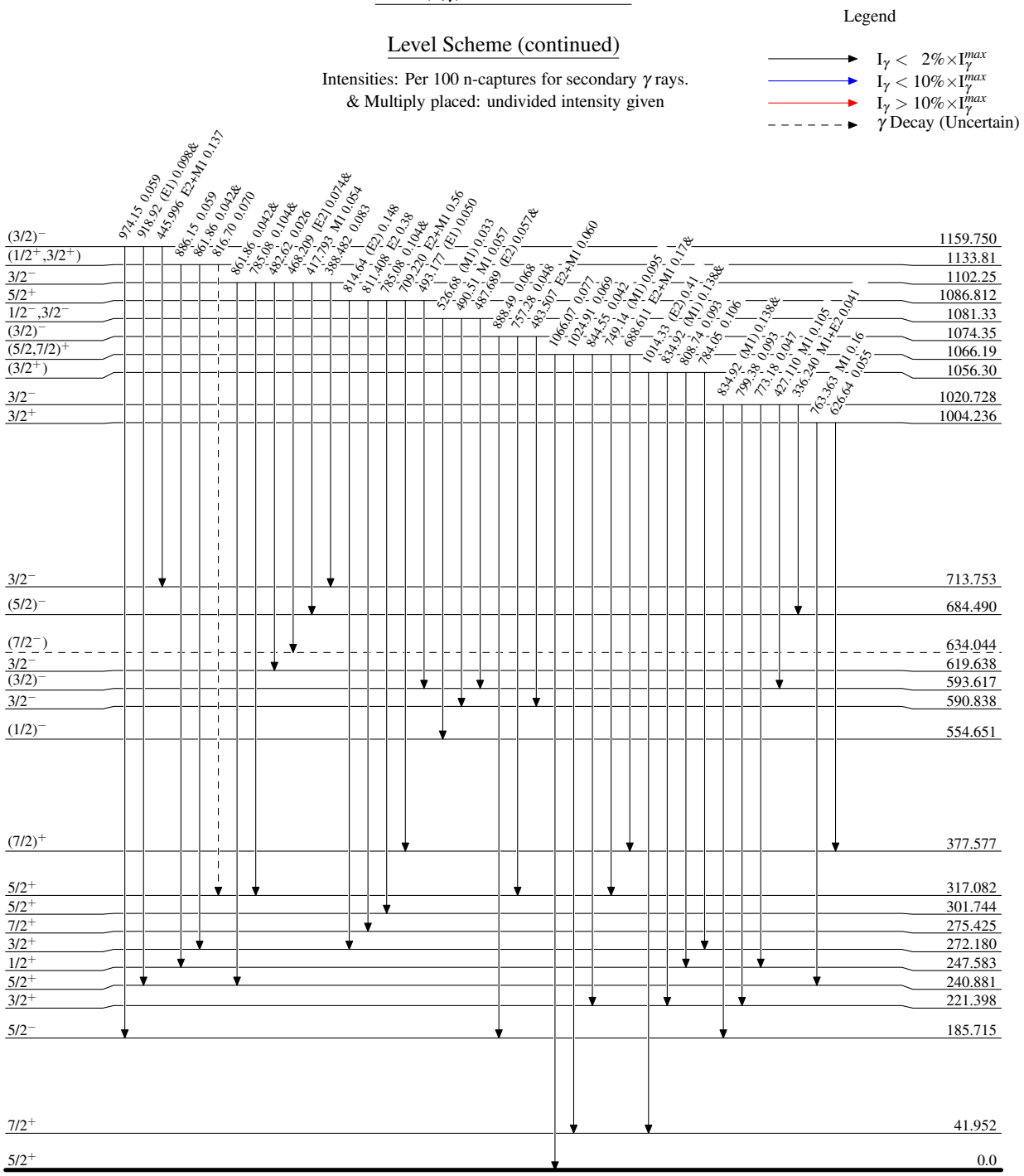


$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01

Level Scheme (continued)

Intensities: Per 100 n-captures for secondary γ rays.
& Multiply placed: undivided intensity given

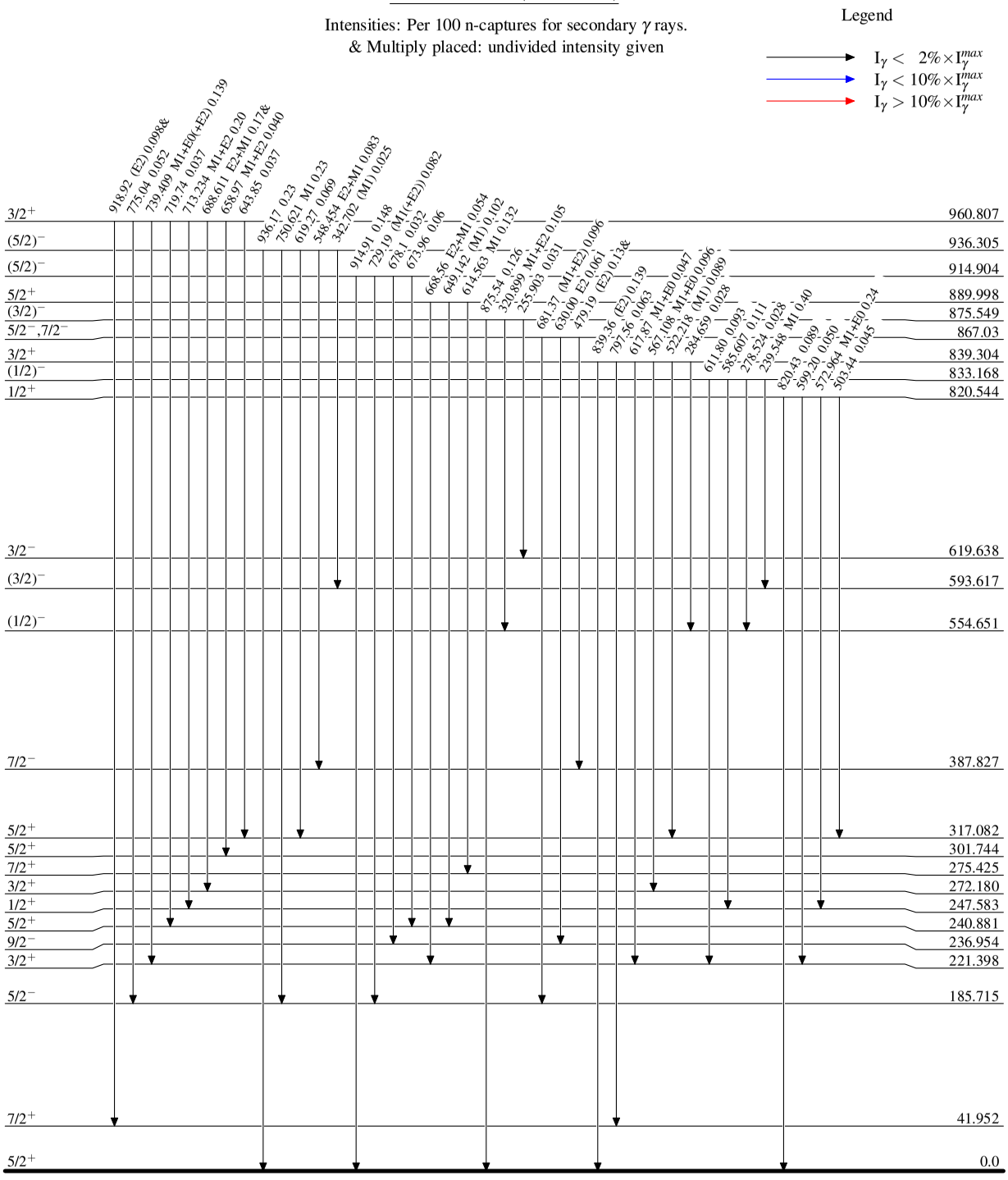


$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01

Level Scheme (continued)

Intensities: Per 100 n-captures for secondary γ rays.
& Multiply placed: undivided intensity given

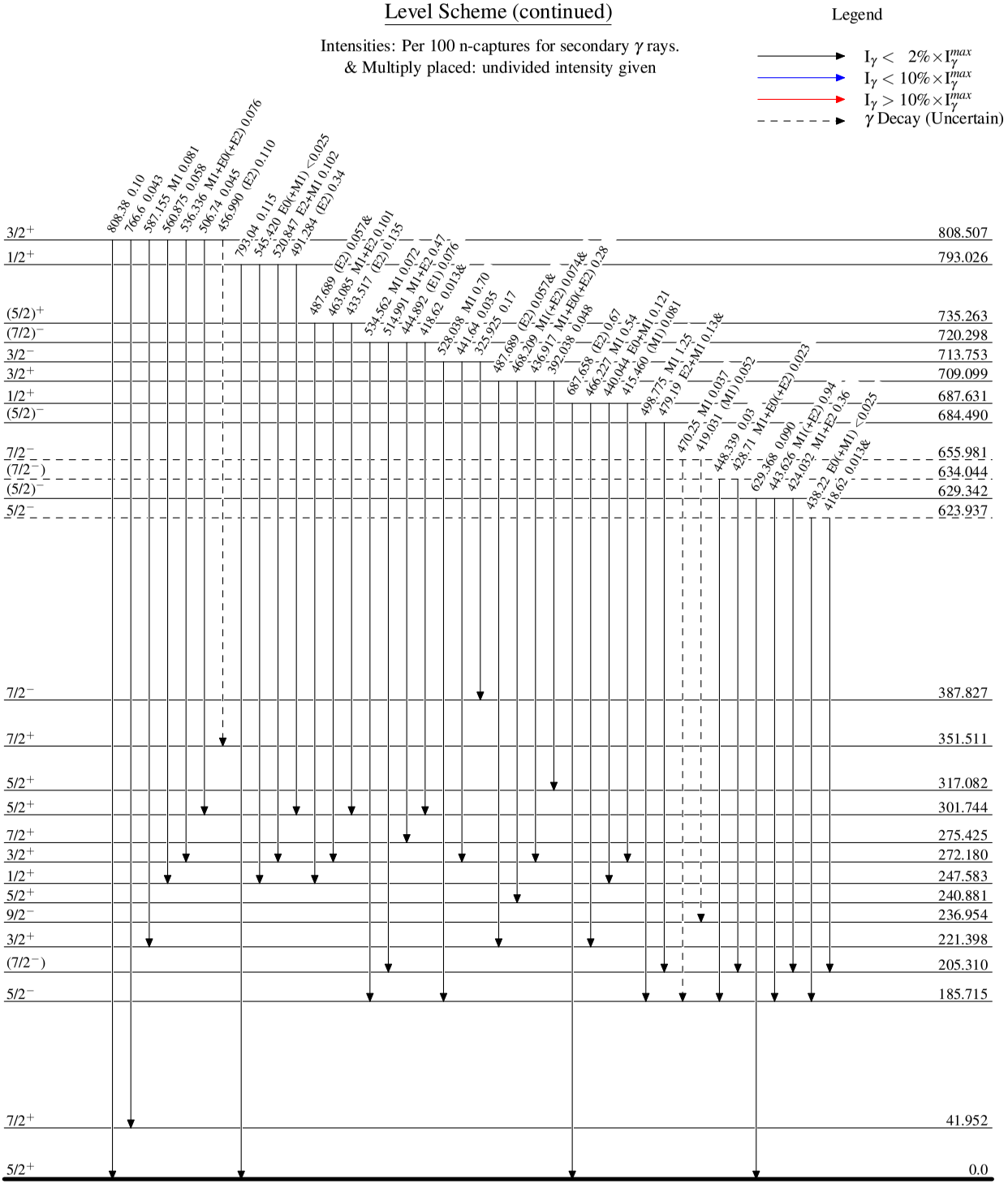


$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01

Level Scheme (continued)

Intensities: Per 100 n-captures for secondary γ rays.
& Multiply placed: undivided intensity given



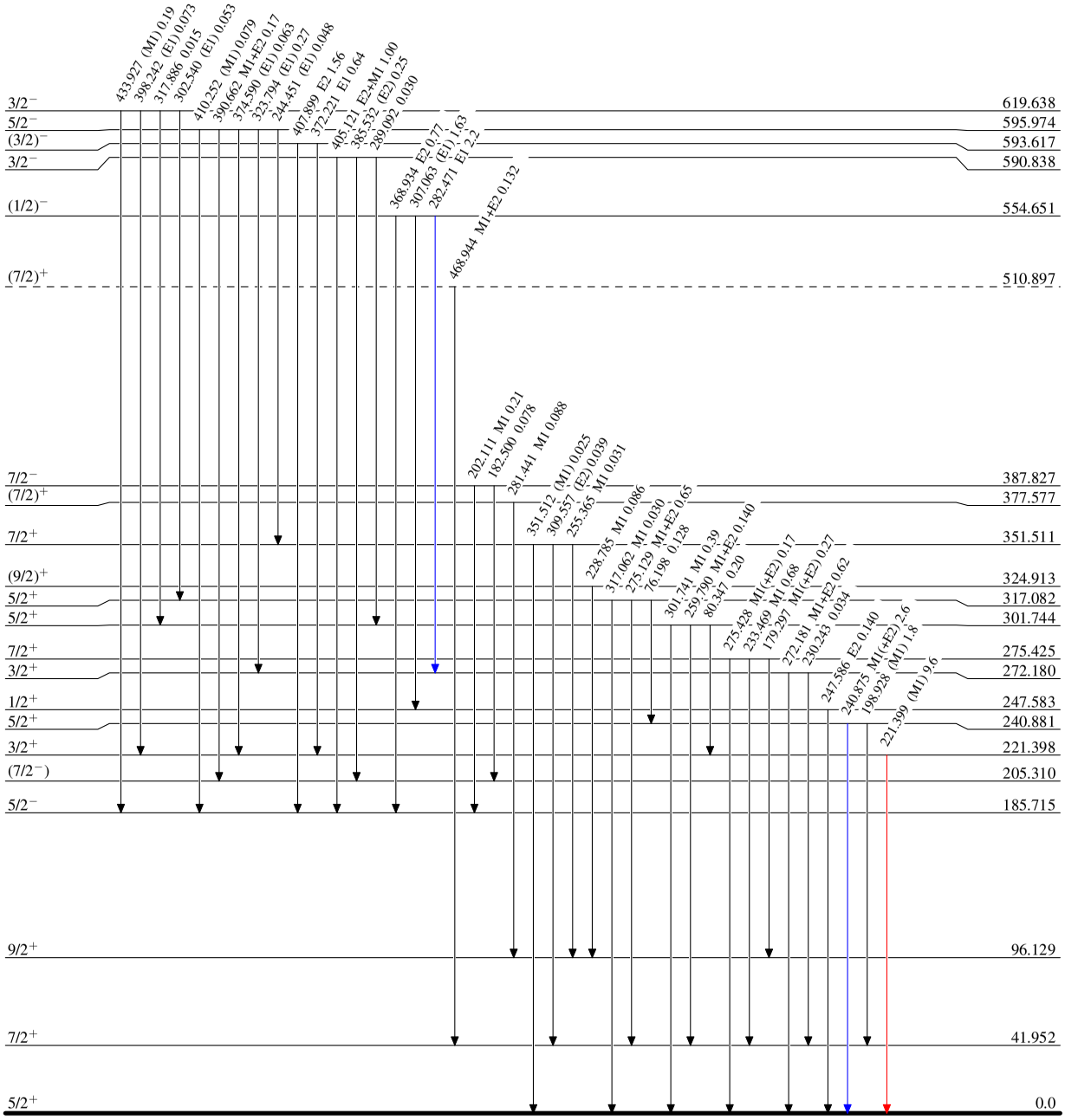
$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01

Level Scheme (continued)

Intensities: Per 100 n-captures for secondary γ rays.
& Multiply placed: undivided intensity given

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

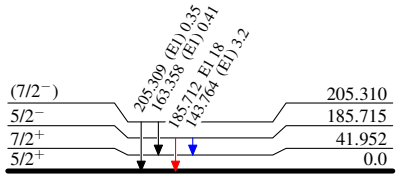


$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01

Level Scheme (continued)

Intensities: Per 100 n-captures for secondary γ rays.
& Multiply placed: undivided intensity given

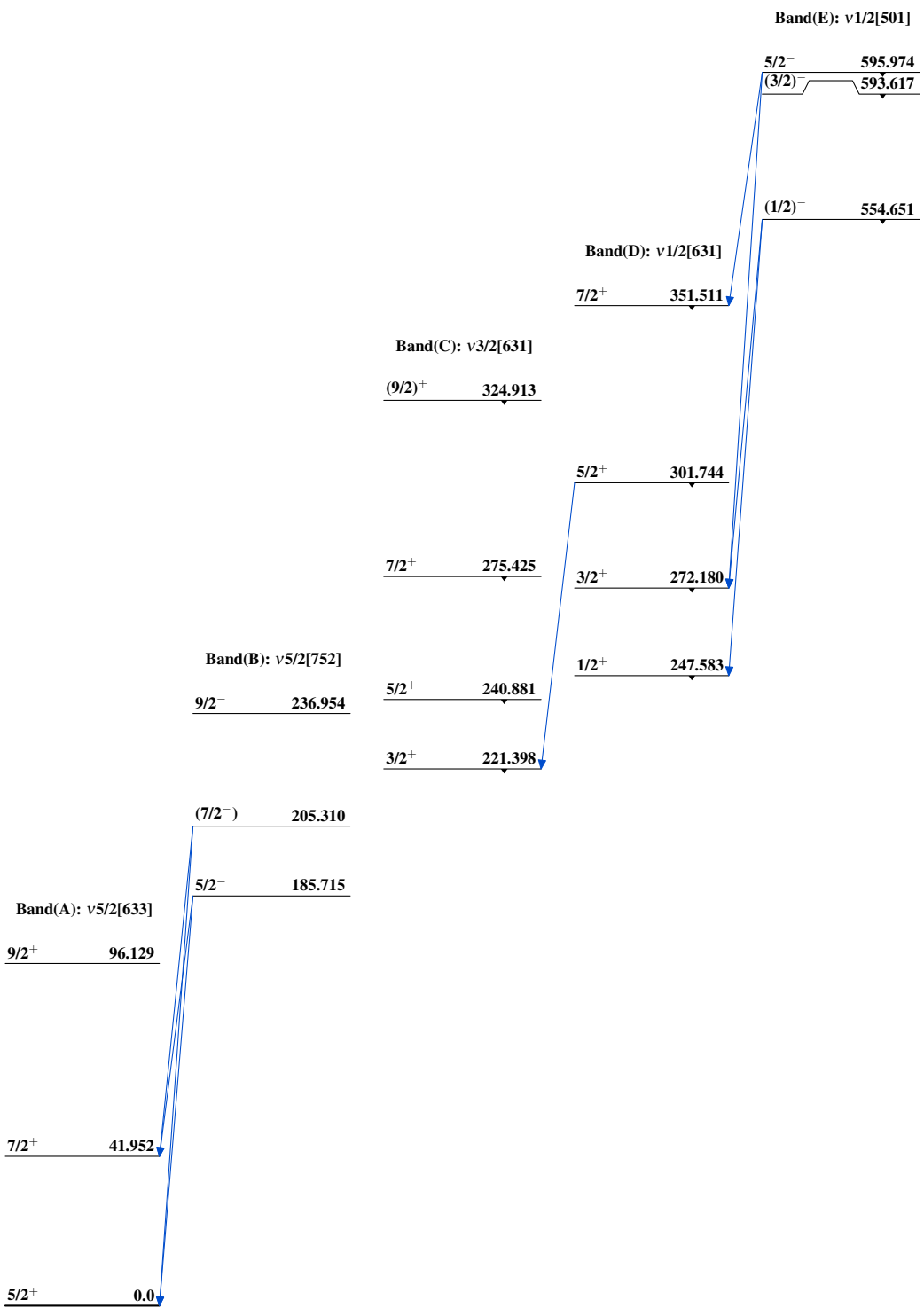


$^{231}_{90}Th_{141}$

Legend

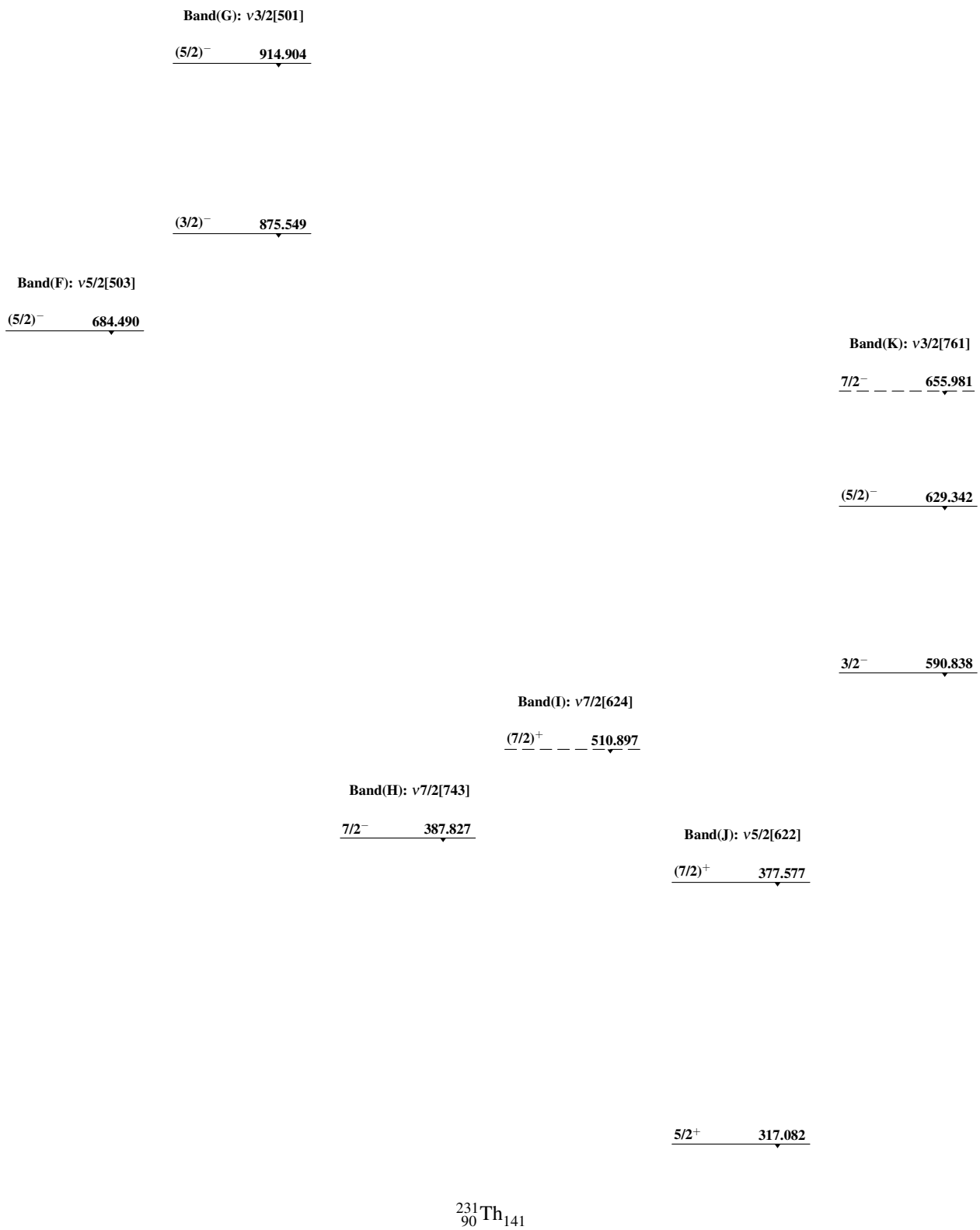
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

^{230}Th(n,γ) E=th 1987Wh01



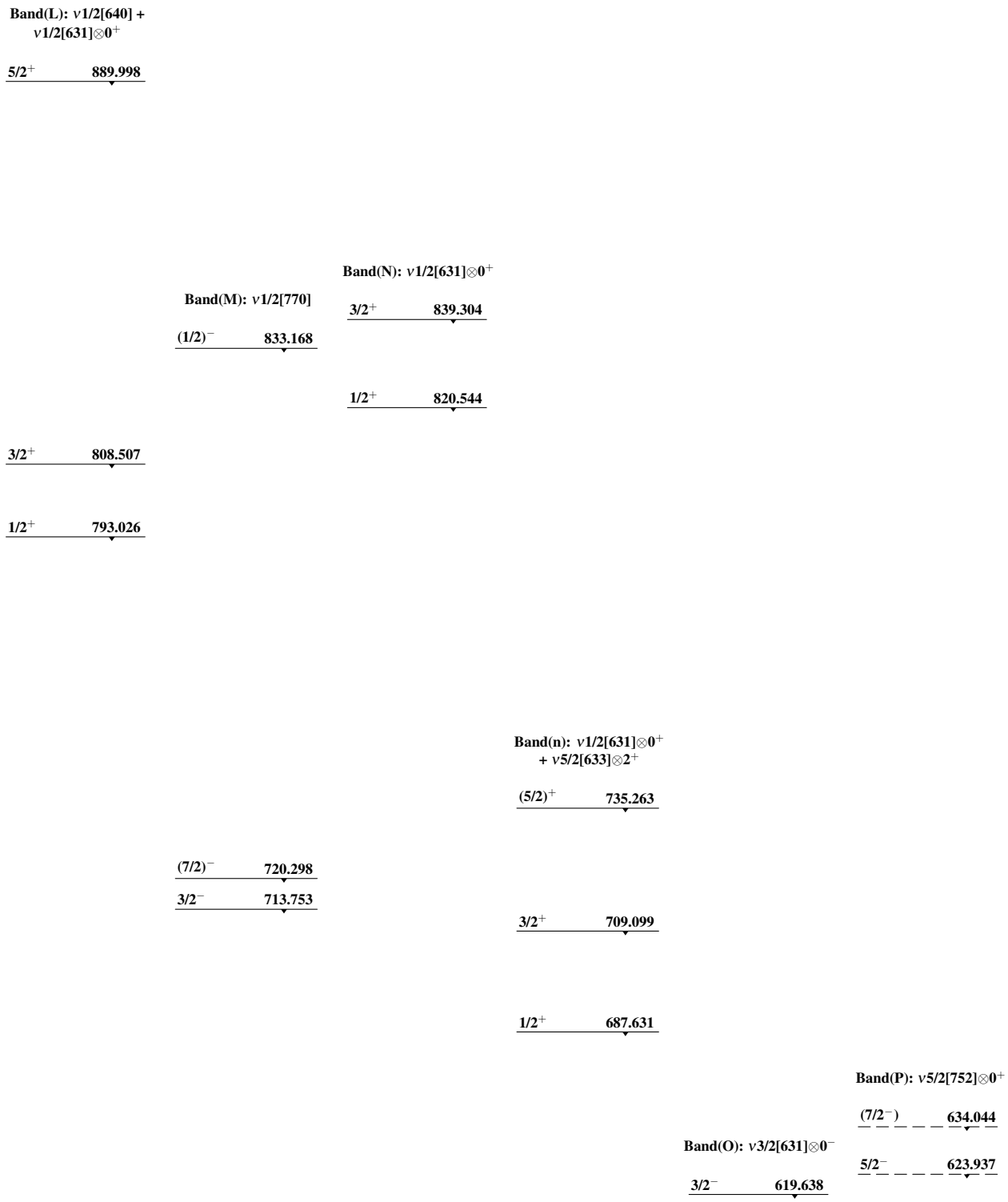
$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01 (continued)



$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01 (continued)



$^{231}_{90}Th_{141}$

^{230}Th(n,γ) E=th 1987Wh01 (continued)

Band(Q): ν3/2[631]$\otimes$0$^+$
Plausible configuration
(1987Wh01)

3/2$^+$ 960.807

$^{231}_{90}Th_{141}$