(HI,xnγ) 1990Ba29,1989We06,1982Du13

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 75,199 (1995)	31-May-1995

1990Ba29: ^{144}Sm(^{31}P,p2nγ) E=150 MeV. Measured γ, γγ, γ(θ).
1989We06 (also 1987We06,1989ViZV): ^{144}Nd(^{32}S,4nγ) E=162 MeV. Measured γ, γγ, γγ(θ) (DCO ratios at 24° and 87°).
1982Du13: ^{148}Sm(^{28}Si,4nγ) E=145 MeV. Measured γ, γγ, γ(θ).
DCO ratios are from 1989We06. A_2 and A_4 coefficients are from 1990Ba29.
1994ViZY: ^{144}Nd(^{32}S,4nγ) E=162 MeV. Measured $T_{1/2}$(level) by RDDS method for members of the yrast band and a negative parity band.
Additional information 1.

^{172}Os Levels

Q(transition), given under comments, are are deduced from $T_{1/2}$ data (1994ViZY) using rotational model and K=0 for g.s. and the negative parity band.

E(level)†	Jπ‡	$T_{1/2}$#	Comments
0.0@	0^+		
227.80@ *10*	2^+	116 ps *7*	$T_{1/2}$: feeding time=63 ps *31*. Q(transition)=5.7 *3*.
606.19@ *15*	4^+	7.1 ps *7*	$T_{1/2}$: feeding time=17 ps *8*. Q(transition)=5.9 *3*.
1054.59@ *17*	6^+	1.8 ps *2*	$T_{1/2}$: feeding time=76 ps *38*. Q(transition)=7.4 *+5−4*.
1137.7a *3*	4^+		
1525.0@ *2*	8^+	1.1 ps *+3−2*	$T_{1/2}$: feeding time=15 ps *7*. Q(transition)=8.2 *+10−8*.
1551.2a *3*	6^+		
1656.35b *18*	$5^{(-)}$		
1728.1c *3*	(4^-)		
1873.4 *4*			
1978.47b *19*	$7^{(-)}$	6.4 ps *12*	Q(transition)=8.6 *+9−7*.
2023.9@ *2*	10^+	1.2 ps *+2−3*	$T_{1/2}$: feeding time=4 ps *2*. Q(transition)=6.6 *+7−5*.
2061.5c *2*	(6^-)		
2374.7b *2*	$9^{(-)}$	4.1 ps *+29−20*	Q(transition)=6.4 *+25−15*.
2415.2c *2*	(8^-)		Level based on the ordering of 221-354 cascade given by 1990Ba29. 1989We06 suggested the opposite order implying a level at 2282.
2564.6@ *2*	12^+	0.76 ps *+14−21*	$T_{1/2}$: feeding time=0.7 ps *3*. Q(transition)=7.0 *+10−6*.
2635.5c *2*	(10^-)		
2765.8b *2*	$11^{(-)}$	6.9 ps *6*	Q(transition)=6.9 *6*.
2840.7? *3*			
2846.0d *3*	(10^-)		
3004.9c *3*	(12^-)		
3101.3& *3*	14^+	0.76 ps *28*	$T_{1/2}$: feeding time=4.8 ps *24*. Q(transition)=7.3 *+16−11*.
3194.5b *3*	$13^{(-)}$	3.4 ps *+6−5*	Q(transition)=5.6 *4*.
3199.5@ *3*	(14^+)		
3322.1d *3*	(12^-)		

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(HI,xnγ) 1990Ba29,1989We06,1982Du13 (continued)

^{172}Os Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
3513.2[c] *3*	(14⁻)		
3589.8[&] *3*	16⁺	2.5 ps *+4−5*	$T_{1/2}$: feeding time=1.4 ps *7*. Q(transition)=5.0 *+8−4*.
3711.4[b] *3*	(15⁻)	1.2 ps *+6−7*	Q(transition)=6.0 *+35−10*.
3823.4[@] *3*	(16⁺)		
3847.5[d] *3*	(14⁻)		
4068.3[c] *3*	(16⁻)		
4176.6[&] *3*	(18⁺)	1.1 ps *+8−4*	$T_{1/2}$: feeding time=0.7 ps *3*. Q(transition)=4.6 *+13−10*.
4277.0[b] *3*	(17⁻)		
4412.4[d] *4*	(16⁻)		
4510.8[@] *3*	(18⁺)		
4640.3[c] *3*	(18⁻)		
4831.7[&] *3*	(20⁺)	<0.9 ps	Q(transition)>4.2.
4872.6[b] *3*	(19⁻)		
5003.9[d] *5*			
5234.7?[@] *4*	(20⁺)		
5245.3[c] *3*	(20⁻)		
5490.7[b] *4*	(21⁻)		
5528.3[&] *4*	(22⁺)		
5633.9[d] *6*			
5892.7[c] *4*	(22⁻)		
5985.7?[@] *11*	(22⁺)		
6103.3 *4*			
6135.1[b] *4*	(23⁻)		
6258.6[&] *4*	(24⁺)		
6298.5[d] *7*			
6585.0[c] *4*	(24⁻)		
6812.4 *5*			
6819.3[b] *5*	(25⁻)		
7028.1[&] *4*	(26⁺)		
7326.8[c] *5*	(26⁻)		
7554.9 *6*			
7842.7[&] *4*	(28⁺)		
8119.3?[c] *6*	(28⁻)		
8690.2?[&] *5*	(30⁺)		

[†] From least-squares fit to Eγ′s.
[‡] From Adopted Levels.
[#] From RDDS (1994ViZY). The side-feeding times are given under comments.
[@] Band(A): g.s. band. (α=0,π=+).
[&] Band(B): (α=0,π=+). Yrast states.
[a] Band(C): $K^{\pi}=0^{+}$ β band.
[b] Band(D): (α=1,π=−).
[c] Band(E): (α=0,π=−).
[d] Band(F): band 1, ΔJ=2.

(HI,xnγ) 1990Ba29,1989We06,1982Du13 (continued)

$\gamma(^{172}Os)$

γ-ray intensities in $^{144}Sm(^{31}P,p2n\gamma)$ E=150 MeV (1990Ba2

Eγ	Iγ	Eγ	Iγ	Eγ	Iγ
161.9	0.7 2	470.8	63.5 15	602.1	9.8 3
220.9	3.0 1	471.6	6.4 11	605.0	1.5 5
227.9	92.5 22	476.1	4.4 5	612	1.6 5
261.1	1.3 3	484.9	1.6 5	618.9	2.6 7
276.0	1.2 3	488.8	15.6 4	624.1	2.8 3
322.3	16.3 5	499.2	40.8 2	635.1	6.2 3
333.9	1.0 4	508.5	4.3 11	644.5	0.7 6
351.3	1.1 3	517.2	10.8 4	655.6	6.9 9
354.2	3.5 4	525.6	4.4 5	697.3	3.4 7
362.6	2.6 4	530.4	4.5 7	729	3.2 15
369.5	6.3 3	531.8	3.0 7	816.8	2.8 5
378.7	100.0 20	536.7	19.3 21	890.3	1.1 4
391.4	14.4 4	540.8	34.5 8	924.3	5.7 3
396.4	29.0 7	555.5	2.7 7	945	2.6 5
413.5	3.5 5	556.3	1.5 5	1006.7	4.4 1
427.6	3.0 8	565.7	3.1 6	1050.7	18.2 14
429.0	13.7 4	565.8	7.0 8	1122.3	0.2 2
431.7	2.1 2	572.5	3.0 6	1267.2	1.8 4
448.6	91.6 19	587.2	10.4 3		
453.6	10.2 3	596.0	4.0 5		

Energy uncertainty is not given by 1990Ba29. It is probably 0.1-0.3 keV

γ-ray intensities from $^{148}Sm(^{28}Si,4n\gamma)$ E=145 MeV (1982Du1

Eγ	Iγ	Eγ	Iγ	Eγ	Iγ
228.0	86 2	488.2	27 2	587.5	17 3
378.7	100 2	499.7	50 2	655.9	9 2
448.7	92 3	537.3	36 3	696.0	5 1
471.1	73 2	541.2	45 3	726.0	1.6 5

Energy uncertainty is not given by 1982Du13. It is probably 0.1-0.3 keV

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[‡]	α[a]	Comments
128.0[#] *3*	2.0[#] *10*	3322.1	(12$^-$)	3194.5	13$^{(-)}$			
[x]161.9[@]								
220.3 *1*	2.9 *4*	2635.5	(10$^-$)	2415.2	(8$^-$)			A$_2$=0.25 *9*.
227.8 *1*	82.1 *15*	227.80	2$^+$	0.0	0$^+$	E2	0.218	DCO=0.65 *3*. A$_2$=0.24 *4*, A$_4$=−0.05 *5*.
261.2 *3*	1.5 *3*	2635.5	(10$^-$)	2374.7	9$^{(-)}$			
276.0[@b]		2840.7?		2564.6	12$^+$			
322.0 *1*	15.0 *6*	1978.47	7$^{(-)}$	1656.35	5$^{(-)}$	E2		DCO=0.87 *11*. A$_2$=0.24 *6*, A$_4$=−0.12 *6*.
333.9[@]	1.0 *4*	2061.5	(6$^-$)	1728.1	(4$^-$)			I$_\gamma$: from Iγ(334γ)/Iγ(1007γ)=0.23 *9* (1990Ba29).
350.8 *2*	2.5 *4*	2374.7	9$^{(-)}$	2023.9	10$^+$			
353.7 *1*	2.7 *5*	2415.2	(8$^-$)	2061.5	(6$^-$)			
[x]362.6[@]								
369.4 *1*	8.3 *5*	3004.9	(12$^-$)	2635.5	(10$^-$)	(E2)		A$_2$=0.42 *5*, A$_4$=−0.19 *6*.
378.4 *1*	100.0 *13*	606.19	4$^+$	227.80	2$^+$	E2	0.047	DCO=0.81 *3*. A$_2$=0.28 *4*, A$_4$=−0.07 *4*.
391.2 *1*	19.3 *7*	2765.8	11$^{(-)}$	2374.7	9$^{(-)}$	E2		DCO=1.09 *21*. A$_2$=0.35 *5*, A$_4$=−0.20 *5*.

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(HI,xnγ) 1990Ba29,1989We06,1982Du13 (continued)

γ(^{172}Os) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[a]	Comments
396.2 *1*	28.5 *8*	2374.7	$9^{(-)}$	1978.47	$7^{(-)}$	(E2)		DCO=1.01 *19*. A_2=0.23 *6*, A_4=−0.04 *5*.
405.0#b *3*	2.9# *6*	2061.5	(6^-)	1656.35	$5^{(-)}$			Absence of this γ ray in ^{172}Ir ε decay (2.0 s) makes the placement suspect.
413.5 *3*		1551.2	6^+	1137.7	4^+			E_γ: from 1990Ba29, uncertainty assigned by the evaluator. Iγ=3.5 *5* (1990Ba29). 1987We06 report Eγ=413.6 *2*, Iγ=8 *2*. From a spectrum Iγ≈5 (1989We06).
427.6@b	3.6 *10*	1978.47	$7^{(-)}$	1551.2	6^+			I_γ: from Iγ(428γ)/Iγ(453γ)=0.29 *8* (1990Ba29).
428.7 *1*	20.8 *10*	3194.5	$13^{(-)}$	2765.8	$11^{(-)}$	E2		DCO=0.99 *13*. A_2=0.34 *7*, A_4=−0.13 *7*.
x431.7@								A_2=0.22 *18*, A_4=0.42 *20*.
439.8# *3*	0.9# *5*	3004.9	(12^-)	2564.6	12^+			
448.4 *1*	88.9 *18*	1054.59	6^+	606.19	4^+	E2	0.030	DCO=0.92 *3*. A_2=0.30 *3*, A_4=−0.09 *4*.
453.5 *1*	12.3 *9*	1978.47	$7^{(-)}$	1525.0	8^+			DCO=0.63 *13*. A_2=−0.09 *5*, A_4=−0.06 *5*.
470.5 *1*	65.8 *18*	1525.0	8^+	1054.59	6^+	E2	0.027	DCO=1.00 *3*. A_2=0.29 *4*, A_4=−0.04 *5*.
471.2 *2*	6.4 *9*	2846.0	(10^-)	2374.7	$9^{(-)}$			
476.1 *1*	6.9 *8*	3322.1	(12^-)	2846.0	(10^-)			A_2=0.31 *7*, A_4=−0.04 *7* (for 476γ+ΔJ=2 γ in ^{173}Os).
x484.9@								
488.5 *1*	24.7 *11*	3589.8	16^+	3101.3	14^+	E2		DCO=1.05 *7*. A_2=0.30 *4*, A_4=−0.04 *5*.
498.9 *1*	54.8 *15*	2023.9	10^+	1525.0	8^+	E2		DCO=0.98 *4*. A_2=0.31 *4*, A_4=−0.08 *5*.
508.3 *1*	12.4 *9*	3513.2	(14^-)	3004.9	(12^-)			
516.9 *1*	18.1 *11*	3711.4	(15^-)	3194.5	$13^{(-)}$	E2		DCO=1.17 *25*. A_2=0.33 *8*, A_4=−0.12 *8*.
525.4 *1*	10.9 *9*	3847.5	(14^-)	3322.1	(12^-)			A_2=0.17 *12* for 525γ+ E2 γ in ^{173}Os.
x530.4@								
531.8@		1137.7	4^+	606.19	4^+			
536.7 *1*	35.2 *13*	3101.3	14^+	2564.6	12^+	E2		DCO=0.99 *4*. A_2=0.35 *6*, A_4=−0.11 *8* (for 537γ+ΔJ=2 γ in ^{173}Os).
540.6 *1*	47.6 *15*	2564.6	12^+	2023.9	10^+	E2		DCO=0.98 *3*. A_2=0.38 *4*, A_4=−0.13 *5*.
555.1 *1*	9.3 *6*	4068.3	(16^-)	3513.2	(14^-)			
556.3 *3*	4.2 *10*	3322.1	(12^-)	2765.8	$11^{(-)}$			
564.9# *2*	6.6# *8*	4412.4	(16^-)	3847.5	(14^-)			
565.6 *1*	18.4 *8*	4277.0	(17^-)	3711.4	(15^-)			DCO=0.98 *13*.
572.0 *1*	7.5 *6*	4640.3	(18^-)	4068.3	(16^-)			
586.8 *1*	24.0 *8*	4176.6	(18^+)	3589.8	16^+	E2		DCO=1.19 *10*. A_2=0.02 *5*, A_4=−0.07 *6*.
591.5# *3*	9.0# *6*	5003.9		4412.4	(16^-)			
595.6 *1*	14.0 *7*	4872.6	(19^-)	4277.0	(17^-)			DCO=0.89 *12*.
601.7 *1*	11.2& *7*	1656.35	$5^{(-)}$	1054.59	6^+			DCO=0.53 *10*. A_2=0.00 *5*.
605.0 *1*	5.9 *6*	5245.3	(20^-)	4640.3	(18^-)			
611.6 *3*	2.1 *10*	2635.5	(10^-)	2023.9	10^+			
612.6# *2*	5.4# *5*	6103.3		5490.7	(21^-)			
618.1 *1*	10.7 *5*	5490.7	(21^-)	4872.6	(19^-)			
623.9 *1*	9.7 *5*	3823.4	(16^+)	3199.5	(14^+)			A_2=0.22 *12*, A_4=0.07 *14*.
630.0# *3*	3.5# *4*	5633.9		5003.9				
634.9 *1*	10.4 *5*	3199.5	(14^+)	2564.6	12^+			A_2=0.22 *9*, A_4=−0.17 *9*.
644.4 *2*	3.2 *4*	6135.1	(23^-)	5490.7	(21^-)			
647.4# *1*	4.3# *4*	5892.7	(22^-)	5245.3	(20^-)			
655.1 *1*	15.6 *5*	4831.7	(20^+)	4176.6	(18^+)	E2		DCO=0.95 *11*.
664.6# *3*	5.2# *5*	6298.5		5633.9				
684.2# *2*	2.5# *5*	6819.3	(25^-)	6135.1	(23^-)			
687.4# *1*	5.5# *4*	4510.8	(18^+)	3823.4	(16^+)			
692.3# *1*	3.0# *5*	6585.0	(24^-)	5892.7	(22^-)			

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(HI,xnγ) 1990Ba29,1989We06,1982Du13 (continued)

$\gamma(^{172}Os)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Comments
696.6 *1*	9.4 *5*	5528.3	(22^+)	4831.7	(20^+)	DCO=1.19 *31*.
709.1[#] *2*	2.7[#] *4*	6812.4		6103.3		
723.9[#b] *3*	3.0[#] *5*	5234.7?	(20^+)	4510.8	(18^+)	
730.3 *1*	4.4 *4*	6258.6	(24^+)	5528.3	(22^+)	
741.8[#] *3*	2.0[#] *5*	7326.8	(26^-)	6585.0	(24^-)	
742.5[#] *3*	1.7[#] *4*	7554.9		6812.4		
751.0[#b] *10*	3.5[#] *5*	5985.7?	(22^+)	5234.7?	(20^+)	
769.5[#] *1*	2.3[#] *4*	7028.1	(26^+)	6258.6	(24^+)	
792.5[#b] *3*	2.9[#] *6*	8119.3?	(28^-)	7326.8	(26^-)	
814.6 *2*	1.4 *5*	7842.7	(28^+)	7028.1	(26^+)	
816.8[@b]		2840.7?		2023.9	10^+	Iγ(817γ)/Iγ(276γ)=2.3 *7* (1990Ba29).
847.5[#] *3*	1.7[#] *5*	8690.2?	(30^+)	7842.7	(28^+)	
890.3[@]	0.8 *2*	2415.2	(8^-)	1525.0	8^+	I_γ: from Iγ(890γ)/Iγ(354γ)=0.31 (1990Ba29).
924.1 *2*	5.0 *4*	1978.47	$7^{(-)}$	1054.59	6^+	DCO=0.74 *15*. A_2=−0.59 *7*, A_4=0.41 *8*.
945[@]		1551.2	6^+	606.19	4^+	I_γ: 6 *2* (1990Ba29).
1006.6 *3*	4.3 *4*	2061.5	(6^-)	1054.59	6^+	A_2=0.33 *8*, A_4=0.07 *10*.
1049.8 *2*	8.0[&] *5*	1656.35	$5^{(-)}$	606.19	4^+	DCO=0.50 *30*. A_2=−0.12 *6*, A_4=−0.03 *7*.
1122.3[@]		1728.1	(4^-)	606.19	4^+	
1267.2[@]		1873.4		606.19	4^+	

[†] From ^{144}Nd(^{32}S,4nγ) E=162 MeV (1989We06) unless otherwise stated. See tables above for intensities from other reactions.
[‡] From $\gamma\gamma(\theta)$ (DCO), $\gamma(\theta)$ and RUL (for E2 and M2).
[#] From 1989We06 only.
[@] From 1990Ba29 only.
[&] Iγ(1050γ)/Iγ(602γ)=1.8 *1* (1990Ba29) is large by a factor of≈2 as compared to that from 1989We06 and from 1994Da02 (^{172}Ir ε decay 2.0 s).
[a] 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.
[b] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

(HI,xnγ) 1990Ba29,1989We06,1982Du13

Level Scheme

Intensities: Relative I_γ

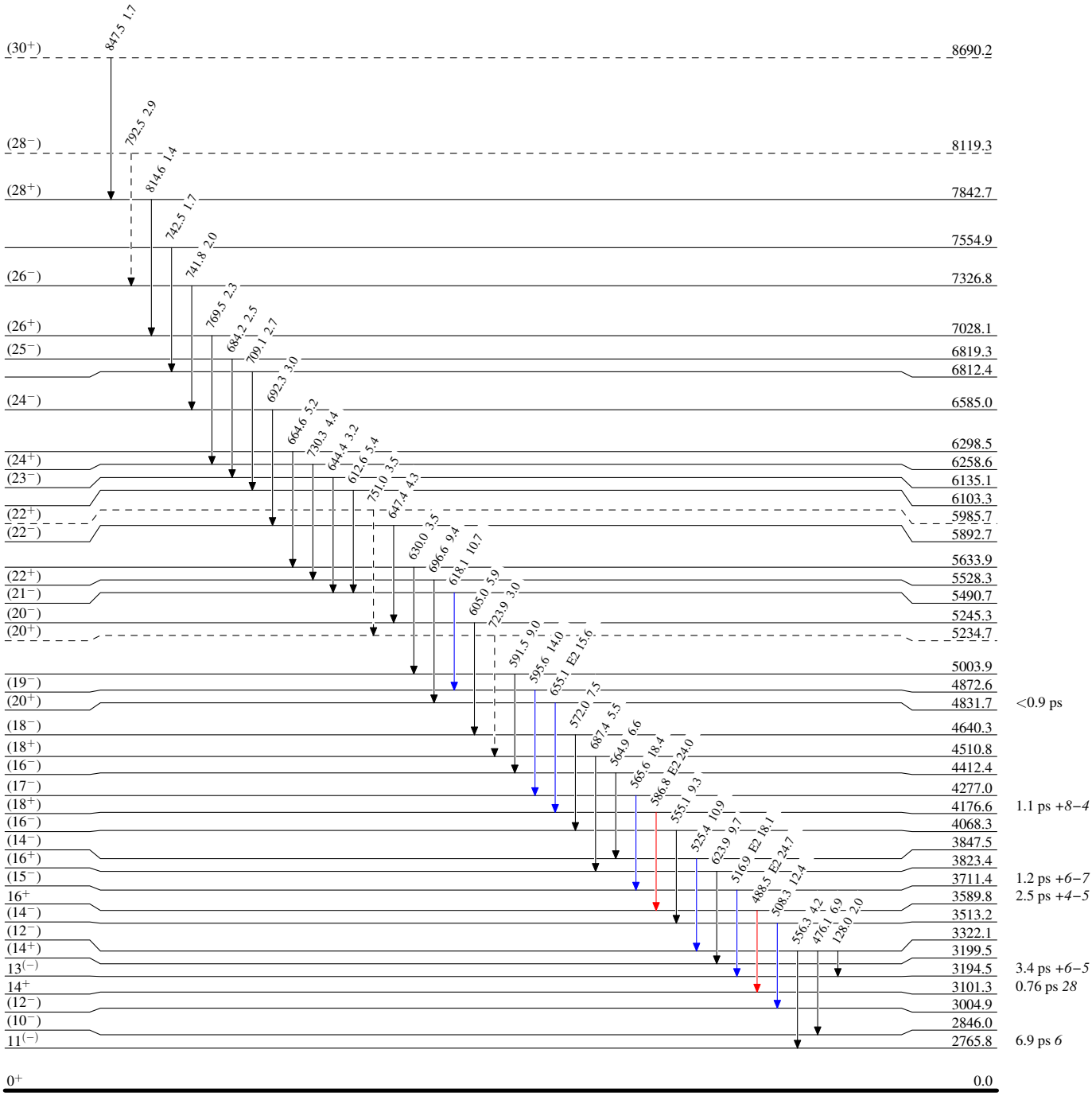
Legend

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

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

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

γ Decay (Uncertain)



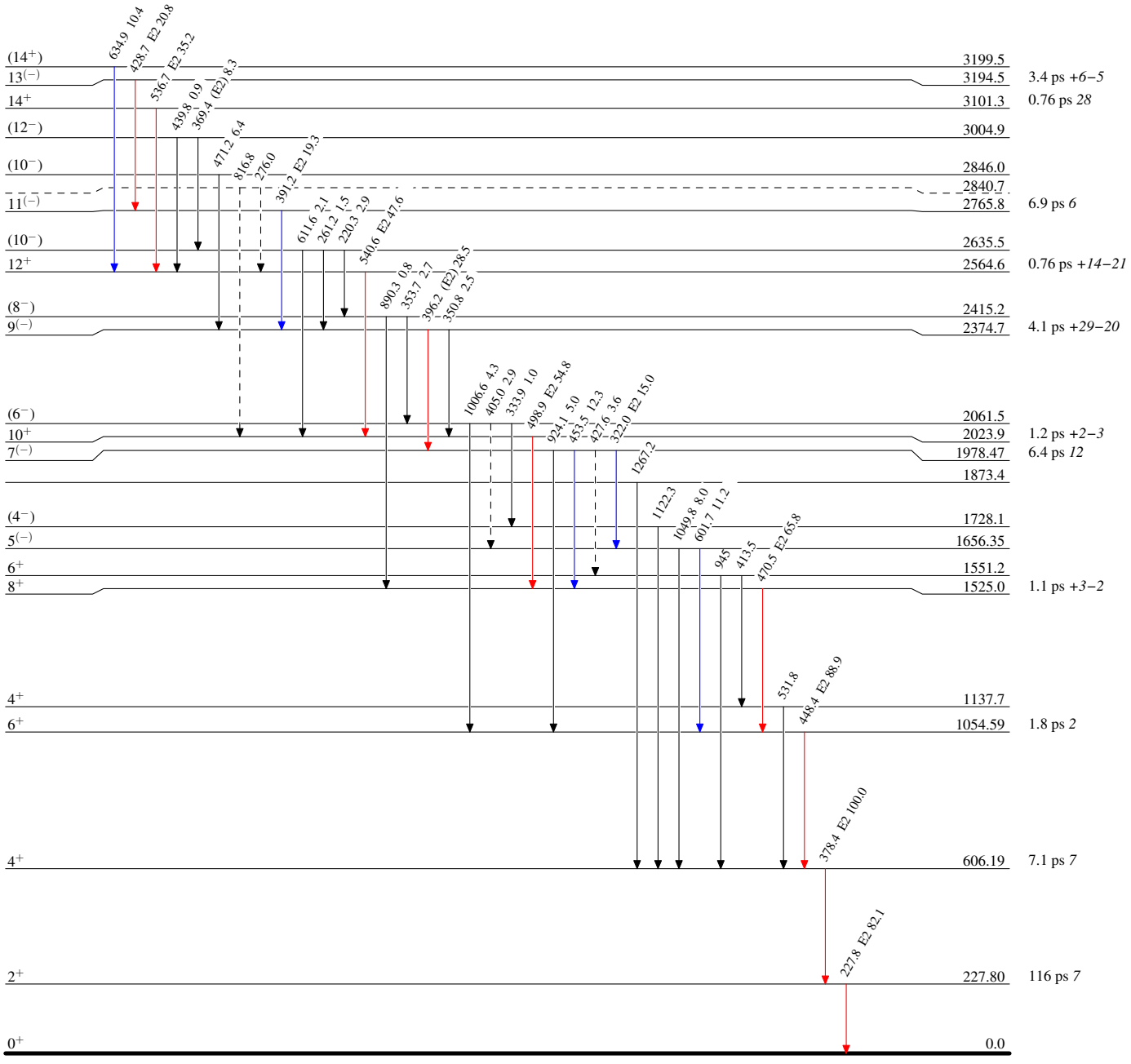
$^{172}_{76}Os_{96}$

(HI,xnγ) 1990Ba29,1989We06,1982Du13

Level Scheme (continued)

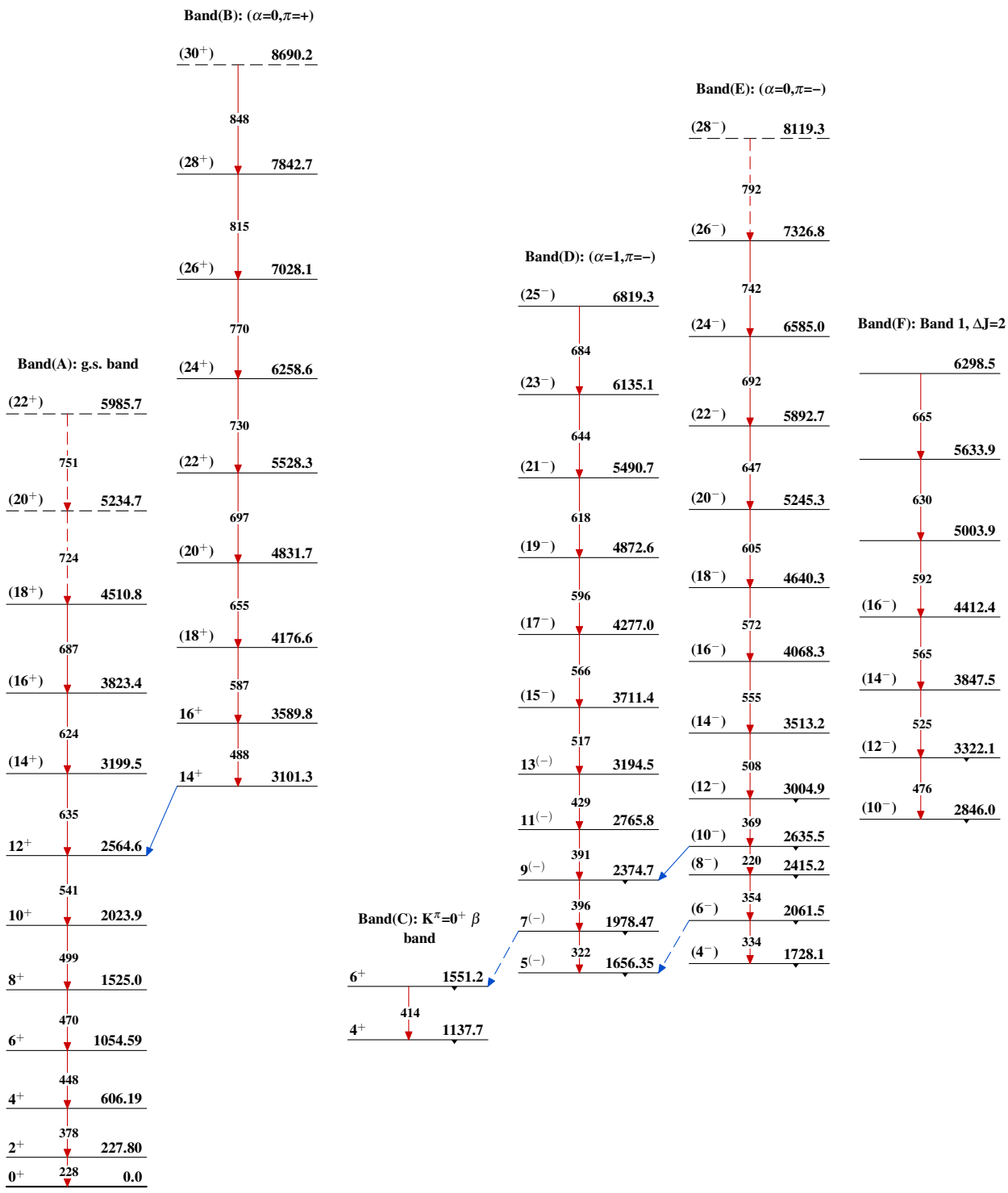
Intensities: Relative I_γ

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)



$^{172}_{76}Os_{96}$

(HI,xnγ) 1990Ba29,1989We06,1982Du13



$^{172}_{76}Os_{96}$