Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 114, 1849 (2013)	31-Dec-2012

Q(β^-)=8444 *4*; S(n)=5514 *3*; S(p)=12.37×10^3 *24*; Q(α)=−9.27×10^3 *18* 2012Wa38

Production and identification:

2010St01: ^{60}Mn from ^{13,14}C(^{48}Ca,x), E=130 MeV, measured Eγ, Iγ, $\gamma\gamma$ coincidence, DCO ratios using Gammasphere array.

2008Va08: ^{60}Mn from ^{238}U(^{70}Zn,x), E=460 MeV, measured Eγ, Iγ, $\gamma\gamma$ coincidence.

2006Li15: ^{60}Mn from ^{60}Cr decay produced from ^{9}Be(^{86}Kr,x), E=140 MeV/nucleon. Measured fragment β- decay, $\beta\gamma$, $\beta\gamma$(t) coincidence.

1988Bo06: ^{60}Mn from W(^{76}Ge,x), E=11.5 MeV/nucleon, mass separation.

1985Ru05: ^{60}Mn from W(^{82}Se,x), E=11.5 MeV/nucleon, mass separation.

1978No03: ^{60}Mn from ^{48}Ca(^{18}O,αpn), E=56 MeV; comparison of Eγ with those of known decay γ rays in ^{60}Fe.

Others:

Discovery of Mn. Compilation: 2012Ga06.

Mass measurements: 2012He13, 2012Na15.

Nuclear structure theory: 2012Su07, 2010Sr03.

Neutrino measurements: 2007Li72, 2005Ju02.

^{60}Mn Levels

Cross Reference (XREF) Flags

- A ^{60}Cr β^- decay
- B ^{60}Mn IT decay (1.77 s)
- C ^{14}C(^{48}Ca,pnγ)
- D ^{238}U(^{70}Zn,Xγ)

E(level)[#]	J$^\pi$[†]	T$_{1/2}$	XREF	Comments
0.0	1$^+$[‡]	0.28 s *2*	ABCD	%β^-=100 J$^\pi$: from log *ft*=4.5 to 0$^+$ (2006Li15) is consistent with G-T decay. Systematics show that β^- log *ft* values in the 3.6 to 6.4 range are inconsistent with 0$^+$ to 0$^+$ decays (1973Ra10). *J*$^\pi$ is consistent with M3 γ-ray from 271-keV level. T$_{1/2}$: from 2006Li15. T=51 s *6* (1988Bo06, was not confirmed in 1993ScZS, since T$_{1/2}$ was very similar to that of Indium isomers detected in the spectra).
271.80 *10*	4$^+$[‡]	1.77 s *2*	BC	%β^-=88.5 *8*; %IT=11.5 *8* %β^-,%IT: From %IT/%β^-=0.13 *1* (from 1985Ru05, 1988Bo06; details not given). J$^\pi$: 271-keV M3 γ ray to *J*$^\pi$=1$^+$ g.s., *J*$^\pi$=4$^+$ from shell-model calculations (2006Li15). T$_{1/2}$: from 1988Bo06. Other: 1.79 s *10* (1978No03).
347.59 *16*	(2$^+$)		A CD	
407.47 *13*	(3$^+$)		CD	
726.40 *13*	(5$^+$)		C	
733.91 *12*	(4)		C	
757.18 *16*	(1$^+$)		A C	
836.48 *13*	(5)		C	
841.67 *24*			C	
965.98[@] *14*	(6)		C	
1090.46 *16*	(6$^+$)		C	
1215.15[&] *17*	(7)		C	
1246.0 *4*			C	
1784.38[@] *19*	(8)		C	
2049.4 *3*	(7$^+$)		C	
2223.34[a] *25*	(6)		C	

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Adopted Levels, Gammas (continued)

^{60}Mn Levels (continued)

E(level)[#]	Jπ[†]	XREF	E(level)[#]	Jπ[†]	XREF	E(level)[#]	Jπ[†]	XREF
2382.13[&] *21*	(9)	C	4132.0 *5*		C	5985.6 *13*		C
2439.11 *24*		C	4388.9 *5*		C	6026.8[b] *3*	(13)	C
2569.51[b] *25*	(7)	C	4532.6 *3*		C	6108.0[&] *4*	(13)	C
3005.62[a] *23*	(8)	C	4612.74[b] *24*	(11)	C	6234.9 *4*		C
3047.62[@] *22*	(10)	C	4644.8 *5*		C	6824.2[@] *5*	(14)	C
3486.02[b] *23*	(9)	C	4781.3[@] *3*	(12)	C	6863.5[a] *3*	(14)	C
3601.62 *24*		C	5001.7 *5*		C	7758.1[b] *3*	(15)	C
3654.0 *5*		C	5075.5 *9*		C	8982.7[a] *9*	(16)	C
4022.67[a] *23*	(10)	C	5234.6 *3*		C	9235[@] *3*	(16)	C
4059.23[&] *24*	(11)	C	5261.65[a] *25*	(12)	C			

[†] From γ-ray multipolarities supported by DCO ratios and rotational structure (2010St01).
[‡] Suggested configuration=((π f7/2)(ν f5/2)) multiplet (2006Li15).
[#] Deduced by evaluators from least-squares fit to γ-ray energies.
[@] Band(A): Band based on J=(6),signature α=0.
[&] Band(a): Band based on J=(7),signature α=1.
[a] Band(B): Band based on J=(6),signature α=0.
[b] Band(b): Band based on J=(7),signature α=1.

γ(^{60}Mn)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.[‡]	α[†]	Comments
271.80	4+	271.9 *1*	100	0.0	1+	M3	0.0520	α(K)=0.0464 *7*; α(L)=0.00488 *7*; α(M)=0.000664 *10*; α(N+..)=2.99×10^{-5} *5* α(N)=2.99×10^{-5} *5* E_γ: From 1993ScZS. Mult.: From ce measurements (1993ScZS).
347.59	(2+)	347.6 *2*	100	0.0	1+			
407.47	(3+)	59.9 *2*	55 *14*	347.59	(2+)			
		135.8 *2*	34 *14*	271.80	4+	(D)		Additional information 1.
		407.0 *2*	100 *33*	0.0	1+	(Q)		Additional information 2.
726.40	(5+)	454.6 *1*	100	271.80	4+	(D)		
733.91	(4)	325.8 *3*	3.4 *5*	407.47	(3+)			
		462.1 *1*	100 *4*	271.80	4+	(D)[#]		
757.18	(1+)	349.7 *1*		407.47	(3+)			
		410.1[@]		347.59	(2+)			E_γ: From ^{50}Cr β$^-$ decay.
		758.2		0.0	1+			E_γ: From ^{60}Cr β$^-$ decay.
836.48	(5)	102.5 *1*	26 *2*	733.91	(4)	D		DCO=0.9 *3*
		565.0 *2*	100 *4*	271.80	4+	D		
841.67		434.2 *2*	100	407.47	(3+)			
965.98	(6)	129.5 *1*	100 *4*	836.48	(5)	D		
		239.6 *1*	18.4 *6*	726.40	(5+)	D		
1090.46	(6+)	364.0 *1*	83 *4*	726.40	(5+)	(D)		
		818.7 *9*	100 *14*	271.80	4+			
1215.15	(7)	249.2 *1*	100	965.98	(6)	D		
1246.0		519.6 *3*	100	726.40	(5+)			
1784.38	(8)	569.1 *2*	100 *4*	1215.15	(7)	D		
		818.4 *2*	0.8 *6*	965.98	(6)			

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Adopted Levels, Gammas (continued)

γ(^{60}Mn) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.‡
2049.4	(7$^+$)	958.1 *5*	49 *7*	1090.46	(6$^+$)	
		1323.8 *7*	100 *12*	726.40	(5$^+$)	Q
2223.34	(6)	1132.7 *3*	100	1090.46	(6$^+$)	
2382.13	(9)	597.6 *2*	100 *3*	1784.38	(8)	D
		1167.2 *2*	21.7 *12*	1215.15	(7)	Q
2439.11		389.6 *3*	62 *8*	2049.4	(7$^+$)	
		1193.5 *9*	100 *11*	1246.0		
2569.51	(7)	346.2@ *10*	3.9 *13*	2223.34	(6)	
		1479.1 *9*	100 *15*	1090.46	(6$^+$)	
3005.62	(8)	436.1 *1*	24 *6*	2569.51	(7)	
		566.5 *1*	76 *11*	2439.11		
		782.2 *2*	53 *8*	2223.34	(6)	
		956.1 *3*	100 *16*	2049.4	(7$^+$)	
		1790.4 *23*	50 *11*	1215.15	(7)	
3047.62	(10)	665.5 *1*	100 *3*	2382.13	(9)	D
		1263.4 *4*	18 *1*	1784.38	(8)	Q
3486.02	(9)	480.4 *2*	100 *8*	3005.62	(8)	
		916.5 *15*	15 *4*	2569.51	(7)	
		1046.9 *2*	25 *4*	2439.11		
		1436.9 *6*	48 *8*	2049.4	(7$^+$)	
		1701.6 *3*	29 *4*	1784.38	(8)	
3601.62		554.0 *1*	100	3047.62	(10)	
3654.0		1869.6 *4*	100	1784.38	(8)	
4022.67	(10)	536.6 *1*	100 *6*	3486.02	(9)	
		1016.9 *2*	17 *4*	3005.62	(8)	
		1640.7 *3*	16.5 *22*	2382.13	(9)	
4059.23	(11)	1011.6 *1*	100 *5*	3047.62	(10)	D
		1676.8 *5*	47 *3*	2382.13	(9)	Q
4132.0		1749.8 *4*	100	2382.13	(9)	
4388.9		2006.7 *4*	100	2382.13	(9)	
4532.6		931.0 *1*	100	3601.62		
4612.74	(11)	590.0 *1*	100 *5*	4022.67	(10)	(D)
		1127.2 *3*	28 *6*	3486.02	(9)	
		1565.2 *3*	5 *2*	3047.62	(10)	
4644.8		512.8 *1*	100	4132.0		
4781.3	(12)	722.0 *2*	100 *5*	4059.23	(11)	
		1734.2 *6*	62 *7*	3047.62	(10)	
5001.7		1954.0 *4*	100	3047.62	(10)	
5075.5		2693.3 *8*	100	2382.13	(9)	
5234.6		702.0 *1*	100	4532.6		
5261.65	(12)	648.9 *1*	100 *6*	4612.74	(11)	
		1239.0 *3*	42 *6*	4022.67	(10)	(Q)
5985.6		1926.3 *12*	100	4059.23	(11)	
6026.8	(13)	765.1 *1*	100 *7*	5261.65	(12)	
		1414.0 *4*	32 *8*	4612.74	(11)	
6108.0	(13)	1326.6 *2*	45 *13*	4781.3	(12)	
		2050 *3*	100 *48*	4059.23	(11)	(Q)
6234.9		1453.6 *2*	100	4781.3	(12)	
6824.2	(14)	716.0 *3*	16 *4*	6108.0	(13)	
		2045.8 *13*	100 *20*	4781.3	(12)	(Q)
6863.5	(14)	836.7 *1*	89 *9*	6026.8	(13)	
		1601.9 *5*	100 *15*	5261.65	(12)	
7758.1	(15)	894.6 *1*	100 *13*	6863.5	(14)	
		1731.3 *6*	88 *28*	6026.8	(13)	
8982.7	(16)	2119.2 *8*	100	6863.5	(14)	
9235	(16)	2411 *3*	100	6824.2	(14)	

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Adopted Levels, Gammas (continued)

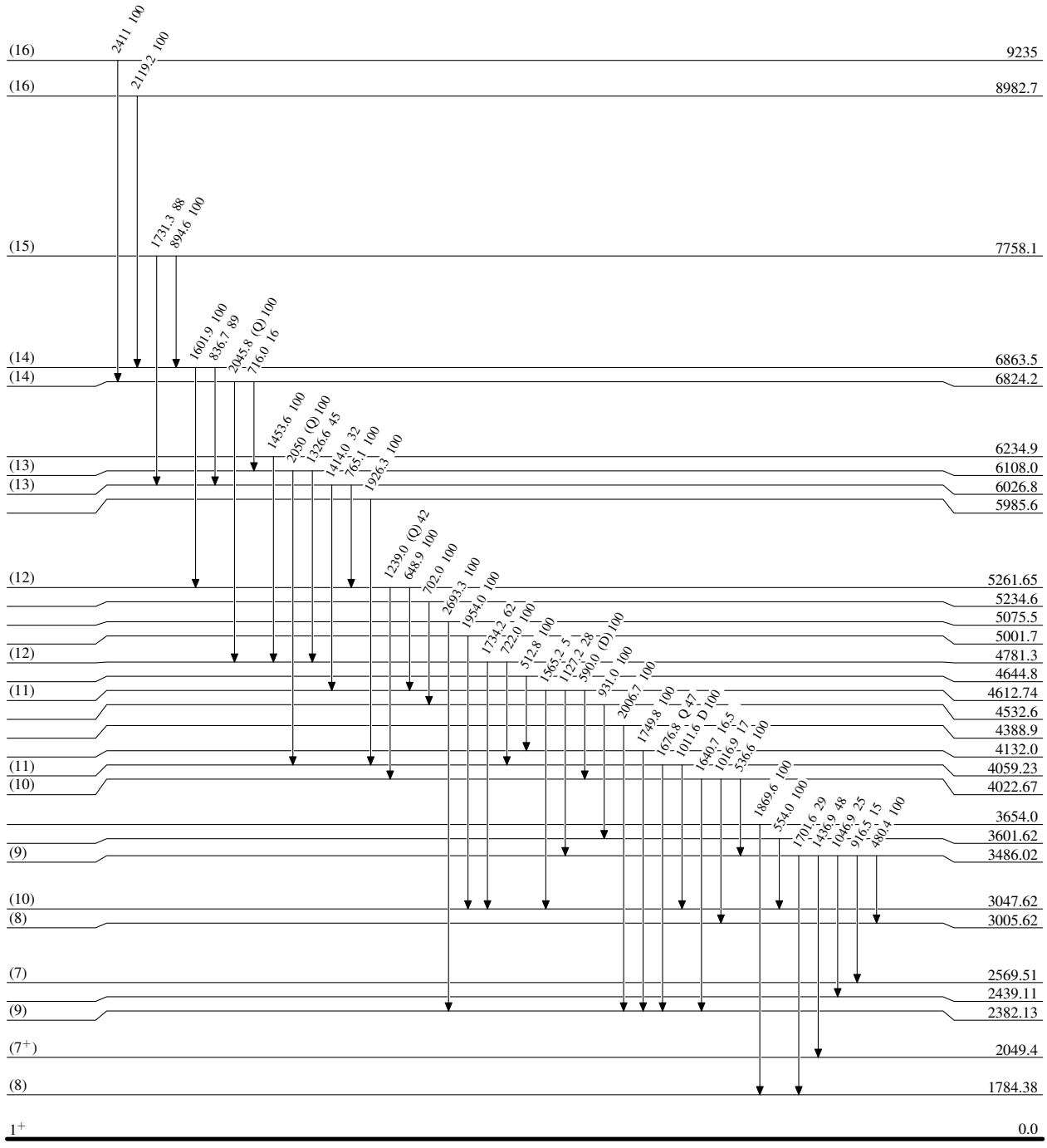
$\gamma(^{60}Mn)$ (continued)

† Additional information 3.
‡ From DCO measurements. Mult=Q indicates ΔJ=2 transition; mult=D, ΔJ=1, dipole transition with possible quadrupole admixture.
# ΔJ=(0) dipole transition.
@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{60}_{25}Mn_{35}$

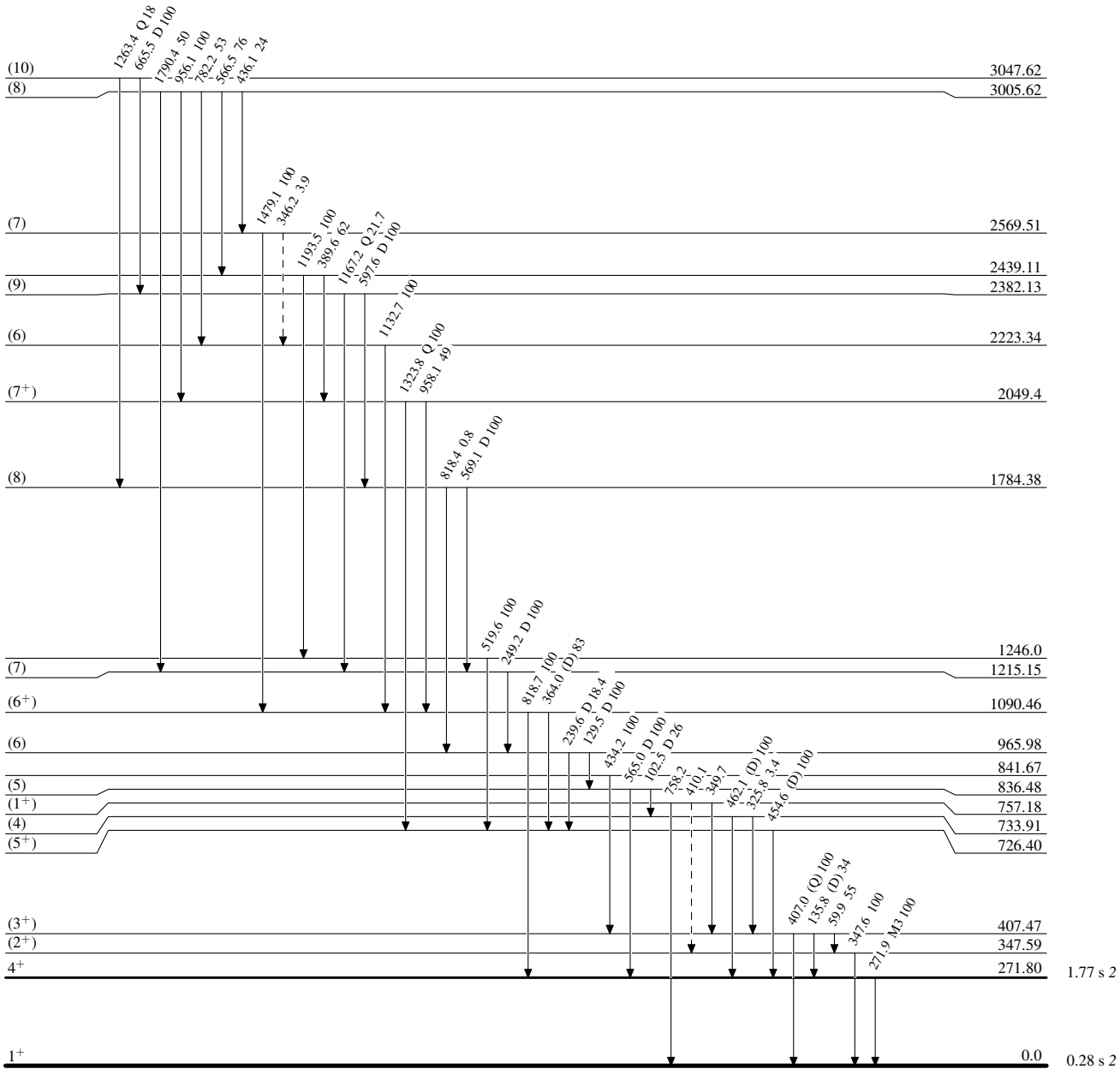
Adopted Levels, Gammas

Legend

Level Scheme (continued)

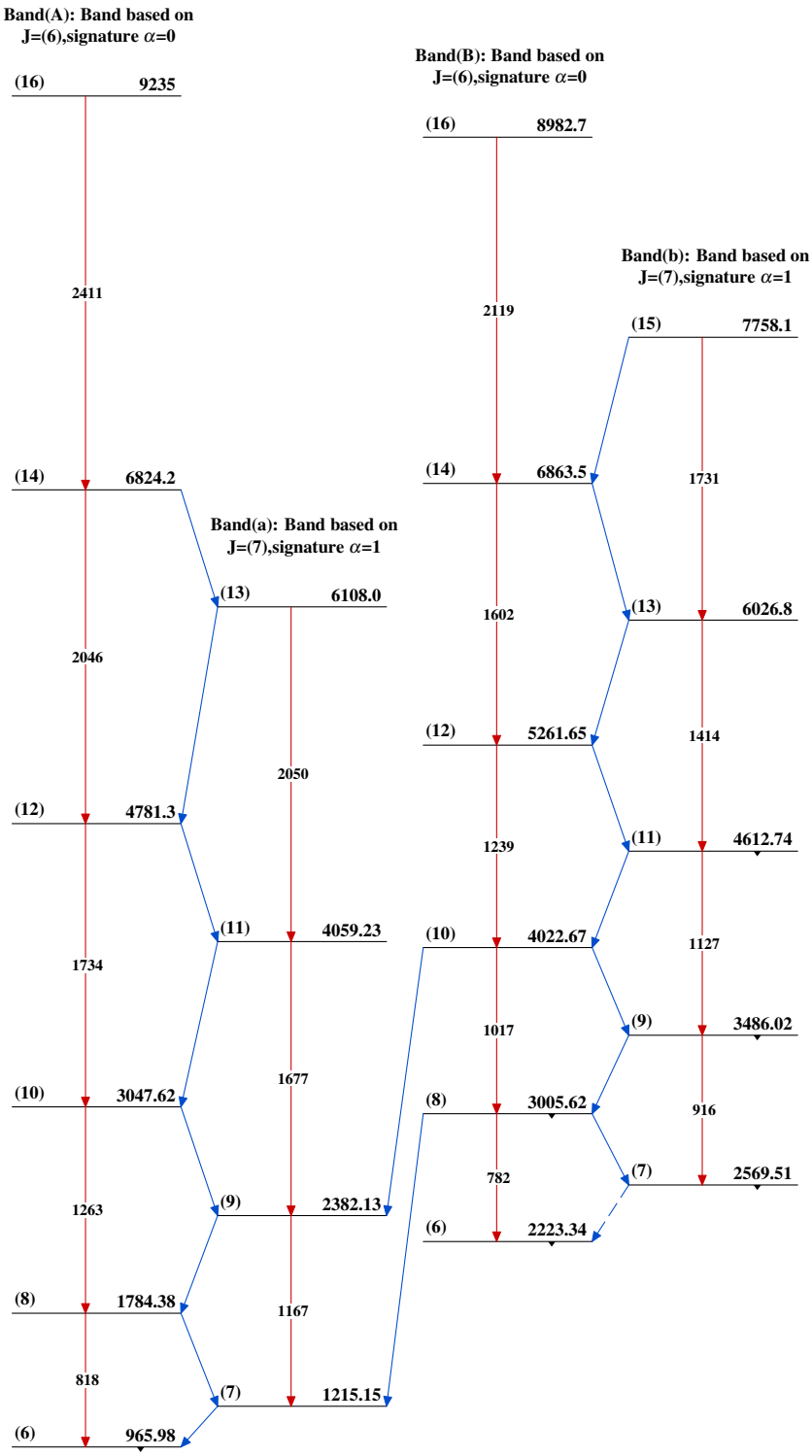
Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{60}_{25}Mn_{35}$

Adopted Levels, Gammas



$^{60}_{25}Mn_{35}$