Adopted **Levels, Gammas**

	Type	Author	History Citation	Literature Cutoff Date
	Full Evaluation	E. Browne	NDS 93,846 (2001)	1-May-2001

$Q(\beta^-)=-2.93\times10^3$ *8*; $S(n)=5889$ *16*; $S(p)=4525$ *11*; $Q(\alpha)=7567$ *4*   2012Wa38
Note: Current evaluation has used the following Q record $ −2950   705891   164526   107567   4   1995Au04.

^{223}Th Levels

The K=5/2 rotational bands of opposite parity (parity-doublet bands), which lie close to each other and are connected by strong E1 transitions, suggest stable quadrupole and octupole deformations for ^{223}Th. The experimental band member energies are consistent with values calculated by 1988Le13 for the octupole single-particle assigned configurations. See ^{208}Pb(^{18}O,3nγ) for two possible additional levels at 1757 (J^π=(31/2$^+$)) and 1953 (J^π=(33/2$^+$)).

Cross Reference (XREF) Flags

A	^{208}Pb(^{18}O,3nγ)
B	^{227}U α decay

E(level)$^@$	$J^{\pi\dagger}$	$T_{1/2}$	XREF	Comments
0.0	(5/2)$^{+\&}$	0.60 s *2*	AB	%α=100 $T_{1/2}$: from ^{223}Th α decay (1987El02). Other values: 0.66 s *1* (1970Va13), 0.9 s *1* (1958To25). J^π: favored α decay (HF=2.3) to 140 level (J^π=(5/2)$^+$) in ^{219}Ra. J^π=5/2$^+$, theoretically predicted in 1987Sh24 using a static quadrupole-octupole deformation.
51.3 *5*	(7/2)$^{+\&}$		AB	J^π: exp δ(51.3γ)=0.21 *1* agrees with a calculated value of 0.21 for J^π=7/2$^+$ and the octupole single-particle assigned configuration (1988Le13).
118.9‡ *6*	(9/2)$^+$		A	
180.5$^\#$ *5*	(9/2$^-$)		A	
209 *1*	(7/2)$^{+\&}$		B	
212.3‡ *6*	(11/2)$^+$		A	
243.0$^\#$ *6*	(11/2$^-$)		A	
247 *1*	(3/2)$^{+\&}$		B	
310 *1*	(5/2)$^{+\&}$		B	
320.0‡ *6*	(13/2$^+$)		A	
324.1$^\#$ *6*	(13/2)$^-$		A	
412.4$^\#$ *6*	(15/2$^-$)		A	
428.7‡ *6*	(15/2)$^+$		A	
547.3$^\#$ *6*	(17/2$^-$)		A	
569.6‡ *6*	(17/2)$^+$		A	
657.0$^\#$ *6*	(19/2$^-$)		A	
706.0‡ *6*	(19/2)$^+$		A	
838.1$^\#$ *6*	(21/2)$^-$		A	
858.1‡ *6*	(21/2)$^+$		A	
962.1$^\#$ *6*	(23/2$^-$)		A	
1021.6‡ *6*	(23/2)$^+$		A	
1179.4$^\#$ *6*	(25/2)$^-$		A	
1185.4‡ *6*	(25/2)$^+$		A	

Adopted Levels, Gammas (continued)

^{223}Th Levels (continued)

E(level)$^{@}$	J$^{\pi\dagger}$	XREF
1313.8$^{\#}$ 6	(27/2)$^{-}$	A
1370.6‡ 6	(27/2)$^{+}$	A
1551.7‡ 6	(29/2)$^{+}$	A
1558.4$^{\#}$ 6	(29/2)$^{-}$	A
1702.5$^{\#}$ 7	(31/2)$^{-}$	A

† J^{π} assignments to levels from ^{208}Pb(^{18}O,3nγ) are based on rotational structure, and on γ-ray multipolarities and decay patterns.
‡ Band(A): 5/2(633) parity doublet rotational band. Rotational parameter: A=7.3 (1990Ja11).
$^{\#}$ Band(B): 5/2−(752) parity doublet rotational band. Rotational parameter: A=5.7 (1990Ja11).
$^{@}$ From ^{208}Pb(^{18}O,3nγ) and ^{227}U α decay.
$^{\&}$ Based also on the similarity of the level structure, γ-ray decay pattern, and relative α-decay hindrance factors in the isotone ^{221}Ra (1991Ho05).

Adopted Levels, Gammas (continued)

$\gamma(^{223}\text{Th})$

E_i(level)	J_i^π	E_γ #	I_γ #	E_f	J_f^π	Mult. #	δ #	α @	Comments
51.3	(7/2)+	51.3 5	100	0.0	(5/2)+	M1+E2	0.214 10	39.2 10	
118.9	(9/2)+	67.5 3	100	51.3	(7/2)+	M1+E2	≈0.2	15 3	
		119.0 5	45 25	0.0	(5/2)+	E2		5.40	
180.5	(9/2−)	129.3 2	100	51.3	(7/2)+				
209	(7/2)+	158‡	100‡ 36	51.3	(7/2)+	M1+E2‡	1.3‡ +7−4	3.0 4	
		209‡	100‡ 36	0.0	(5/2)+	M1+E2‡	1.3‡ +14−5	1.27 25	
212.3	(11/2)+	31.9 3	100 47	180.5	(9/2−)				
		93.4 2	58 16	118.9	(9/2)+	M1+E2	0.27 6	5.7 3	
		161.0† 5	79† 26	51.3	(7/2)+				
243.0	(11/2−)	124.1 2	100	118.9	(9/2)+				
247	(3/2)+	247‡	100‡	0.0	(5/2)+	M1‡	‡	1.53	
310	(5/2)+	259‡	83‡ 33	51.3	(7/2)+	(M1)‡	‡	1.34	
		310‡	100‡ 33	0.0	(5/2)+	M1‡	‡	0.815	
320.0	(13/2+)	76.8 2	98 19	243.0	(11/2−)				
		108.6† 2	56† 5	212.3	(11/2)+				I_γ: Th K x ray + ^{223}Th.
		200.9& 2	100& 5	118.9	(9/2)+				
324.1	(13/2−)	111.4 2	100	212.3	(11/2)+	E1		0.387	
412.4	(15/2−)	87a		324.1	(13/2−)				
		92.3 2	100 13	320.0	(13/2+)				
		170.0 2	10 5	243.0	(11/2−)				
428.7	(15/2)+	104.8† 5	†	324.1	(13/2−)				
		109a		320.0	(13/2+)				
		216.6 3		212.3	(11/2)+	E2		0.504	
547.3	(17/2)−	118.7 2	65 15	428.7	(15/2)+	E1		0.333	
		136.0&a 2	22& 9	412.4	(15/2−)				
		223.2& 2	100& 6	324.1	(13/2−)	E2		0.453	
569.6	(17/2)+	140.9a 2	<4	428.7	(15/2)+				
		157.1† 3	100† 4	412.4	(15/2−)	E1		0.170	
		249.5† 3	30† 5	320.0	(13/2+)				
657.0	(19/2−)	87.4 2	100 9	569.6	(17/2)+				
		109a		547.3	(17/2)−				
		244.6† 2	33† 14	412.4	(15/2−)				
706.0	(19/2)+	136.0&a 2	19& 8	569.6	(17/2)+				
		158.6† 2	100† 5	547.3	(17/2)−	E1		0.166	
		277.4† 2	17† 3	428.7	(15/2)+	E2		0.219	
838.1	(21/2)−	131.9 2	100 13	706.0	(19/2)+	E1		0.258	

Adopted Levels, Gammas (continued)

$\gamma(^{223}$Th) (continued)

E_i(level)	J_i^π	E_γ[#]	I_γ[#]	E_f	J_f^π	Mult.[#]	α[@]
838.1	(21/2)$^-$	290.9 2	41 5	547.3	(17/2)$^-$	E2	0.189
858.1	(21/2)$^+$	200.9[&] 2	100[&] 5	657.0	(19/2$^-$)		
		288.5 2	6 1	569.6	(17/2)$^+$	E2	0.194
962.1	(23/2$^-$)	103.8[†] 5	100[†] 10	858.1	(21/2)$^+$		
		305.2 2	13 1	657.0	(19/2$^-$)	E2	0.163
1021.6	(23/2)$^+$	183.3[†] 3	100[†] 24	838.1	(21/2)$^-$	E1	0.117
		315.7 2	13 2	706.0	(19/2)$^+$	E2	0.147
1179.4	(25/2)$^-$	157.6[†] 3	100[†] 4	1021.6	(23/2)$^+$	E1	0.168
		341.4 2	8 3	838.1	(21/2)$^-$	E2	0.117
1185.4	(25/2)$^+$	223.2[&] 2	675[&] 38	962.1	(23/2$^-$)		
		326.8[†] 5	100[†] 27	858.1	(21/2)$^+$	E2	0.133
1313.8	(27/2)$^-$	128.1 3	70 10	1185.4	(25/2)$^+$	E1	0.276
		351.9 2	100 25	962.1	(23/2$^-$)		
1370.6	(27/2)$^+$	191.3 2	100 8	1179.4	(25/2)$^-$	E1	0.106
		349.0 2	29 11	1021.6	(23/2)$^+$		
1551.7	(29/2)$^+$	237.8 2	100 10	1313.8	(27/2)$^-$	E1	0.0635
		366.3 2	30 10	1185.4	(25/2)$^+$	E2	0.0962
1558.4	(29/2)$^-$	187.8 2	100 6	1370.6	(27/2)$^+$	E1	0.111
		378.9[†] 5	24[†] 6	1179.4	(25/2)$^-$	E2	0.0877
1702.5	(31/2)$^-$	150.7 3	100 22	1551.7	(29/2)$^+$	E1	0.187
		388.8 2	61 17	1313.8	(27/2)$^-$	E2	0.0818

[†] Doublet.

[‡] From ^{227}U α decay.

[#] From ^{208}Pb(^{18}O,3nγ), unless otherwise specified.

[@] 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.

[&] Multiply placed with undivided intensity.

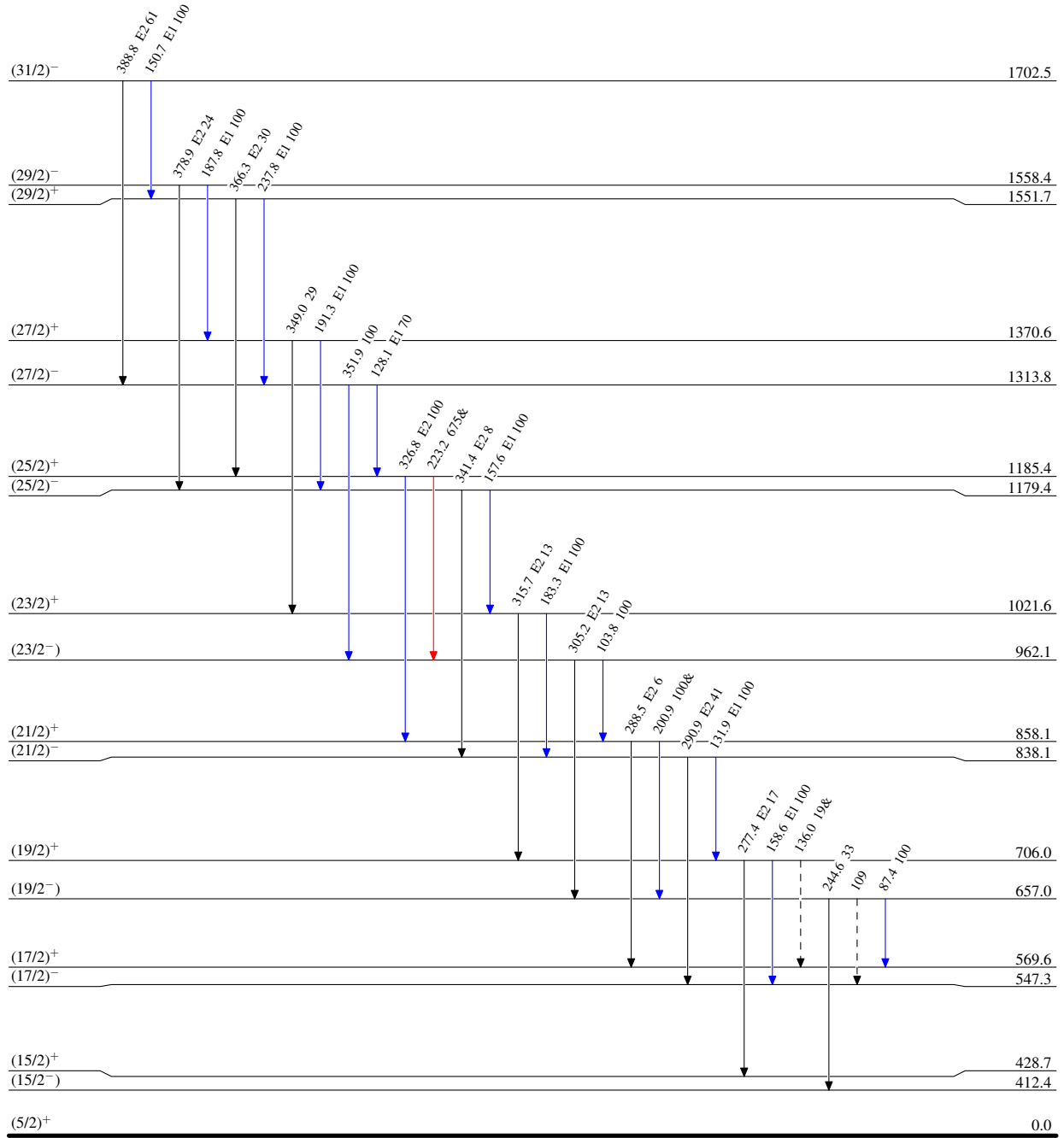[a] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

<u>Level Scheme</u>

Intensities: Type not specified
& Multiply placed: undivided intensity given

Legend

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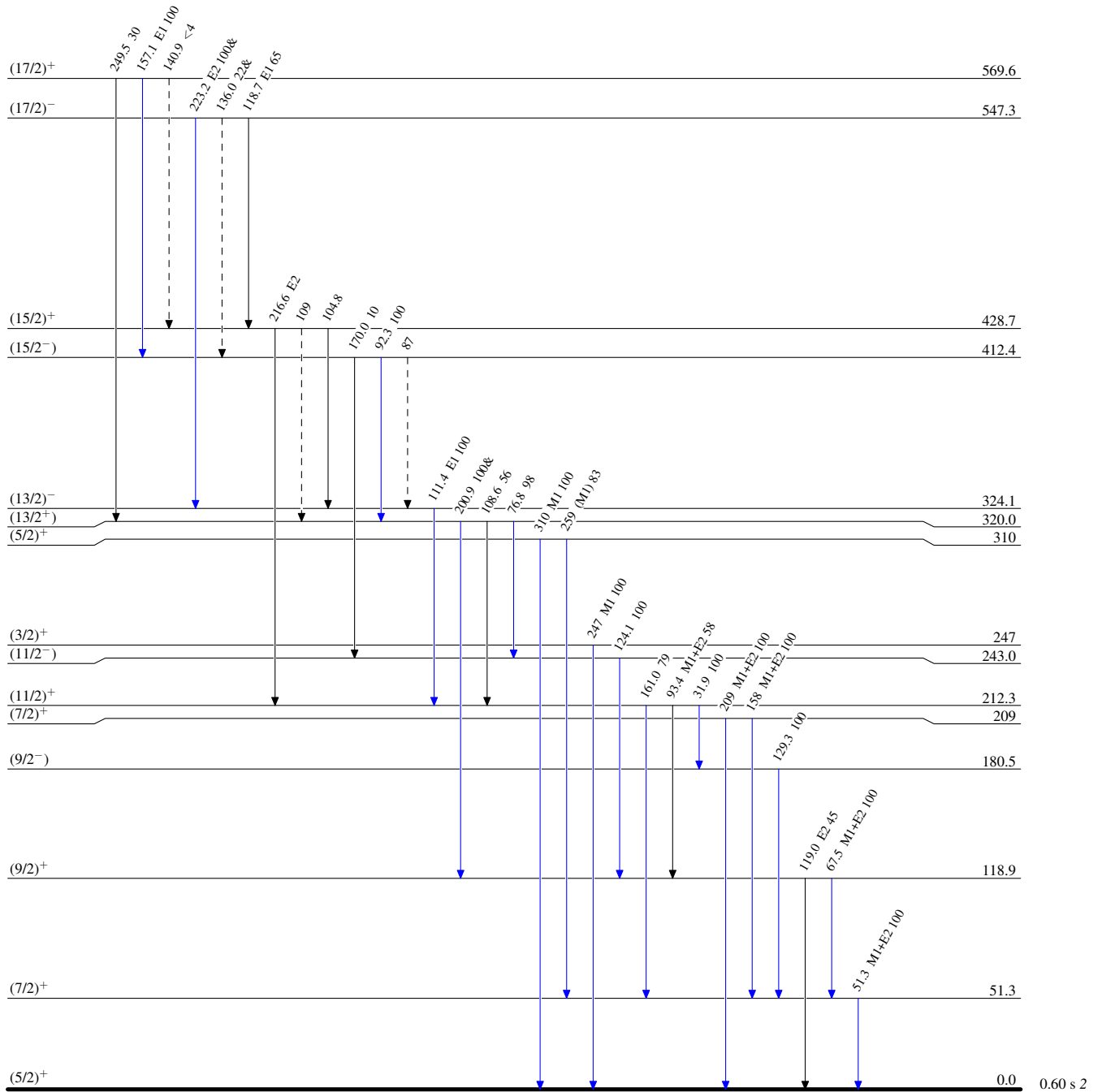

$^{223}_{90}$Th$_{133}$

Adopted Levels, Gammas

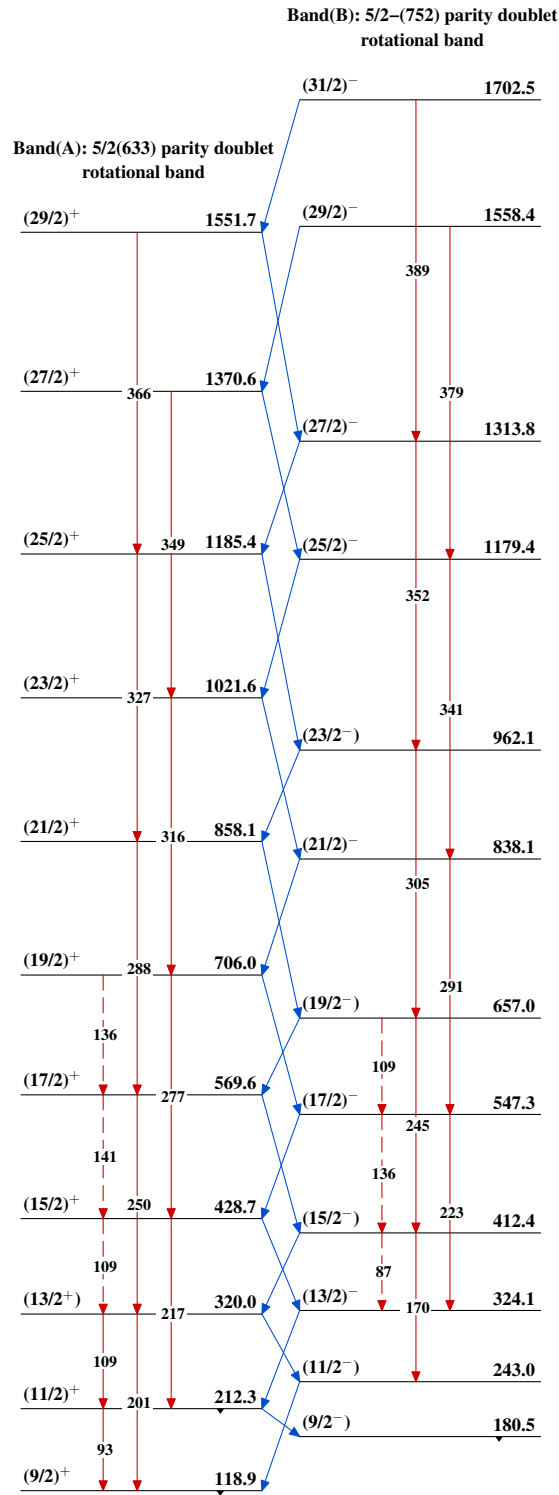Level Scheme (continued)

Intensities: Type not specified
& Multiply placed: undivided intensity given

Legend

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

$^{223}_{90}$Th$_{133}$

Adopted Levels, Gammas

Band(B): 5/2−(752) parity doublet
rotational band

(31/2)⁻　　　1702.5

Band(A): 5/2(633) parity doublet
rotational band

(29/2)⁺　　　1551.7　　　　(29/2)⁻　　　1558.4

389

(27/2)⁺　366　1370.6

379

(27/2)⁻　　　1313.8

(25/2)⁺　349　1185.4　　　(25/2)⁻　　　1179.4

352

(23/2)⁺　327　1021.6

341

(23/2⁻)　　　962.1

(21/2)⁺　316　858.1　　　(21/2)⁻　　　838.1

305

(19/2)⁺　288　706.0

291

(19/2⁻)　　　657.0

136

(17/2)⁺　277　569.6　　　(17/2)⁻　　　547.3

109

245

141

136

(15/2)⁺　250　428.7　　　(15/2⁻)　223　412.4

109

87

(13/2⁺)　217　320.0　　　(13/2)⁻　170　324.1

109

(11/2)⁺　201　212.3　　　(11/2⁻)　　　243.0

93

(9/2⁻)　　　180.5

(9/2)⁺　　　118.9

$^{223}_{90}$Th$_{133}$