

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 141, 1 (2017)	1-Feb-2017

Q(β⁻)=936.7 25; S(n)=6778.5 10; S(p)=5936.2 10; Q(α)=-157.5 13 2017Wa10
 Q(ε)=1218.9 10; S(2n)=15523 10; S(2p)=13966 10 2017Wa10

Additional information 1.

2016Ka22 deal with possible observation of dineutron in ¹⁵⁹Tb(n,²n)¹⁵⁸Tb(g.s.) reaction.

¹⁵⁸Tb Levels

Since the uncertainty of the levels populated in particle-transfer reactions can be about 5 keV (or higher), some levels in the table can be a single level: 322.6 and 324, 439 and 444.4, 531 and 536, 814.3 and 817, 832 and 837.

Cross Reference (XREF) Flags

A	¹⁵⁹ Tb(d,t)	E	¹⁵⁷ Gd(³ He,d), (α,t)
B	¹⁵⁸ Tb IT decay (10.70 s)	F	¹⁵⁹ Tb(³ He,α)
C	¹⁵⁸ Tb IT decay (0.40 ms)	G	¹⁶¹ Dy(p,α)
D	¹⁵⁴ Sm(⁷ Li,3nγ)		

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
0.0 [#]	3 ⁻	180 y 11	ABC EF	%ε+%β ⁺ =83.4 7; %β ⁻ =16.6 7 μ= +1.758 7; Q= +2.7 5 J ^π : J measured by paramagnetic resonance (1968Ea04). π from μ and assignment of configuration of ((p,3/2[411])(n,3/2[521])) based on (p,3/2[411]) assignment to the ground states of 155, 157, 159, and 161 terbium and (n,3/2[521]) to ground states of the N=93 isotones ¹⁵⁵ Sm, ¹⁵⁷ Gd, ¹⁵⁹ Dy, and ¹⁶¹ Er; 3 ⁻ assignment is confirmed by good agreement of measured and theoretical cross sections in particle-transfer reactions (1974EIZW, 1989Bu03). T _{1/2} : From 1984Pr07; others: 1963Pr12, 1961Le02. μ: From 2014StZZ compilation and based on data of 1968Ea04. Q: From 2016St14 evaluation and based on data of 1968Ea04. %β ⁻ : From the sum of the transition intensities to the ground states of ¹⁵⁸ Dy by β ⁻ decay and ¹⁶⁸ Gd by ε+β ⁺ decay.
55.04 ^{&} 5	4 ⁺		A C G	J ^π : Also from E1 γ to 3 ⁻ level.
79.9 [#]	4 ⁻		A EF	
110.3 [@] 12	0 ⁻	10.70 s 17	AB	%IT=100; %β ⁻ <0.6; %ε+%β ⁺ <0.01 %β ⁻ , %ε: From 1965Sc11 in IT decay. J ^π : Also, from M3 γ to 3 ⁻ level. T _{1/2} : Weighted average of 11.0 s 2 (1957Ha12 with uncertainty increased from 0.1 to be more consistent with those of later measurements), 10.5 s 3 (1958Go78), and 10.5 s 2 (1965Sc11); others: 10.2 s (1965Br21) and 10.8 s (1966Pr13).
115.5 [@]	1 ⁻		A E	
128.24 ^a 7	5 ⁺		A CD FG	J ^π : Also, from γ to 4 ⁺ level.
167.4 [@]	2 ⁻		A E	
178.9 [#]	5 ⁻		a f	XREF: a(178.9)f(175).
178.9 ^b	1 ⁺		a fg	XREF: a(178.9)f(175)g(180).
207.8 [@]	3 ⁻		a Ef	XREF: a(207.8)E(208)f(212).
207.8 ^b	2 ⁺		a fg	XREF: a(207.8)f(212)g(208).
217.31 ^{&} 8	6 ⁺		A CD	J ^π : Also, from γ's to 4 ⁺ and 5 ⁺ levels.

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Adopted Levels, Gammas (continued) ^{158}Tb Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
242.0 ^b	3 ⁺		A FG	
280.6			A	
298.4 ^b	4 ⁺		a fG	XREF: a(298.5)f(301)G(298). Additional information 2.
298.5 [@]	4 ⁻		a Ef	XREF: a(298.5)E(298)f(301).
298.6 [#]	6 ⁻		A f	XREF: f(301).
322.64 ^a 10	7 ⁺		A CD FG	J ^π : Q γ to 5 ⁺ level and expected band structure.
324			E	
338.1			A	
359.8 ^b	5 ⁺		A fG	XREF: f(359).
371.2 [@]	5 ⁻		A f	XREF: f(359).
381.1			A E	
388.39 ^c 11	7 ⁻	0.40 ms 4	A C F	%IT=100 J ^π : From E1 γ to 7 ⁺ level and expected configuration for isomeric state. T _{1/2} : From 1961Kr01.
406			F	
408.1 ^d	(0 ⁺)		A	
419.3 ^d	(1 ⁺)		A	
439			E	
444.4 ^b	6 ⁺		a fg	XREF: a(444.4)f(445)g(445).
445.63 ^{&} 21	8 ⁺		a D fg	XREF: a(444.4)f(445)g(445).
460.9 ^k	5 ⁺		A E	
469.7			A	
484			G	
487.3 ^d	(2 ⁺)		A f	XREF: f(496).
495.4 ^e	4 ⁻		a efg	XREF: a(495.4)e(499)f(496)g(501).
495.4 ^f	5 ⁻		a efg	XREF: a(495.4)e(499)f(496)g(501).
505.9			A ef	XREF: e(499)f(496).
531 ^k	6 ⁺		E	
536			G	
540.0 ^b	7 ⁺		A F	
556			G	
571			E	
584.2 ^a 3	9 ⁺		D	J ^π : Q γ to 7 ⁺ and expected band structure.
587 ^f	6 ⁻		e G	XREF: e(588).
590.0 ^g	3 ⁺		A ef	XREF: e(588)f(596).
601.5 ^e	5 ⁻		A f	XREF: f(596).
610.1			A f	XREF: f(596).
613			G	
627 ^k	7 ⁺		E	
638.7 ^h	2 ⁺		A	
644			F	
650.7			A G	
659.7 ^l	4 ⁺		A E	
665 ^f	7 ⁻		G	
670			F	
677.3			A	
693			G	
699.6 ⁱ	(1 ⁺)		A F	XREF: F(696).
709 ^m	2 ⁻		E	

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Adopted Levels, Gammas (continued) ^{158}Tb Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
719.7 ^h	3 ⁺	A	
733		F	
737 ^j	(4 ⁻)	G	
740.0 ^{& 3}	10 ⁺	D	J ^π : Q γ to 8 ⁺ and expected band structure.
740.2?		A	this level is very close in energy to 10 ⁺ , 740 from $^{154}\text{Sm}(^7\text{Li},3n\gamma)$ dataset.
750.0 ^l	5 ⁺	A E	
753		F	
758.5		A	
759 ^f	8 ⁻	G	
767.5 ⁱ	(2 ⁺)	A	
780 ^j	(3 ⁻)	G	
782 ^m	3 ⁻	E	
794.6		A	
805		G	
814.3		A	
817 ⁿ	5 ⁻	E	
824.0		A	
832		E	
837		G	
840.6		A	
849.7 ⁱ	(3 ⁺)	A	
859		G	
863.3 ^l	6 ⁺	A E	
874.4		A	
879 ^j	(6 ⁻)	G	
881.9		A E	
891 ^j	(5 ⁻)	G	
900.7		A	
913.8 ^{a 4}	11 ⁺	D	J ^π : Q γ to 9 ⁺ and expected band structure.
916		G	this level is close in energy to 11 ⁺ , 914 from $^{154}\text{Sm}(^7\text{Li},3n\gamma)$ dataset.
923.8		A	
936		E	
944.0		A G	XREF: G(943).
953.5		A	
963 ^o	4 ⁻	E G	
986		A	
999		E G	
1017		A	
1032		A E	
1051		A	
1068 ^p	1 ⁻	A E	
1094		A	
1099.0 ^{& 4}	12 ⁺	D	J ^π : Q γ to 10 ⁺ and expected band structure.
1110 ^p	2 ⁻	A E	
1138		G	
1157		A	
1169		A	
1311.1 ^{a 5}	13 ⁺	D	J ^π : Q γ to 11 ⁺ and expected band structure.
1522.0 ^{& 7}	14 ⁺	D	J ^π : Q γ to 12 ⁺ and expected band structure.
1773.9 ^{a 7}	(15 ⁺)	D	
2008.3 ^{& 10}	(16 ⁺)	D	
2300.5 ^{a 10}	(17 ⁺)	D	

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Adopted Levels, Gammas (continued)

¹⁵⁸Tb Levels (continued)

† From a least-squares fit to E_γ values.

‡ From (d,t) angular distributions, and comparison of measured and calculated charged-particle reaction cross sections for essentially all levels; additional arguments are given for individual levels.

Band(A): K^π=3⁻ band. Based on Configuration=((π 3/2(411))+(ν 3/2(521))).

@ Band(B): K^π=0⁻ band. Based on Configuration=((π 3/2(411))-(ν 3/2(521))).

& Band(C): K^π=4⁺ band, α=0. Based on Configuration=((π 3/2(411))+(ν 5/2(642))).

^a Band(c): K^π=4⁺ band, α=1. Based on Configuration=((π 3/2(411))+(ν 5/2(642))).

^b Band(D): K^π=1⁺ band. Based on Configuration=((π 3/2(411))-(ν 5/2(642))).

^c Band(E): K^π=7⁻ band. Based on Configuration=((π 3/2(411))+(ν 11/2(505))).

^d Band(F): K^π=0⁺ band. Based on Configuration=((π 3/2(411))-(ν 3/2(402))).

^e Band(G): K^π=4⁻ band. Based on Configuration=((π 3/2(411))-(ν 11/2(505))).

^f Band(H): K^π=5⁻ band. Based on Configuration=((π 5/2(532))+(ν 5/2(642))).

^g Band(I): K^π=3⁺ band. Based on Configuration=((π 3/2(411))+(ν 3/2(402))).

^h Band(J): K^π=2⁺ band. Based on Configuration=((π 3/2(411))+(ν 1/2(400))).

ⁱ Band(K): K^π=1⁺ band. Based on Configuration=((π 3/2(411))-(ν 1/2(400))).

^j Band(L): K^π=0⁻ band. Based on Configuration=((π 5/2(532))-(ν 5/2(642))).

^k Band(M): K^π=4⁺ band. Based on Configuration=((π 5/2(532))+(ν 3/2(521))).

^l Band(N): K^π=1⁺ band. Based on Configuration=((π 5/2(532))-(ν 3/2(521))).

^m Band(O): K^π=2⁻ band. Based on Configuration=((π 7/2(404))-(ν 3/2(521))).

ⁿ Band(P): K^π=5⁻ band. Based on Configuration=((π 7/2(404))+(ν 3/2(521))).

^o Band(Q): K^π=4⁻ band. Based on Configuration=((π 5/2(402))+(ν 3/2(521))).

^p Band(R): K^π=1⁻ band. Based on Configuration=((π 5/2(402))-(ν 3/2(521))).

E _i (level)	J _i ^π	E _γ	I _γ	E _f	J _f ^π	Mult.‡	γ(¹⁵⁸ Tb)		Comments
							α [†]		
55.04	4 ⁺	55.04 5	100	0.0	3 ⁻	E1	1.439		α(K)=1.177 17; α(L)=0.206 3; α(M)=0.0450 7; α(N+..)=0.01157 17 α(N)=0.01011 15; α(O)=0.001402 20; α(P)=6.08×10 ⁻⁵ 9
110.3	0 ⁻	110.3 12	100	0.0	3 ⁻	M3	108 6		α(K)=56.6 25; α(L)=38.8 24; α(M)=9.8 6; α(N+..)=2.61 17 α(N)=2.28 15; α(O)=0.319 20; α(P)=0.0124 7 B(M3)(W.u.)=0.34 4 Mult.: From ¹⁵⁸ Tb IT decay (10.7 s).
128.24	5 ⁺	73.21 5		55.04	4 ⁺				
217.31	6 ⁺	89.08 5	100 6	128.24	5 ⁺				
		162.22 10	44 6	55.04	4 ⁺	Q			
322.64	7 ⁺	105.33 10	76 5	217.31	6 ⁺				
		194.41 10	100 5	128.24	5 ⁺	Q			
388.39	7 ⁻	65.76 10	56 2	322.64	7 ⁺	E1	0.913		B(E1)(W.u.)=5.3×10 ⁻¹⁰ 6 α(K)=0.754 11; α(L)=0.1247 19; α(M)=0.0272 4; α(N+..)=0.00705 11 α(N)=0.00614 9; α(O)=0.000865 13; α(P)=3.95×10 ⁻⁵ 6
		171.07 10	100 2	217.31	6 ⁺	[E1]	0.0711		B(E1)(W.u.)=5.4×10 ⁻¹¹ 6 α(K)=0.0600 9; α(L)=0.00870 13; α(M)=0.00189 3; α(N+..)=0.000500 7 α(N)=0.000432 6; α(O)=6.40×10 ⁻⁵ 9; α(P)=3.58×10 ⁻⁶ 5
445.63	8 ⁺	123.0 [#] 3	47 [#] 9	322.64	7 ⁺				

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Adopted Levels, Gammas (continued) $\gamma(^{158}\text{Tb})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult. [‡]
445.63	8 ⁺	228.3 [#] 3	100 [#] 7	217.31	6 ⁺	Q
584.2	9 ⁺	138.6 [#] 5	37 [#] 5	445.63	8 ⁺	D
		261.6 [#] 3	100 [#] 7	322.64	7 ⁺	Q
740.0	10 ⁺	155.8 [#] 5	25 [#] 4	584.2	9 ⁺	D
		294.4 [#] 3	100 [#] 4	445.63	8 ⁺	Q
913.8	11 ⁺	173.8 [#] 5	23 [#] 6	740.0	10 ⁺	
		329.6 [#] 3	100 [#] 3	584.2	9 ⁺	Q
1099.0	12 ⁺	185.2 [#] 7	21 [#] 2	913.8	11 ⁺	
		359.0 [#] 3	100 [#] 7	740.0	10 ⁺	Q
1311.1	13 ⁺	212.1 [#] 7	15 [#] 5	1099.0	12 ⁺	
		397.3 [#] 5	100 [#] 7	913.8	11 ⁺	Q
1522.0	14 ⁺	210.9 [#] 7	41 [#] 25	1311.1	13 ⁺	
		423.0 [#] 7	100 [#] 13	1099.0	12 ⁺	Q
1773.9	(15 ⁺)	462.8 [#] 5	100 [#]	1311.1	13 ⁺	
2008.3	(16 ⁺)	486.3 [#] 7	100 [#]	1522.0	14 ⁺	
2300.5?	(17 ⁺)	526.5 [#] @ 7	100 [#]	1773.9	(15 ⁺)	

[†] Additional information 3.

[‡] From α deduced from intensity balances (1984Bu30, ^{158}Tb IT decay (0.40 ms) dataset). Values given as Q and D are determined by Angular Distribution from Oriented nuclei (2015Zh25, $^{154}\text{Sm}(^7\text{Li},3n\gamma)$ dataset). The stretched quadrupole transitions are most likely E2, and the stretched dipole transition are most likely M1 or M1+E2 for an intraband transition.

[#] From 2015Zh25, $^{154}\text{Sm}(^7\text{Li},3n\gamma)$ dataset.

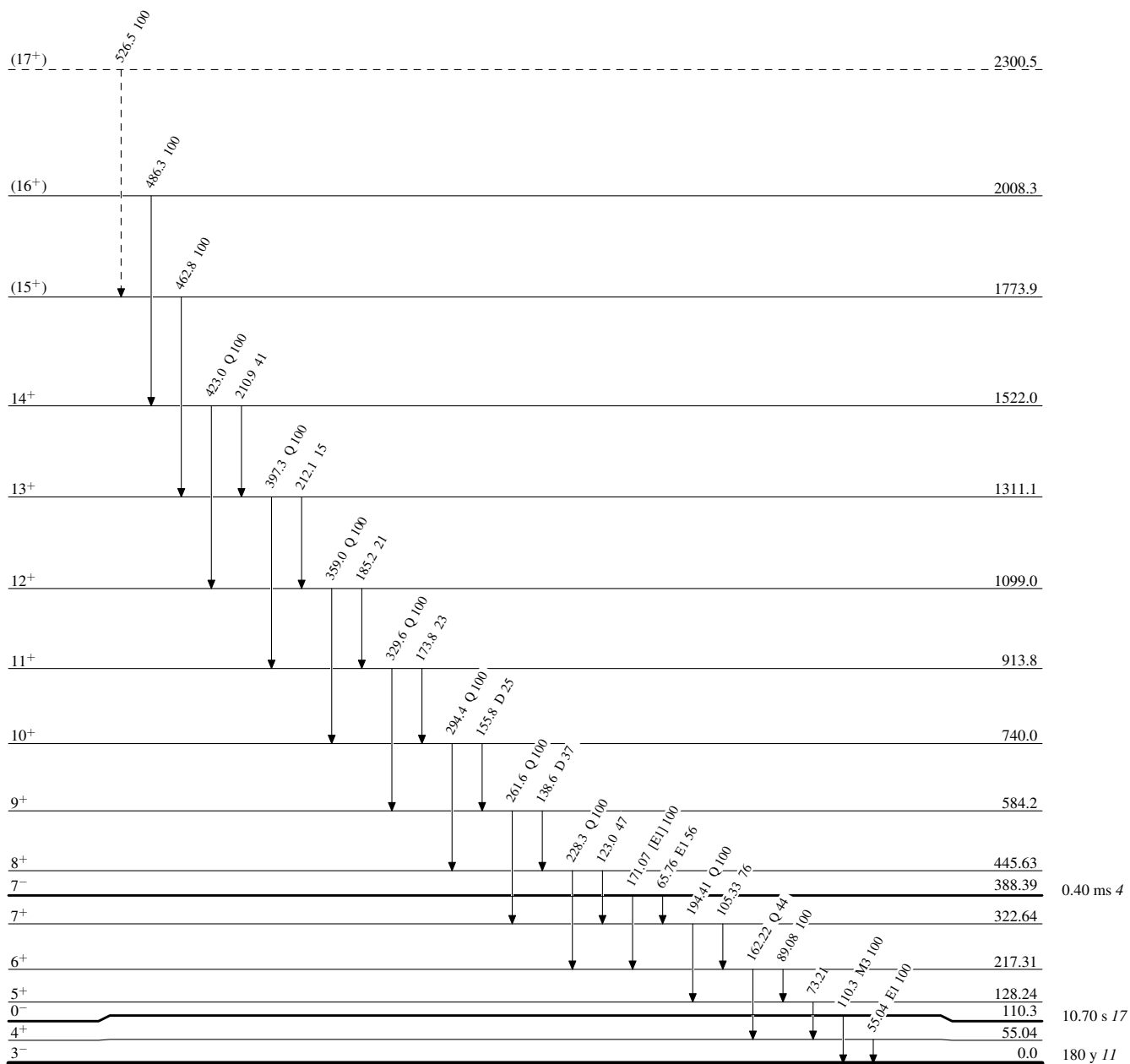
@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

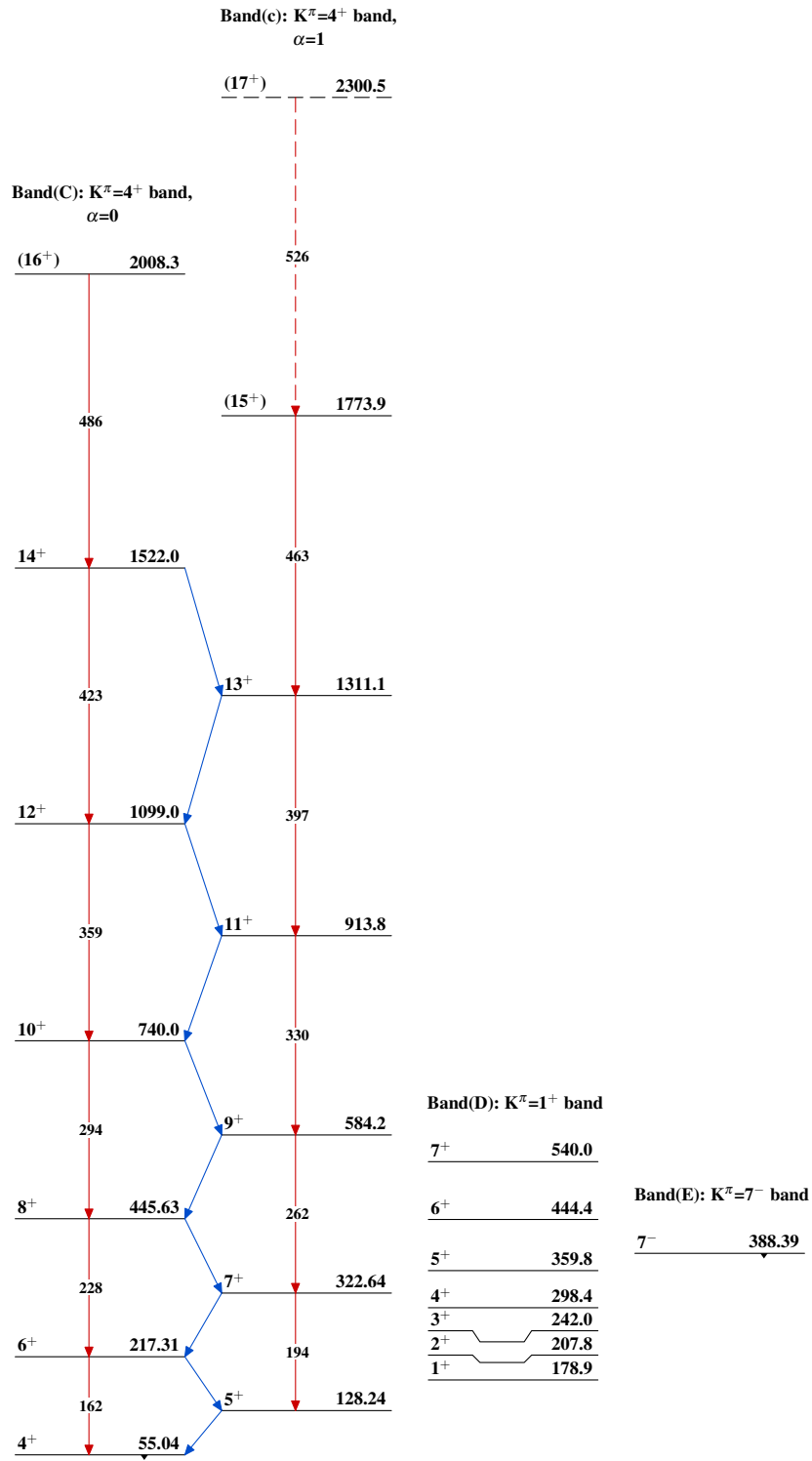
Legend

Level Scheme

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain) $^{158}_{65}\text{Tb}_{93}$

Adopted Levels, GammasBand(B): $K^\pi=0^-$ band5⁻ 371.2Band(A): $K^\pi=3^-$ band6⁻ 298.6 4⁻ 298.53⁻ 207.85⁻ 178.92⁻ 167.41⁻ 115.50⁻ 110.34⁻ 79.93⁻ 0.0 $^{158}_{65}\text{Tb}_{93}$

Adopted Levels, Gammas (continued) $^{158}_{65}\text{Tb}_{93}$

Adopted Levels, Gammas (continued)

				Band(K): $K^\pi=1^+$ band	
				(3^+)	<u>849.7</u>
		Band(H): $K^\pi=5^-$ band		(2^+)	<u>767.5</u>
		<u>8⁻</u>	<u>759</u>		
				Band(J): $K^\pi=2^+$ band	
				<u>3⁺</u>	<u>719.7</u>
				(1^+)	<u>699.6</u>
		<u>7⁻</u>	<u>665</u>		
				<u>2⁺</u>	<u>638.7</u>
	Band(G): $K^\pi=4^-$ band		Band(I): $K^\pi=3^+$ band		
	<u>5⁻</u>	<u>601.5</u>		<u>3⁺</u>	<u>590.0</u>
				<u>6⁻</u>	<u>587</u>
Band(F): $K^\pi=0^+$ band					
(2^+)	<u>487.3</u>	<u>4⁻</u>	<u>495.4</u>	<u>5⁻</u>	<u>495.4</u>
(1^+)	<u>419.3</u>				
(0^+)	<u>408.1</u>				

Adopted Levels, Gammas (continued)

					Band(Q): $K^\pi=4^-$ band
					<u>4⁻ 963</u>
Band(L): $K^\pi=0^-$ band					
<u>(5⁻) 891</u>					
<u>(6⁻) 879</u>					
					Band(N): $K^\pi=1^+$ band
					<u>6⁺ 863.3</u>
					Band(P): $K^\pi=5^-$ band
					<u>5⁻ 817</u>
					Band(O): $K^\pi=2^-$ band
					<u>3⁻ 782</u>
<u>(3⁻) 780</u>					
					<u>5⁺ 750.0</u>
					Band(M): $K^\pi=4^+$ band
<u>(4⁻) 737</u>					<u>4⁺ 659.7</u>
					<u>7⁺ 627</u>
					<u>6⁺ 531</u>
					<u>5⁺ 460.9</u>

Adopted Levels, Gammas (continued)**Band(R): $K^\pi=1^-$ band**2⁻ 11101⁻ 1068 $^{158}\text{Tb}_{93}$