Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, M. S. Basunia, Murray Martin et al. ,	NDS 160, 405 (2019)	30-Oct-2019

Q(β^-)=−4190 *50*; S(n)=7310 *13*; S(p)=4952 *13*; Q(α)=8546 *6* 2017Wa10
S(2n)=12783 *14*, S(2p)=8180 *13* (2017Wa10).
Additional information 1.
Theory references: consult NSR database (www.nndc.bnl.gov/nsr/) for 62 primary references for nuclear structure, and 42 for calculations of half-lives of radioactive decays.
From lifetime measurements, 1988Ga33 conclude that higher spin states exhibit enhanced B(E1) rates of about 0.006 which may be a result of collective dipole deexcitations from a reflection- asymmetric intrinsic state.

^{218}Ra Levels

Cross Reference (XREF) Flags

A ^{222}Th α decay (1.964 ms)
B ^{208}Pb(^{13}C,3nγ),(^{14}C,4nγ),

E(level)†	J$^\pi$‡	$T_{1/2}$#	XREF	Comments
0.0&	0$^+$	25.91 μs *14*	AB	%α=100 Additional information 2. $T_{1/2}$: weighted average of 25.99 μs *10* (E. Parr et al., Phys Rev. C 100, 044323 (2019)), 25.2 μs *3* (2001Ku07), 26 μs *2* (1992Wi14) and 25.6 μs *11* (1986To02). Others: 15.6 μs *10* (1991AnZZ), 14 μs *2* (1970Va13).
388.90& *10*	2$^+$	29.8 ps *28*	AB	J$^\pi$: E2 γ to 0$^+$.
741.10& *14*	4$^+$	19.4 ps *35*	B	J$^\pi$: ΔJ=2, E2 γ to 2$^+$.
793.21a *18*	(3$^-$)		AB	J$^\pi$: ΔJ=1, D γ to 2$^+$.
853a *6*	(1$^-$)		A	E(level): from Eα and Q(α) values. J$^\pi$: on the basis of the similarity in the hindrance factor for the 853 level with that of the 793 level, and the γ to 0$^+$, 2016Pa28 propose that the 853 level is the bandhead of the octupole band.
1038.32a *18*	5$^-$		B	J$^\pi$: ΔJ=1, E1 γ to 4$^+$.
1122.04& *20*	6$^+$	13.2 ps *28*	B	J$^\pi$: ΔJ=2, E2 γ to 4$^+$; E1 γ to 5$^-$.
1340.85a *21*	7$^-$	@	B	J$^\pi$: ΔJ=1, E1 γ to 6$^+$; ΔJ=2, E2 γ to 5$^-$.
1546.70& *23*	8$^+$	@	B	J$^\pi$: ΔJ=1, E1 γ to 7$^-$; ΔJ=2, E2 γ to 6$^+$.
1573.01 *19*	(3$^-$,4,5$^-$)		B	J$^\pi$: γ rays to (3$^-$) and 5$^-$.
1694.35a *25*	9$^-$	@	B	J$^\pi$: γ to 8$^+$; ΔJ=2, E2 γ to 7$^-$.
1714.60 *25*			B	J$^\pi$: γ to 4$^+$.
1725.8 *3*			B	J$^\pi$: γ to 5$^-$.
1803.60 *24*			B	J$^\pi$: γ rays to 6$^+$ and 7$^-$.
1855.9 *3*			B	J$^\pi$: γ to 6$^+$.
1896.8 *3*			B	J$^\pi$: γ to 8$^+$.
1961.7& *3*	10$^+$	@	B	J$^\pi$: ΔJ=1, E1 γ to 9$^-$; ΔJ=2, E2 γ to 8$^+$.
2031.8 *3*			B	J$^\pi$: γ to 9$^-$.
2109.3a *3*	11$^-$	@	B	J$^\pi$: ΔJ=2, E2 γ to 9$^-$; ΔJ=1, D γ to 10$^+$.
2328.3 *4*			B	
2390.8& *3*	12$^+$	<1.4 ps	B	J$^\pi$: ΔJ=1, E1 γ to 11$^-$; ΔJ=2, E2 γ to 10$^+$.
2420.0b *3*	(12$^-$)		B	J$^\pi$: ΔJ=1, (M1+E2) γ to 11$^-$.
2442.4 *4*			B	
2465.6 *3*			B	J$^\pi$: γ to 10$^+$.
2526.3a *3*	13$^-$	<4.9 ps	B	J$^\pi$: ΔJ=1, E1 γ to 12$^+$; ΔJ=2, E2 γ to 11$^-$.

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Adopted Levels, Gammas (continued)

^{218}Ra Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
2825.5[&] *3*	14^+	<1.4 ps	B	Jπ: ΔJ=1, E1 γ to 13^-; ΔJ=2, E2 γ to 12^+.
2966.4[a] *4*	15^-	<1.4 ps	B	Jπ: ΔJ=1, E1 γ to 14^+; ΔJ=2, E2 γ to 13^-. $T_{1/2}$: This $T_{1/2}$ leads to B(E2)(W.u)>218, a factor of about 3 larger than any of the other E2 or E1 reduced transition probabilities. The $T_{1/2}$ limit may be a typo.
2967.2[b] *4*	(14^-)		B	Jπ: ΔJ=2, E2 γ to (12^-); γ to 13^-.
3285.1[&] *4*	16^+		B	Jπ: γ rays to 14^+ and 15^-.
3387.7[b] *7*	(16^-)		B	Jπ: γ to (14^-).
3388.8[a] *4*	17^-	<13 ps	B	Jπ: ΔJ=2, E2 γ to 15^-; γ to 16^+.
3719.8[b] *7*	(18^-)		B	Jπ: γ rays to (16^-) and 17^-.
3756.0[&] *7*	18^+		B	Jπ: γ to 17^-, and member of g.s. band.
3805.9[a] *8*	19^-		B	Jπ: γ rays to 17^-, (18^-) and 18^+.
4117.7[b] *9*	(20^-)		B	Jπ: γ rays to (18^-) and 19^-.
4191.1?[&] *11*	(20^+)		B	Jπ: γ rays to 18^+ and 19^-.
4212.6[a] *10*	(21^-)		B	Jπ: γ to 19^-.
4391.6[c] *11*	(21^+)		B	Jπ: γ to (20^-).
4588.3[&] *11*	(22^+)		B	Jπ: γ to (21^-).
4675.3[a] *10*	(23^-)		B	Jπ: γ rays to (21^-) and (22^+).
4682.6[b] *10*	(22^-)		B	Jπ: γ rays to (20^-) and (21^-).
4835.5[c] *11*	(23^+)		B	Jπ: γ rays to (21^+), (22^+) and (22^-).
5020.3[&] *12*	(24^+)		B	Jπ: γ rays to (22^+) and (23^-).
5125.4[a] *13*	(25^-)		B	Jπ: γ rays to (23^-) and (24^+).
5139.4[b] *11*	(24^-)		B	Jπ: γ rays to (22^-) and (23^+).
5363.5[c] *13*	(25^+)		B	Jπ: γ rays to (23^+) and (24^-).
5470.1[&] *13*	(26^+)		B	Jπ: γ rays to (24^+) and (25^-).
5588.1[a] *13*	(27^-)		B	Jπ: γ rays to (25^-) and (26^+).
5901.7[&] *14*	(28^+)		B	Jπ: γ rays to (26^+) and (27^-).
6134.9[a] *15*	(29^-)		B	Jπ: γ rays to (27^-) and (28^+).
6343.8[&] *15*	(30^+)		B	Jπ: γ rays to (28^+) and (29^-).
6678.8[a] *16*	(31^-)		B	Jπ: γ rays to (29^-) and (30^+).

[†] From a least-squares fit to the adopted Eγ data except for the 853 level which comes from the E(α) branch to that level.

[‡] From γ(θ) and γ(lin pol) data in ^{208}Pb(^{13}C,3nγ), and association of levels in bands or sequences. Additional γ mult arguments are given explicitly.

[#] From recoil-distance Doppler-shift method in inverse kinematic reaction: ^{13}C(^{208}Pb,3nγ)(1988Ga33). No delayed component with a half-life longer than 5 ns was observed for any of the transitions (1986Go21).

[@] 1988Ga33 deduced $T_{1/2}$=3.1 ps *4* for 1341, 7^-; 2.3 ps *3* for 1547, 8^+; 5.9 ps *6* for 1694, 9^-; 2.6 ps *4* for 1962, 10^+; and 4.2 ps *5* for 2109, 11^- levels using average B(E2) for transitions from some of the above levels.

[&] Band(A): $K^\pi=0^+$ g.s. band.

[a] Band(B): Octupole band.

[b] Seq.(C): γ sequence based on 12^-.

[c] Seq.(D): γ sequence based on (21^+).

Adopted Levels, Gammas (continued)

$\gamma(^{218}Ra)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	α[#]	Comments
388.90	2^+	388.9 *1*	100	0.0	0^+	E2	0.0727	B(E2)(W.u.)=25.5 *24*
741.10	4^+	352.2 *1*	100	388.90	2^+	E2	0.0954	B(E2)(W.u.)=63 *12*
793.21	(3^-)	404.3 *2*	100	388.90	2^+	D		
853	(1^-)	853		0.0	0^+			
1038.32	5^-	245.1 *2*		793.21	(3^-)			
		297.3 *2*		741.10	4^+	E1	0.0359	
1122.04	6^+	83.7 *2*	35 *7*	1038.32	5^-	(E1)	0.177 *3*	B(E1)(W.u.)=0.0057 *17*
		380.9 *2*	100 *6*	741.10	4^+	E2	0.0769	B(E2)(W.u.)=46 *11*
1340.85	7^-	218.8 *1*	100 *5*	1122.04	6^+	E1	0.0729	
		302.6 *2*	8.7 *22*	1038.32	5^-	E2	0.1482	
1546.70	8^+	205.8 *2*	100 *7*	1340.85	7^-	E1	0.0843	
		424.6 *2*	71 *20*	1122.04	6^+	E2	0.0578	
1573.01	$(3^-,4,5^-)$	534.7 *2*		1038.32	5^-			
		779.8 *2*		793.21	(3^-)			
		831.9 *2*		741.10	4^+			
1694.35	9^-	147.5[&] *2*	100[&] *45*	1546.70	8^+		0.190	
		353.6 *2*	58 *20*	1340.85	7^-	E2	0.0943	
1714.60		973.5 *2*		741.10	4^+			
1725.8		687.5 *2*	100	1038.32	5^-			
1803.60		462.7 *2*		1340.85	7^-			
		681.6 *2*		1122.04	6^+			
1855.9		733.9 *2*	100	1122.04	6^+			
1896.8		350.1 *2*	100	1546.70	8^+			
1961.7	10^+	267.3 *1*	100 *5*	1694.35	9^-	E1	0.0457	
		415.0[&] *2*	36[&] *9*	1546.70	8^+	E2	0.0613	
2031.8		337.5 *2*	100	1694.35	9^-			
2109.3	11^-	77.5 *2*		2031.8				
		147.5[&] *2*	42[&] *42*	1961.7	10^+		0.190	
		415.0[&] *2*	100[&] *25*	1694.35	9^-	E2	0.0613	
2328.3		472.4 *2*	100	1855.9				
2390.8	12^+	281.4 *2*	100 *7*	2109.3	11^-	E1	0.0407	B(E1)(W.u.)>0.004
		429.3 *2*	33 *7*	1961.7	10^+	E2	0.0562	B(E2)(W.u.)>84
2420.0	(12^-)	310.6 *2*	100	2109.3	11^-	(M1+E2)	0.4 *3*	
2442.4		410.6 *2*	100	2031.8				
2465.6		503.9 *2*		1961.7	10^+			
		568.8 *2*		1896.8				
2526.3	13^-	106.1 *2*		2420.0	(12^-)			
		135.6 *2*	33 *3*	2390.8	12^+	E1	0.230	B(E1)(W.u.)>0.0034
		416.9 *2*	100 *27*	2109.3	11^-	E2	0.0606	B(E2)(W.u.)>80
2825.5	14^+	299.3 *2*	100 *28*	2526.3	13^-	E1	0.0354	B(E1)(W.u.)>0.0035
		434.8[@] *2*	<45	2390.8	12^+	E2	0.0544	E_γ: double placement, with intensity not divided.
2966.4	15^-	140.9 *2*	32 *5*	2825.5	14^+	E1	0.210	B(E1)(W.u.)>0.011
		440.0 *2*	100 *5*	2526.3	13^-	E2	0.0528	B(E2)(W.u.)>218
2967.2	(14^-)	142		2825.5	14^+			
		440.8 *2*		2526.3	13^-			
		547.3 *2*		2420.0	(12^-)	E2	0.0313	
3285.1	16^+	318.7	100 *20*	2966.4	15^-			
		459.7	60 *20*	2825.5	14^+			
3387.7	(16^-)	420.5	100	2967.2	(14^-)			
3388.8	17^-	104		3285.1	16^+			
		422.4 *2*		2966.4	15^-	E2	0.0586	
3719.8	(18^-)	331		3388.8	17^-			
		332.1 *3*		3387.7	(16^-)			

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Adopted Levels, Gammas (continued)

$\gamma(^{218}Ra)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Comments
3756.0	18^+	367		3388.8	17^-	
		471[a]		3285.1	16^+	
3805.9	19^-	50		3756.0	18^+	
		86		3719.8	(18^-)	
		417		3388.8	17^-	
4117.7	(20^-)	312		3805.9	19^-	
		398		3719.8	(18^-)	
4191.1?	(20^+)	385		3805.9	19^-	
		434.8[@] 2		3756.0	18^+	E_γ: double placement, with intensity not divided.
4212.6	(21^-)	406.6	100	3805.9	19^-	
4391.6	(21^+)	274	100	4117.7	(20^-)	
4588.3	(22^+)	376		4212.6	(21^-)	
		397[a]		4191.1?	(20^+)	
4675.3	(23^-)	87		4588.3	(22^+)	
		462.7[@]		4212.6	(21^-)	
4682.6	(22^-)	291[a]		4391.6	(21^+)	
		470		4212.6	(21^-)	
		565		4117.7	(20^-)	
4835.5	(23^+)	153		4682.6	(22^-)	
		247		4588.3	(22^+)	
		444		4391.6	(21^+)	
5020.3	(24^+)	345[@]		4675.3	(23^-)	
		432[@]		4588.3	(22^+)	
5125.4	(25^-)	105		5020.3	(24^+)	
		450[@]		4675.3	(23^-)	
5139.4	(24^-)	304		4835.5	(23^+)	
		457		4682.6	(22^-)	
		464[a]		4675.3	(23^-)	
5363.5	(25^+)	224		5139.4	(24^-)	
		528		4835.5	(23^+)	
5470.1	(26^+)	345[@]		5125.4	(25^-)	
		450[@]		5020.3	(24^+)	
5588.1	(27^-)	118		5470.1	(26^+)	
		463[@]		5125.4	(25^-)	
5901.7	(28^+)	313		5588.1	(27^-)	
		432[@]		5470.1	(26^+)	
6134.9	(29^-)	233		5901.7	(28^+)	
		547		5588.1	(27^-)	
6343.8	(30^+)	209		6134.9	(29^-)	
		442		5901.7	(28^+)	
6678.8	(31^-)	335		6343.8	(30^+)	
		544		6134.9	(29^-)	

† From $^{208}Pb(^{13}C,3n\gamma),(^{14}C,4n\gamma)$ dataset.
‡ From $\gamma(\theta)$ and γ(lin pol) data in $^{208}Pb(^{13}C,3n\gamma)$.
# 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.
& Multiply placed with intensity suitably divided.
a Placement of transition in the level scheme is uncertain.

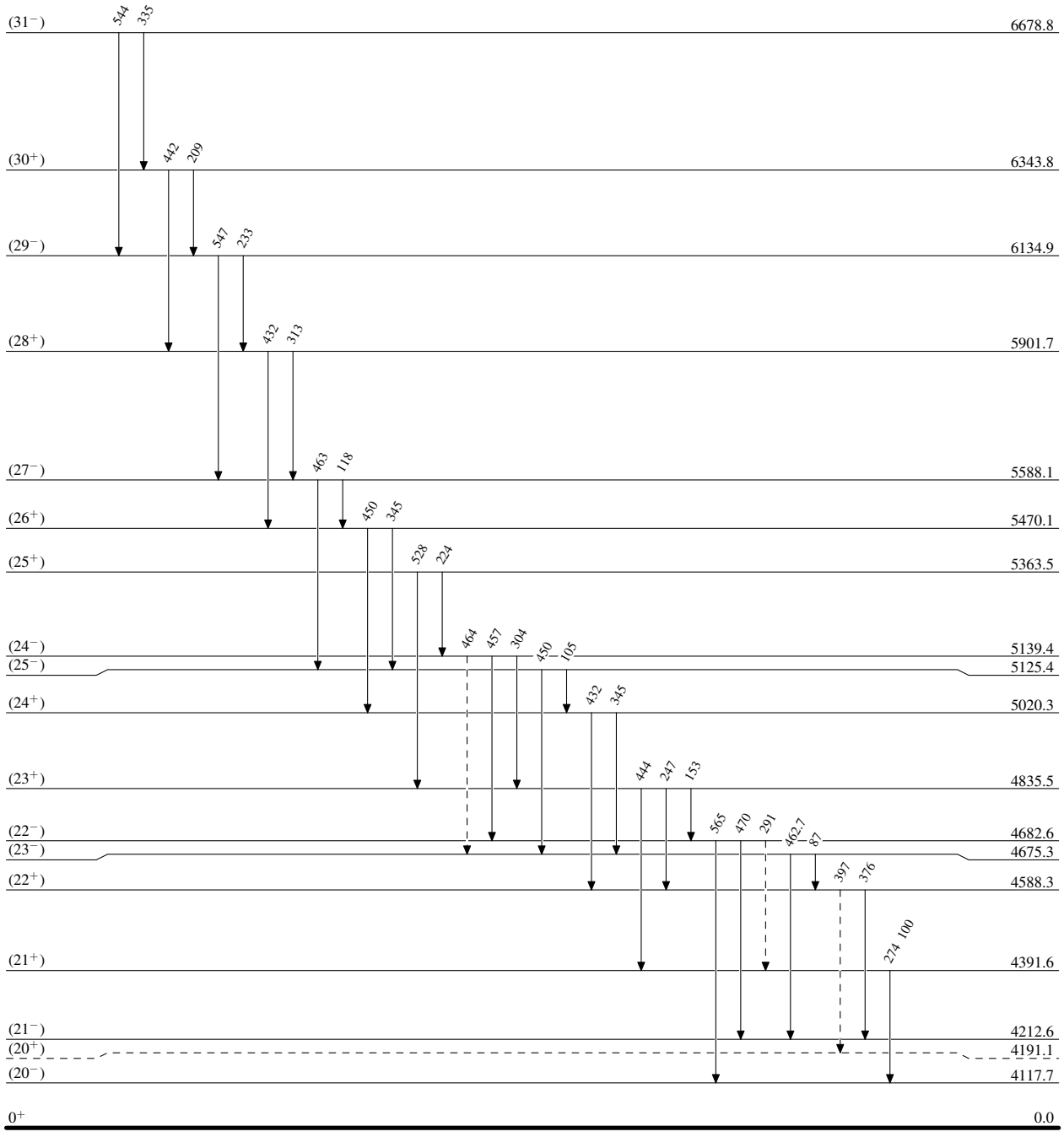
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{218}_{88}Ra_{130}$

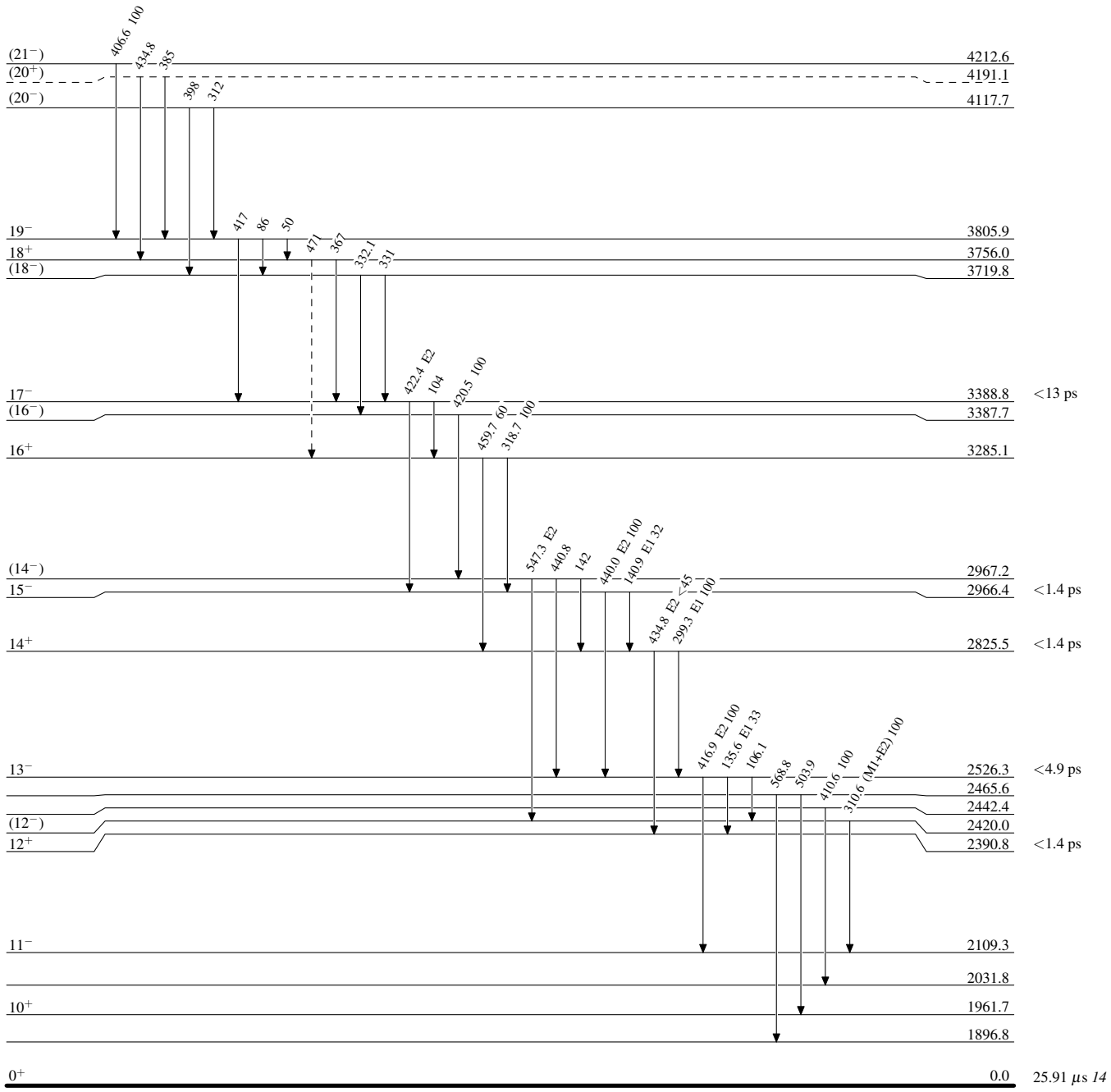
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

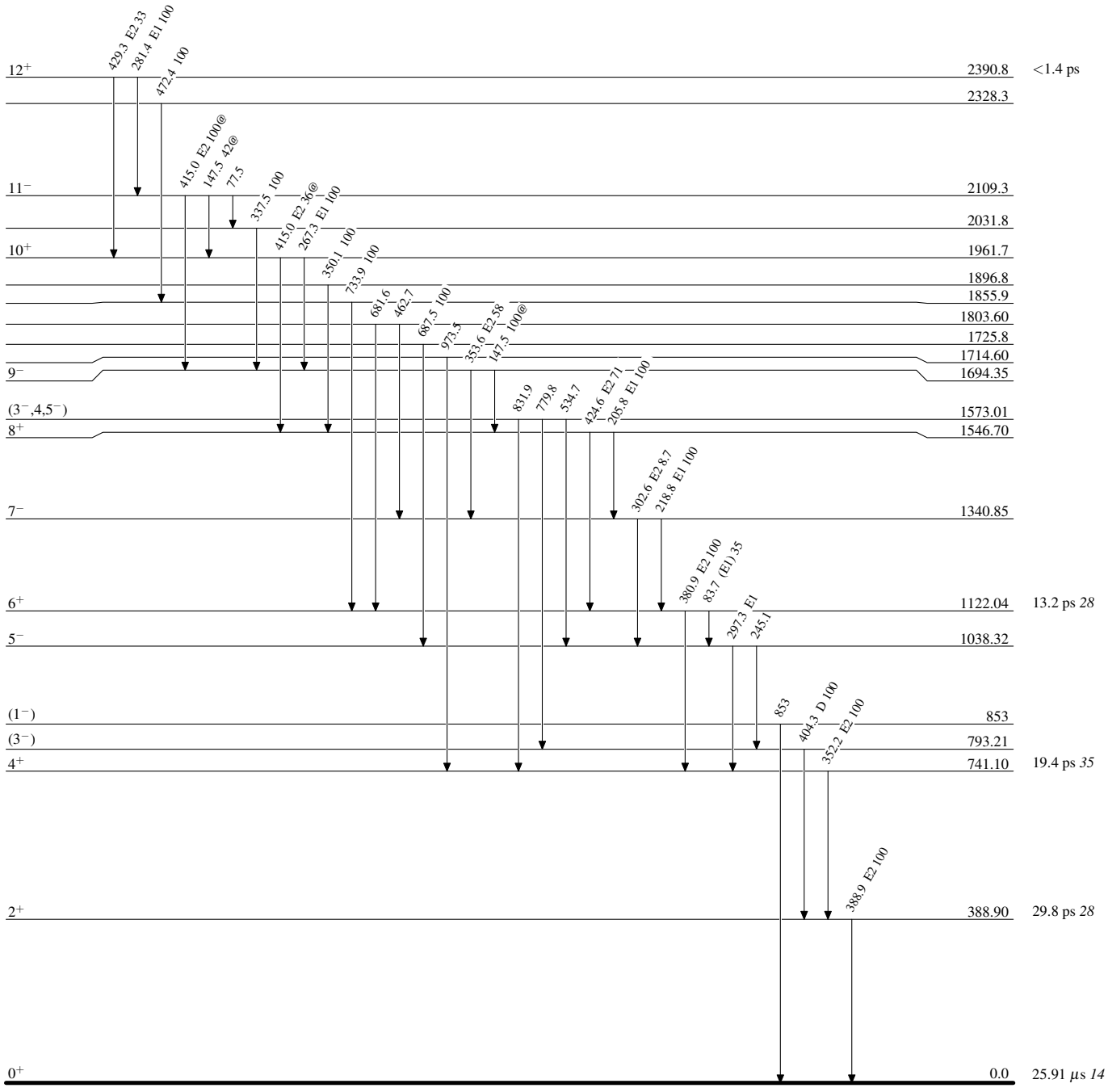


$^{218}_{88}Ra_{130}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



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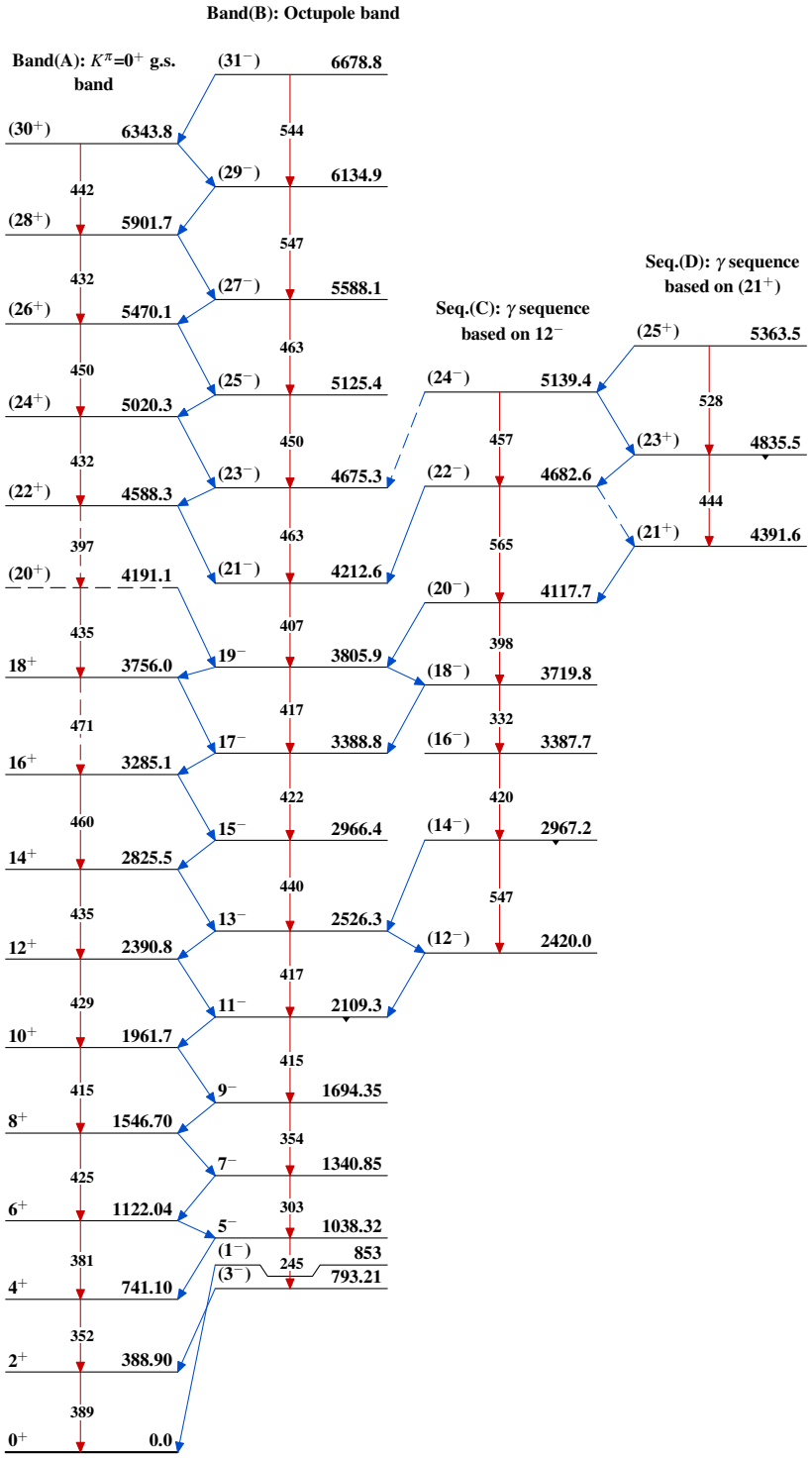
Adopted Levels, Gammas



$^{218}_{88}Ra_{130}$