

Adopted Levels, Gammas

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Huang Xiaolong and Kang Mengxiao		NDS 133, 221 (2016)	1-Dec-2015

Q(β^-)=-145×10¹ 8; S(n)=723×10¹ 8; S(p)=424×10¹ 8; Q(α)=229×10¹ 8 [2012Wa38](#)

¹⁹⁸Tl Levels

For the interacting boson-fermion-fermion model theory, see [1987BI02](#).

Cross Reference (XREF) Flags

- A** ¹⁹⁸Tl IT decay (1.87 h)
- B** ¹⁹⁸Tl IT decay (32.1 ms)
- C** ¹⁹⁸Pb ϵ decay
- D** ¹⁹⁷Au(α ,3n γ)

E(level) [†]	J $\pi^{\#}$	T _{1/2}	XREF	Comments
0.0	2 ⁻	5.3 h 5	ABCD	$\% \epsilon + \% \beta^+ = 100$ $\mu = 0.00$ 1 (1976Ek03,2011StZZ) μ : Atomic Beam Magnetic Resonance(AB); ²⁰³ Tl standard. $\langle r^2 \rangle^{1/2} = 5.438$ fm 5 (2004An14). T _{1/2} : From 1954Mi16 , 1954Pa19 . J π : J=2 from atomic beam (1976Fu06); $\pi = -$ from decay to 0 ⁺ and 4 ⁺ states in ¹⁹⁸ Hg.
173.41 8	0 ⁻ , 1 ⁻	4.5 ns 10	C	J π : E2 γ to 2 ⁻ , log ft=6.2 from 0 ⁺ . T _{1/2} : From (K x-ray)(173.4 γ)(t) in ¹⁹⁸ Pb ϵ decay (1959Jo21).
259.52 7	(2) ⁻		ABCD	J π : M1 γ from 3 ⁻ , possible ϵ feeding from 0 ⁺ suggests 2 ⁻ .
282.65 11	3 ⁻		AB D	J π : M1 γ to 2 ⁻ , M4 γ from 7 ⁺ .
290.31 6	1 ⁻ \ddagger		C	
382.11 7	1 ⁻ \ddagger		C	
397.67 9	1 ⁻ , 2 ⁻ , 3 ⁻		C	J π : M1(+E2) γ to 2 ⁻ , log f ^{lu} t \approx 7.2 from 0 ⁺ . log f ^{lu} t \approx 7.2 but feeding is weak and the log ft should probably be considered as a lower limit. J π =1 if the log ft argument is reliable.
543.6 4	7 ⁺	1.87 h 3	AB D	$\%IT = 44.1$ 23; $\% \epsilon + \% \beta^+ = 55.9$ 23 $\mu = 0.641$ 10 (1983Bu04,2011StZZ) J π : J=7 from atomic beam (1976Fu06); $\pi = +$ from M4 and M1 cascade to 2 ⁻ . T _{1/2} : From ce(t) in ¹⁹⁸ Tl IT decay (1960Ju01). Others: 1.8 h (1949Or01), 1.75 h (1954Mi16), 1.90 h (1956Fi23). $\%IT$, $\% \epsilon + \% \beta$: deduced from I($\gamma + ce$)(587.2 $\gamma + 767.3\gamma$) (representing all decays by $\epsilon + \beta^+$) relative to I($\gamma + ce$)(259.6 $\gamma + 282.8\gamma$) (representing all decay by IT) (1971Pa06). μ : Atomic Beam Magnetic Resonance(AB); ²⁰³ Tl standard. Other: 0.64 7 (1976Fu06,1978LeZA,1984Be40).
648.90 8	1 ⁻ \ddagger		C	
655.72 12	0 ⁻ , 1 ⁻		C	J π : M1 γ to 1 ⁻ ; log ft=5.79 from 0 ⁺ .
674.3 4	(6,8) ⁺		D	
686.8 ^C 5	(5,7,9) ⁺	150 ns 40	D	T _{1/2} : From γ (t) in ¹⁹⁷ Au(α ,3n γ) (1977Kr04).
742.4 4	(10 ⁻)	32.1 ms 10	B	$\%IT = 100$ T _{1/2} : From IT decay (32.1 ms) (1975Se12). J π : From T _{1/2} and systematics of even-mass Tl nuclei.
865.33 8	1 ⁻ \ddagger		C	
934.5 [@] 4	8 ⁻	12.3 ns 3	D	T _{1/2} : From γ (t) in ¹⁹⁷ Au(α ,3n γ) (1977Kr04).

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Adopted Levels, Gammas (continued) ^{198}Tl Levels (continued)

E(level) [†]	J ^π #	XREF	Comments
966.2 ^c 4	(6,8) ⁺	D	
977.4 ^c 4	(6,8,10) ⁺	D	
1000.6 4	(6,8) ⁺	D	
1006.4& 5	9 ⁻	D	
1128.9@ 5	10 ⁻	D	
1140.7 3	0 ⁻ ,1 ⁻	C	J ^π : M1 γ to 1 ⁻ ,2 ⁻ ,3 ⁻ ; log ft=5.9 from 0 ⁺ .
1189.7 4	(7,9) ⁺	D	
1230.3?		C	
1290.4 ^c 4	(7,9) ⁺	D	
1388.1& 5	11 ⁻	D	
1617.5 ^c 4	(8,10) ⁺	D	
1634.4@ 5	12 ⁻	D	
1654.3 ^b 5	10 ⁻	D	
1779.8 5	(7)	D	
1836.8 ^b 5	11 ⁻	D	
1865.8 6		D	
1873.3 5		D	
1875.4 5		D	
1893.4 ^c 4	(9,11) ⁺	D	
1921.7 6	11	D	
2003.9 5		D	
2004.1 5		D	
2014.2 6		D	
2036.2& 5	13 ⁻	D	
2084.7 ^b 5	12 ⁻	D	
2089.8 ^c 5	(10,12) ⁺	D	
2153.9 ^a 5	11 ⁺	D	
2190.2 6		D	
2197.4 6		D	
2213.7 ^a 6	12 ⁺	D	
2254.9 6		D	
2263.4 5		D	
2279.8 5	(12 ⁻)	D	
2325.4 ^a 6	13 ⁺	D	
2333.3@ 5	14 ⁻	D	
2366.8 6		D	
2400.9 ^b 5	13 ⁻	D	
2430.4 7		D	
2442.7 ^a 7	14 ⁺	D	
2474.1 6		D	
2482.4 6	(13 ⁻)	D	
2488.7 6		D	
2504.6 6		D	
2590.6 6		D	
2611.6 5	14 ⁻	D	
2624.7 6		D	
2636.1 7		D	
2646.4 6		D	
2666.0 ^a 8	15 ⁺	D	
2690.0 6	15 ⁻	D	
2716.9 6		D	
2793.1 7		D	

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Adopted Levels, Gammas (continued) ^{198}Tl Levels (continued)

<u>E(level)[†]</u>	<u>J^π#</u>	<u>XREF</u>	<u>E(level)[†]</u>	<u>J^π#</u>	<u>XREF</u>	<u>E(level)[†]</u>	<u>J^π#</u>	<u>XREF</u>	<u>E(level)[†]</u>	<u>J^π#</u>	<u>XREF</u>
2821.9 ^{&} 5	15 ⁻	D	3017.0 6	14	D	3422.7 6		D	3900.4 ^{&} 7	19 ⁻	D
2838.0 ^b 5	14 ⁻	D	3096.0 [@] 6	16 ⁻	D	3490.7 ^{&} 6	17 ⁻	D	4068.2 [@] 8	20 ⁻	D
2864.5 ^a 8	16 ⁺	D	3145.0 6	16 ⁻	D	3537.3 ^a 8	18 ⁺	D			
3008.9 8		D	3234.3 ^a 8	17 ⁺	D	3762.9 [@] 7	18 ⁻	D			

[†] From level scheme and $E\gamma$'s by using least-squares fit to the $E\gamma$ values. Uncertainty set to 1 keV for unknown $\Delta E\gamma$.

[‡] M1 γ to 2^- gives $1^-, 2^-, 3^-$; $\log ft < 8.5$ from 0^+ rules out $2^-, 3^-$ in ^{198}Pb ε decay.

From γ -ray multiplicities and band structure in $^{197}\text{Au}(\alpha, 3n\gamma)$, except as noted.

@ Band(A): $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}, \alpha=0$.

& Band(a): $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}, \alpha=1$.

^a Band(B): $\pi h_{9/2} \otimes \nu(i_{13/2}^{-2}, j)$.

^b Band(C): $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}$. Possible chiral-partner of $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}$ band based on 934.7-keV, 8^- .

^c Band(D): Band based on 686.9-keV level.

Adopted Levels, Gammas (continued)

E _i (level)	J _i ^π	<u>γ(¹⁹⁸Tl)</u>							Comments
		E _γ [†]	I _γ [‡]	E _f	J _f ^π	Mult.#	δ ^{#c}	α ^b	
173.41	0 ⁻ ,1 ⁻	173.4 @ 1	100 @	0.0	2 ⁻	E2 @		0.677	B(E2)(W.u.)=7.0 16
259.52	(2) ⁻	259.5 @ 1	100 @	0.0	2 ⁻	M1 @		0.584	
282.65	3 ⁻	23.1 & 1	0.14 & 2	259.52	(2) ⁻	M1 &		116.6 23	
		282.8 & 2	100 & 10	0.0	2 ⁻	M1 &		0.461	
290.31	1 ⁻	30.8 @ 1	0.21 @ 5	259.52	(2) ⁻	M1 @		49.8 9	
		116.9 @ 1	3.2 @ 5	173.41	0 ⁻ ,1 ⁻	M1 @		5.50	
		290.3 @ 1	100 @ 15	0.0	2 ⁻	M1+E2 @	2.2 @ +8-4	0.175 22	
382.11	1 ⁻	122.6 @ 1	2.0 @ 3	259.52	(2) ⁻	M1 @		4.80	
		382.0 @ 1	100 @ 13	0.0	2 ⁻	M1(+E2) @	1.20 @ +31-24	0.117 17	
397.67	1 ⁻ ,2 ⁻ ,3 ⁻	107.3 @	0.25 @	290.31	1 ⁻	[M1]		7.03	
		138.3 @	5.0 @	259.52	(2) ⁻				
		397.7 @ 1	100 @ 19	0.0	2 ⁻	M1(+E2) @	0.8 @ +5-4	0.13 4	
543.6	7 ⁺	260.9 3	100	282.65	3 ⁻	M4		34.0 6	B(M4)(W.u.)=1.80 11
648.90	1 ⁻	266.7 @ 1	48 @	382.11	1 ⁻	(M1+E2) @	≈5.0 @	≈0.1734	
		649.0 @ 1	100 @ 10	0.0	2 ⁻	M1 @		0.0502	
655.72	0 ⁻ ,1 ⁻	365.4 @ 1	100 @ 16	290.31	1 ⁻	M1 @		0.230	
		396.5 @	1.12 @ 19	259.52	(2) ⁻				
674.3	(6,8) ⁺	130.7 3	100	543.6	7 ⁺	M1		4.00 7	
686.8	(5,7,9) ⁺	(13)	100	674.3	(6,8) ⁺				
742.4	(10 ⁻)	198.8 2	100	543.6	7 ⁺	(E3) ^d		3.85	B(E3)(W.u.)=0.273 10
865.33	1 ⁻	216.5 @	0.70 @	648.90	1 ⁻				
		467.8 @ 2	12 @ 3	397.67	1 ⁻ ,2 ⁻ ,3 ⁻	(M1) @		0.1187	
		575.0 @ 1	52 @ 6	290.31	1 ⁻	M1 @		0.0689	
		605.9 @ 4	9 @ 5	259.52	(2) ⁻				
		865.3 @ 1	100 @ 9	0.0	2 ⁻	M1(+E2) @	0.8 @ 3	0.018 3	
934.5	8 ⁻	391.0 3	100	543.6	7 ⁺	E1+M2	-0.035 +12-8	0.0164 5	B(E1)(W.u.)=2.66×10 ⁻⁷ 7; B(M2)(W.u.)=0.010 7
966.2	(6,8) ⁺	279.4 3	100 25	686.8	(5,7,9) ⁺	M1+E2	1.7 +23-6	0.22 7	
		292.0 3	82 25	674.3	(6,8) ⁺	M1		0.422	
		422.6 3	33 12	543.6	7 ⁺				
977.4	(6,8,10) ⁺	290.7 3	100 30	686.8	(5,7,9) ⁺	M1		0.427	
		303.1 3	8 3	674.3	(6,8) ⁺				
1000.6	(6,8) ⁺	326.3 3	100 25	674.3	(6,8) ⁺	(M1+E2)	1.9 +4-3	0.136 15	
		457.1 3	100 25	543.6	7 ⁺	M1		0.1262	
1006.4	9 ⁻	71.8 3	100	934.5	8 ⁻	M1		4.13 8	
1128.9	10 ⁻	122.5 3	100	1006.4	9 ⁻	M1		4.81 8	
1140.7	0 ⁻ ,1 ⁻	275.4 @	19 @ 4	865.33	1 ⁻				
		743.0 @ 3	100 @ 19	397.67	1 ⁻ ,2 ⁻ ,3 ⁻	M1 @		0.0353	

Adopted Levels, Gammas (continued)

$\gamma(^{198}\text{Tl})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ^\dagger	I_γ^\ddagger	E_f	J_f^π	Mult.#	$\delta^\#c$	α^b
1189.7	(7,9) ⁺	189.1 3	51 12	1000.6	(6,8) ⁺	M1		1.407
		646.2 3	100 25	543.6	7 ⁺			
1290.4	(7,9) ⁺	312.9 3	67 17	977.4	(6,8,10) ⁺	M1+E2	-1.0 +5-5	0.22 8
		324.2 3	100 33	966.2	(6,8) ⁺	M1		0.318
		603.5 5	100 33	686.8	(5,7,9) ⁺	E2		0.0181
1388.1	11 ⁻	259.1 3	100 3	1128.9	10 ⁻	M1		0.586
		381.8 3	8.6 10	1006.4	9 ⁻	E2		0.0560
1617.5	(8,10) ⁺	327.1 3	100 27	1290.4	(7,9) ⁺	M1+E2	-4.0 +5-7	0.099 5
		640.1 3	40 13	977.4	(6,8,10) ⁺			
		651.3 3	46 14	966.2	(6,8) ⁺			
1634.4	12 ⁻	246.4 3	100 12	1388.1	11 ⁻	M1		0.673
		505.5 3	37.3 19	1128.9	10 ⁻	E2		0.0274
1654.3	10 ⁻	266.3 3	83 13	1388.1	11 ⁻			
		525.3 3	74 17	1128.9	10 ⁻	M1		0.0873
		719.8 3	100 22	934.5	8 ⁻			
1779.8	(7)	779.2 3	100	1000.6	(6,8) ⁺	M1+E2	2.7 +13-7	0.0130 17
1836.8	11 ⁻	182.6 3	69 13	1654.3	10 ⁻			
		707.9 3	100 19	1128.9	10 ⁻			
		830.3 3	88 25	1006.4	9 ⁻			
1865.8		675.9 ^d 3	100	1189.7	(7,9) ⁺			
1873.3		683.6 3	100	1189.7	(7,9) ⁺			
1875.4		874.8 3	100	1000.6	(6,8) ⁺			
1893.4	(9,11) ⁺	275.9 3	81 25	1617.5	(8,10) ⁺	M1		0.493
		603.0 5	100 31	1290.4	(7,9) ⁺	E2		0.0182
		703.6 3	11 6	1189.7	(7,9) ⁺			
1921.7	11	792.8 3	100	1128.9	10 ⁻			
2003.9		1003.3 3	100	1000.6	(6,8) ⁺			
2004.1		814.4 3	100	1189.7	(7,9) ⁺			
2014.2		1079.5 ^d 3	100	934.5	8 ⁻			
2036.2	13 ⁻	401.8 3	100 10	1634.4	12 ⁻	M1		0.178
		648.2 3	31.8 24	1388.1	11 ⁻			
2084.7	12 ⁻	247.8 3	100 22	1836.8	11 ⁻			
		696.6 3	65 24	1388.1	11 ⁻			
		955.8 3	9 4	1128.9	10 ⁻			
2089.8	(10,12) ⁺	196.4 5	100 29	1893.4	(9,11) ⁺	M1		1.266 20
		472.3 3	50 14	1617.5	(8,10) ⁺	E2		0.0323
2153.9	11 ⁺	64.1 3	100 30	2089.8	(10,12) ⁺	M1		5.76 12
		260.5 3	22 10	1893.4	(9,11) ⁺			
		519.4 3	40 5	1634.4	12 ⁻			
		765.8 5	86 14	1388.1	11 ⁻	E1		0.00394
		1025.0 3	56 13	1128.9	10 ⁻			
2190.2		802.1 3	100	1388.1	11 ⁻			
2197.4		563.0 3	100	1634.4	12 ⁻			

Adopted Levels, Gammas (continued)

$\gamma(^{198}\text{Tl})$ (continued)							
$E_i(\text{level})$	J_i^π	E_γ^\dagger	I_γ^\ddagger	E_f	J_f^π	Mult.#	α^b
2213.7	12 ⁺	59.8 3	100	2153.9	11 ⁺	M1	7.05 15
2254.9		165.0 ^d 3	100	2089.8	(10,12) ⁺		
2263.4		1073.6 3	100	1189.7	(7,9) ⁺		
2279.8	(12 ⁻)	891.6 ^d 3	100 19	1388.1	11 ⁻		
		1150.7 ^d 3	26 13	1128.9	10 ⁻		
2325.4	13 ⁺	111.7 3	100	2213.7	12 ⁺	M1	6.26 10
2333.3	14 ⁻	297.0 3	69 7	2036.2	13 ⁻	M1	0.403
		698.8 5	100 15	1634.4	12 ⁻	E2	0.01316
2366.8		978.7 3	100	1388.1	11 ⁻		
2400.9	13 ⁻	316.2 3	100 18	2084.7	12 ⁻		
		564.1 3	29 7	1836.8	11 ⁻		
		766.6 3	57 18	1634.4	12 ⁻		
2430.4		175.5 ^d 3	100	2254.9		M1+E2	1.2 6
2442.7	14 ⁺	117.3 3	100	2325.4	13 ⁺	M1+E2	4.2 12
2474.1		694.3 3	100	1779.8	(7)		
2482.4	(13 ⁻)	202.6 ^d 3	100	2279.8	(12 ⁻)	M1	1.160
2488.7		208.9 ^d 3	100	2279.8	(12 ⁻)		
2504.6		350.7 3	100	2153.9	11 ⁺		
2590.6		668.9 3	100	1921.7	11		
2611.6	14 ⁻	575.4 3	100 27	2036.2	13 ⁻	M1+E2	0.044 25
		977.2 3	73 23	1634.4	12 ⁻		
2624.7		990.1 ^d 3	100	1634.4	12 ⁻		
2636.1		205.7 ^d 3	100	2430.4			
2646.4		141.8 3	100	2504.6			
2666.0	15 ⁺	223.3 3	100	2442.7	14 ⁺	M1	0.885
2690.0	15 ⁻	356.7 3	100	2333.3	14 ⁻		
2716.9		851.1 ^d 3	100	1865.8			
2793.1		146.7 3	100	2646.4			
2821.9	15 ⁻	488.7 3	100 13	2333.3	14 ⁻	M1	0.1057
		785.7 3	41 7	2036.2	13 ⁻		
2838.0	14 ⁻	437.1 3	100 19	2400.9	13 ⁻	M1	0.1421
		753.2 3	81 38	2084.7	12 ⁻		
2864.5	16 ⁺	198.5 3	100 23	2666.0	15 ⁺	M1	1.229
		421.7 ^d 3	50 25	2442.7	14 ⁺		
3008.9		215.7 ^d 3	100	2793.1		M1+E2	0.6 4
3017.0	14	980.8 3	100	2036.2	13 ⁻		
3096.0	16 ⁻	274.1 3	73 22	2821.9	15 ⁻		
		762.7 3	100 14	2333.3	14 ⁻	E2	0.01094
3145.0	16 ⁻	323.1 3	44 10	2821.9	15 ⁻		
		811.7 3	100 10	2333.3	14 ⁻	E2	0.00962

Adopted Levels, Gammas (continued)

$\gamma(^{198}\text{Tl})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^\dagger	I_γ^\ddagger	E_f	J_f^π	Mult.#	α^b	$E_i(\text{level})$	J_i^π	E_γ^\dagger	I_γ^\ddagger	E_f	J_f^π	Mult.#	α^b
3234.3	17 ⁺	369.7 ^d 3	100	2864.5	16 ⁺			3537.3	18 ⁺	303.0 ^d 3	100 41	3234.3	17 ⁺		
3422.7		1089.3 ^d 3	100	2333.3	14 ⁻					672.7 ^d 3	65 24	2864.5	16 ⁺		
3490.7	17 ⁻	345.8 3	100 20	3145.0	16 ⁻	M1	0.267	3762.9	18 ⁻	272.2 3	100	3490.7	17 ⁻	M1	0.512
		394.8 3	53 20	3096.0	16 ⁻			3900.4	19 ⁻	137.5 3	100	3762.9	18 ⁻		
		668.7 3	47 13	2821.9	15 ⁻			4068.2	20 ⁻	167.8 3	100	3900.4	19 ⁻		

[†] From $^{197}\text{Au}(\alpha,3n\gamma)$, except as noted.

[‡] Relative photon branching from each level. Values are from $^{197}\text{Au}(\alpha,3n\gamma)$, except as noted.

[#] From $\alpha(\text{K})\text{exp}$, $\alpha(\text{L})\text{exp}$, $\gamma(\theta)$ or DCO measurements in $^{197}\text{Au}(\alpha,3n\gamma)$, except as noted.

[@] From ^{198}Pb ε decay.

[&] From ^{198}Tl IT decay (1.87 h).

^a From RULER program on the basis of given $T_{1/2}$, and ΔJ and $\Delta\pi$ between transition levels.

^b [Additional information 1](#).

^c If No value given it was assumed $\delta=1.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

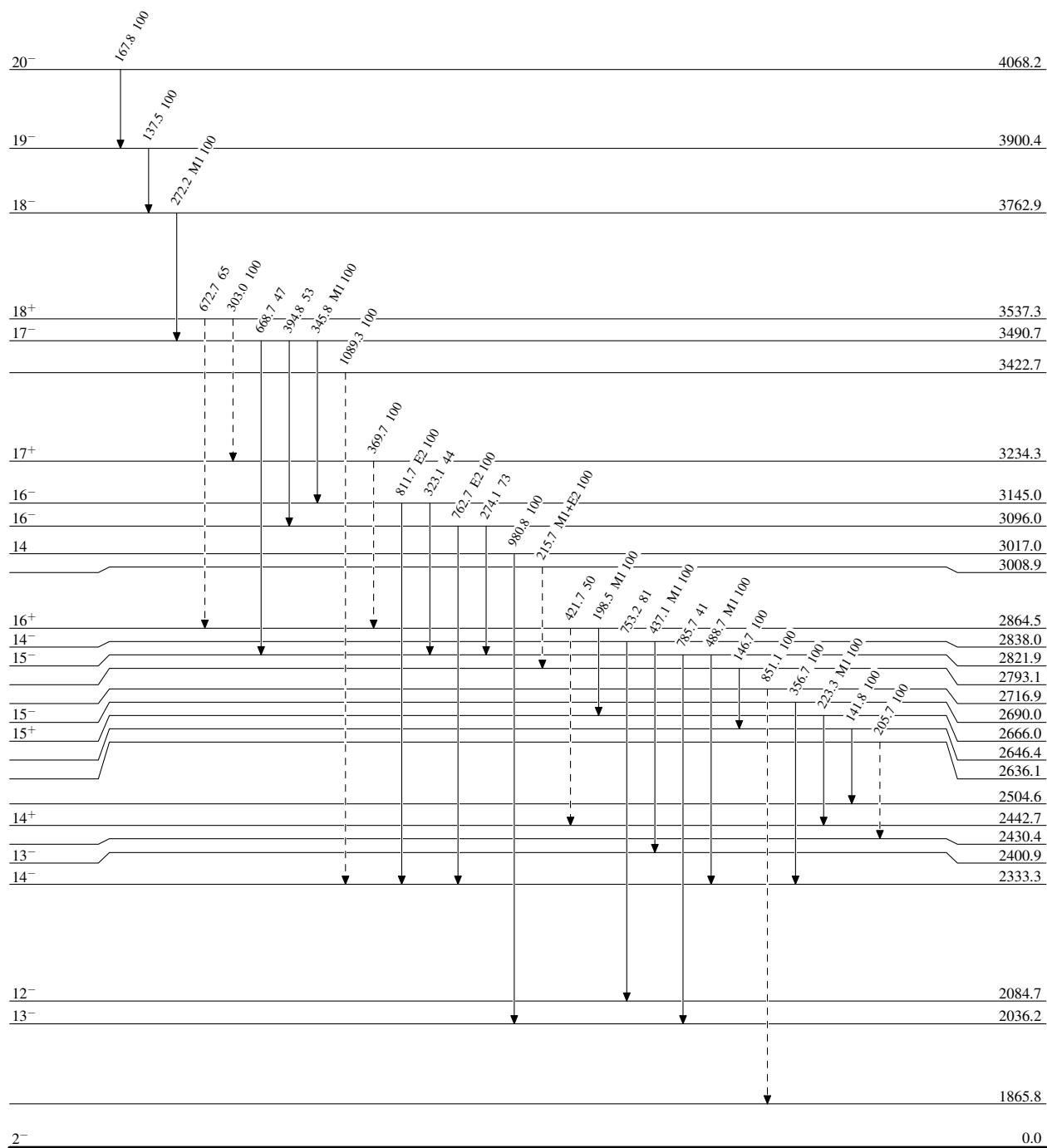
^d Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain) $^{198}_{81}\text{Tl}_{117}$

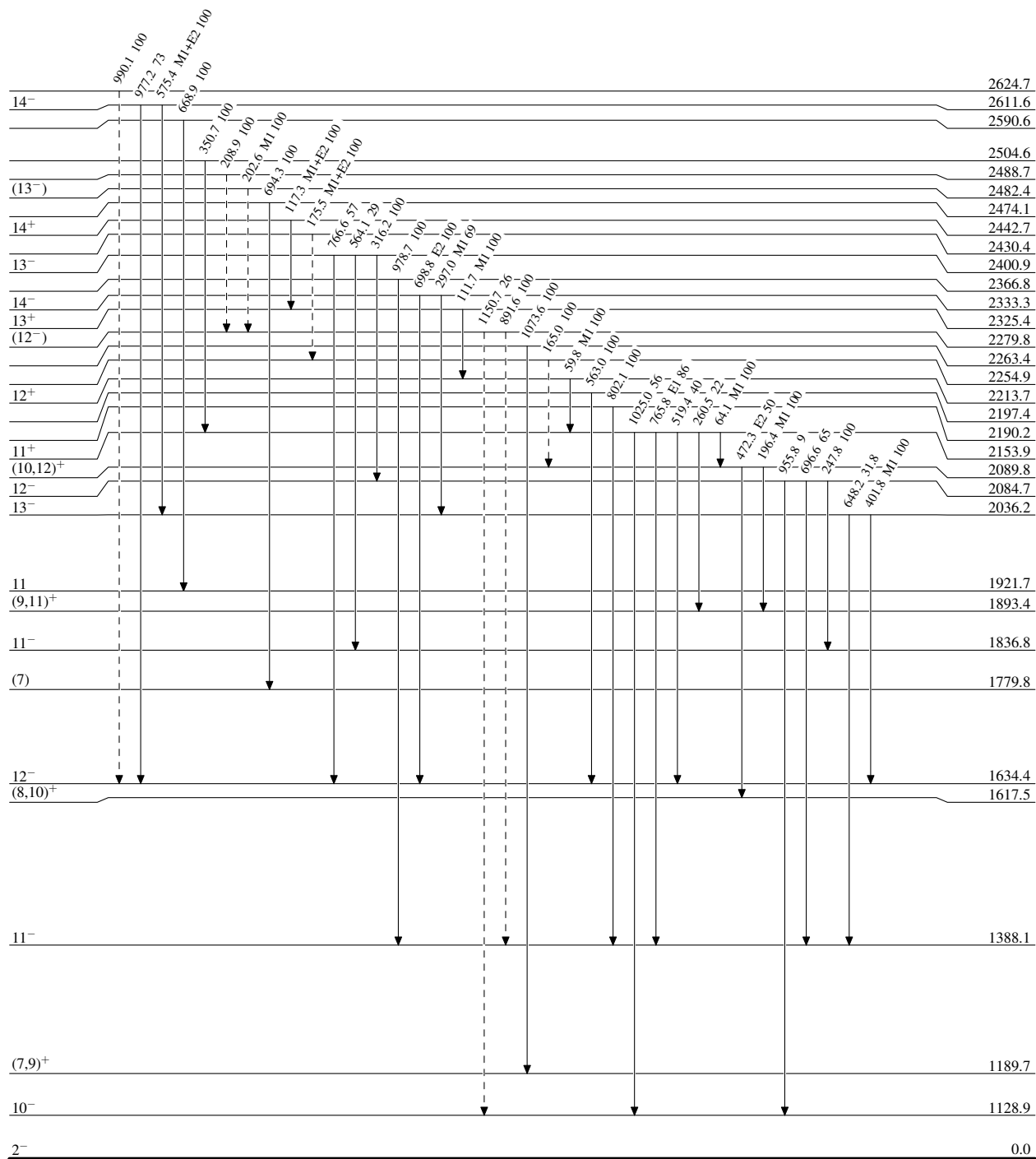
0.0 5.3 h 5

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)

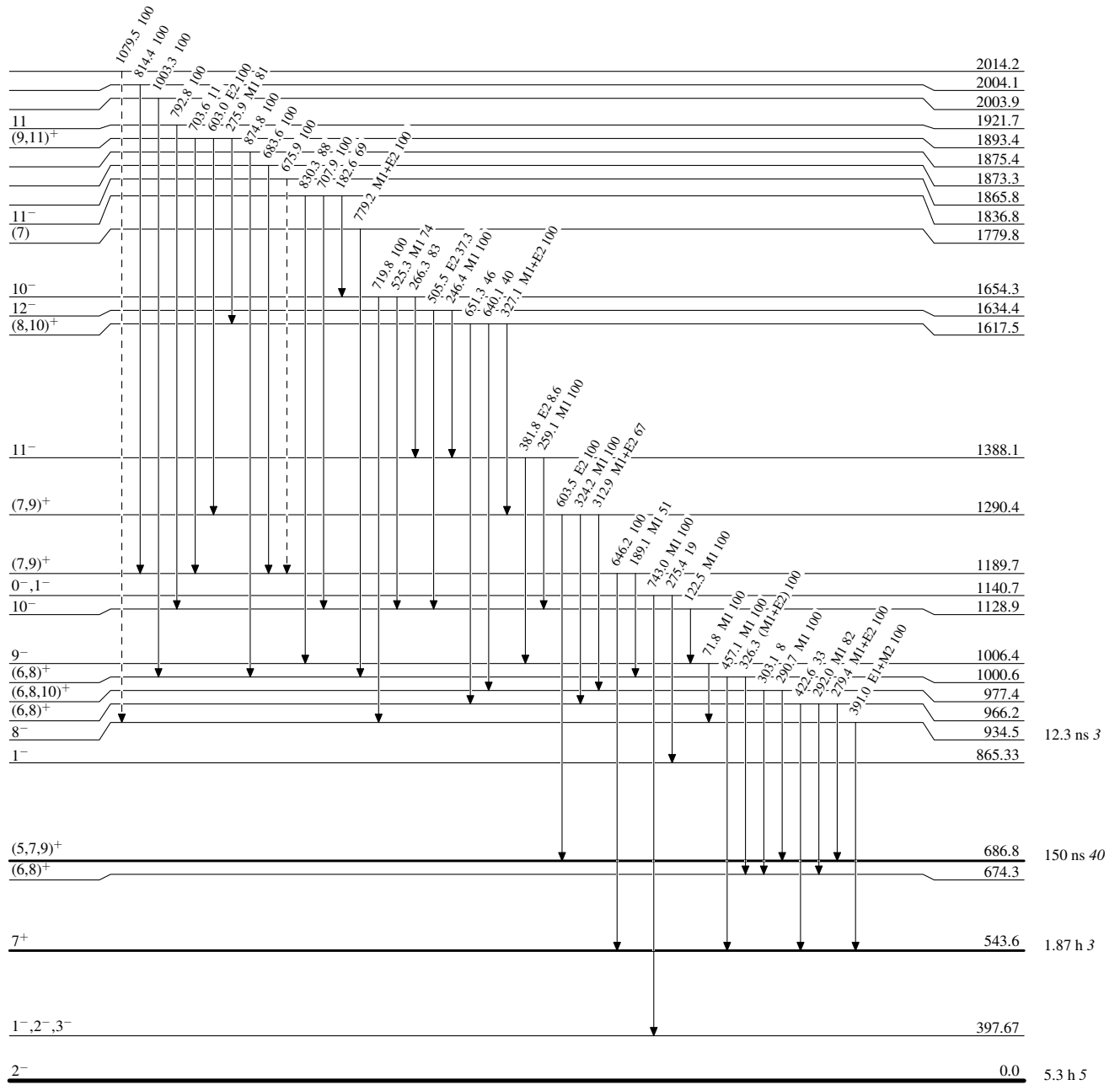
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



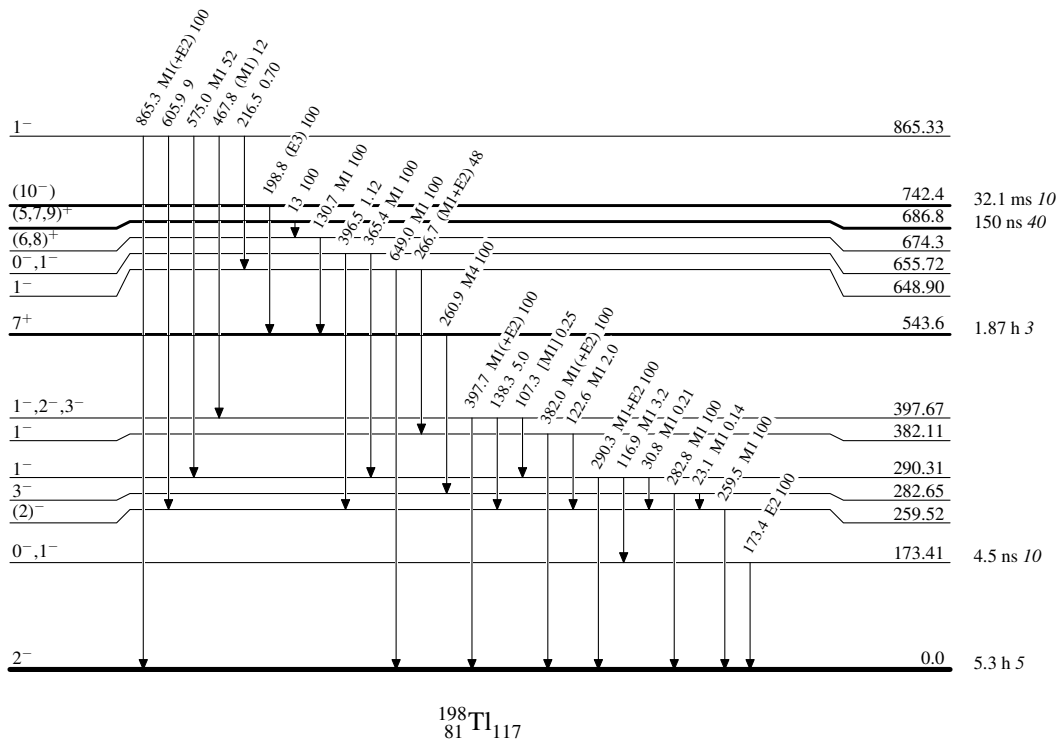
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

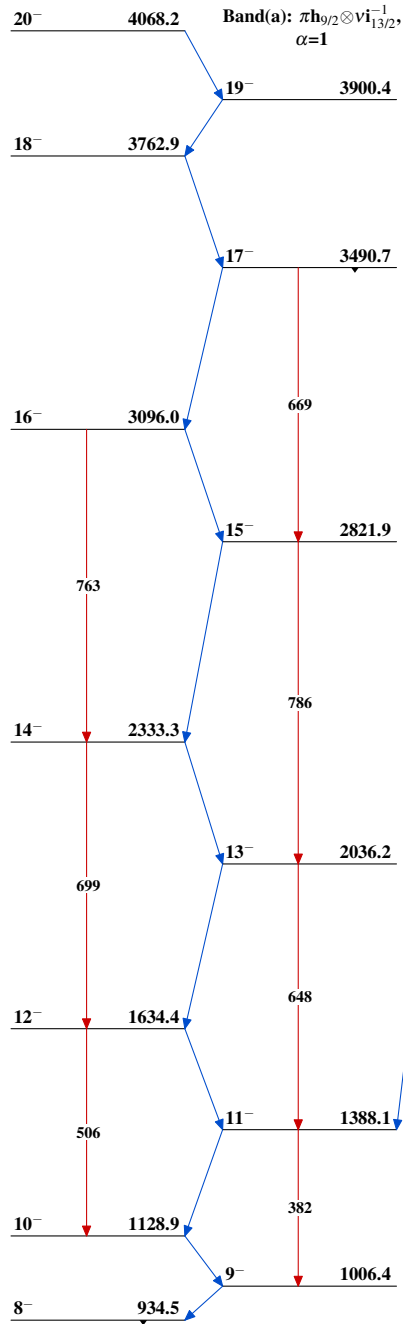
-----► γ Decay (Uncertain)



$^{198}\text{Tl}_{117}$

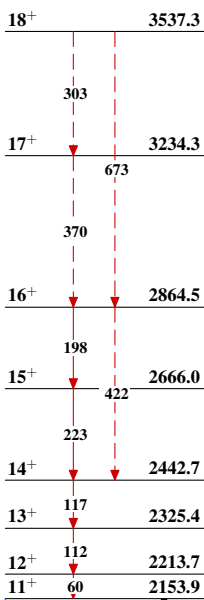
Adopted Levels, Gammas

Band(A): $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}$, $\alpha=0$

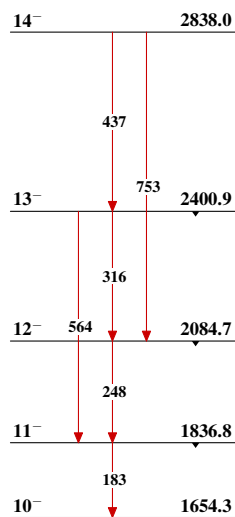


Band(a): $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}$, $\alpha=1$

Band(B): $\pi h_{9/2} \otimes \nu(i_{13/2}^{-2}, j)$



Band(C): $\pi h_{9/2} \otimes \nu i_{13/2}^{-1}$



Band(D): Band based on 686.9-keV level

