^{189}Os(α,2nγ),^{191}Ir(d,2nγ) 1977Ke18

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia	NDS 195,368 (2024)	1-Dec-2023

Includes ^{191}Ir(p,nγ).

Target: 76% enriched ^{189}Os. Projectile: α, E=23,25,27 MeV. Target: 89% enriched ^{191}Ir. Projectiles: p, E=10 MeV; d, E=13 MeV. Measured γ-rays, $\gamma\gamma$-coin, α,γ(t), α,γ(θ) at six angles between 90° and 160°, γ-ray excitation functions; detector: Ge(Li). Measured conversion electrons; detector: Si(Li).

^{191}Pt Levels

The level scheme has been constructed based on $\gamma\gamma$-coin measurements. Spin assignments are primarily from α,γ(θ), γ-ray multipolarities, and γ-ray excitation functions. Level energies and γ-ray branching ratios of even-parity states are interpreted in terms of one quasiparticle coupled to a rigid triaxial rotor or to an anharmonic vibrator. See Adopted Levels for evaluator's spin assignments.

E(level)†	J$^\pi$#	Comments
0.0	3/2$^-$	
9.554‡ *16*	(5/2,7/2)$^-$	Additional information 1.
100.55 *10*	(9/2)$^-$	
148.92@ *10*	(13/2)$^+$	
173.31 *10*	(11/2)$^+$	
306.26 *21*	(9/2)$^+$	
453.74 *21*	(7/2,9/2)$^+$	
470.97@ *13*	(17/2)$^+$	
529.19 *12*	(15/2)$^+$	
599.23 *14*	(15/2)$^+$	
659.8 *4*	(5/2$^+$)	
919.08 *18*	(17/2$^+$)	
950.98@ *16*	(21/2)$^+$	
989.36 *14*	(19/2)$^+$	
996.3 *4*	(13/2$^+$,15/2,17/2$^+$)	
1158.46 *15*	(19/2)$^+$	
1302.66 *19*	(17/2,19/2)$^+$	
1309.57 *21*	(15/2$^+$,17/2,19/2$^+$)	
1381.35 *16*	(21/2)$^-$	
1471.4 *3*		J$^\pi$: 1977Ke18 suggests (23/2$^+$).
1545.5 *3*	(25/2)$^-$	
1550.0@ *11*	(25/2)$^+$	
1590.4 *4*	(19/2,21/2,23/2)	J$^\pi$: 1977Ke18 suggests (23/2)$^-$.
1861.5 *11*	(27/2)$^-$	likely the same level observed at 1862.8 keV in other experiments.

† From least-squares fit to Eγ, holding the first excited level energy fixed.

‡ From Adopted Levels.

Spin assignments are primarily from α,γ(θ), γ-ray multipolarities, and γ-ray excitation functions (1977Ke18).

@ Favored decoupled band.

γ(^{191}Pt)

Includes ^{191}Ir(p,nγ).
γ rays observed in the ^{191}Ir(p,nγ) and ^{191}Ir(d,2nγ) reactions are also given here.
Angular distribution coefficients A_2 and A_4 measured in the (α,2nγ) E=27 MeV reaction.

E_γ[†]	I_γ[b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[c]	α[d]	Comments
(9.6)		9.554	(5/2,7/2)$^-$	0.0	3/2$^-$			From level energy difference.
(24.39 *1*)		173.31	(11/2)$^+$	148.92	(13/2)$^+$			E_γ: from adopted gammas.
(48.37 *1*)		148.92	(13/2)$^+$	100.55	(9/2)$^-$			E_γ: from adopted gammas.
91.0[‡#] *1*	35 *4*	100.55	(9/2)$^-$	9.554	(5/2,7/2)$^-$			A_2=0.00 *5*; A_4=0.00 *7*
132.9[‡#a] *3*	≈4.5[a]	306.26	(9/2)$^+$	173.31	(11/2)$^+$			
144.2[‡] *3*	1.5 *5*	1302.66	(17/2,19/2)$^+$	1158.46	(19/2)$^+$			
147.3[‡#] *3*	1.9 *6*	453.74	(7/2,9/2)$^+$	306.26	(9/2)$^+$	D(+Q)		A_2=−0.3 *2*
151.1[‡a] *3*	1.1[a] *3*	1309.57	(15/2$^+$,17/2,19/2$^+$)	1158.46	(19/2)$^+$			
157.2[‡#] *3*	2.5 *8*	306.26	(9/2)$^+$	148.92	(13/2)$^+$			
164.2 *2*	14 *3*	1545.5	(25/2)$^-$	1381.35	(21/2)$^-$	Q		A_2=+0.25 *8*; A_4=−0.2 *1* $I_e$exp=6.7 (1977Ke18) for 164.2 L + 168.7 L + 222.9 K shells.
168.7 *2*	6.20 *12*	1471.4		1302.66	(17/2,19/2)$^+$	(Q)		A_2=+0.3 *1* $I_e$exp=6.7 (1977Ke18) for 164.2 L + 168.7 L + 222.9 K shells.
206.1[‡#] *3*	1.8 *5*	659.8	(5/2$^+$)	453.74	(7/2,9/2)$^+$	D(+Q)		A_2=−0.5 *2*
207.6 *3*	1.1 *3*	1158.46	(19/2)$^+$	950.98	(21/2)$^+$			
209.1 *3*	3.50 *10*	1590.4	(19/2,21/2,23/2)	1381.35	(21/2)$^-$			
222.9[‡] *1*	19.0 *19*	1381.35	(21/2)$^-$	1158.46	(19/2)$^+$	D(+Q)		A_2=−0.21 *4*; A_4=−0.05 *6* Mult.: Main component not M1 (1977Ke18). $I_e$exp=6.7 for 164.2 L + 168.7 L + 222.9 K shells.
^{x}271.6[&f]	19							A_2=+0.43 *5*; A_4=0.00 *6*
280.5[‡#] *2*	5.7 *11*	453.74	(7/2,9/2)$^+$	173.31	(11/2)$^+$			A_2=+0.2 *3*
^{x}310.5[&f]	17							A_2=−0.30 *7*; A_4=+0.1 *1* $I_e$exp=4.8 (1977Ke18) for 310.5 L + 380.3 K shells.
316[a@] *1*	≈15[a]	1861.5	(27/2)$^-$	1545.5	(25/2)$^-$			
319.9[‡] *3*	5.0 *15*	919.08	(17/2$^+$)	599.23	(15/2)$^+$	D(+Q)		A_2=−0.25 *8*; A_4=+0.0 *1* $I_e$exp=6.5 (1977Ke18) for 319.9 K + 322.0 K shells.
322.0[‡#] *1*	100 *10*	470.97	(17/2)$^+$	148.92	(13/2)$^+$	E2	0.0800	α(K)=0.0513 *8*; α(L)=0.0217 *3*; α(M)=0.00543 *8*; α(N+..)=0.001553 *22* α(N)=0.001330 *19*; α(O)=0.000218 *3*; α(P)=5.21×10^{-6} *8* A_2=+0.25 *2*; A_4=−0.12 *2* $I_e$exp=6.5 (1977Ke18) for 319.9 K + 322.0 K shells.

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γ(^{191}Pt) (continued)

E_γ[†]	I_γ[b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[c]	α[d]	Comments
351.7 3	4.0 12	1302.66	(17/2,19/2)$^+$	950.98	(21/2)$^+$			
353.7[‡#]	4	659.8	(5/2$^+$)	306.26	(9/2)$^+$			
355.9[‡#] 1	28 3	529.19	(15/2)$^+$	173.31	(11/2)$^+$	E2	0.0602	α(K)=0.0402 6; α(L)=0.01516 22; α(M)=0.00376 6; α(N+..)=0.001079 16 α(N)=0.000923 13; α(O)=0.0001521 22; α(P)=4.13×10^{-6} 6 A_2=+0.26 4; A_4=−0.08 4 α(K)exp=0.057 16 α(K)exp from I_e=1.6 (1977Ke18) and assuming 25% uncertainty.
380.3[‡#] 1	20 2	529.19	(15/2)$^+$	148.92	(13/2)$^+$	M1	0.1610	α(K)=0.1330 19; α(L)=0.0216 3; α(M)=0.00498 7; α(N+..)=0.001468 21 α(N)=0.001231 18; α(O)=0.000222 4; α(P)=1.503×10^{-5} 21 A_2=−0.74 3; A_4=+0.15 5 $I_e$exp=4.8 (1977Ke18) for 310.5 L + 380.3 K shells. I_γ: contains an unplaced component, with Iγ=6, whose assignment to ^{191}Pt is uncertain.
383.7 3	1.6 5	1302.66	(17/2,19/2)$^+$	919.08	(17/2$^+$)			
[x]385.7[&f]	1.5							
390.1[e‡#] 2	6.0[e] 12	919.08	(17/2$^+$)	529.19	(15/2)$^+$			$I_e$exp=2.4 (1977Ke18) for 450.3 K + 380.3 L + 390.1 L + 392.0 L shells.
390.1[e‡#] 3	3.0[e] 9	989.36	(19/2)$^+$	599.23	(15/2)$^+$			$I_e$exp=2.4 (1977Ke18) for 450.3 K + 380.3 L + 390.1 L + 392.0 L shells.
392.0 2	9.0 18	1381.35	(21/2)$^-$	989.36	(19/2)$^+$	D(+Q)		A_2=−0.22 7; A_4=−0.1 1 $I_e$exp=2.4 (1977Ke18) for 450.3 K + 380.3 L + 390.1 L + 392.0 L shells.
[x]400.0[&f]	4							A_2=+0.3 1
426[a] 3	≈2[a]	599.23	(15/2)$^+$	173.31	(11/2)$^+$			
430.3 2	13 3	1381.35	(21/2)$^-$	950.98	(21/2)$^+$	D		A_2=+0.23 7; A_4=−0.1 1 Mult.: Main component not M1 (1977Ke18). $I_e$exp=0.4 for 430.3 K + 432 K (not assigned). α(K)(theory) for E2 or E1 using Iγ gives I_e=0.3 or 0.12, respectively, favours E2. However, γ(θ) data is consistent with a ΔJ=0 transition.
447.7[a] 3	≈4[a]	919.08	(17/2$^+$)	470.97	(17/2)$^+$			
450.3[‡#] 1	23.0 23	599.23	(15/2)$^+$	148.92	(13/2)$^+$	M1	0.1027	α(K)=0.0849 12; α(L)=0.01371 20; α(M)=0.00316 5; α(N+..)=0.000932 13 α(N)=0.000782 11; α(O)=0.0001408 20; α(P)=9.56×10^{-6} 14 A_2=−0.97 9; A_4=+0.2 1 Mult.: From 1977Ke18. $I_e$exp=2.4 for 450.3 K + 380.3 L + 390.1 L + 392.0 L shells.
[x]451.7[&f]	6							
460.2[‡] 1	17.0 17	989.36	(19/2)$^+$	529.19	(15/2)$^+$	E2	0.0304	α(K)=0.0220 3; α(L)=0.00640 9; α(M)=0.001562 22; α(N+..)=0.000451

γ(^{191}Pt) (continued)

E_γ[†]	I_γ[b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[c]	α[d]	Comments
								7 α(N)=0.000384 6; α(O)=6.45×10^{-5} 9; α(P)=2.31×10^{-6} 4 A_2=+0.30 5; A_4=−0.04 6 α(K)exp=0.029 8 α(K)exp from I_e=0.5 (1977Ke18) and assuming 25% uncertainty.
480.0[‡] 1	34 3	950.98	(21/2)$^+$	470.97	(17/2)$^+$	E2	0.0274	α(K)=0.0200 3; α(L)=0.00560 8; α(M)=0.001365 20; α(N+..)=0.000394 6 α(N)=0.000335 5; α(O)=5.65×10^{-5} 8; α(P)=2.10×10^{-6} 3 A_2=+0.27 4; A_4=−0.16 6 α(K)exp=0.015 4 α(K)exp from I_e=0.5 (1977Ke18) and assuming 25% uncertainty.
518.3 2	8.0 16	989.36	(19/2)$^+$	470.97	(17/2)$^+$			
525.3[‡a] 3	5.0[a] 15	996.3	(13/2$^+$,15/2,17/2$^+$)	470.97	(17/2)$^+$	(Q)		A_2=+0.30 15
[x]543.3[&f]	6							A_2=+0.30 15
559.2[‡] 2	10.0 20	1158.46	(19/2)$^+$	599.23	(15/2)$^+$	(Q)		A_2=+0.4 2
599[a@] 1	≈10.0[a]	1550.0	(25/2)$^+$	950.98	(21/2)$^+$			
687.5 1	19.0 19	1158.46	(19/2)$^+$	470.97	(17/2)$^+$	D(+Q)		A_2=−0.78 6; A_4=−0.03 6
704[@] 1	≈1	1302.66	(17/2,19/2)$^+$	599.23	(15/2)$^+$			
710[@] 1	≈2	1309.57	(15/2$^+$,17/2,19/2$^+$)	599.23	(15/2)$^+$			
780.1 3	3.5 11	1309.57	(15/2$^+$,17/2,19/2$^+$)	529.19	(15/2)$^+$			Authors placed this γ-ray deexciting the 1302.79-keV level; probably a misquote.
831.6 2	9 18	1302.66	(17/2,19/2)$^+$	470.97	(17/2)$^+$	D(+Q)		A_2=−0.6 2
838.9[a] 3	4.0[a] 12	1309.57	(15/2$^+$,17/2,19/2$^+$)	470.97	(17/2)$^+$			
847[a] 2	6.0[a] 12	996.3	(13/2$^+$,15/2,17/2$^+$)	148.92	(13/2)$^+$			

[†] Authors state that uncertainties are 0.1 − 0.3 keV; evaluator assigned 0.1 keV when Iγ>15, 0.2 keV when 5<Iγ≤15, 0.3 keV when Iγ<5 and to lines affected or obscured by γ-rays not listed in this table, and 1 keV to lines seen only in coincidence.

[‡] Observed also in (d,2nγ).

[#] Observed also in (p,nγ).

[@] Evidence from the coincidence measurement.

[&] Assignment to ^{191}Pt is uncertain.

[a] Affected or obscured by γ rays not listed in this table.

[b] Relative photon intensity measured in the (α,2nγ) E=27 MeV reaction at θ=125°. Authors state that uncertainties are 10-30; evaluator assigned relative uncertainties of 10% for Iγ>15, 20 for 5<Iγ≤15, and 30 for Iγ<5. Values are also given by the authors for E(α)=25 and 23 MeV, and for (d,2nγ) and (p,nγ).

[c] E2, M1 are the main multipole component derived from Ice measurements, where ce and γ intensities were normalized using g.s. rotational band transitions in ^{190}Pt and ^{192}Pt. Mult=Q assignments are based in A_2>0, A_4<0 and correspond to stretched quadrupole; Mult=D or D+Q assignments are based on A_2<0 and correspond to ΔJ=1 or 0.

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γ(^{191}Pt) (continued)

[d] 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.
[e] Multiply placed with intensity suitably divided.
[f] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{191}_{78}$Pt$_{113}$-5

^{189}Os(α,2nγ),^{191}Ir(d,2nγ) 1977Ke18

Level Scheme

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

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)
- ● Coincidence