^{186}W(α,4nγ) 1978Sp05,1997Ba08

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. C. Batchelder and A. M. Hurst, M. S. Basunia	NDS 183, 1 (2022)	1-Mar-2022

Others: 1993BaZD, 1973Wa15,1985KrZW, 1993BaZC.

1978Sp05: Eα=47 MeV; measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma(\theta)$, γ(t).

1997Ba08, 1993BaZD, 1993BaZC: Eα=55 MeV; 6-member Compton-suppressed Ge detector array (OSIRIS); measured Eγ, Iγ, $\gamma\gamma$.

1973Wa15: Eα=48 MeV; measured Eγ, $\gamma(\theta)$, γ excit (125°). coin, DCO ratios (θ=36° or 144°, and 93°).

1985KrZW: Eα=50 MeV; 3 asymmetric BGO Compton-suppressed spectrometers with n-type Ge detectors; measured Eγ, $\gamma\gamma$ coin, DCO ratios.

1993BaZD present a partial level scheme for the γ band (intraband transitions only); 1997Ba08 and 1993BaZC present partial level schemes for transitions feeding into the yrast 14^+ level (this supersedes scheme of 1985KrZW, in which the 531γ was placed differently). More levels are added from 1978Sp05, including a K=4 γ-γ band. Note that 1993BaZC show three levels, absent from 1997Ba08, whose existence was confirmed in a later (HI,xnγ) study (viz., 1999Wh02).

^{186}Os Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0[@]	0^+		
137.2[@]	2^+		
434.1[@]	4^+		
767.5[a]	2^+		
868.8[@]	6^+		
910.5[a]	3^+		
1070.5[a]	4^+		
1275.5[a]	5^+		
1352.0[b]	4^+		
1420.8[@]	8^+		
1491.3[a]	6^+		
1559.8[b]	(5^+)		
1628.6	5^-		
1750.7[a]	(7^+)		
1774.7	7^-	8.1 ns *4*	
1968.4	$(8)^-$		
2015.1[a]	8^+		
2067.8[@]	10^+		
2165.6	$(9^-,10^-)$	5.3 ns *2*	
2188.1	$(8^-,9^-)$		
2317.4[a]	9^+		
2431.2	$(9^-,10^-)$		
2562.8[&]			
2624.5[a]	10^+		
2781.1[@]	12^+		
2805.8[&]			
2955.9[a]	11^+		
3038.9[&]			
3102.5?			E(level): existence of level unconfirmed in subsequent, more extensive (HI,xnγ) studies (e.g., 1999Wh02); not included in Adopted Levels.
3295.4[a]	12^+		
3439.6[&]	(14^+)		
3558.1[@]	(14^+)		

Continued on next page (footnotes at end of table)

^{186}W(α,4nγ) 1978Sp05,1997Ba08 (continued)

^{186}Os Levels (continued)

E(level)†	Jπ‡	Comments
3628.0[a]	13+	
3934.1[&]	16+	
4493.5[&]	(18+)	
4504.1	(16,17)	Jπ: (18+) in Adopted Levels.
4956.4	(19+)	Jπ: From Adopted Levels. J=19 in 1978Sp05.
5024.6	(19)	Jπ: (18−) in Adopted Levels.
5166.8	(18,19)	Jπ: (20+) in Adopted Levels.
5330.8	(20)	Jπ: (19−) in Adopted Levels.
5373.3	(20+)	Jπ: From Adopted Levels. J=(20) in 1978Sp05.
5499.9	(20)	
5563.7	(21)	Jπ: (20−) in Adopted Levels.
5700.8	(21)	
5831.8	(22)	Jπ: (21−) in Adopted Levels.
5914.3	(20,21)	Jπ: (22+) in Adopted Levels.
6025.2	(22)	

† From least-squares adjustment of Eγ, allowing equal weight for all gammas.
‡ From 1978Sp05, based on measured γ(θ) and deduced band structure, except as noted.
# From γ(t) (1978Sp05).
@ Band(A): Kπ=0+ g.s. band (1973Wa15).
& Band(B): π=+ band. Yrast for J≥14.
a Band(C): Kπ=2+ γ band.
b Band(D): Possible K=4 γγ band.

γ(^{186}Os)

Eγ†	Iγ†	Ei(level)	Jiπ	Ef	Jfπ	Mult.‡	Comments
137.2[&]	72 *14*	137.2	2+	0.0	0+	(Q)	A2=+0.039 *25*, A4=−0.02 *5* (1978Sp05). DCO=0.98 *8* (494.5γ gate) (1997Ba08). Iγ: Iγ = 55 *3* (1997Ba08).
143.2[&]	7.0 *14*	910.5	3+	767.5	2+		Iγ: Other: 2.3 *2* (1997Ba08).
146.1 *2*	31 *6*	1774.7	7−	1628.6	5−	(Q)	A2=+0.070 *24*, A4=−0.03 *3* (1978Sp05).
159.9	<2	1070.5	4+	910.5	3+		Eγ,Iγ: From 1997Ba08.
x167.2 *2*	5 *1*						
193.7 *2*	29 *6*	1968.4	(8)−	1774.7	7−	D+Q	A2=−0.50 *4*, A4=+0.01 *7* (1978Sp05).
197.2 *2*	18[a] *7*	2165.6	(9−,10−)	1968.4	(8)−		Iγ=29 *6*, A2=+0.09 *2*, A4=0.00 *3* for contaminated line (1978Sp05).
200.9 *1*	≤2.1	5700.8	(21)	5499.9	(20)		
220.0 *5*	5[a] *2*	2188.1	(8−,9−)	1968.4	(8)−	(D)	Iγ=10 *2*, A2=−0.31 *6*, A4=−0.08 *9* for contaminated line (1978Sp05).
233.1 *2*	3.1 *6*	3038.9		2805.8			
243.0 *2*	9.4 *19*	2805.8		2562.8		D+Q	A2=−0.67 *7*, A4=−0.01 *5* (1978Sp05).
x245.4 *2*	3.8 *8*						
265.7 *2*	6.3 *13*	2431.2	(9−,10−)	2165.6	(9−,10−)	D+Q	A2=−0.64 *6*, A4=+0.11 *8* (1978Sp05).
x269.5 *2*	6.2 *12*						
276.5[&]	45 *9*	1628.6	5−	1352.0	4+	D	A2=−0.082 *25*, A4=+0.04 *5* (1978Sp05).
296.8[@c]	≈3[#]	3102.5?		2805.8			A2=+0.156 *20*, A4=−0.07 *3* (1978Sp05) for doublet.
296.9[@&]	100 *20*	434.1	4+	137.2	2+	Q	Mult.: DCO=0.99 *6* (494.5γ gate) (1997Ba08). A2=+0.156 *20*, A4=−0.07 *3* (1978Sp05).

Continued on next page (footnotes at end of table)

^{186}W(α,4nγ) 1978Sp05,1997Ba08 (continued)

$\gamma(^{186}Os)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
302.9		1070.5	4^+	767.5	2^+		E_γ: From (1997Ba08).
306.2 *1*		5330.8	(20)	5024.6	(19)		E_γ: From 1997Ba08. Iγ=2.2 *6* from 1993BaZC.
327.5 *1*	≤2.1	5700.8	(21)	5373.3	(20^+)	D	Mult.: DCO=0.59 *11* (1997Ba08).
353.2[@] *5*	12.0 *24*	1628.6	5^-	1275.5	5^+		
365.2[&]	2.2 *4*	1275.5	5^+	910.5	3^+		I_γ: Other: 2.1 *3* (1997Ba08).
397.2 *2*	15 *3*	2562.8		2165.6	(9^-,10^-)	D	A_2=−0.22 *4*, A_4=+0.08 *5* (1978Sp05).
413.3 *3*	6.0[#] *24*	2188.1	(8^-,9^-)	1774.7	7^-		I_γ: ≈5 from singles spectrum.
416.9 *1*	2.0 *7*	5373.3	(20^+)	4956.4	(19^+)		E_γ,I_γ: From 1997Ba08.
420.8[&]	3.1 *6*	1491.3	6^+	1070.5	4^+		I_γ: Iγ = 2.3 *3* (1997Ba08).
434.8[&]	83 *17*	868.8	6^+	434.1	4^+	Q	Mult.: DCO=1.01 *6* (494.5γ gate) (1997Ba08). A_2=+0.246 *17*, A_4=−0.05 *3* (1978Sp05). I_γ: Other: 55 *3* (1997Ba08).
441.5[&]	17 *3*	1352.0	4^+	910.5	3^+		
462.8 *2*	4.0[#] *16*	2431.2	(9^-,10^-)	1968.4	$(8)^-$		
462.8 *1*	8.2 *6*	4956.4	(19^+)	4493.5	(18^+)	D+Q	Mult.: ΔJ=1 from DCO=0.34 *8* (1997Ba08). δ: −1.5 *+5−13* or −0.62 *+18−38* from DCO ratio (1997Ba08). E_γ,I_γ: From 1997Ba08.
475 *1*	8.2[b] *19*	1750.7	(7^+)	1275.5	5^+		I_γ: ≈8 from coin.
476.4[&]	1.2[b] *3*	910.5	3^+	434.1	4^+		
489.5[&]	7.2 *14*	1559.8	(5^+)	1070.5	4^+		
494.5 *5*	11.0 *22*	3934.1	16^+	3439.6	(14^+)	(Q)	Mult.: DCO=1.03 *7* (494.5γ gate) (1997Ba08). A_2=+0.20 *7*, A_4=−0.01 *12* (1978Sp05). I_γ: Other: 27 *3* (1997Ba08).
501.0 *1*	3.5 *7*	5831.8	(22)	5330.8	(20)		E_γ,I_γ: From 1997Ba08, unresolved doublet (1997Ba08).
523.9	6.2 *5*	2015.1	8^+	1491.3	6^+		E_γ,I_γ: From 1993BaZD. I_γ: Contaminated transition.
531.0 *1*	5.1 *5*	5024.6	(19)	4493.5	(18^+)	Q(+D)	E_γ,I_γ: From (1997Ba08). Mult.: DCO=0.87 *6* (1997Ba08). δ: +5.7 *+38−15* or +0.24 *6* if ΔJ=1, −0.67 *+18−20* or +1.6 *+6−7* if ΔJ=0, but ΔJ=2 also possible; from DCO ratio (1997Ba08).
539.1 *1*	≤2.1	5563.7	(21)	5024.6	(19)	(Q)	E_γ,I_γ: From 1997Ba08. Mult.: DCO=0.92 *19* (1997Ba08). Interpreted by authors as ΔJ=2 γ.
540[c]		3102.5?		2562.8			E_γ: from fig. 5 of 1978Sp05; absent in table IV.
543.5 *1*	≤2.1	5499.9	(20)	4956.4	(19^+)		E_γ,I_γ: From 1997Ba08.
552.0[&]	43 *9*	1420.8	8^+	868.8	6^+	Q	Mult.: DCO=1.00 *7* (494.5γ gate) (1997Ba08). A_2=+0.330 *21*, A_4=−0.08 *3* (1978Sp05). I_γ: Other: 45 *3* (1997Ba08).
557.8[&]	11[#] *4*	1628.6	5^-	1070.5	4^+		Iγ=18 *4*, A_2=+0.09 *4*, A_4=−0.12 *8* (1978Sp05) for doublet.
559.4 *5*	7 *6*	4493.5	(18^+)	3934.1	16^+	Q	I_γ: from I(559.4γ+558.0γ)=18 *4* and I(558γ)=11 *4* from coin. A_2=+0.09 *4*, A_4=−0.12 *8* (1978Sp05) for doublet. I_γ: Other: 19 *2* (1997Ba08).
566.7	2.1 *4*	2317.4	9^+	1750.7	(7^+)		I_γ: Other: 45 *3* (1993BaZD).
569.9 *1*	3.4 *4*	4504.1	(16,17)	3934.1	16^+		Mult.: ΔJ≠2 favored by DCO values of 1.7 *3* (662.7γ gate), ≥2 (747.5γ gate), 1.3 *1* (494.5 gate) (1993BaZC). However, ΔJ=2 for this transition in adopted gammas. Reason for discrepancy unknown. E_γ,I_γ: Eγ, Iγ from (1993BaZD).

Continued on next page (footnotes at end of table)

^{186}W(α,4nγ) 1978Sp05,1997Ba08 (continued)

$\gamma(^{186}Os)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
584.4[&]	37 *7*	1352.0	4^+	767.5	2^+		A_2=+0.06 *5*, A_4=−0.07 *8* (1978Sp05).
609.4	5.5 *6*	2624.5	10^+	2015.1	8^+		I_γ: contaminated transition, Iγ = 45 *3* (1993BaZD).
622.3[&@]	6.3 *13*	1491.3	6^+	868.8	6^+		Quoted Iγ and A_2=−0.04 *9*, A_4=−0.12 *17* (1978Sp05) are for doublet.
630.3[&]	17 *3*	767.5	2^+	137.2	2^+	D	A_2=−0.11 *3*, A_4=+0.05 *6* (1978Sp05).
636.4[&]	21 *4*	1070.5	4^+	434.1	4^+		A_2=+0.029 *26*, A_4=−0.02 *5* (1978Sp05).
638.5		2955.9	11^+	2317.4	9^+		E_γ: From (1997Ba08).
647.0 *5*	≈26	2067.8	10^+	1420.8	8^+	Q	I_γ: In 1978Sp05 from I(649.8γ+647.0γ)=34 *7* and I(649.8γ)≈8 from coincidence. Mult.: DCO=1.00 *7* (494.5γ gate) (1997Ba08). Iγ: for doublet. A_2=+0.285 *17*, A_4=−0.09 *3* (1978Sp05) for doublet dominated by this transition. I_γ: Other: 41 *3* (1997Ba08).
649.1[&]	≈8[#]	1559.8	(5^+)	910.5	3^+		I_γ: 34 *7* for 649.8γ+647.0γ doublet.
651.9 *1*	<2	6025.2	(22)	5373.3	(20^+)		E_γ,I_γ: From 1997Ba08.
658.5 *5*	13 *3*	3439.6	(14^+)	2781.1	12^+	Q	Mult.: DCO=1.01 *7* (494.5γ gate) (1997Ba08). A_2=+0.30 *3*, A_4=−0.09 *5* (1978Sp05). I_γ: Other: 26 *4* (1993BaZD).
662.7 *1*		5166.8	(18,19)	4504.1	(16,17)		E_γ: From 1993BaZD.
670.9	4.0 *5*	3295.4	12^+	2624.5	10^+		I_γ: for unresolved doublet. E_γ: from 1993BaZD.
672.1		3628.0	13^+	2955.9	11^+		E_γ: From 1993BaZD.
713.3 *5*	26 *5*	2781.1	12^+	2067.8	10^+	Q	Mult.: DCO=0.98 *6* (494.5γ gate) (1997Ba08). Iγ: for doublet. A_2=+0.285 *21*, A_4=−0.08 *4* (1978Sp05). I_γ: Other: 35 *3* (1997Ba08).
747.5 *1*	<1.2	5914.3	(20,21)	5166.8	(18,19)		E_γ,I_γ: From 1993BaZC.
759.9[&]	13 *3*	1628.6	5^-	868.8	6^+	D	A_2=−0.13 *4*, A_4=−0.06 *7* (1978Sp05).
767.5[&]	17 *3*	767.5	2^+	0.0	0^+	(E2)	A_2=+0.06 *3*, A_4=−0.02 *5* (1978Sp05).
773.3[&]	18 *4*	910.5	3^+	137.2	2^+		A_2=−0.032 *28*, A_4=+0.07 *5* (1978Sp05).
777 *1*	2.4 *5*	3558.1	(14^+)	2781.1	12^+		E_γ: 776.8 in 1973Wa15.
841.5[&]	15[#] *6*	1275.5	5^+	434.1	4^+		
879.6 *1*	5.6 *6*	5373.3	(20^+)	4493.5	(18^+)	Q	Mult.: DCO=0.80 *8* (494.5γ gate) (1997Ba08); D component possible. E_γ,I_γ: From (1997Ba08). δ(D,Q)=+10 *+47−5* or +0.16 *8* if ΔJ=1, −0.9 *+3−5* or +2.2 *+23−7* if ΔJ=0, but ΔJ=2 also possible; from DCO ratio (1997Ba08). ΔJ=2 in adopted gammas.
882 *1*	≈5[#]	1750.7	(7^+)	868.8	6^+		
933.3[&]	9.2 *18*	1070.5	4^+	137.2	2^+		
[x]1014 *1*	≈3[#]						Coincident with 297γ (1978Sp05).
1057.3[&]	≈4[#]	1491.3	6^+	434.1	4^+		

[†] From singles data of 1978Sp05, unless noted otherwise. Iγ is normalized so I(296.8γ)=100. ΔI_γ is 20% for singles data, 30-40% for coin data (1978Sp05). For E$\gamma\leq$500, Iγ is from low energy photon spectrometer spectrum at 90°, corrected by authors for angular distribution effects when possible.

[‡] From measured $\gamma(\theta)$ (1978Sp05) or DCO ratios (1997Ba08). 1978Sp05 assumes that Q transitions are E2 and that D intraband transitions are M1.

[#] From coin data (1978Sp05).

[@] Member of unresolved doublet.

Continued on next page (footnotes at end of table)

^{186}W(α,4nγ) 1978Sp05,1997Ba08 (continued)

γ(^{186}Os) (continued)

[&] Rounded-off energy from adopted gammas.
[a] From coin, allowing 40% uncertainty; γ from singles spectrum contains contaminant activity (1978Sp05).
[b] 476-doublet Iγ divided by the evaluators based on adopted branching from the 910 level. Undivided I(475γ+476.9γ)= 9.4 *19*.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

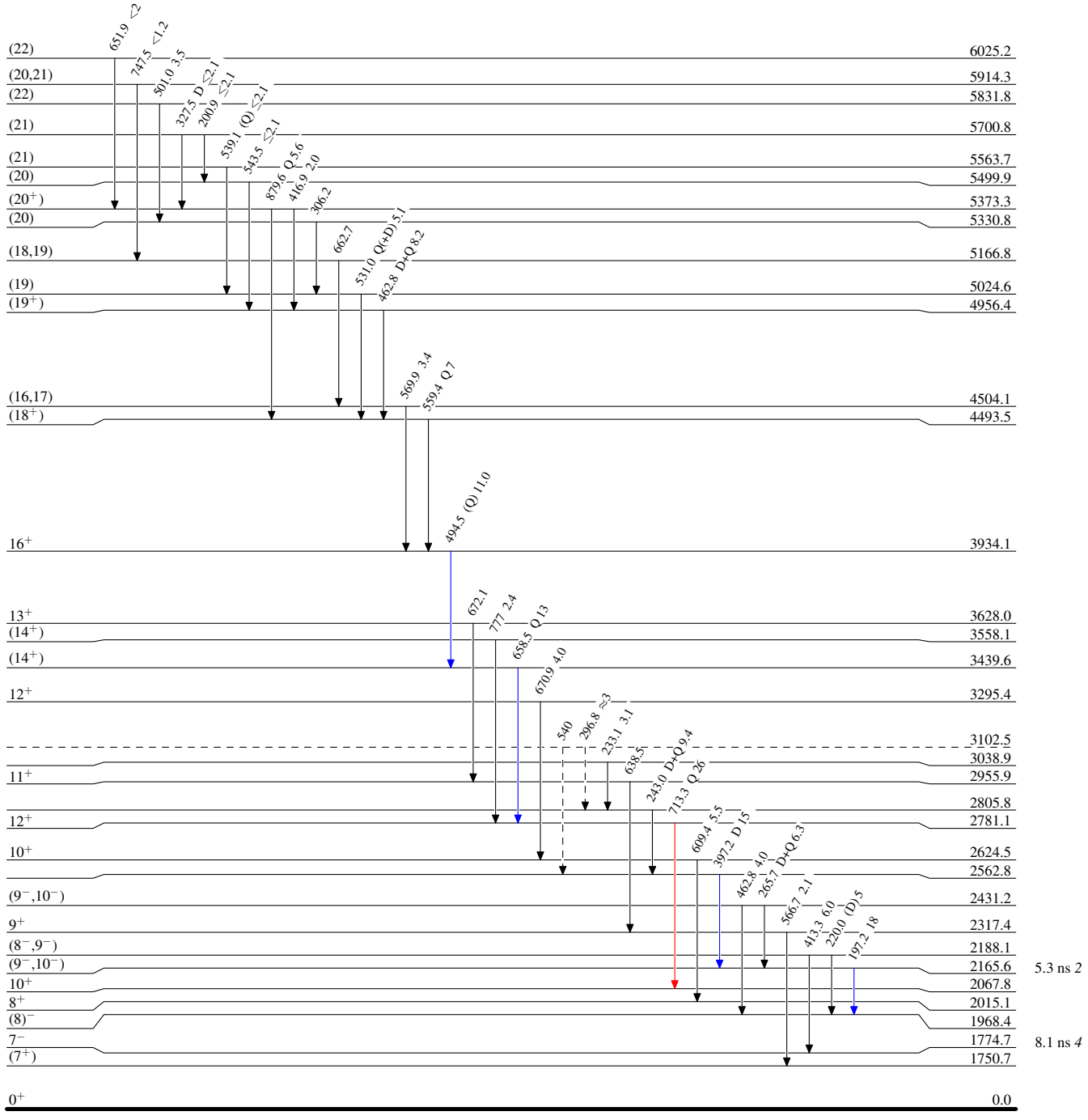
$^{186}W(\alpha,4n\gamma)$ **1978Sp05,1997Ba08**

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)

Level Scheme

Intensities: Relative Iγ for Eα=47 MeV.



$^{186}_{76}Os_{110}$

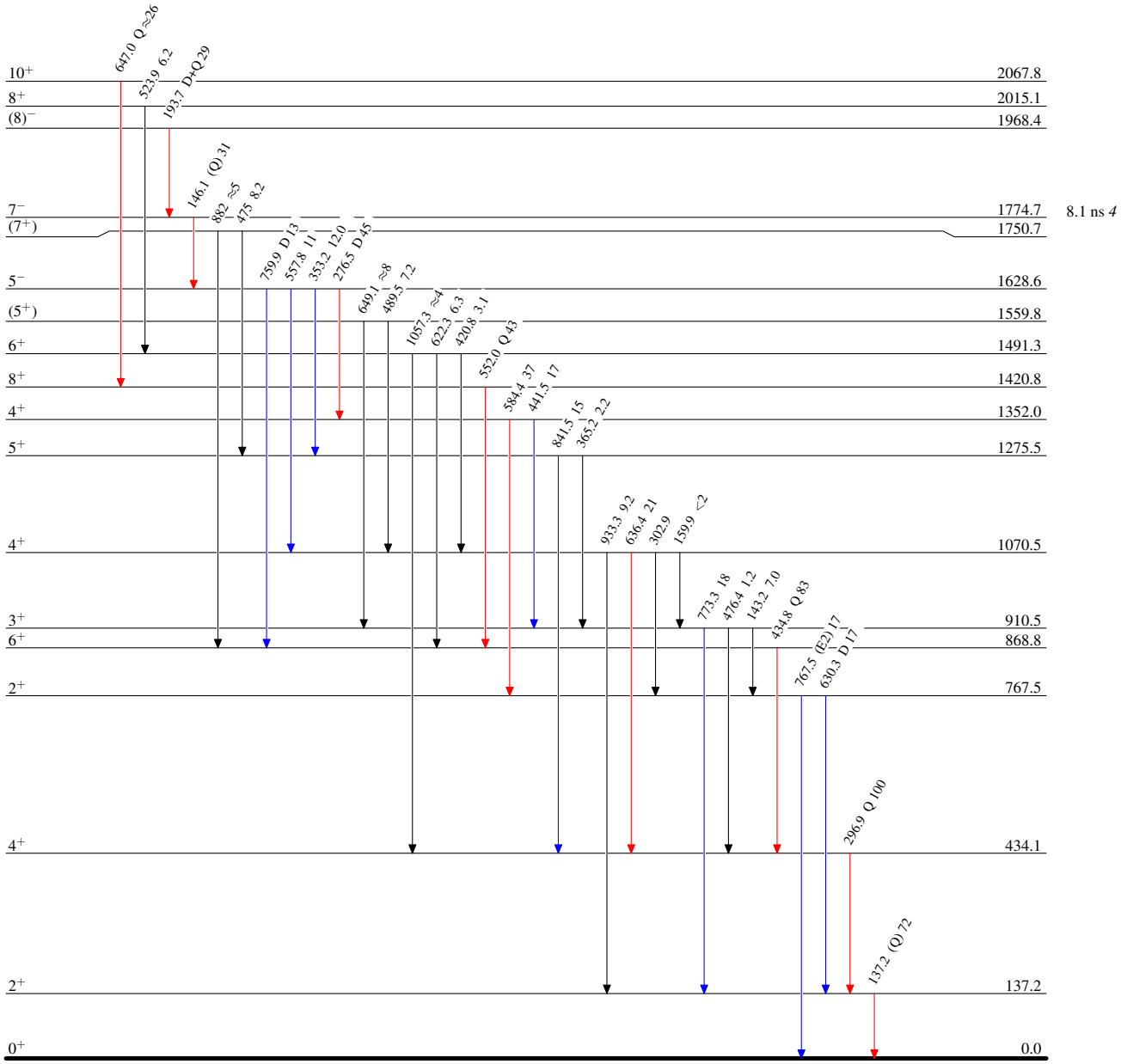
$^{186}W(\alpha,4n\gamma)$ **1978Sp05,1997Ba08**

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

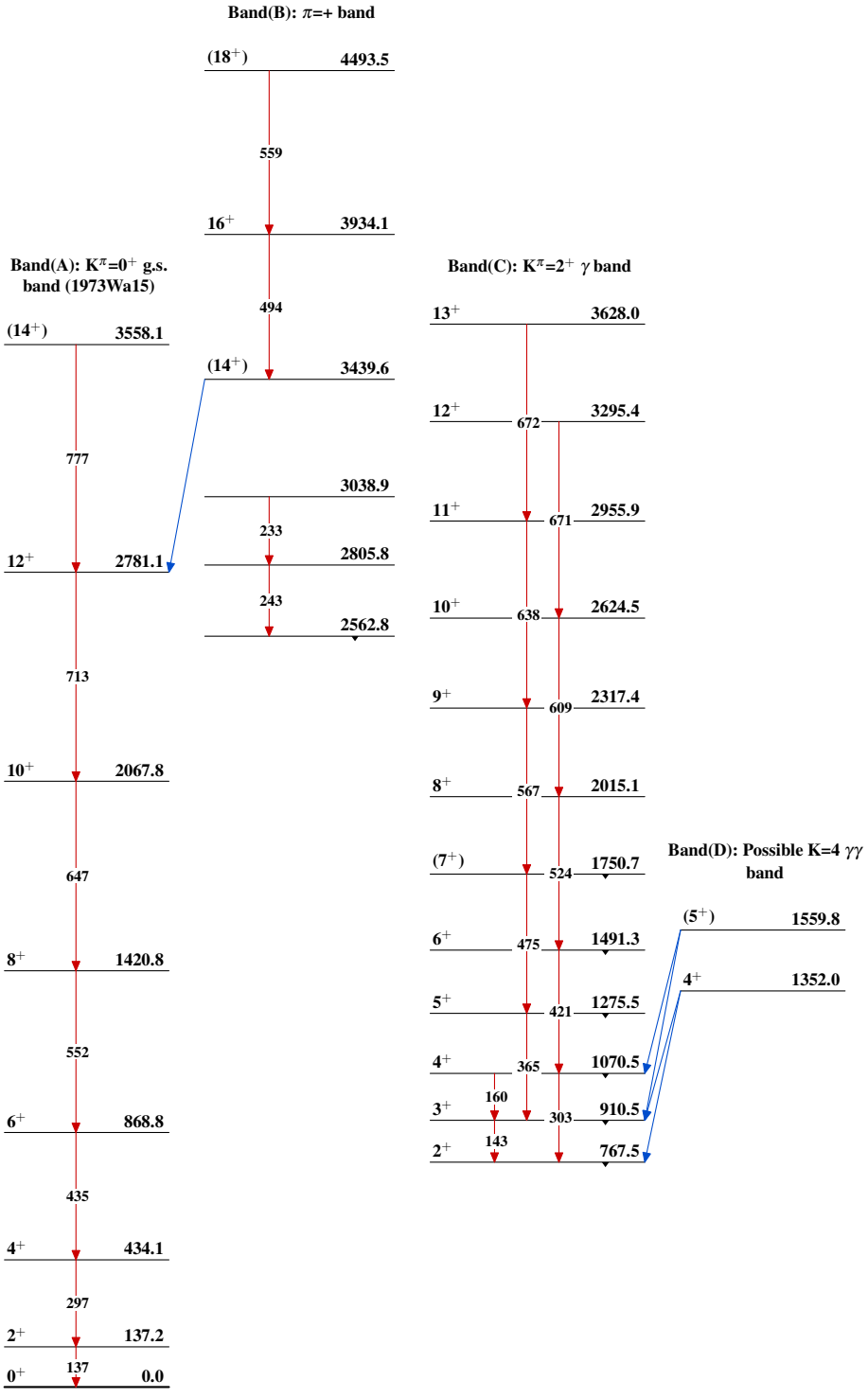
Level Scheme (continued)

Intensities: Relative $I\gamma$ for $E\alpha$=47 MeV.



$^{186}_{76}Os_{110}$

^{186}W(α,4nγ) 1978Sp05,1997Ba08



$^{186}_{76}Os_{110}$