^{164}Er(^{17}O,4nγ), ^{166}Er(^{16}O,5nγ) 1983Dr05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 159, 1 (2019)	30-Aug-2019

Produced using the ^{164}Er(^{17}O,4nγ) and ^{166}Er(^{16}O,5nγ) reactions. Projectiles: ^{16}O, E=102, 106, and 107 MeV; ^{17}O, 88 and 90 MeV. Targets: metallic foils, rolled to be between 3 and 4 mg/cm^2 in thickness, in some cases with Pb evaporated on the back, enriched in ^{164}Er and ^{166}Er. Measured Eγ, Iγ, $\gamma\gamma$ coin, nγ coin, $\gamma\gamma$(t), nγ(t), $\gamma(\theta)$. Detectors: Ge(Li), Ge LEPS, Ge(Li) anti-Compton, NE213 liquid scintillator.

^{177}Os Levels

E(level)†	J^{π}‡	$T_{1/2}$	Comments
0.0#	1/2−	3.0 min *2*	J^{π},$T_{1/2}$: From Adopted Levels.
75.6# *3*	3/2−		
90.60# *22*	5/2−		
152.30@ *24*	5/2−	40 ns *3*	$T_{1/2}$: From $\gamma\gamma$(t) by gating on γ rays below and above the isomer (1983Dr05).
240.4@ *4*	7/2−		
259.2# *4*	7/2−		
285.1# *4*	9/2−		
300.6& *4*	7/2+	46.3 ns *3*	$T_{1/2}$: From nγ(t) by gating on the 148.3γ (1983Dr05).
318.9& *5*	9/2+		
355.3@ *5*	9/2−		
375.7& *5*	11/2+		
433.5& *5*	13/2+		
494.5@ *5*	11/2−		
534.0# *5*	11/2−		
567.5# *5*	13/2−		
595.2& *5*	15/2+		
655.9@ *5*	13/2−		
678.7& *5*	17/2+		
837.0@ *5*	15/2−		
885.5# *6*	15/2−		
924.9# *6*	17/2−		
946.7& *6*	19/2+		
1036.7@ *5*	17/2−		
1047.3& *6*	21/2+		
1252.3@ *5*	19/2−		
1305.3# *7*	19/2−		
1348.5# *7*	21/2−		
1395.0& *6*	23/2+		
1484.0@ *6*	21/2−		
1519.1& *6*	25/2+		
1727.4@ *6*	23/2−		
1788.3# *8*	23/2−		
1831.2# *7*	25/2−		
1913.2& *6*	27/2+		
1987.7@ *6*	25/2−		
2069.8& *7*	29/2+		

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^{164}Er(^{17}O,4nγ), ^{166}Er(^{16}O,5nγ) 1983Dr05 (continued)

^{177}Os Levels (continued)

E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]
2255.2[@] 7	27/2−	2766.8 12		3135.7[@] 12	(33/2−)	4501.2[&] 13	(43/2+)
2327.3[#] 8	(27/2−)	2826.8[@] 7	31/2−	3338.5[&] 8	37/2+	4787.8[#] 10	(45/2−)
2362.6[#] 8	29/2−	2910.3[#] 13	(31/2−)	3477.6[#] 9	37/2−	4806.0[&] 9	(45/2+)
2486.6[&] 7	31/2+	2911.9[#] 9	33/2−	3779.2[&] 8	39/2+	4811.5 10	
2540.7[@] 7	29/2−	3038.7 9	(33/2−)	4044.5[&] 8	41/2+	5612.0[&] 14	(49/2+)
2679.4[&] 7	33/2+	3108.2[&] 7	35/2+	4102.8[#] 10	41/2−		

† From a least-squares fit to Eγ, unless otherwise stated.

‡ From 1983Dr05, based on the measured angular distributions, the apparent band structures with both cascade (ΔJ=1) and crossover (ΔJ=2) transitions, and the complex γ-ray decay patterns, unless otherwise stated.

\# Band(A): K^π=1/2−, ν1/2[521] ($p_{3/2}$) band. The assignment is supported by the observed in-band properties, such as large signature splitting and rotational alignment, and systematics of similar structures in neighboring nuclei.

@ Band(B): K^π=5/2−, ν5/2[512] ($h_{9/2}$) band. The assignment is supported by the observed in-band properties, such as alignment and g_K-g_R values ((g_K-g_R)/Q_0=−0.1137 28, weighted average from values deduced from the 9/2− to 19/2− levels), and systematics of similar structures in neighboring nuclei.

& Band(C): K^π=7/2+, ν7/2[633] Coriolis-mixed ($i_{13/2}$) band. The assignment is supported by the observed in-band properties, such as alignment and g_K-g_R values ((g_K-g_R)/Q_0=−0.022 4, weighted average from values deduced from the 11/2+ to 25/2+ levels), and systematics of similar structures in neighboring nuclei.

γ(^{177}Os)

Mixing ratios values are deduced from the branching ratios and the rotational model, and by assuming pure K. The sign of δ is determined from γ(θ).It is assumed that the sign of δ does not change within a given band.

Eγ[†]	Iγ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
(15.0 4)		90.60	5/2−	75.6	3/2−		Eγ: From level energy differences. Not observed directly, but required from the γγ coincidence relationship.
(18.3 6)		318.9	9/2+	300.6	7/2+		Eγ: From level energy differences. Not observed directly, but required from the γγ coincidence relationship.
56.8 3	20[@] 2	375.7	11/2+	318.9	9/2+	[M1+E2]	δ: =−0.55 12, assuming K=7/2.
57.8 3	26[@] 3	433.5	13/2+	375.7	11/2+	[M1+E2]	δ: =−0.17 1, assuming K=7/2.
60.2 3	38[&] 1	300.6	7/2+	240.4	7/2−	[E1]	
61.7[c] 3	≤4[@]	152.30	5/2−	90.60	5/2−	[M1]	
75.1 3	4.0 15	375.7	11/2+	300.6	7/2+	[E2]	
75.6 3	16.5 9	75.6	3/2−	0.0	1/2−	[M1+E2]	
83.5 3	4.9 4	678.7	17/2+	595.2	15/2+	(M1+E2)	Mult.: A_2=−0.34 16. δ: =−0.23 1, assuming K=7/2.
88.1 3	7[a] 2	240.4	7/2−	152.30	5/2−	(M1+E2)	Mult.: A_2=−0.31 7.
90.6 3	11.4[b] 6	90.60	5/2−	0.0	1/2−	[E2]	
100.6 3	≈3.4[b]	1047.3	21/2+	946.7	19/2+	[M1+E2]	δ: =−0.16 1, assuming K=7/2.
114.6 3	10.5[b] 6	433.5	13/2+	318.9	9/2+	[E2]	
114.9 3	≈6[b]	355.3	9/2−	240.4	7/2−	[M1+E2]	δ: =−0.20 2, assuming K=5/2.
124.3 3	4.0 17	1519.1	25/2+	1395.0	23/2+	[M1+E2]	δ: =−0.10 2, assuming K=7/2.
139.2 3	12 1	494.5	11/2−	355.3	9/2−	M1+E2	Mult.: A_2=−0.52 8, A_4=+0.03 9. δ: =−0.24 2, assuming K=5/2.

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^{164}Er(^{17}O,4nγ), ^{166}Er(^{16}O,5nγ) 1983Dr05 (continued)

γ(^{177}Os) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
148.3 3	133.8 8	300.6	7/2+	152.30	5/2−	(E1)	Mult.: A_2=+0.054 12, A_4=−0.004 15.
152.3[c] 3	3.0 5	152.30	5/2−	0.0	1/2−	[E2]	
161.4 3	11 2	655.9	13/2−	494.5	11/2−	M1+E2	Mult.: From A_2=−0.81 2, A_4=−0.02 3. δ: =−0.17 2, assuming K=5/2.
161.6 3	33 1	595.2	15/2+	433.5	13/2+	M1+E2	Mult.: From A_2=−0.81 2, A_4=−0.02 3. δ: =−0.76 2, assuming K=7/2.
181.1 3	13.1 5	837.0	15/2−	655.9	13/2−	M1+E2	Mult.: A_2=−0.37 10, A_4=−0.05 13. δ: =−0.19 1, assuming K=5/2.
183.6 3	10.4 9	259.2	7/2−	75.6	3/2−	[E2]	
194.5 3	43 1	285.1	9/2−	90.60	5/2−	E2	Mult.: A_2=+0.34 3, A_4=−0.08 4.
199.7 3	7 2	1036.7	17/2−	837.0	15/2−	[M1+E2]	δ: =−0.23 3, assuming K=5/2.
[x]203[c] 1	<1.3						E_γ: Placed in 1983Dr05 to depopulate the 9/2− level. The assignment is tentative.
203[c] 1	<1.3	355.3	9/2−	152.30	5/2−	[E2]	
215.8 3	5.5 6	1252.3	19/2−	1036.7	17/2−	(M1+E2)	Mult.: A_2=−0.5 3. δ: =−0.22 2, assuming K=5/2.
219.5 3	41.3 11	595.2	15/2+	375.7	11/2+	(E2)	Mult.: A_2=+0.32 5, A_4=−0.06 6.
231.3 3	4.2 5	1484.0	21/2−	1252.3	19/2−	(M1+E2)	Mult.: A_2=−0.5 2. δ: =−0.30 2, assuming K=5/2.
243.0 3	≈2	1727.4	23/2−	1484.0	21/2−	[M1+E2]	δ: =−0.52 7, assuming K=5/2.
245.2 3	59 3	678.7	17/2+	433.5	13/2+	E2	Mult.: A_2=+0.21 3, A_4=−0.05 4.
254.1 3	10 1	494.5	11/2−	240.4	7/2−	(E2)	Mult.: A_2=+0.31 16.
261 1	≈1	1987.7	25/2−	1727.4	23/2−	[M1+E2]	δ: =−0.45 5, assuming K=5/2.
268.2 3	14.2 7	946.7	19/2+	678.7	17/2+	M1+E2	Mult.: A_2=−1.0 2, A_4=+0.3 2. δ: =−1.58 21, assuming K=7/2.
274.8 3	12.3 6	534.0	11/2−	259.2	7/2−	(E2)	Mult.: A_2=+0.29 5.
282.4 3	52.3 7	567.5	13/2−	285.1	9/2−	E2	Mult.: A_2=+0.262 13, A_4=−0.035 15.
300.6 3	≈8[a]	655.9	13/2−	355.3	9/2−	[E2]	
342.5 3	18.6 9	837.0	15/2−	494.5	11/2−	(E2)	Mult.: A_2=+0.51 13.
347.7 3	14[b] 2	1395.0	23/2+	1047.3	21/2+	[M1+E2]	δ: =−0.77 8, assuming K=7/2.
351.5 3	28 3	885.5	15/2−	534.0	11/2−	(E2)	Mult.: From A_2=+0.2 1.
351.5 3	56 3	946.7	19/2+	595.2	15/2+	(E2)	Mult.: From A_2=+0.2 1.
357.4 3	66.5 7	924.9	17/2−	567.5	13/2−	E2	Mult.: A_2=+0.26 2, A_4=−0.04 3.
368.5 3	100	1047.3	21/2+	678.7	17/2+	E2	Mult.: A_2=+0.265 13, A_4=−0.09 2.
380.7 3	20.8 7	1036.7	17/2−	655.9	13/2−	E2	Mult.: A_2=0.27 3, A_4=0.00 4.
394.4 3	13.6 8	1913.2	27/2+	1519.1	25/2+	M1+E2	Mult.: A_2=−0.42 4, A_4=+0.25 5. δ: =−0.58 2, assuming K=7/2.
415.4 3	≈20	1252.3	19/2−	837.0	15/2−	(E2)	Mult.: A_2=(0.30 9).
416.7 3	7 2	2486.6	31/2+	2069.8	29/2+	[M1+E2]	δ: =−0.48 8, assuming K=7/2.
419.8 3	12.4[b] 15	1305.3	19/2−	885.5	15/2−	[E2]	
423.6 3	47.3 7	1348.5	21/2−	924.9	17/2−	E2	Mult.: A_2=+0.30 3, A_4=0.00 4.
439[c] 1	3	3477.6	37/2−	3038.7	(33/2−)	[E2]	
447.1 3	37.1 11	1484.0	21/2−	1036.7	17/2−	(E2)	Mult.: From A_2=+0.29 3, A_4=−0.04 3.
448.3 3	42.1 12	1395.0	23/2+	946.7	19/2+	(E2)	Mult.: From A_2=+0.29 3, A_4=−0.04 3.
471.8 3	94 2	1519.1	25/2+	1047.3	21/2+	E2	Mult.: A_2=+0.26 2, A_4=−0.02 2.
475.6 3	≈29[b]	1727.4	23/2−	1252.3	19/2−	[E2]	
482.7 3	54 2	1831.2	25/2−	1348.5	21/2−	(E2)	Mult.: From A_2=+0.24 3, A_4=−0.03 2.
483.0 3	18 2	1788.3	23/2−	1305.3	19/2−	(E2)	Mult.: From A_2=+0.24 3, A_4=−0.03 2.
503.7 3	26[b] 2	1987.7	25/2−	1484.0	21/2−	[E2]	
518.1 3	43.5 8	1913.2	27/2+	1395.0	23/2+	E2	Mult.: A_2=+0.29 2, A_4=−0.05 3.
527.8 3	20.3[b] 15	2255.2	27/2−	1727.4	23/2−	[E2]	
531.4 3	36.4 5	2362.6	29/2−	1831.2	25/2−	E2	Mult.: A_2=+0.27 2, A_4=−0.04 2.
539.0 3	15	2327.3	(27/2−)	1788.3	23/2−	(E2)	Mult.: A_2=(+0.3).
549.3 3	27.0 6	2911.9	33/2−	2362.6	29/2−	(E2)	Mult.: From A_2=+0.26 2, A_4=−0.03 3.

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^{164}Er(^{17}O,4nγ), ^{166}Er(^{16}O,5nγ) 1983Dr05 (continued)

γ(^{177}Os) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
550.6 3	58 1	2069.8	29/2+	1519.1	25/2+	(E2)	Mult.: From A_2=+0.26 2, A_4=−0.03 3.
553.0 3	25 2	2540.7	29/2−	1987.7	25/2−	(E2)	Mult.: A_2=+0.27 3.
565.7 3	25.4 8	3477.6	37/2−	2911.9	33/2−	(E2)	Mult.: A_2=+0.18 6.
571.6 3	≈16	2826.8	31/2−	2255.2	27/2−	[E2]	
573.4 3	29 2	2486.6	31/2+	1913.2	27/2+	E2	Mult.: A_2=+0.26 3, A_4=−0.04 3.
583[c] 1	17.0 5	2910.3	(31/2−)	2327.3	(27/2−)	(E2)	Mult.: A_2=+0.20 4.
595 1	≈25[b]	3135.7	(33/2−)	2540.7	29/2−	[E2]	
609.6 3	43 1	2679.4	33/2+	2069.8	29/2+	E2	Mult.: A_2=+0.28 2, A_4=−0.05 3.
621.6 3	12.5 5	3108.2	35/2+	2486.6	31/2+	(E2)	Mult.: A_2=+0.33 6.
625.2 3	18[b] 2	4102.8	41/2−	3477.6	37/2−	(E2)	Mult.: A_2=+0.30 3.
659.1 3	31.6 20	3338.5	37/2+	2679.4	33/2+	(E2)	Mult.: A_2=+0.21 5.
671.0 3	17[b] 3	3779.2	39/2+	3108.2	35/2+	(E2)	Mult.: A_2=(+0.28 3).
676.1 3	8[b] 2	3038.7	(33/2−)	2362.6	29/2−	[E2]	
685.0 3	13[b] 2	4787.8	(45/2−)	4102.8	41/2−	[E2]	
697 1	11.3[b] 7	2766.8		2069.8	29/2+		
706.0 3	19.7 8	4044.5	41/2+	3338.5	37/2+	[E2]	
708.7 3	8 2	4811.5		4102.8	41/2−		
722 1	≈13	4501.2	(43/2+)	3779.2	39/2+	[E2]	
761.5 3	6.6 4	4806.0	(45/2+)	4044.5	41/2+	[E2]	
[x]774.9 3	5 2						
806 1	3 1	5612.0	(49/2+)	4806.0	(45/2+)	[E2]	

† From 1983Dr05. ΔEγ were assigned by the evaluator. The authors stated that ΔEγ range from ±0.15 keV for strong, low-energy transitions to ± 0.3 keV for weak high-energy transitions.

‡ Relative intensities deduced from singles spectra in 1983Dr05, unless otherwise stated.

Based on the measured angular distribution information, the apparent band structures with both cascade (ΔJ=1) and crossover (ΔJ=2) transitions, and the band assignment, unless otherwise stated.

@ Obscured by X-rays in singles. Iγ is from coincidence spectra.

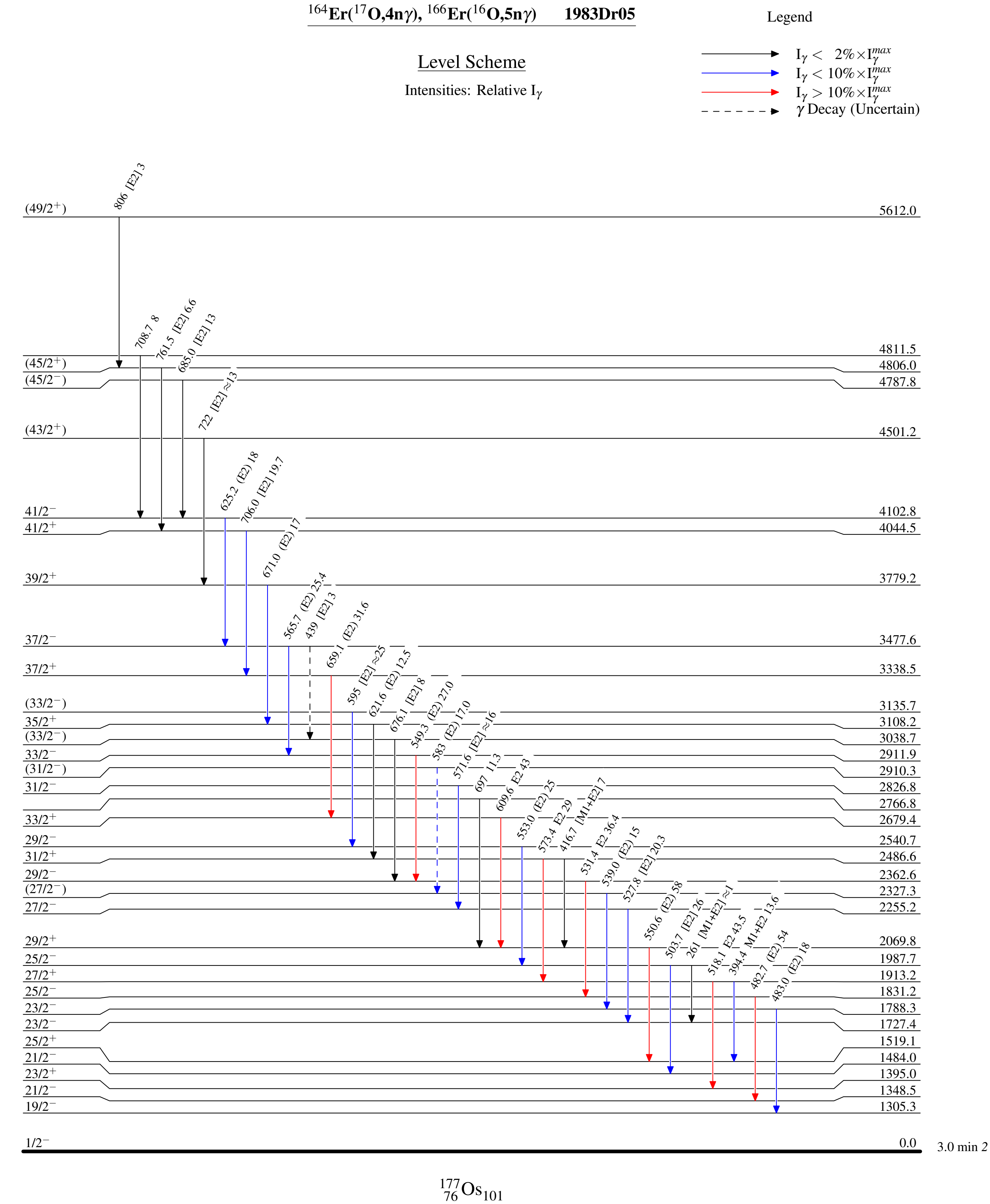
& Obscured in singles. Iγ deduced from delayed nγ coincidences.

a Contaminated by ^{168}Yb line in singles.

b Contaminated by impurities in singles. Iγ deduced from γγ coin or nγ coin data.

c Placement of transition in the level scheme is uncertain.

x γ ray not placed in level scheme.

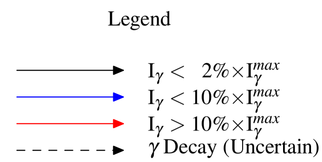


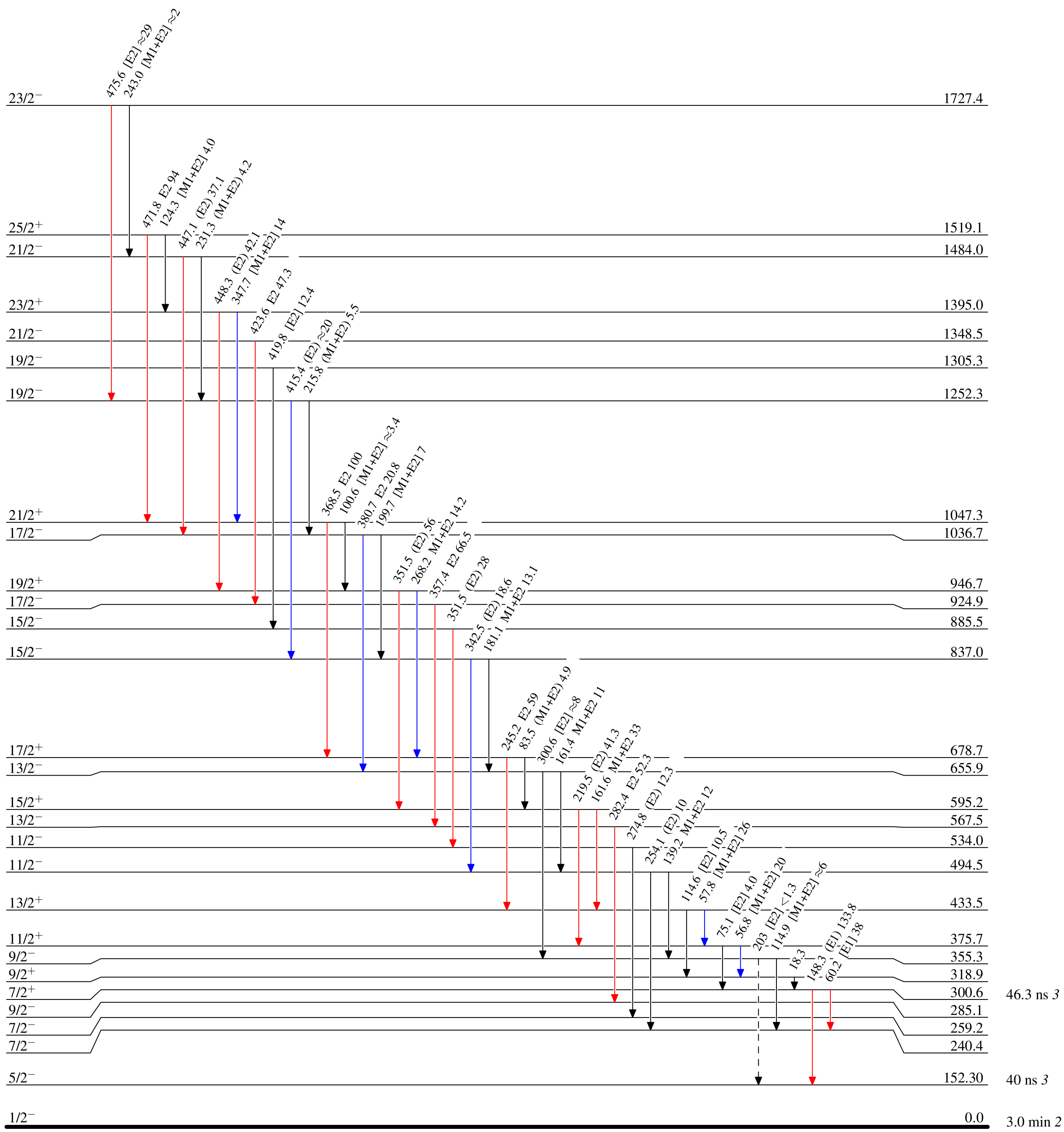
^{164}Er(^{17}O,4nγ), ^{166}Er(^{16}O,5nγ) 1983Dr05
Level Scheme
Intensities: Relative I_γ
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
(49/2+) 5612.0
4811.5
(45/2+) 4806.0
(45/2−) 4787.8
(43/2+) 4501.2
41/2− 4102.8
41/2+ 4044.5
39/2+ 3779.2
37/2− 3477.6
37/2+ 3338.5
(33/2−) 3135.7
35/2+ 3108.2
(33/2−) 3038.7
33/2− 2911.9
(31/2−) 2910.3
31/2− 2826.8
2766.8
33/2+ 2679.4
29/2− 2540.7
31/2+ 2486.6
29/2− 2362.6
(27/2−) 2327.3
27/2− 2255.2
29/2+ 2069.8
25/2− 1987.7
27/2+ 1913.2
25/2− 1831.2
23/2− 1788.3
23/2− 1727.4
25/2+ 1519.1
21/2− 1484.0
23/2+ 1395.0
21/2− 1348.5
19/2− 1305.3
1/2− 0.0 3.0 min 2
806 [E2] 3
708.7 8
761.5 [E2] 6.6
685.0 [E2] 13
722 [E2] ≈13
625.2 (E2) 18
706.0 [E2] 19.7
671.0 (E2) 17
565.7 (E2) 25.4
439 [E2] 3
659.1 (E2) 31.6
595 [E2] ≈25
621.6 (E2) 12.5
676.1 [E2] 8
549.3 (E2) 27.0
583 (E2) 17.0
571.6 [E2] ≈16
697 11.3
609.6 E2 43
553.0 (E2) 25
573.4 E2 29
416.7 [M1+E2] 7
531.4 E2 36.4
539.0 (E2) 15
527.8 [E2] 20.3
550.6 (E2) 58
503.7 [E2] 26
261 [M1+E2] ≈1
518.1 E2 43.5
394.4 M1+E2 13.6
482.7 (E2) 54
483.0 (E2) 18
$^{177}_{76}Os_{101}$

$^{164}Er(^{17}O,4n\gamma)$, $^{166}Er(^{16}O,5n\gamma)$ 1983Dr05

Level Scheme (continued)

Intensities: Relative I_γ



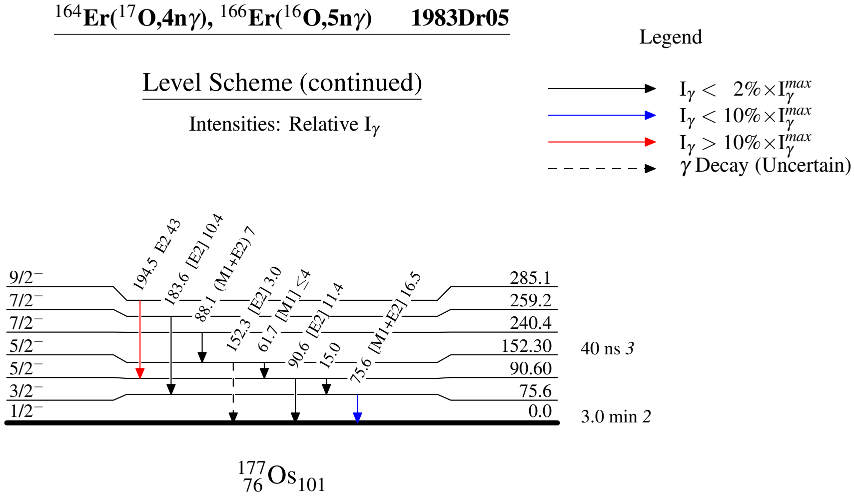


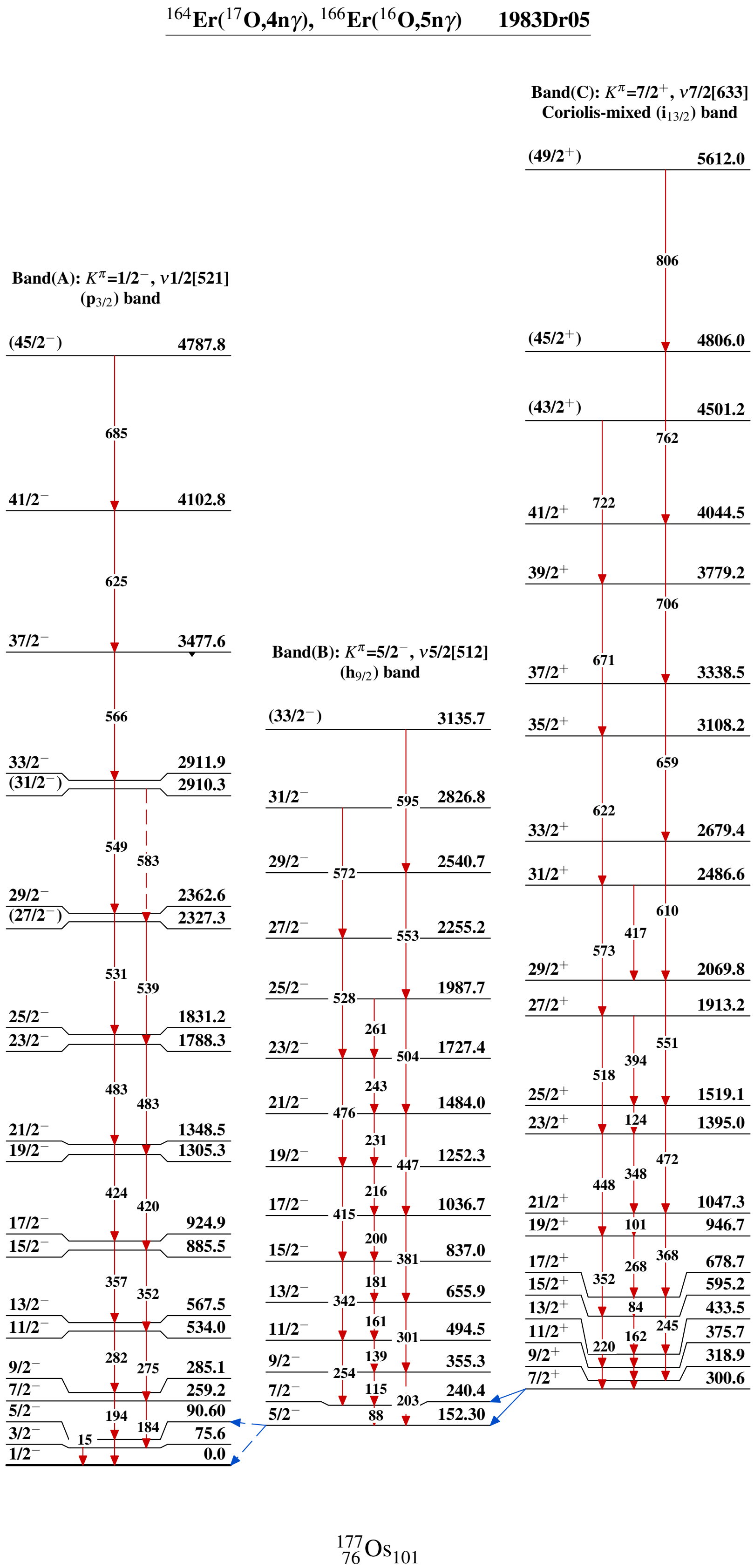
$^{177}_{76}Os_{101}$

$^{164}Er(^{17}O,4n\gamma)$, $^{166}Er(^{16}O,5n\gamma)$ 1983Dr05

Level Scheme (continued)

Intensities: Relative I_γ




$^{164}Er(^{17}O,4n\gamma)$, $^{166}Er(^{16}O,5n\gamma)$ 1983Dr05
Band(A): $K^{\pi}=1/2^-$, ν1/2[521] ($p_{3/2}$) band
Band(B): $K^{\pi}=5/2^-$, ν5/2[512] ($h_{9/2}$) band
Band(C): $K^{\pi}=7/2^+$, ν7/2[633] Coriolis-mixed ($i_{13/2}$) band
(45/2⁻) 4787.8
41/2⁻ 4102.8
37/2⁻ 3477.6
33/2⁻ 2911.9
(31/2⁻) 2910.3
29/2⁻ 2362.6
(27/2⁻) 2327.3
25/2⁻ 1831.2
23/2⁻ 1788.3
21/2⁻ 1348.5
19/2⁻ 1305.3
17/2⁻ 924.9
15/2⁻ 885.5
13/2⁻ 567.5
11/2⁻ 534.0
9/2⁻ 285.1
7/2⁻ 259.2
5/2⁻ 90.60
3/2⁻ 75.6
1/2⁻ 0.0
685 625 566 549 583 531 539 483 483 424 420 357 352 282 275 194 184 15
(33/2⁻) 3135.7
31/2⁻ 2826.8
29/2⁻ 2540.7
27/2⁻ 2255.2
25/2⁻ 1987.7
23/2⁻ 1727.4
21/2⁻ 1484.0
19/2⁻ 1252.3
17/2⁻ 1036.7
15/2⁻ 837.0
13/2⁻ 655.9
11/2⁻ 494.5
9/2⁻ 355.3
7/2⁻ 240.4
5/2⁻ 152.30
595 572 553 528 261 504 243 476 231 447 216 415 200 381 181 342 161 301 139 254 115 203 88
(49/2⁺) 5612.0
(45/2⁺) 4806.0
(43/2⁺) 4501.2
41/2⁺ 4044.5
39/2⁺ 3779.2
37/2⁺ 3338.5
35/2⁺ 3108.2
33/2⁺ 2679.4
31/2⁺ 2486.6
29/2⁺ 2069.8
27/2⁺ 1913.2
25/2⁺ 1519.1
23/2⁺ 1395.0
21/2⁺ 1047.3
19/2⁺ 946.7
17/2⁺ 678.7
15/2⁺ 595.2
13/2⁺ 433.5
11/2⁺ 375.7
9/2⁺ 318.9
7/2⁺ 300.6
806 762 722 706 671 659 622 610 417 573 551 394 518 124 472 348 448 101 368 268 352 84 245 162 220
$^{177}_{76}Os_{101}$