Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Q(β^-)=−7260 *syst*; S(n)=8277 *21*; S(p)=3280 *30*; Q(α)=4751 *30* 2021Wa16
Estimated uncertainty for Q(β^-)=40 keV (2021Wa16).
S(2n)=19370 *30*, S(2p)=5040 *30*, Q(εp)=4480 *30*, Q(ε)=6260 *30* (2021Wa16).
Q(α)=4671 *13* or 4659 *20*, respectively, from Eα=4559 *13* (1991Me05) or 4550 *20* (1989Me02), if g.s. to g.s. transition in the decay of ^{167}W to ^{163}Hf.
1987ScZL: ^{167}W produced and identified in Cs,Ba,La,Pr(^{36}Ar,X), (^{40}Ar,X) reactions, through cross-bombardments, excitation functions, and coincidences with x rays. In 1989Me02, ^{167}W produced in ^{136}Ba(^{36}Ar,xn),E=191 MeV reaction, and half-life measured.
2019Mi12: theoretical calculations of band-crossing frequencies of the first (AB) and the second (BC) $i_{13/2}$ neutron alignments.
Additional information 1.

^{167}W Levels

Band assignments are proposed by 1992Th06, unless otherwise stated.
Quasiparticle nomenclature for orbitals:
A: first $\nu i_{13/2}$,α=+1/2.
B: first $\nu i_{13/2}$,α=−1/2.
C: second $\nu i_{13/2}$,α=+1/2.
D: second $\nu i_{13/2}$,α=−1/2.
E: lowest negative-parity neutron orbital,α=−1/2.
F: lowest negative-parity neutron orbital,α=+1/2.

Cross Reference (XREF) Flags

A	^{167}Re ε decay (5.9 s)	D	^{142}Nd(^{30}Si,5nγ)
B	^{171}Os α decay (8.3 s)	E	^{147}Sm(^{24}Mg,4nγ)
C	^{171}Os α decay (790 ms)		

E(level)†	J$^\pi$‡	T$_{1/2}$#	XREF	Comments
0.0[e]	(5/2$^-$)	19.9 s *5*	AB D	%ε+%β^+=99.96 *1*; %α=0.04 *1* (1989Me02) J$^\pi$: low-lying ν5/2[523] bandhead expected based on Nilsson model calculations and on J^π systematics in N=93 isotones (1989Me02); unhindered α decay from (5/2$^-$) ^{171}Os. T$_{1/2}$: from 1989Me02, from 94γ- and 110.2γ-decay curves; also 21 s *4* from decay curve for 4550α. Others: 23 s *6* (1992HeZV), 19 s *7* (1989Br19 and 1987Es08 from the same authors, T$_{1/2}$ from 142γ decay curve, but no 142γ is reported in ^{167}W decay study by 1989Me02). Additional information 2.
79.2[e] *3*	(7/2$^-$)		AB D	
127.1[@] *17*	(13/2$^+$)		CDE	This level could be an isomer decaying by E3 transition to the 79, (7/2$^-$), with T$_{1/2}$>1 μs from systematic trend (2021Ko07).
134.20 *30*	(9/2$^-$)		B	J$^\pi$: E2 γ to (5/2$^-$).
215.8[c] *4*	(9/2$^-$)		A D	
351.8[@] *17*	(17/2$^+$)	139 ps *10*	DE	Transition quadrupole moment Q(t)=4.4 *2* (2016Li49).
553.5[c] *6*	(13/2$^-$)		D	
757.1[@] *17*	(21/2$^+$)	7.0 ps *9*	DE	Transition quadrupole moment Q(t)=4.7 *3* (2016Li49).
1023.4[c] *8*	(17/2$^-$)		D	
1296.0[@] *17*	(25/2$^+$)	1.8 ps *6*	DE	Transition quadrupole moment Q(t)=4.5 *7* (2016Li49).

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Adopted Levels, Gammas (continued)

^{167}W Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
1527.3[d] *9*	(21/2⁻)	D	3313.6[b] *17*	(37/2⁻)	D	5700.9[d] *24*	(49/2⁻)	D
1598.9[c] *12*	(21/2⁻)	D	3331.2[@] *17*	(37/2⁺)	DE	5848.3[a] *21*	(51/2⁻)	D
1782.6[a] *17*	(23/2⁻)	DE	3509.3[a] *17*	(39/2⁻)	DE	6052.8[&] *19*	(53/2⁺)	DE
1920.6[d] *14*	(25/2⁻)	D	3557.0[d] *16*	(37/2⁻)	D	6242.1[b] *23*	(53/2⁻)	D
1932.7[@] *17*	(29/2⁺)	DE	3908.0[b] *18*	(41/2⁻)	D	6499.6[d] *26*	(53/2⁻)	D
2093.8[b] *12*	(25/2⁻)	D	3983.5[&] *18*	(41/2⁺)	DE	6763.7[a] *23*	(55/2⁻)	D
2105.1[a] *17*	(27/2⁻)	DE	4197.2[a] *18*	(43/2⁻)	DE	6859.7[&] *22*	(57/2⁺)	D
2408.0[d] *15*	(29/2⁻)	D	4213.4[d] *19*	(41/2⁻)	D	7153.4[b] *25*	(57/2⁻)	D
2428.3[b] *16*	(29/2⁻)	D	4602.3[b] *18*	(45/2⁻)	D	7334.3?[d] *28*	(57/2⁻)	D
2479.4[a] *17*	(31/2⁻)	DE	4627.0[&] *18*	(45/2⁺)	DE	7693.6[a] *25*	(59/2⁻)	D
2629.1[@] *17*	(33/2⁺)	DE	4934.1[d] *22*	(45/2⁻)	D	7730.4[&] *24*	(61/2⁺)	D
2822.0[b] *16*	(33/2⁻)	D	4983.4[a] *18*	(47/2⁻)	DE	8108.6[b] *27*	(61/2⁻)	D
2937.1[a] *17*	(35/2⁻)	DE	5310.6[&] *18*	(49/2⁺)	DE	8660.4[&] *26*	(65/2⁺)	D
2960.5[d] *15*	(33/2⁻)	D	5385.5[b] *21*	(49/2⁻)	D	9661.8?[&] *28*	(69/2⁺)	D

† From a least-squares fit to Eγ data, however, most levels in the level scheme decay by single transitions. In addition, absolute level energies and their uncertainties are unknown.

‡ From multipolarities and ΔJ deduced from γγ(θ)(DCO) ratios and γ(θ) in ^{142}Nd(^{30}Si,5nγ) and ^{147}Sm(^{24}Mg,4nγ), band structure and systematics of known structures in heavier isotopes and isotones. See (^{24}Mg,4nγ) data set for additional details.

From 2016Li49 for excited states, using recoil-distance Doppler-shift (RDDS) method, uncertainty is statistical only. See ^{142}Nd(^{30}Si,5nγ) dataset.

@ Band(A): Band A, $\nu i_{13/2}$,α=+1/2.

& Band(a): Band ABC,α=+1/2. Configuration=$\nu i_{13/2}\otimes\nu i^2_{13/2}$.

a Band(B): Band FAB,α=−1/2.

b Band(C): Band EAB,α=+1/2.

c Band(D): Band E,α=+1/2.

d Band(E): α=+1/2 band. Cranked shell model classification is uncertain (1992Th06); the alignment pattern differs greatly from those for the other π=− bands. Assigned as α=+1/2 based on systematics for similar bands in lighter N=93 isotones.

e Band(F): Possible ν5/2[523] band. Band assignment proposed by 1995Hi02.

γ(^{167}W)

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.@	α&	Comments
79.2	(7/2⁻)	79.2 *3*	100	0.0	(5/2⁻)	M1	9.3 *4*	E_γ: from ^{171}Os α decay. Mult.: from α(K)exp=9.0 *11* (2023Zh03) in ^{171}Os α decay (8.3 s).
134.20	(9/2⁻)	134.2 *3*	100	0.0	(5/2⁻)	E2	1.261 *12*	E_γ: from ^{171}Os α decay. Mult.: from α(K)exp=0.39 *8* (2023Zh03) in ^{171}Os α decay (8.3 s).
215.8	(9/2⁻)	136.6 *2*	100	79.2	(7/2⁻)	[M1,E2]	1.6 *4*	E_γ: from ^{167}Re ε decay. Other: 136.4 *5* in ^{142}Nd(^{30}Si,5nγ).
351.8	(17/2⁺)	224.7# *2*	100	127.1	(13/2⁺)	E2	0.210 *3*	B(E2)(W.u.)=108 *9*
553.5	(13/2⁻)	337.7 *5*	100	215.8	(9/2⁻)			
757.1	(21/2⁺)	405.3# *2*	100	351.8	(17/2⁺)	E2	0.0362 *5*	B(E2)(W.u.)=131 *17*
1023.4	(17/2⁻)	469.9 *5*	100	553.5	(13/2⁻)	(E2)		
1296.0	(25/2⁺)	538.9# *2*	100	757.1	(21/2⁺)	E2	0.0175 *3*	B(E2)(W.u.)=120 *40*
1527.3	(21/2⁻)	503.9 *5*	100	1023.4	(17/2⁻)	(E2)		

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Adopted Levels, Gammas (continued)

$\gamma(^{167}W)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[@]	Comments
1598.9	(21/2$^-$)	575.4 *10*	100	1023.4	(17/2$^-$)	(E2)	
1782.6	(23/2$^-$)	487.2 *10*	50 *20*	1296.0	(25/2$^+$)		
		1025.7[#] *5*	100 *7*	757.1	(21/2$^+$)	D	
1920.6	(25/2$^-$)	393.3 *10*	100	1527.3	(21/2$^-$)	(E2)	
1932.7	(29/2$^+$)	636.7[#] *2*	100	1296.0	(25/2$^+$)	(E2)	
2093.8	(25/2$^-$)	494.9 *10*	100 *23*	1598.9	(21/2$^-$)	(E2)	
		566.6 *10*	72 *25*	1527.3	(21/2$^-$)	(E2)	
2105.1	(27/2$^-$)	322.8[#] *5*	39 *8*	1782.6	(23/2$^-$)	(E2)	Other Iγ: 27 *12* in (^{24}Mg,4nγ). Mult from (^{30}Si,5nγ).
		809.1[#] *2*	100 *12*	1296.0	(25/2$^+$)	D	
2408.0	(29/2$^-$)	487.4 *5*	100	1920.6	(25/2$^-$)	(E2)	
2428.3	(29/2$^-$)	323.4 *10*	44 *20*	2105.1	(27/2$^-$)		
		334.5 *10*	100 *16*	2093.8	(25/2$^-$)	(E2)	
2479.4	(31/2$^-$)	374.3[#] *2*	100 *5*	2105.1	(27/2$^-$)	(E2)	
		546.6[#] *5*	37 *6*	1932.7	(29/2$^+$)	D	Iγ: weighted average of 32 *4* from (^{30}Si,5nγ), 45 *5* from (^{24}Mg,4nγ).
2629.1	(33/2$^+$)	696.4[#] *2*	100	1932.7	(29/2$^+$)	(E2)	
2822.0	(33/2$^-$)	342.6 *10*	17 *3*	2479.4	(31/2$^-$)		
		393.7 *5*	100 *16*	2428.3	(29/2$^-$)	(E2)	
2937.1	(35/2$^-$)	457.7[#] *2*	100	2479.4	(31/2$^-$)	(E2)	
2960.5	(33/2$^-$)	552.5 *5*	100	2408.0	(29/2$^-$)		
3313.6	(37/2$^-$)	376.3 *10*	≈12	2937.1	(35/2$^-$)		
		491.7 *5*	100 *8*	2822.0	(33/2$^-$)	(E2)	
3331.2	(37/2$^+$)	702.1[#] *2*	100	2629.1	(33/2$^+$)	(E2)	
3509.3	(39/2$^-$)	572.2[#] *2*	100	2937.1	(35/2$^-$)	(E2)	
3557.0	(37/2$^-$)	596.5 *5*	100	2960.5	(33/2$^-$)	(E2)	
3908.0	(41/2$^-$)	594.4 *5*	100	3313.6	(37/2$^-$)	(E2)	
3983.5	(41/2$^+$)	652.3[#] *2*	100	3331.2	(37/2$^+$)	(E2)	
4197.2	(43/2$^-$)	687.9[#] *5*	100	3509.3	(39/2$^-$)	(E2)	
4213.4	(41/2$^-$)	656.4 *10*	100	3557.0	(37/2$^-$)	(E2)	
4602.3	(45/2$^-$)	694.3 *5*	100	3908.0	(41/2$^-$)	(E2)	
4627.0	(45/2$^+$)	643.5 *4*	100	3983.5	(41/2$^+$)	(E2)	Eγ: weighted average from (^{24}Mg,4nγ) and (^{30}Si,5nγ).
4934.1	(45/2$^-$)	720.7 *10*	100	4213.4	(41/2$^-$)	(E2)	
4983.4	(47/2$^-$)	786.2 *4*	100	4197.2	(43/2$^-$)	(E2)	Eγ: weighted average from (^{24}Mg,4nγ) and (^{30}Si,5nγ).
5310.6	(49/2$^+$)	683.6 *4*	100	4627.0	(45/2$^+$)		Eγ: weighted average from (^{24}Mg,4nγ) and (^{30}Si,5nγ).
5385.5	(49/2$^-$)	783.2 *10*	100	4602.3	(45/2$^-$)	(E2)	
5700.9	(49/2$^-$)	766.8 *10*	100	4934.1	(45/2$^-$)		
5848.3	(51/2$^-$)	864.9 *10*	100	4983.4	(47/2$^-$)	(E2)	
6052.8	(53/2$^+$)	742.2[#] *5*	100	5310.6	(49/2$^+$)	(E2)	
6242.1	(53/2$^-$)	856.6 *10*	100	5385.5	(49/2$^-$)	(E2)	
6499.6	(53/2$^-$)	798.7 *10*	100	5700.9	(49/2$^-$)		
6763.7	(55/2$^-$)	915.4 *10*	100	5848.3	(51/2$^-$)		
6859.7	(57/2$^+$)	806.9 *10*	100	6052.8	(53/2$^+$)	(E2)	
7153.4	(57/2$^-$)	911.3 *10*	100	6242.1	(53/2$^-$)		
7334.3?	(57/2$^-$)	834.7[a] *10*	100	6499.6	(53/2$^-$)		
7693.6	(59/2$^-$)	929.9 *10*	100	6763.7	(55/2$^-$)		
7730.4	(61/2$^+$)	870.7 *10*	100	6859.7	(57/2$^+$)	(E2)	
8108.6	(61/2$^-$)	955.2 *10*	100	7153.4	(57/2$^-$)		

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Adopted Levels, Gammas (continued)

$\gamma(^{167}W)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π
8660.4	$(65/2^+)$	930.0 *10*	100	7730.4	$(61/2^+)$
9661.8?	$(69/2^+)$	1001.4[a] *10*	100	8660.4	$(65/2^+)$

† From ^{142}Nd(^{30}Si,5nγ), except as noted.
‡ Relative photon branching from ^{142}Nd(^{30}Si,5nγ), except as noted.
# From ^{147}Sm(^{24}Mg,4nγ).
@ From DCO ratio in (^{30}Si,5nγ) and/or $\gamma(\theta)$ in (^{24}Mg,4nγ). Stretched quadrupole intraband transitions with mult=Q or (Q) in reaction datasets are assigned here as $\Delta J=2$, (E2).
& 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.
[a] Placement of transition in the level scheme is uncertain.

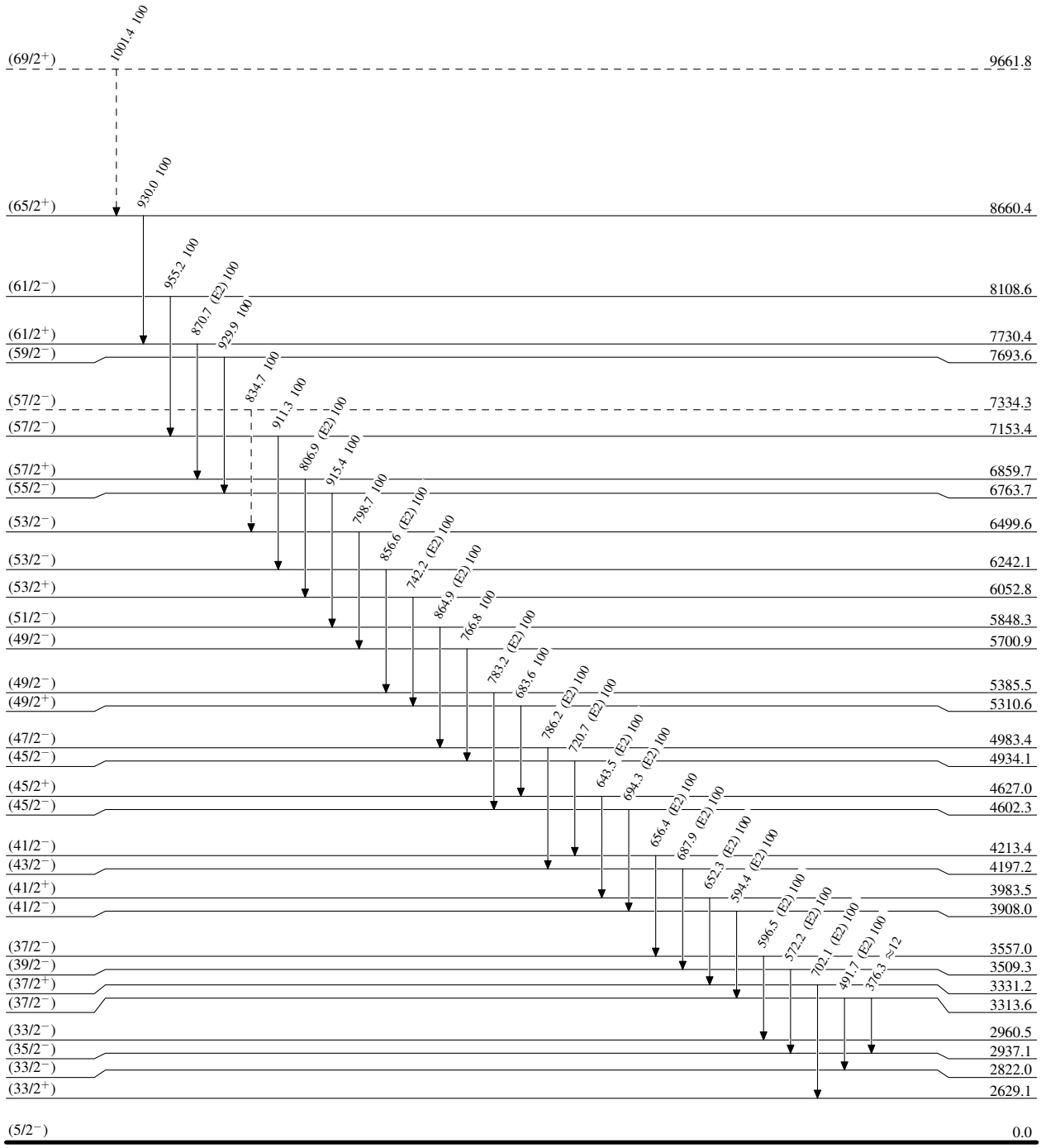
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

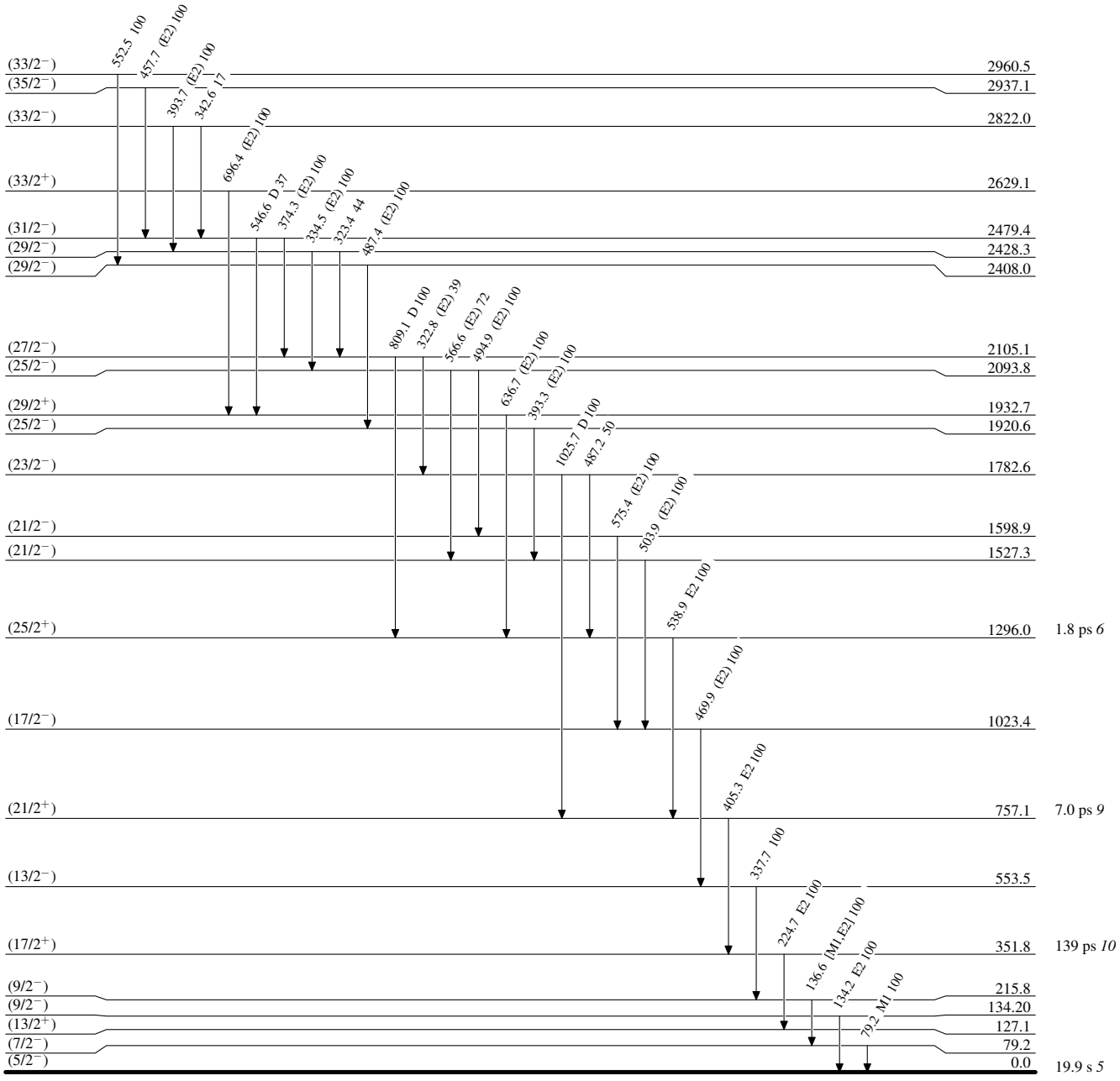


$^{167}_{74}W_{93}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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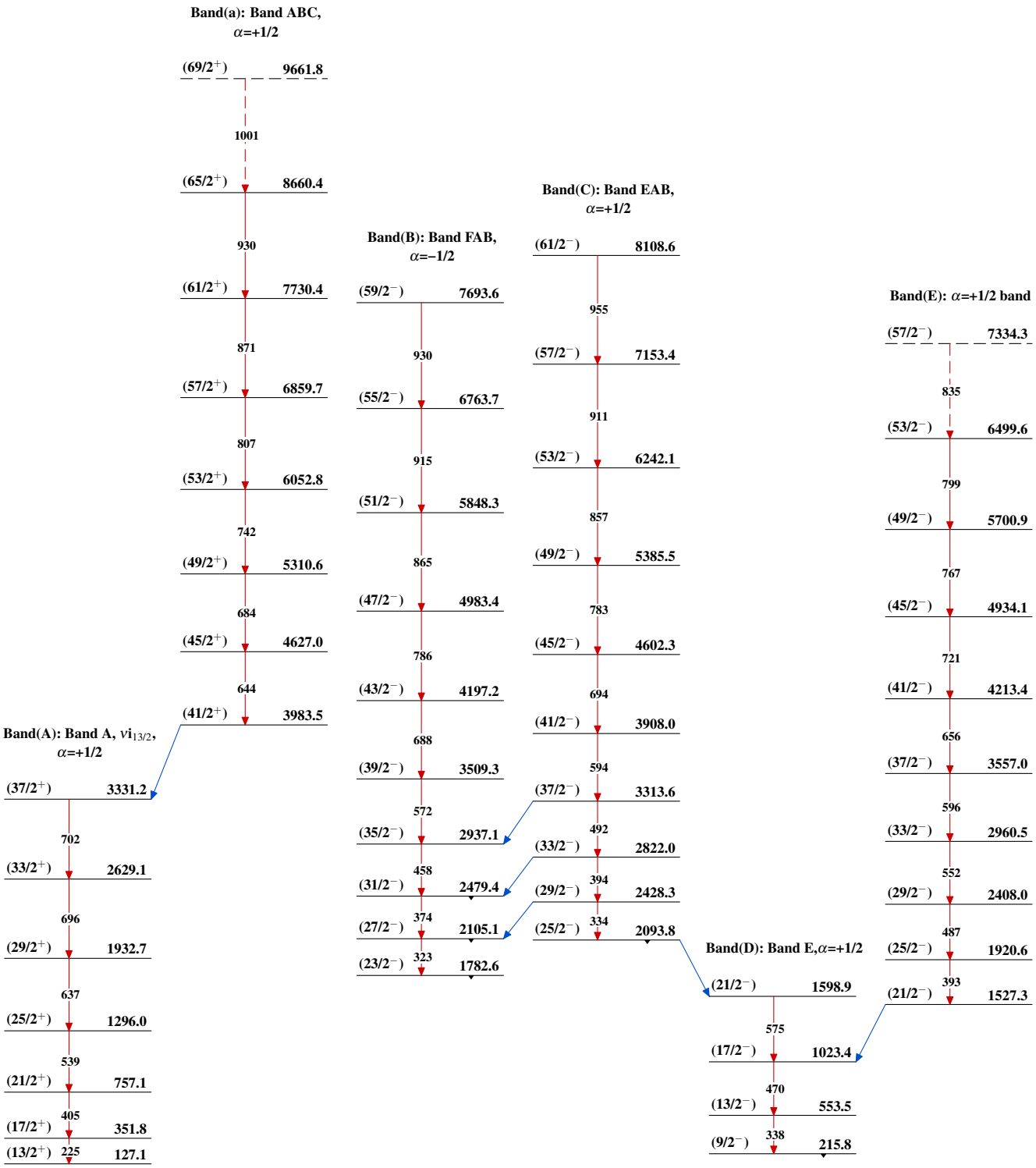
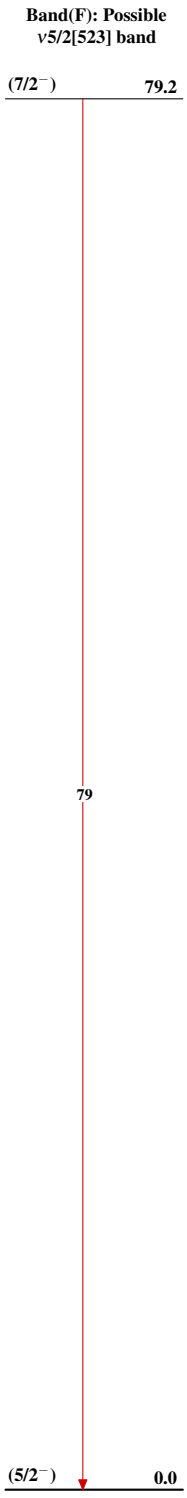
Adopted Levels, Gammas



Adopted Levels, Gammas (continued)



$^{167}_{74}W_{93}$