Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 121, 561 (2014)	31-Mar-2014

Q(β^-)=−3793 *21*; S(n)=7636 *21*; S(p)=1693 *25*; Q(α)=6672 *5* 2012Wa38

^{210}Fr beam production: 2006St01, 2005Co02.

^{210}Fr Levels

Cross Reference (XREF) Flags

- A ^{214}Ac α decay
- B ^{176}Yb(^{37}Cl,3nγ)
- C ^{197}Au(^{16}O,3nγ):1
- D ^{197}Au(^{16}O,3nγ):2

E(level)[†]	Jπ[#]	$T_{1/2}$[@]	XREF	Comments
0.0	6^+	3.18 min *6*	A CD	%α=60 *30*; %ε+%β^+=40 *30* μ=+4.40 *9*; Q=+0.19 *2* From α syst (1980Sc26). Others: 1996Vo14, 1996Si06. $T_{1/2}$: Weighted average of 3.4 min *2* (2010Ka29), 3.18 min *6* (1967Va20), and 3.0 min *2* (1972KeYY). Others: 2.65 min *8* (1964Gr04), 3.2 min (1978Ek02). Jπ: from J=6 (1978Ek02) atomic beam. Configuration=((π $1h_{9/2}$) (ν $2f_{5/2}$)) as for 7^+, ^{208}Fr g.s., is consistent with experimental μ (calculated μ=4.33 for this configuration (1986Ek02)). μ,Q: LASER induced optical pumping (1985Co24,1989Ra17). Other: μ=4.38 *5* (Trap LASER spectroscopy − 2008Go11). Measured isotope shifts (1980Li22,1985Co24,1987Co19).
0.0+x		0.36 μs *14*	B	Additional information 1. $T_{1/2}$: From (^{37}Cl,3nγ).
62.68 *6*			A	
138.96 *7*	$(5,6,7)^+$		A	Jπ: 138.6γ M1 to 6^+. E(level): From Eγ=138.6 keV *2* in ^{214}Ac α decay (2000He17).
195.55 *8*			A	
209.06 *7*			A C	Jπ: 7^+ in (^{16}O,3nγ). 209γ to 6^+ gives 4^+,5,6,7,8^+.
244.20 *7*	$(5,6,7)^+$		A	Jπ: 244.2γ M1 to 6^+.
333.00[‡] *10*			A	
339.50[‡] *10*			A	
346.40[‡] *10*			A	
363.69 *9*	$(4\text{ to }8)^+$		A	Jπ: 224.7γ M1 to $(5,6,7)^+$.
444.20[‡] *20*			A	
525.71 *7*	$(4\text{ to }8)^+$		A C	Jπ: 281.4γ M1 to $(5,6,7)^+$; Jπ=9^+ in (^{16}O,3nγ).
601.40[‡] *20*			A	
622.50[‡] *20*			A	
713.4[‡] *7*			A	
729.1 *23*	(9^-)	41 ns *2*	C	Jπ: 2011Ka37 (^{16}O,3nγ) assigned Jπ=9^- based on 203.4γ (E1) to Jπ=9^+ (assumed) state at 525 keV. Adopted Jπ $(4\text{ to }8)^+$.
753.7[‡] *7*			A	
820.1[b] *14*	(8^+)	10[&] ps *+4−6*	D	Jπ: 820.1γ (E2) to 6^+.
986[a] *3*	(11)		C	

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Adopted Levels, Gammas (continued)

^{210}Fr Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[@]	XREF	E(level)[†]	Jπ[#]	XREF
1342.7[b] *21*	(9+)	0.35[&] ps *6*	D	2524[a] *4*	(13)	C
1506 *4*	(11)		C	2610 *5*	(13)	C
1572.0 *22*	(10)		D	2853[a] *5*	(14)	C
1687 *4*	(12)		C	2884 *4*	(13)	D
1721.2[b] *22*	(10)		D	2952 *5*	(13)	C
1731 *4*	(12)		C	3081 *4*	(14)	D
1803[a] *4*	(12)		C	3359[a] *5*	(15)	C
1973.5[b] *24*	(11)		D	3443 *5*	(15)	C
2058 *3*	(11)		D	3648[a] *5*	(16)	C
2073 *4*	(13)		C	3766[a] *5*	(17)	C
2178.2[b] *25*	(12)		D	4253[a] *6*	(18)	C
2288 *3*	(12)		D	4539[a] *6*	(19)	C
2408 *5*	(12)		C	5292[a] *6*	(20)	C

[†] From a least-squares fit to γ-ray energies.
[‡] Possible (unobserved) transition from this to a low-lying level.
[#] From γ-ray feeding, except otherwise noted.
[@] From (^{16}O,3nγ):1, except otherwise noted. Systematic uncertainties up to 10% are not included in the quoted uncertainty.
[&] From (^{16}O,3nγ):2, except otherwise noted. Systematic uncertainties up to 10% are not included in the quoted uncertainty.
[a] Band(A): ΔJ=1 sequence based on (11).
[b] Band(B): ΔJ=1 sequence based on (8^+).

γ(^{210}Fr)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[@]	Comments
62.68		62.6[#] *1*	100[#]	0.0	6^+			
138.96	$(5,6,7)^+$	76.3[#] *1*	6[#] *2*	62.68				
		138.9[#] *1*	100[#] *3*	0.0	6^+	M1[#]	5.62	α(K)=4.53 *7*; α(L)=0.832 *12*; α(M)=0.198 *3* α(N)=0.0520 *8*; α(O)=0.01162 *17*; α(P)=0.00186 *3*; α(Q)=0.0001040 *15*
195.55		133.1[#&] *1*	37[#] *12*	62.68				
		195.5[#] *1*	100[#] *4*	0.0	6^+			
209.06		146.4[#] *1*	59[#] *3*	62.68				
		209.0[#] *1*	100[#] *3*	0.0	6^+			Mult.: (M1+E2) in 2004Ku24 (^{214}Ac α decay), pure E2 not excluded.
244.20	$(5,6,7)^+$	181.4[#] *1*	13[#] *11*	62.68				
		244.2[#] *1*	100[#] *6*	0.0	6^+	M1[#]	1.149	α(K)=0.927 *13*; α(L)=0.1687 *24*; α(M)=0.0402 *6* α(N)=0.01053 *15*; α(O)=0.00235 *4*; α(P)=0.000378 *6*; α(Q)=2.11×10^{-5} *3*
333.00		333.0[#] *1*	100[#]	0.0	6^+			
339.50		339.5[#] *1*	100[#]	0.0	6^+			
346.40		346.4[#] *1*	100[#]	0.0	6^+			
363.69	$(4\text{ to }8)^+$	154.6[#] *1*	78[#] *12*	209.06				
		224.7[#] *1*	100[#] *9*	138.96	$(5,6,7)^+$	M1[#]	1.449	α(K)=1.168 *17*; α(L)=0.213 *3*;

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Adopted Levels, Gammas (continued)

γ(^{210}Fr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[@]	Comments
								α(M)=0.0507 *8* α(N)=0.01329 *19*; α(O)=0.00297 *5*; α(P)=0.000477 *7*; α(Q)=2.66×10^{-5} *4*
363.69	(4 to 8)$^+$	363.9[#] *2*	24[#] *4*	0.0	6$^+$			
444.20		444.2[#] *2*	100[#]	0.0	6$^+$			
525.71	(4 to 8)$^+$	281.4[#] *1*	74[#] *7*	244.20	(5,6,7)$^+$	M1[#]	0.776	α(K)=0.627 *9*; α(L)=0.1137 *16*; α(M)=0.0271 *4* α(N)=0.00709 *10*; α(O)=0.001586 *23*; α(P)=0.000254 *4*; α(Q)=1.420×10^{-5} *20*
		316.6[#] *2*	33[#] *5*	209.06		(E2)	0.1233	α(K)=0.0623 *9*; α(L)=0.0452 *7*; α(M)=0.01191 *17* α(N)=0.00312 *5*; α(O)=0.000660 *10*; α(P)=9.08×10^{-5} *13*; α(Q)=1.496×10^{-6} *21*
		330.1[#] *1*	57[#] *8*	195.55				
		386.7[#] *2*	31[#] *4*	138.96	(5,6,7)$^+$			
		463.0[#] *2*	23[#] *4*	62.68				
		525.9[#] *1*	100[#] *6*	0.0	6$^+$			
601.40		601.4[#] *2*	100[#]	0.0	6$^+$			
622.50		622.5[#] *2*	100[#]	0.0	6$^+$			
713.4		713.4[#] *7*	100[#]	0.0	6$^+$			
729.1	(9$^-$)	203.4 *23*	100	525.71	(4 to 8)$^+$			Mult.: (E1) in (^{16}O,3nγ).
753.7		753.7[#] *7*	100[#]	0.0	6$^+$			
820.1	(8$^+$)	820.1[‡] *14*	100[‡]	0.0	6$^+$	(E2)[‡]	0.01262	B(E2)(W.u.)=2.1 *+13−9* α(K)=0.00954 *14*; α(L)=0.00232 *4*; α(M)=0.000572 *9* α(N)=0.0001498 *22*; α(O)=3.27×10^{-5} *5*; α(P)=4.97×10^{-6} *8*; α(Q)=2.06×10^{-7} *3*
986	(11)	256.9 *19*	100	729.1	(9$^-$)	Q		
1342.7	(9$^+$)	522.6[‡] *21*	100[‡]	820.1	(8$^+$)	(M1+E2)[‡]		
1506	(11)	519.6 *20*	100	986	(11)	D		
1572.0	(10)	229.4[‡] *19*	16.7[‡] *25*	1342.7	(9$^+$)	D[‡]		
		751.8[‡] *26*	100[‡] *6*	820.1	(8$^+$)	Q[‡]		
1687	(12)	700.5 *24*	100	986	(11)	D		
1721.2	(10)	378.4[‡] *17*	100[‡] *10*	1342.7	(9$^+$)	D[‡]		
		901.2[‡] *25*	54[‡] *8*	820.1	(8$^+$)	Q[‡]		
1731	(12)	225.4 *17*	100	1506	(11)	D		
1803	(12)	816.8 *26*	100	986	(11)	D		
1973.5	(11)	252.2[‡] *19*	100[‡] *7*	1721.2	(10)	D[‡]		
		401.4[‡] *22*	25[‡] *5*	1572.0	(10)	D[‡]		
2058	(11)	486.4[‡] *20*	100[‡]	1572.0	(10)	D[‡]		
2073	(13)	270.7 *15*	100	1803	(12)	D		

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Adopted Levels, Gammas (continued)

γ(^{210}Fr) (continued)

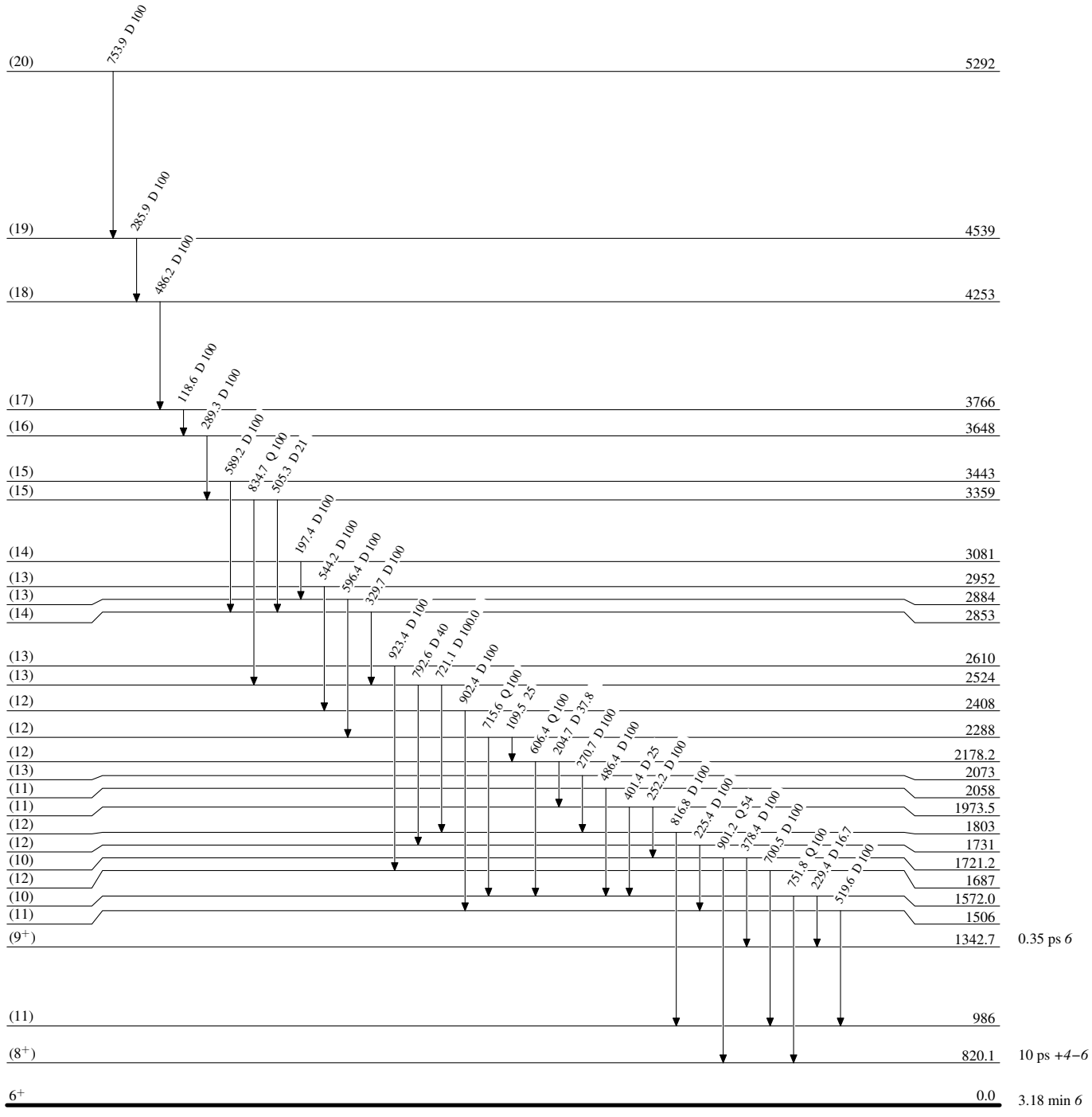
E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.†
2178.2	(12)	204.7‡ *18*	37.8‡ *22*	1973.5	(11)	D‡
		606.4‡ *21*	100‡ *4*	1572.0	(10)	Q‡
2288	(12)	109.5‡ *20*	25‡ *7*	2178.2	(12)	
		715.6‡ *21*	100‡ *7*	1572.0	(10)	Q‡
2408	(12)	902.4 *25*	100	1506	(11)	D
2524	(13)	721.1 *22*	100.0 *21*	1803	(12)	D
		792.6 *22*	40 *7*	1731	(12)	D
2610	(13)	923.4 *25*	100	1687	(12)	D
2853	(14)	329.7 *19*	100	2524	(13)	D
2884	(13)	596.4‡ *24*	100‡	2288	(12)	D‡
2952	(13)	544.2 *21*	100	2408	(12)	D
3081	(14)	197.4‡ *18*	100‡	2884	(13)	D‡
3359	(15)	505.3 *17*	21 *3*	2853	(14)	D
		834.7 *23*	100 *8*	2524	(13)	Q
3443	(15)	589.2 *21*	100	2853	(14)	D
3648	(16)	289.3 *20*	100	3359	(15)	D
3766	(17)	118.6 *18*	100	3648	(16)	D
4253	(18)	486.2 *19*	100	3766	(17)	D
4539	(19)	285.9 *15*	100	4253	(18)	D
5292	(20)	753.9 *17*	100	4539	(19)	D

† From (^{16}O,3nγ):1, except otherwise noted.
‡ From (^{16}O,3nγ):2.
# ^{214}Ac α decay.
@ Additional information 2.
& Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{210}_{87}Fr_{123}$

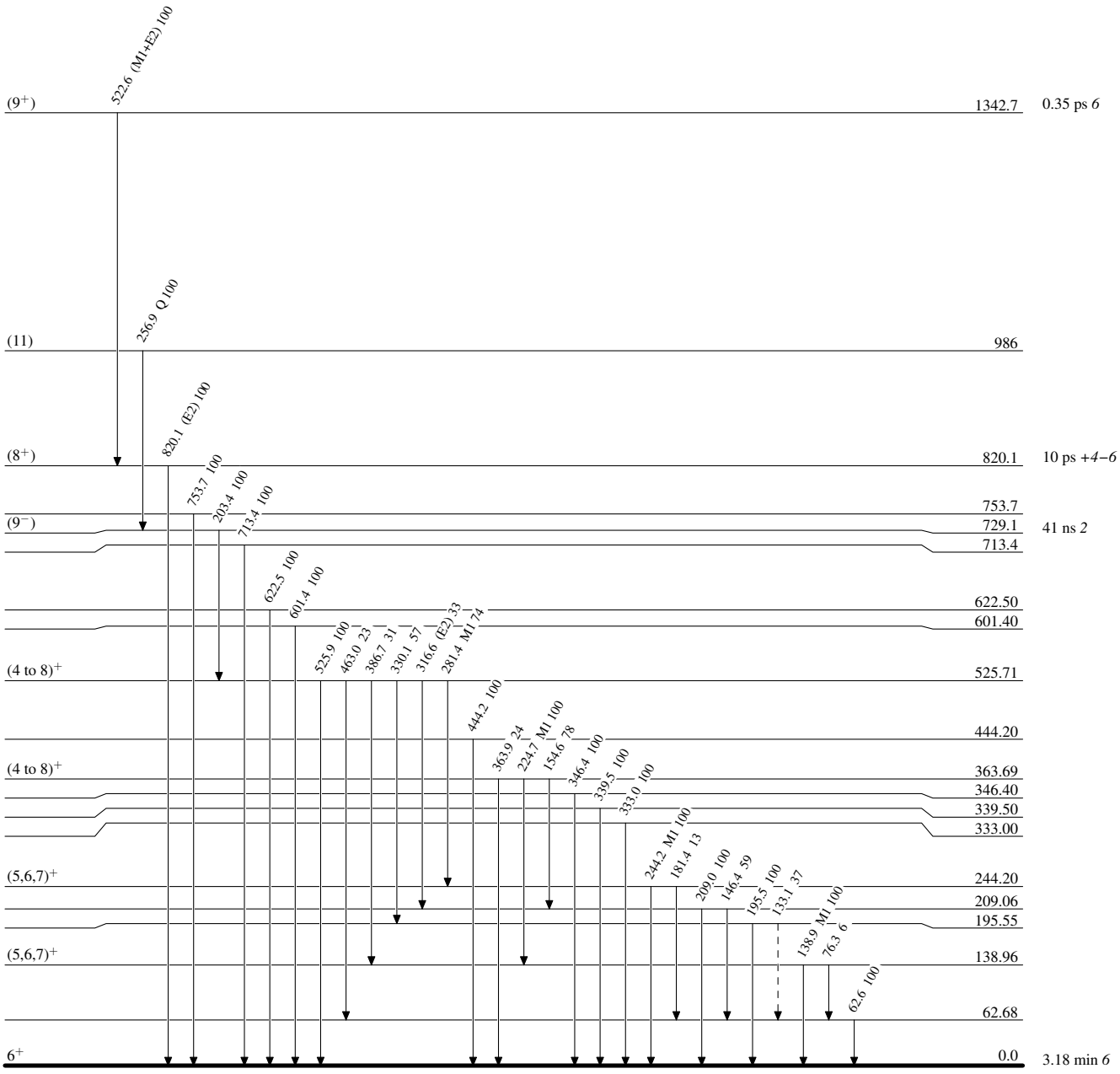
Adopted Levels, Gammas

Legend

Level Scheme (continued)

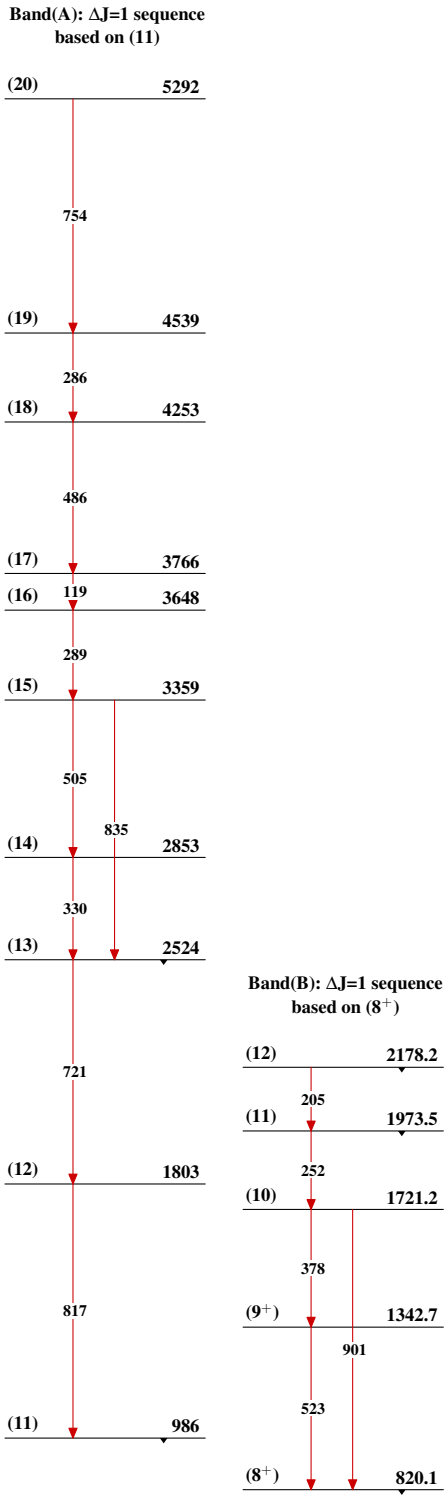
Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{210}_{87}Fr_{123}$

Adopted Levels, Gammas



$^{210}_{87}Fr_{123}$