Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Caroline D. Nesaraja, Scott D. Geraedts and Balraj Singh	NDS 111,897 (2010)	12-Jan-2010

Q(β^-)=6327 *3*; S(n)=6413 *3*; S(p)=10592 *4*; Q(α)=−8360 *16* 2012Wa38
Note: Current evaluation has used the following Q record 6250 30 *6491* 30 *10672* 30 −8441 *34* 2009AuZZ,2003Au03.
S(2n)=15140 *30*, S(2p)=24400 *210* (2009AuZZ).
First identification of ^{58}Mn nuclide by 1961Ch04 in ^{58}Fe(n,p) reaction.
2007Na31: ^{136}Xe(p,X) E=1 GeV/nucleon, measured cross section.
Additional information 1.
2006Li15: Shell-model calculations in the full *pf* space.
Other reaction: 1989AnZZ: ^{58}Fe(^{12}C,^{12}N) E=70 MeV/nucleon. Deduced Gamow-Teller strengths. The details of this study are not available.

^{58}Mn Levels

Cross Reference (XREF) Flags

A	^{58}Cr β^- decay (7.0 s)	D	^{48}Ca(^{13}C,2npγ)
B	^{58}Mn IT decay (65.4 s)	E	^{58}Fe(t,^{3}He)
C	^{13}C(^{48}Ca,p2nγ),^{14}C(^{48}Ca,p3nγ)	F	^{238}U(^{70}Zn,Xγ)

E(level)[†]	J^π[‡]	$T_{1/2}$[&]	XREF	Comments
0.0	1$^+$	3.0 s *1*	AB E	%β^-=100 E(level): the group in (t,^{3}He) is a broad group with a spacing of 35 keV *15*, implying that there may be another level near 35 keV. J^π: strong β feeding (log *ft*≈4.9) to 0$^+$. Shell-model calculations in the full *fp* space (2006Li15) predict 4$^+$ g.s. and 1$^+$ as the first excited state. First 0$^+$ in this calculation is predicted above 1.5 MeV. The ^{60}Mn nuclide also has 1$^+$ g.s. and 4$^+$ isomer (2006Li15). J^π=2$^+$,3$^+$ assigned from $\sigma(\theta)$ in (t,^{3}He) is inconsistent, which may be due to the complex structure of the lowest energy group in (t,^{3}He) that is assigned (1985Aj02) to the g.s. $T_{1/2}$: from timing of β decay curve (1969Wa10). Other: 2.4 s *9* (1988Bo06).
71.77[a] *5*	4$^+$[#]	65.4 s *5*	BCDEF	%β^-≈90; %IT≈10 XREF: E(88). %IT: B(M3)(W.u.) values in ENSDF database for A=45-90 mass region. The highest value of B(M3)(W.u.)=4.8 *10* in this mass region gives %IT<20, but B(M3)(W.u.)=0.159 *12* for a similar M3 transition in ^{60}Mn gives %IT=0.5. $T_{1/2}$: from timing of β, γ and ce; weighted average of 66 s 6 (1961Ch04), 65 s *1* (1969Wa10), 65.3 s *7* (1971Dy01,1972Dy01), 65.1 s *11* (1978Wy02) and 69 s *2* (1993ScZS,timing of 72-keV γ and corresponding ce(K) line). J^π: M3 γ to 1$^+$; See also comment for g.s.
125.69[a] *16*	(2$^+$)[#]		C	J^π: γ to 1$^+$.
169.92[a] *15*	(3$^+$)[#]		C	J^π: γ's to 4$^+$ and (2$^+$).
183 *10*	1$^+$[@]		E	
289.4 *4*	1$^+$[@]		A E	XREF: E(303).
429.67[a] *15*	(3$^+$)[#]		C	J^π: γ's to 4$^+$ and (2$^+$).
448.03[a] *10*	(5$^+$)[#]	<35 ps	CD F	J^π: ΔJ=1, D+Q γ to 4$^+$. $T_{1/2}$: recoil-distance method in (^{13}C,2npγ).
463.4 *11*	(0 to 3$^+$)		A E	XREF: E(466). J^π: γ to 1$^+$.
591.22[a] *18*	(4$^+$)[#]		C	J^π: γ's to (2$^+$) and (3$^+$).
651 *15*	1$^+$[@]		E	

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Adopted Levels, Gammas (continued)

^{58}Mn Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[&]	XREF	Comments
661.11[a] *14*	5^{+}[#]		C E	XREF: E(679). J^{π}: γ's to (3^{+}) and (5^{+}); $\sigma(\theta)$ and coupled-channels analysis in ^{58}Fe(t,^{3}He). E(level): 679 *10* level in (t,^{3}He) is associated with 661.1 level from (^{48}Ca,p2nγ), based on J^{π} analogy, although, the energy matching is somewhat poor.
683.1 *6*	(0 to 3^{+})		A	J^{π}: γ from 1^{+}.
735.38[a] *12*	(4^{+})[#]		C	J^{π}: γ's to (3^{+}) and (5^{+}).
748 *10*	1^{+}[@]		E	
809.7 *6*	1^{+}		A	J^{π}: strong β feeding (log *ft*≈4.0) from 0^{+}.
817 *10*	1^{+}[@]		E	
1044 *15*	1^{+}[@]		E	
1240.16[a] *19*	(6^{+})[#]		C	J^{π}: γ to 5^{+}.
1250 *20*	$(2)^{+}$[@]		E	
1275 *20*	1^{+}[@]		E	
1338.13 *19*	(4)		C	J^{π}: γ's to 4^{+} and (5^{+}).
1350 *15*	3^{+}[@]		E	E(level): from energy matching, this level may be the same as 1338.1, but the spins differ by one unit.
1385 *15*	5^{+}[@]		E	
1413 *15*			E	
1457.59 *13*	(5)		C	J^{π}: γ's 4^{+} and (5^{+}).
1470 *15*	$(4)^{+}$[@]		E	E(level): from energy matching, this level may be the same as 1457.6, but the spins differ by one unit.
1535 *20*	$(4)^{+}$[@]		E	
1601.43 *16*	(6)		CD F	J^{π}: ΔJ=1, dipole γ to 5^{+}; γ to (6^{+}). $T_{1/2}$: >0.4 ps or <35 ps from DSA in (^{13}C,2npγ).
1880.42[b] *18*	(7)	<35 ps	CD F	$T_{1/2}$: recoil-distance method in (^{13}C,2npγ). J^{π}: ΔJ=1, dipole γ to (6^{+}).
2259 *15*	$(3,4)^{+}$[@]		E	
2282 *15*	$(5,4)^{+}$[@]		E	
2339.7 *3*			C	
2368 *10*	$(2,3,4)^{+}$[@]		E	
2412 *10*	$(2,3)^{+}$[@]		E	
2459.7[b] *5*	(8)	<0.4 ps	CD F	J^{π}: γ to (7); band member.
2487 *10*	$(2,3)^{+}$[@]		E	
2506 *15*	(NOT 1^{+})[@]		E	
2564 *10*			E	
2854.7 *4*			C	
2988 *10*			E	
3040 *10*	(NOT 1^{+})[@]		E	
3042.6[b] *5*	(9)	<0.4 ps	CD F	J^{π}: ΔJ=1, dipole γ to (8); γ to and (7); band member. $T_{1/2}$: DSA in (^{13}C,2npγ).
3218 *10*			E	
3258 *15*			E	
3415 *20*			E	
3462.1 *5*			C	
3721.4[b] *5*	(10)	<0.3 ps	CD	J^{π}: ΔJ=1, dipole γ to (9); ΔJ=(2), (Q) γ to and (8); band member. $T_{1/2}$: DSA in (^{13}C,2npγ).
4707.6 *18*			C	J^{π}: γ to (8) suggests (8,9,10).
4733.1[b] *5*	(11)		CD	J^{π}: ΔJ=1, dipole γ to (10); γ to (9); band member.

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Adopted Levels, Gammas (continued)

^{58}Mn Levels (continued)

E(level)[†]	J^{π}[‡]	XREF	Comments
4812.4 *5*	(11)	C	J^{π}: γ's to (9) and (10).
4941.1 *6*		C	J^{π}: γ to (9) suggests (9,10,11).
5311.9 *6*		C	J^{π}: γ to (10) suggests (10,11,12).
5424.4[b] *5*	(12)	C	J^{π}: γ's to (10) and (11); band member.
6337.2 *12*		C	J^{π}: γ to (10) suggests (10,11,12).
6566.4 *7*		C	J^{π}: γ to (11) suggests (11,12,13).
6872.6[b] *5*	(13)	C	J^{π}: γ's to (11) and (12); band member.
7442.5[b] *9*	(14)	C	J^{π}: γ to (12); band member.
9831.1[b] *14*	(16)	C	J^{π}: γ to (14); band member.

† From least-squares fit to Eγ's. In earlier evaluation (1997Bh02), energy of 72 keV was added to each level in the (t,^{3}He) dataset. With the revised assignment of 4^+ for the isomer, the adjustment in the energy levels seems to be no longer required.
‡ In (t,^{3}He) reaction target $J^{\pi}=0^+$.
\# From GXPF1A shell-model calculations and predictions (2010St01) for low-lying, low-spin states.
@ From $\sigma(\theta)$ and coupled-channels analysis (1985Aj02) in ^{58}Fe(t,^{3}He).
& From (^{13}C,2npγ), except as noted otherwise.
a Band(A): multiplet structure.
b Band(B): ΔJ=1 band based on (7). Possible negative-parity rotational band involving $g_{9/2}$ neutron excitation (2010St01).

γ(^{58}Mn)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[†]	E_f	J^{π}_f	Mult.[‡]	α[#]	Comments
71.77	4^+	71.78 *5*	100	0.0	1^+	M3	14.07	α(K)=12.09 *18*; α(L)=1.734 *25*; α(M)=0.236 *4*; α(N+..)=0.00891 *13* α(N)=0.00891 *13* Mult.: from α(K)exp and α(L)exp (1993ScZS) in ^{58}Mn it decay.
125.69	(2^+)	125.5 *2*	100	0.0	1^+			
169.92	(3^+)	44.2 *3*	42 *8*	125.69	(2^+)			
		97.9 *3*	100.0 *22*	71.77	4^+			
289.4	1^+	289.5 *4*	100	0.0	1^+			
429.67	(3^+)	303.1 *4*	45 *9*	125.69	(2^+)			
		358.0 *2*	100 *27*	71.77	4^+			
448.03	(5^+)	376.1 *1*	100	71.77	4^+	D+Q		
463.4	(0 to 3^+)	174 *1*	100	289.4	1^+			
591.22	(4^+)	421.4 *2*	100 *14*	169.92	(3^+)			
		465.8 *5*	13 *3*	125.69	(2^+)			
661.11	5^+	212.8 *2*	14.2 *18*	448.03	(5^+)			
		490.9 *4*	14.8 *18*	169.92	(3^+)			
		589.8 *2*	100 *14*	71.77	4^+			
683.1	(0 to 3^+)	682.9 *6*	100	0.0	1^+			
735.38	(4^+)	286.8 *2*	18.6 *14*	448.03	(5^+)			
		305.6 *2*	21.1 *23*	429.67	(3^+)			
		565.3 *2*	100 *9*	169.92	(3^+)			
		663.8 *2*	17.4 *17*	71.77	4^+			
809.7	1^+	126 *1*	100 *4*	683.1	(0 to 3^+)			
		520.4 *5*	21 *1*	289.4	1^+			
1240.16	(6^+)	580.0 *6*	100 *10*	661.11	5^+			
		792.1 *3*	30 *6*	448.03	(5^+)			
1338.13	(4)	601.9 *5*	21 *3*	735.38	(4^+)			
		890.3 *2*	22 *6*	448.03	(5^+)			

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Adopted Levels, Gammas (continued)

$\gamma(^{58}Mn)$ (continued)

E_i(level)	J^{π}_i	E_γ †	I_γ †	E_f	J^{π}_f	Mult. ‡
1338.13	(4)	1266.6 *9*	100 *20*	71.77	4^+	
1457.59	(5)	119.8 *4*	30 *4*	1338.13	(4)	
		721.7 *2*	46 *5*	735.38	(4^+)	
		866.5 *2*	10.0 *11*	591.22	(4^+)	
		1009.5 *2*	100 *11*	448.03	(5^+)	
		1386.2 *3*	51 *5*	71.77	4^+	
1601.43	(6)	143.7 *2*	25.2 *21*	1457.59	(5)	(D)
		361.4 *2*	4.3 *3*	1240.16	(6^+)	
		940.3 *2*	2.9 *3*	661.11	5^+	
		1153.5 *3*	100 *8*	448.03	(5^+)	D
1880.42	(7)	279.0 *1*	100 *6*	1601.43	(6)	D
		640.2 *2*	6.1 *6*	1240.16	(6^+)	
2339.7		459.3 *2*	100	1880.42	(7)	
2459.7	(8)	579.1 *5*	100	1880.42	(7)	
2854.7		515.0 *2*	100	2339.7		
3042.6	(9)	582.8 *5*	100 *13*	2459.7	(8)	D
		1162.4 *5*	41 *3*	1880.42	(7)	
3462.1		607.4 *3*	100	2854.7		
3721.4	(10)	678.7 *1*	100 *7*	3042.6	(9)	D
		1261.6 *7*	27 *3*	2459.7	(8)	(Q)
4707.6		2247.9 *17*	100	2459.7	(8)	
4733.1	(11)	1012.1 *4*	99 *8*	3721.4	(10)	D
		1690.5 *2*	100 *7*	3042.6	(9)	
4812.4	(11)	1090.9 *2*	100 *9*	3721.4	(10)	
		1770.6 *7*	73 *4*	3042.6	(9)	
4941.1		1898.4 *3*	100	3042.6	(9)	
5311.9		1590.5 *3*	100	3721.4	(10)	
5424.4	(12)	612.0 *2*	11.6 *11*	4812.4	(11)	
		691.6 *2*	100 *7*	4733.1	(11)	
		1702.3 *4*	42 *3*	3721.4	(10)	
6337.2		2615.7 *11*	100	3721.4	(10)	
6566.4		1833.3 *5*	100	4733.1	(11)	
6872.6	(13)	1448.2 *2*	100 *9*	5424.4	(12)	
		2059.9 *12*	23.2 *23*	4812.4	(11)	
		2138.9 *10*	68 *5*	4733.1	(11)	
7442.5	(14)	2018.0 *7*	100	5424.4	(12)	
9831.1	(16)	2388.6 *11*	100	7442.5	(14)	

† From $^{13}C(^{48}Ca,p2n\gamma)$,$^{14}C(^{48}Ca,p3n\gamma)$ for levels populated in in-beam γ-ray studies. This work provides the most complete set of transitions and levels. The level schemes in $^{48}Ca(^{13}C,2np\gamma)$ and $^{238}U(^{70}Zn,X\gamma)$ are incomplete and the ordering of the cascades have been rearranged in the more extensive study in $(^{48}Ca,p2n\gamma)$ reaction (2010St01).

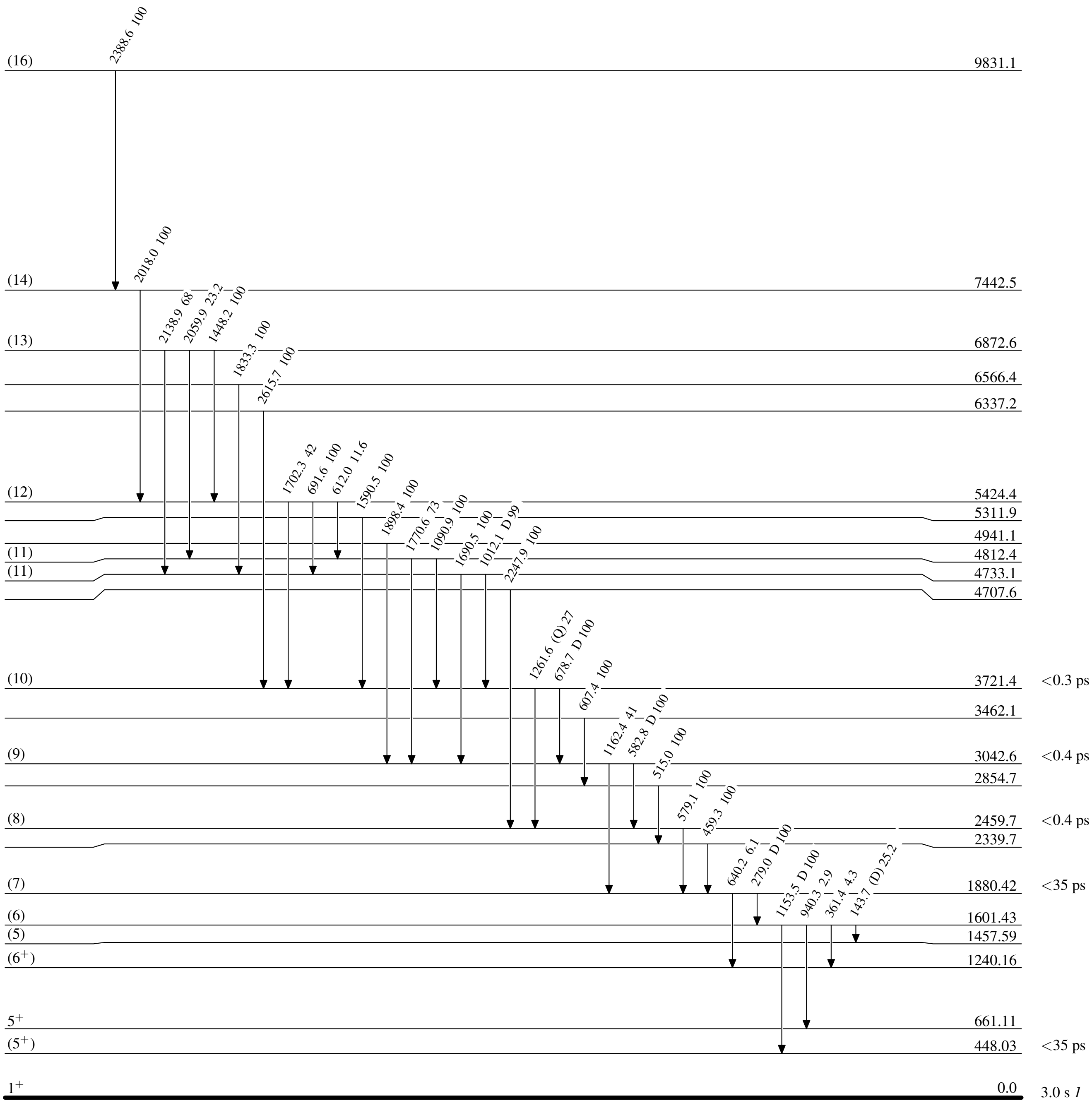
‡ From $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in $(^{13}C,2np\gamma)$, except as noted. Mult=D or D+Q indicates $\Delta J=1$; mult=Q indicates $\Delta J=2$ transition no multipolarity information is provided in the $(^{48}Ca,p2n\gamma)$ reaction.

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.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

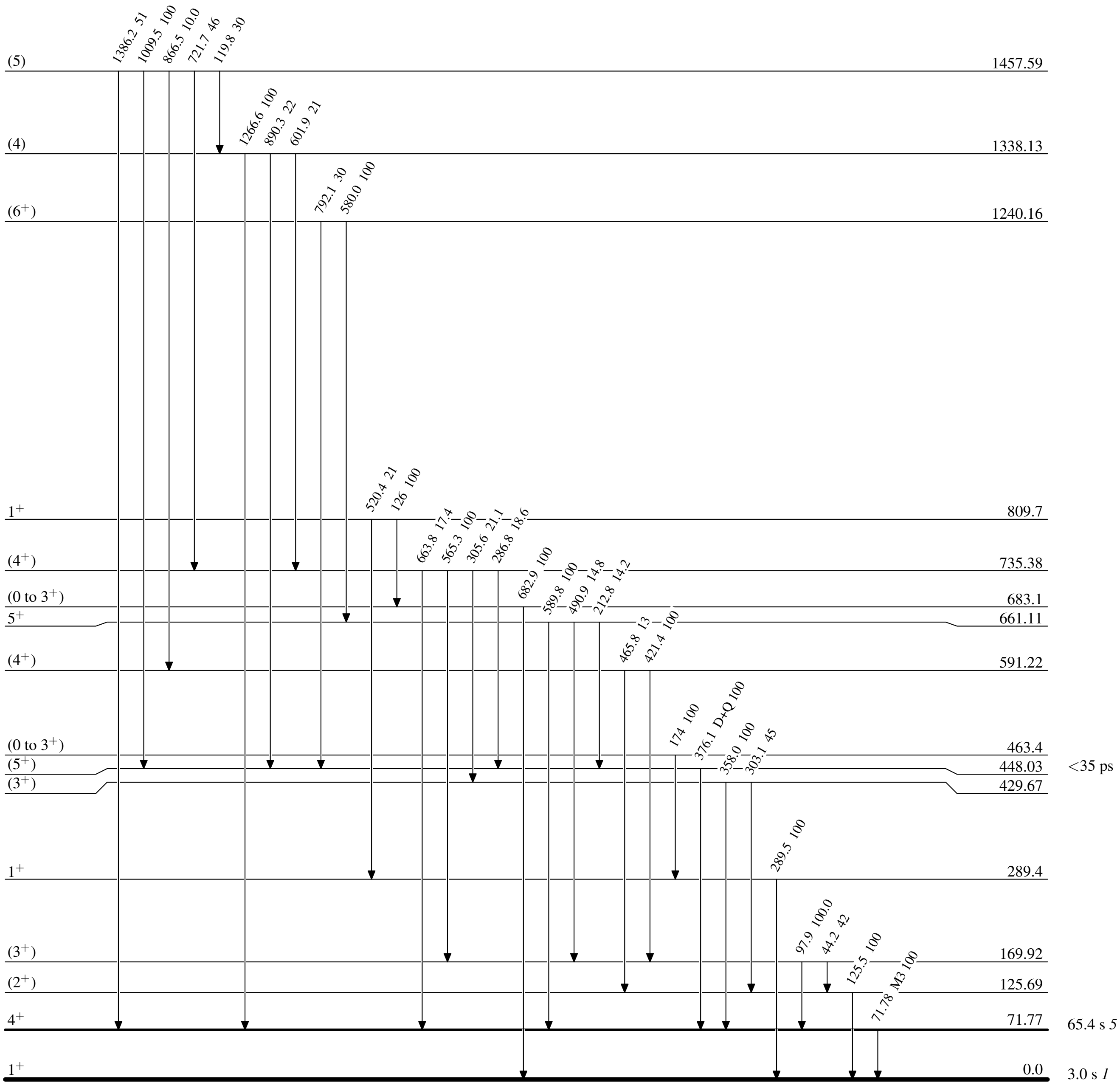


$^{58}_{25}Mn_{33}$

Adopted Levels, Gammas

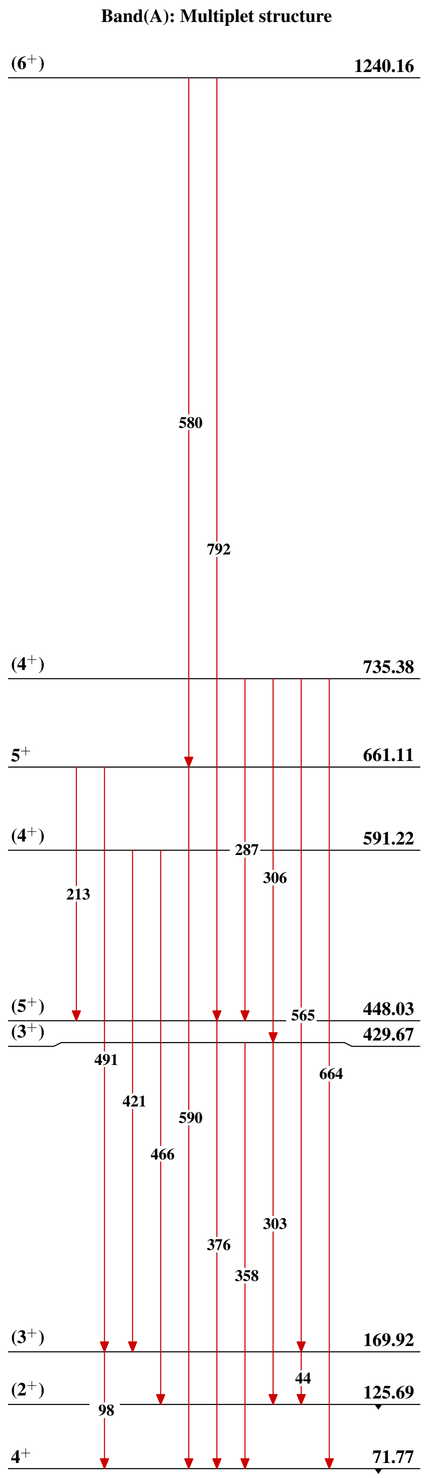
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{58}_{25}Mn_{33}$

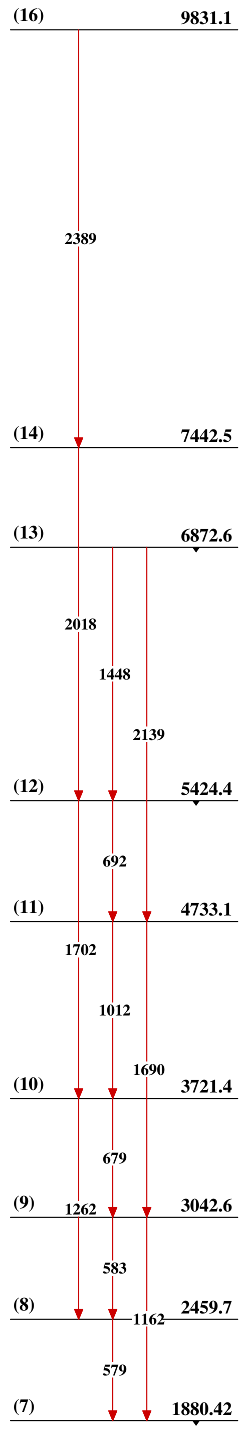
Adopted Levels, Gammas



$^{58}_{25}Mn_{33}$

Adopted Levels, Gammas (continued)

Band(B): ΔJ=1 band based on (7)



$^{58}_{25}Mn_{33}$