Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Huang Xiaolong	NDS 108,1093 (2007)	1-Jan-2006

Q(β^-)=−2136 *19*; S(n)=7413 *17*; S(p)=3.79×10^3 *3*; Q(α)=2854 *20* 2012Wa38
Note: Current evaluation has used the following Q record −2136 197413 183786 262855 20 2003Au03.
Nuclear structure calculation: 1978Ya09, 1979Pa14, 1979To17, 1980Kr03, 1980Kr20, 1990Va15, 1991Sa12.
Hyperfine structure and isotope shift measurements: 1989MeZZ, 1989MeZV, 1990Di09, 1992Me07.
Cross section and yield measurements: 1982Si11, 1984ShZP, 1989DaZS.

^{196}Tl Levels

Cross Reference (XREF) Flags

- A ^{196}Tl IT decay (1.41 h)
- B ^{196}Pb ε decay (37 min)
- C ^{197}Au(α,5nγ),^{194}Pt(^{6}Li,4nγ)

E(level)[†]	J$^\pi$	T$_{1/2}$	XREF	Comments
0.0	2$^-$	1.84 h *3*	ABC	%ε+%β^+=100 Configuration=((π s$_{1/2}$)(ν f$_{5/2}$))+((P,s$_{1/2}$)(N,p$_{3/2}$)) (1976Ek03,1984Be40). μ=+0.072 *3* (1992Me07). μ: Others: 0.07 *1* (1976Ek03,1989Ra17) includes effect of hyperfine anomaly. Others: 1989MeZV, 1989MeZZ. The electronic g-factor γ(J)(2p1/2)=0.66576 *5* (1976Ek03); γ(J)=0.665692 from Fowler (UCRL-18331, 1968); dipole constant R(MHZ)=±228.6 *9* (1984Be40). Q=−0.178 *14* (1992Me07). J$^\pi$: atomic beam (1976Ek03). Parity from shell-model assignment based on comparison of experimental and calculated μ. T$_{1/2}$: from 1960Ju01, 1958An52.
191.7 *4*	0$^-$		B	J$^\pi$: 191.7γ E2 to 2$^-$, fed with log *ft*=6.37 from J^π=0$^+$, and systematics of even-A ^{198}Tl, ^{200}Tl.
240.2 *4*	(2)$^-$		AB	J$^\pi$: 240γ M1+E2 to 2$^-$ gives 1$^-$,2$^-$,3$^-$.
253.2 *4*	1$^-$		B	J$^\pi$: 253γ M1 to 2$^-$, fed with log *ft*=6.27 from J^π=0$^+$.
274.1 *4*	(3$^-$)		A	J$^\pi$: 274.6γ (M1) to 2$^-$, no γ to 0$^-$ 191.7 level, absence in ^{196}Pb ε decay spectrum.
366.5 *5*	1$^-$		B	J$^\pi$: 366.5γ M1 to 2$^-$, fed with log *ft*=5.93 from J^π=0$^+$.
394.2 *5*	(7$^+$)	1.41 h *2*	A	%ε+%β^+=96.2 *4*; %IT=3.8 *4* Branching: Based upon the assumption that essentially all ε decays go through the 84(E2) transition in ^{196}Hg and all IT decays go through the 120(M4) transition in ^{196}Tl; ce(L3)(84)/ce(L3)(120)=16.9 *17* (1960Ju01), and using theoretical conversion coefficients with 1.5% uncertainties. μ=+0.549 *8* (1992Me07). Q=+0.763 *21* (1992Me07). J$^\pi$: 120.1γ M4 to (3$^-$). T$_{1/2}$: from 1960Ju01.
493.9 *4*	1$^-$		B	J$^\pi$: 493.9γ M1 to 2$^-$, fed with log *ft*=6.20 from J^π=0$^+$.
638.1 *6*		2.5 ns	C	T$_{1/2}$: from $\gamma\gamma$(t) (1978Kr12). J$^\pi$: 244γ to (7$^+$).
738.1[‡] *6*	(8$^-$)	21.3 ns *5*	C	J$^\pi$: 343.9γ E1(+M2) to (7$^+$). Bandhead, because the 343.9γ is the strongest line and it is in delayed coincidence with all the other members of the γ-ray cascade. T$_{1/2}$: from time distributions of 343.9γ (1978Kr12).
738.1+x?	(9$^-$)		C	E(level): level energy held fixed in least-squares adjustment. J$^\pi$: based on rotational structure of negative-parity band.
755.3 *4*	(1$^-$)		B	J$^\pi$: fed with log *ft*=5.58 from 0$^+$, 755γ (M1) to 2$^-$.
799.5 *7*			C	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{196}Tl Levels (continued)

E(level)[†]	J^π	XREF	Comments
799.6+x[‡] *3*	(10^-)	C	J^π: from 61.5γ D+Q to (9^-), negative-parity band member.
908.4+x[‡] *4*	(11^-)	C	J^π: 108.6γ D+Q to (10^-), negative-parity band member.
954.2 *5*	(1^-)	B	J^π: fed with log *ft*=6.11 from 0^+, 954γ (M1) to 2^-.
1179.7+x[‡] *4*	(12^-)	C	J^π: 271.4 d+Q γ to (11^-).
1274.8 *7*		C	
1416.1+x[‡] *4*	(13^-)	C	J^π: 236.4γ D+Q to (12^-), negative-parity band member.
1544.6 *7*		C	
1812.9+x[‡] *4*	(14^-)	C	J^π: 396.9γ D+Q to (13^-), negative-parity band member.
1995.8 *7*		C	
2079.6+x[‡] *5*	(15^-)	C	J^π: 266.7γ D+Q to (14^-), negative-parity band member.
2171.2+x *5*		C	
2222.8 *7*		C	
2335.1+x *6*		C	
2527.3+x *6*		C	
2527.4+x[‡] *5*	(16^-)	C	J^π: 447.8γ D+Q to (15^-), negative-parity band member.
2760.3+x[‡] *5*	(17^-)	C	J^π: from 233.1γ D+Q to (16^-), negative-parity band member.
2846.8+x *7*		C	
3045.6+x[‡] *6*	(18^-)	C	J^π: 285.3γ D+Q to (17^-), negative-parity band member.
3163.5+x *8*		C	
3334.6+x[‡] *7*	(19^-)	C	J^π: 289.0γ M1+E2 to (18^-), negative-parity band member.
3500.1+x?		C	
3523.4+x[‡] *7*	(20^-)	C	J^π: 188.8γ M1+E2 to (19^-), negative-parity band member.
3629.8+x?[‡] *8*	(21^-)	C	J^π: 106.4γ M1+E2 to (20^-), negative-parity band member.

[†] From least-squares fit to Eγ's.
[‡] Band(A): the negative-parity band.

Adopted Levels, Gammas (continued)

γ(^{196}Tl)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	δ[#]	α[@]	Comments
191.7	0⁻	191.7[‡] *5*	100	0.0	2⁻	E2		0.474 *8*	α(K)=0.187 *3*; α(L)=0.215 *4*; α(M)=0.0558 *10*; α(N+..)=0.0165 *3* Mult.: K:L2:L3:M:N=13 *2*:9 *2*:6 *2*:8 *2*:1.5 *7* (1961Sv01). K/L=0.8 *2*, L2/L3=1.7 *6*, L/M=2.1 *8*, M/N=5 *2* (1961Sv01). E2 theory: K/L=0.87, L2/L3=1.6. ce(K)(191.8)/ce(K)(253.2)=0.13 *2* (1961Sv01). Mult.: M1 from 1982Hi04.
240.2	(2)⁻	240.0[‡] *5*	30 *5*	0.0	2⁻	M1+E2	<0.6	0.66 *7*	α(K)=0.53 *7*; α(L)=0.098 *3*; α(M)=0.0232 *5*; α(N+..)=0.00709 *15* Mult.,δ: based upon ce ratios: K(240)/K(253)=0.34 *4*, ce(L)≤12 (1961Sv01); K(240)/L3(120)≤0.23 (1960Ju01). M1 theory: α(K)/α(L)=5.8, α(K)/α(L3)=850; E2 theory: α(K)/α(L)=1.3, α(K)/α(L3)=4.4.
253.2	1⁻	253.1[‡] *5*	100	0.0	2⁻	M1		0.625	α(K)=0.512 *8*; α(L)=0.0867 *13*; α(M)=0.0202 *3*; α(N+..)=0.00620 *10* Mult.: the strongest ce line in ^{196}Pb ε decay. M1 theory: K/L=5.90, L/M=4.3, α(K)=0.5321; E1 theory: K/L=5.87, L/M=4.3, α(K)=0.03523.
274.1	(3⁻)	33.7 *3*		240.2	(2)⁻	[E2]		1.02×10^3 *5*	ce(L)/(γ+ce)=0.75 *3*; ce(M)/(γ+ce)=0.194 *12*; ce(N+)/(γ+ce)=0.057 *4* E_γ: from ^{196}Tl IT decay only. Mult.: Ice(L1)(33.7)/Ice(L3)(120.1)=0.25 *10* (1960Ju01).
		274.6 *6*		0.0	2⁻	(M1)		0.500 *8*	ce(K)/(γ+ce)=0.273 *4*; ce(L)/(γ+ce)=0.0461 *8*; ce(M)/(γ+ce)=0.01077 *18*; ce(N+)/(γ+ce)=0.00330 *6* E_γ: from ^{196}Tl IT decay. Mult.: supported by Ice(K)(274.6)/Ice(L3)(120.1)=0.50 *10*; K/L≥6(1960Ju01); M1 theory: K/L=5.9.
366.5	1⁻	113[‡&] *1*	2.4 *10*	253.2	1⁻	[M1]		6.06 *18*	α(K)=4.95 *15*; α(L)=0.85 *3*; α(M)=0.199 *6*; α(N+..)=0.0608 *18* Mult.: supported by ce(K)(113)/ce(K)(253)=0.10 *3* (1961Sv01).
		126[‡&] *1*	2.0 *7*	240.2	(2)⁻	[M1]		4.44 *12*	α(K)=3.63 *10*; α(L)=0.622 *17*; α(M)=0.145 *4*; α(N+..)=0.0445 *12* Mult.: supported by ce(K)(126)/ce(K)(253)=0.06 *2* (1961Sv01).
		175[‡&] *2*	7 *3*	191.7	0⁻	[M1]		1.75 *7*	α(K)=1.43 *6*; α(L)=0.244 *9*; α(M)=0.0570 *21*; α(N+..)=0.0174 *7* Mult.: supported by ce(K)(175)/ce(K)(253)=0.08 *3* (1961Sv01).
		366.5[‡] *5*	100 *15*	0.0	2⁻	M1		0.228	α(K)=0.187 *3*; α(L)=0.0314 *5*; α(M)=0.00732 *11*; α(N+..)=0.00224 *4* Mult.: based upon ce ratios: K/L>5, ce(K)(367)/ce(K)(253)=0.18 *6* (1961Sv01); M1 theory: K/L=5.92.
394.2	(7⁺)	120.1 *3*	100	274.1	(3⁻)	M4		2.30×10^3 *5*	ce(K)/(γ+ce)=0.0676 *17*; ce(L)/(γ+ce)=0.649 *12*; ce(M)/(γ+ce)=0.216 *6*; ce(N+)/(γ+ce)=0.0671 *20* B(M4)(W.u.)=4.01 *16* α: M4 α(theory)'s mult. By 0.975 *5* (Cf. 1990Ne01). Mult.: supported by K:L:M:N=0.14 *7*:1.00:0.33 *3*:0.13 *3* and L1:L2:L3=0.36 *7*:0.14 *5*:1.00 (1960Ju01); M4 theory: K:L:M=0.11:1.0:0.33, L1:L2:L3=0.37:0.078:1.0.
493.9	1⁻	127[‡&] *1*	4.3 *19*	366.5	1⁻	[M1]		4.34 *12*	α(K)=3.55 *10*; α(L)=0.608 *17*; α(M)=0.142 *4*; α(N+..)=0.0435 *12* K(127)/K(253.2)=0.06 *2* (1961Sv01).

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Adopted Levels, Gammas (continued)

γ(^{196}Tl) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	δ[#]	α[@]	Comments
493.9	1⁻	241[‡&] *2*	17 *5*	253.2	1⁻	[M1]		0.716 *20*	α(K)=0.586 *16*; α(L)=0.099 *3*; α(M)=0.0232 *7*; α(N+..)=0.00710 *20* K(241)/K(253.2)=0.04 *1* (1961Sv01).
		302.2[‡] *5*	67 *19*	191.7	0⁻	M1		0.384	α(K)=0.315 *5*; α(L)=0.0531 *8*; α(M)=0.01240 *19*; α(N+..)=0.00380 *6* Mult.: based upon ce ratios; ce(K)(302)/ce(K)(253.2)=0.012 *5* (1961Sv01).
		493.9[‡] *5*	100 *19*	0.0	2⁻	M1		0.1027	α(K)=0.0844 *12*; α(L)=0.01406 *20*; α(M)=0.00327 *5*; α(N+..)=0.001003 *15* Mult.: based upon ce ratios; ce(K)(494)/ce(K)(253.2)=0.04 *2* (1961Sv01).
638.1		243.9 *3*	100	394.2	(7⁺)				
738.1	(8⁻)	343.9 *3*	100	394.2	(7⁺)	E1+M2	−0.14 *+4−7*	0.039 *22*	α(K)=0.031 *17*; α(L)=0.006 *4*; α(M)=0.0014 *10*; α(N+..)=0.0004 *3* B(E1)(W.u.)=2.18×10^{-7} *7*; B(M2)(W.u.)=0.17 *10*
738.1+x?	(9⁻)	x		738.1	(8⁻)	[M1]			E_γ: Eγ<34 keV.
755.3	(1⁻)	502.1[‡] *5*	100 *8*	253.2	1⁻	(M1)		0.0984	α(K)=0.0808 *12*; α(L)=0.01345 *20*; α(M)=0.00313 *5*; α(N+..)=0.000959 *14*
		515.2[‡] *5*	5.1 *25*	240.2	(2)⁻	(M1)		0.0919	α(K)=0.0755 *11*; α(L)=0.01256 *18*; α(M)=0.00293 *5*; α(N+..)=0.000896 *13*
		755.2[‡] *8*	7 *3*	0.0	2⁻	(M1)		0.0339	α(K)=0.0279 *4*; α(L)=0.00458 *7*; α(M)=0.001066 *16*; α(N+..)=0.000326 *5*
799.5		161.4 *3*	100	638.1		D+Q	−0.16 *+6−284*	2.3 *13*	
799.6+x	(10⁻)	61.5 *3*	100	738.1+x?	(9⁻)	D+Q	−0.18 *+14−7*	8.315	
908.4+x	(11⁻)	108.6 *3*	100	799.6+x	(10⁻)	D+Q	−0.05 *+1−2*	7.068 *7*	
954.2	(1⁻)	701.0[‡] *8*	47 *20*	253.2	1⁻	(M1)		0.0411	α(K)=0.0338 *5*; α(L)=0.00557 *8*; α(M)=0.001296 *19*; α(N+..)=0.000397 *6*
		714.1[‡] *8*	20 *10*	240.2	(2)⁻	(M1)		0.0391	α(K)=0.0322 *5*; α(L)=0.00531 *8*; α(M)=0.001234 *18*; α(N+..)=0.000378 *6*
		954.1[‡] *8*	100 *25*	0.0	2⁻	(M1)		0.0186	α(K)=0.01531 *22*; α(L)=0.00250 *4*; α(M)=0.000580 *9*; α(N+..)=0.000178 *3*
1179.7+x	(12⁻)	271.4 *3*	100	908.4+x	(11⁻)	D+Q	−0.45 *+10−25*	0.47 *7*	
		380.3 *3*	7.0	799.6+x	(10⁻)				
1274.8		475.3 *2*	100	799.5		D+Q	−1.1 *+6−4*	0.07 *3*	
1416.1+x	(13⁻)	236.4 *3*	100	1179.7+x	(12⁻)	D+Q	−0.44 *+8−11*	0.70 *4*	
		507.6 *2*	58	908.4+x	(11⁻)				
1544.6		269.8[&]		1274.8					
		745.2 *2*	100	799.5					
1812.9+x	(14⁻)	396.9 *3*	100	1416.1+x	(13⁻)	D+Q	−0.62 *+9−23*	0.152 *20*	
		633.3 *2*	41	1179.7+x	(12⁻)				

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Adopted Levels, Gammas (continued)

γ(^{196}Tl) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	δ[#]	α[@]
1995.8		451.3 *2*	100	1544.6		D+Q	−0.6 *+2−13*	0.11 *6*
		721.0 *2*	100	1274.8				
2079.6+x	(15$^-$)	266.7 *3*	43	1812.9+x	(14$^-$)	D+Q	−0.31 *+8−7*	0.528 *16*
		663.3 *2*	100	1416.1+x	(13$^-$)			
2171.2+x		991.5 *2*	100	1179.7+x	(12$^-$)			
2222.8		227.3 *3*	53	1995.8		D(+Q)	0.00 *10*	
		678.1 *2*	100	1544.6				
2335.1+x		163.9 *3*	100	2171.2+x		D+Q	−0.25 *+5−7*	2.11 *5*
2527.3+x		192.2 *3*	100	2335.1+x		D+Q	−0.78 *+23−70*	1.0 *3*
		356.0[&]		2171.2+x				
2527.4+x	(16$^-$)	447.8 *2*	100	2079.6+x	(15$^-$)	D+Q	−0.55 *+6−12*	0.115 *8*
		714.6 *2*	91	1812.9+x	(14$^-$)			
2760.3+x	(17$^-$)	233.1 *3*	45	2527.4+x	(16$^-$)	D+Q	−0.27 *+8−7*	0.777 *21*
		680.6 *2*	100	2079.6+x	(15$^-$)			
2846.8+x		319.5 *3*	100	2527.3+x		D+Q	−0.78 *+18−65*	0.25 *8*
3045.6+x	(18$^-$)	285.3 *3*	100	2760.3+x	(17$^-$)	D+Q	−0.07 *2*	0.4663 *11*
3163.5+x		316.7 *3*	100	2846.8+x		D+Q	−0.18 *+4−3*	0.344 *4*
3334.6+x	(19$^-$)	289.0 *3*	100	3045.6+x	(18$^-$)	D+Q	−0.46 *+16−21*	0.39 *5*
3500.1+x?		336.2[&] *3*	100	3163.5+x		D+Q	−0.14 *5*	0.295 *4*
3523.4+x	(20$^-$)	188.8 *3*	100	3334.6+x	(19$^-$)	D+Q	−0.12 *4*	1.453 *11*
3629.8+x?	(21$^-$)	106.4 *3*	100	3523.4+x	(20$^-$)	D+Q	−0.07 *+4−3*	7.487 *15*

[†] From ^{197}Au(α,5nγ) unless otherwise specified.
[‡] From ^{196}Pb ε decay (37 min).
[#] From γ(θ) analysis of data unless indicated otherwise.
[@] 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.
[&] Placement of transition in the level scheme is uncertain.

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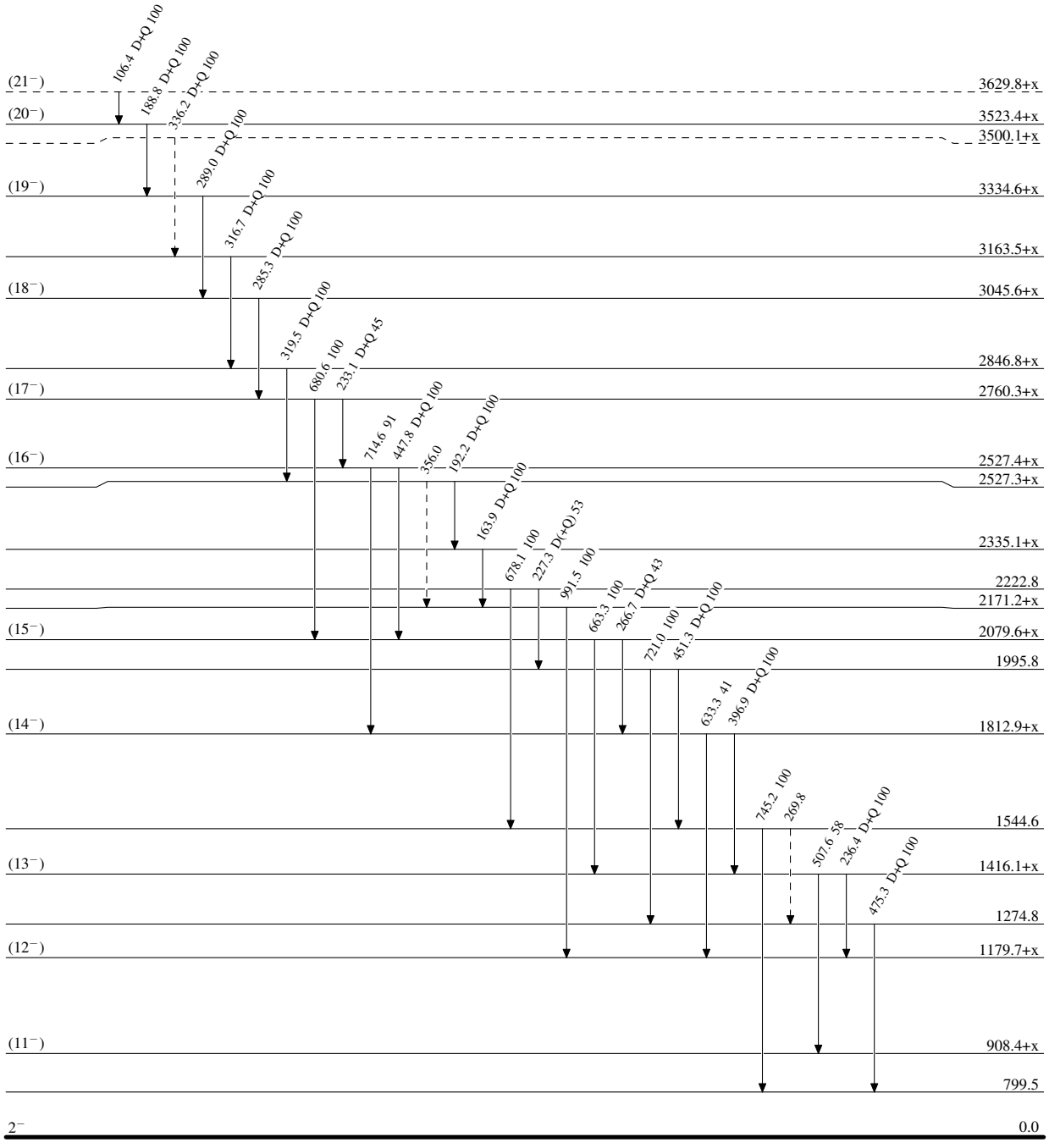
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



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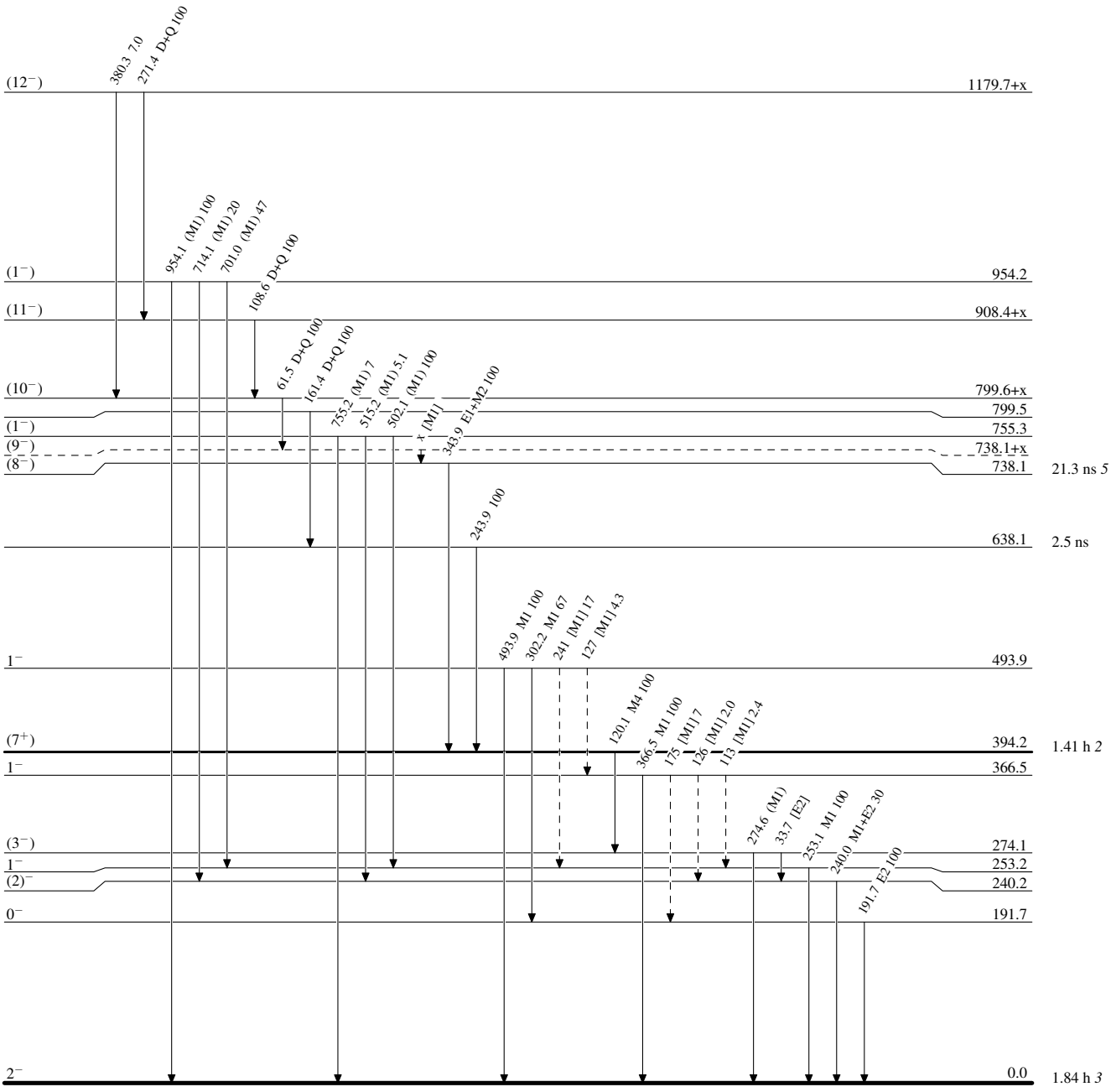
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



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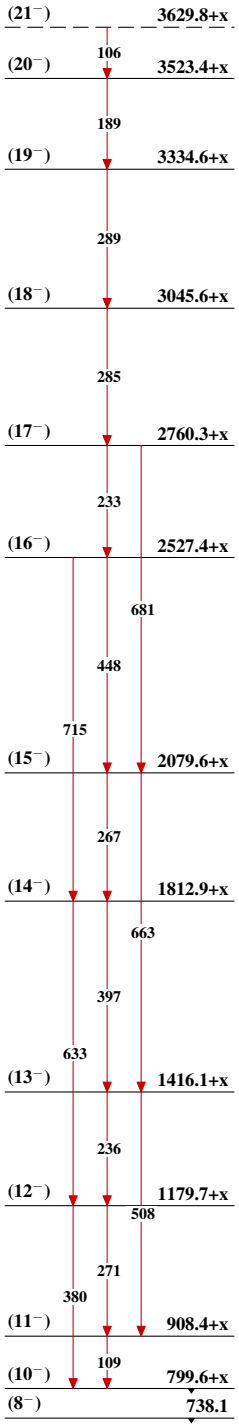
Adopted Levels, Gammas

Band(A): The negative-parity band



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