^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, Huo Junde	NDS 87, 15 (1999)	1-Nov-1998

Data from ^{174}Yb(α,4nγ) (1983Wa21,1972Fe08) and (^{3}He,3nγ) (1979Ki05) have been included. See also 1972Fe08 for ^{173}Yb(α,3nγ).

1983Wa21: target: ^{172}Yb, E(α)=26-28 MeV, measured Ice, detectors: Si(Li). Target: ^{174}Yb, E(α)=48-50 MeV, measured γ rays, $\gamma(\theta)$, $\gamma\gamma$(t), detectors: Ge, Ge(Li), scin. Target: ^{160}Gd, E(^{18}O)=80-85 MeV, measured γ rays, $\gamma\gamma$(t), detectors:Ge(Li).

1971Ej01: target: enriched ^{172}Yb, E(α)=20.5 MeV, measured γ rays, Ice, $\gamma(\theta)$, θ=0° to 90°, detectors:Ge(Li), magnetic spectrometer.

1979Ki05: target:>95% enriched ^{172}Yb, E(α)=22 MeV, measured γ ray Iγ at θ=50°, Ice at θ=125°, Ag(t), (α)(ce)(t), detectors:Ge(Li), Si(Li). Target:>95% enriched ^{174}Yb, E(^{3}He)=25 MeV. Measured γ ray Iγ at θ=50°, Ice at θ=125°, ^{3}He γ(t), ^{3}He Ce(t), detectors:Ge(Li), Si(Li).

Others: 1981Ej01, 1980Sa19, 1973Re16, 1969Ka03, 1966Mo01.

^{174}Hf Levels

E(level)	J$^\pi$[†]	T$_{1/2}$	Comments
0.0[‡]	0$^+$		
91.0[‡]	2$^+$		
297.5[‡]	4$^+$		
608.2[‡]	6$^+$		
827.4[#]	0$^+$		
900.4[#]	2$^+$		
1009.6[‡]	8$^+$		
1062.5[#]	4$^+$		
1303.6[&]	(3$^+$)		
1307.4[#]	6$^+$		
1394.8[&]	(4$^+$)		
1425.5[@]	(4$^-$)		
1485.9[‡]	10$^+$		
1508.2[&]	(5$^+$)		
1549.3[a]	6$^+$	138 ns *4*	T$_{1/2}$: measured in a perturbed Ag(θ,H,t) angular correlation experiment (1980Wa23). Other value: 133 ns (1983Wa21,1976KhZR). T$_{1/2}$: 2.1 μs (1969EjZZ) and>200 ns (1971Ej01) probably correspond to the 1797.5-keV level. g-factor=0.892 *8* (1980Wa23).
1630.5[#]	8$^+$		
1634.4[@]	6$^-$		
1650.6[@]	7$^-$		
1713.5[b]	6$^-$		
1737.4[a]	7$^+$		
1797.5[c]	8$^-$	2.39 μs *4*	T$_{1/2}$: from 1974KhZW.
1798.0[&]	(7$^+$)		
1827.4[b]	7$^-$		
1928.4[@]	8$^-$		
1943.9[@]	9$^-$		
1948.1[a]	8$^+$		
1963.4[b]	8$^-$		
2020.5[‡]	12$^+$		

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^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)

^{174}Hf Levels (continued)

E(level)	J^{π}[†]	$T_{1/2}$	Comments
2026.3[#]	10^+		
2028.0[c]	9^-		
2119.0[b]	9^-		
2167.1[&]	(9^+)		
2180.0[a]	9^+		
2279.2[c]	10^-		
2295.7[b]	10^-		
2299.4[@]	10^-		
2319.2[@]	11^-		
2431.2[a]	10^+		
2488.0[b]	11^-		
2488.9[#]	12^+		
2554.6[c]	11^-		
2597.5[‡]	14^+		
2609.5[&]	(11^+)		
2700.3[a]	11^+		
2700.8[b]	12^-		
2744.2[@]	12^-		
2772.0[@]	13^-		
2847.4[c]	(12^-)		
2932.7[b]	13^-		
2959.1	(11^-)		
2983.3[a]	12^+		
2992.5[#]	14^+		
3117.4[&]	(13^+)		
3157.9?[c]	(13^-)		
3180.7[b]	14^-		
3208.9[‡]	16^+		
3260.2[@]	14^-		
3269.0[a]	13^+		
3296.3[@]	15^-		
3311.7[d]	14^+	3.7 μs *2*	$T_{1/2}$: from 1974KhZW.
3449.7[b]	15^-		
3500.4[#]	(16^+)		
3545.5[d]	15^+		
3680.5[&]	(15^+)		
3795.6[d]	16^+		
3857.3[‡]	18^+		
3885.9[@]	(17^-)		
4065.7[d]	(17^+)		
4331?[e]	(17^+)	$\approx$1 μs	$T_{1/2}$: from pulsed-beam measurement (1983Wa21).
4358.1[d]	(18^+)		
4550.8[‡]	20^+		
4676?[d]	(19^+)		

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^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)

^{174}Hf Levels (continued)

† Spin, band, and quasiparticle configuration assignments are based on rotational structure and on γ ray multipolarities determined from experimental conversion coefficients and $\gamma(\theta)$.
‡ Band(A): $K^\pi=0^+$ g.s.-rotational band.
# Band(B): $K^\pi=0^+$ β-vibrational band.
@ Band(C): $K^\pi=(1^-)$ octupole-vibrational band.
& Band(D): $K^\pi=(3^+)$ band. Probable Configuration=(ν 1/2[521])+(ν 5/2[512]).
a Band(E): $K^\pi=6^+$ band. Probable Configuration=(π 7/2[404])+(π 5/2[402]).
b Band(F): $K^\pi=6^-$ band. probable Configuration=(ν 7/2[633])+(ν 5/2[512]).
c Band(G): $K^\pi=8^-$ band. Probable Configuration=(π 9/2[514])+(π 7/2[404]).
d Band(H): $K^\pi=14^+$ band.
e Band(I): $K^\pi=(17^+)$ band.

$\gamma(^{174}Hf)$

Unplaced γ rays are from 1971Ej01.

E_γ ‡	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
43[a]		3311.7	14^+	3269.0	13^+		
60.1		1797.5	8^-	1737.4	7^+		
90.6		91.0	2^+	0.0	0^+		E_γ: from 1969Ka03.
113.9		1827.4	7^-	1713.5	6^-		
131.2[a]		3311.7	14^+	3180.7	14^-		E_γ: assignment to ^{174}Hf is uncertain.
136.1		1963.4	8^-	1827.4	7^-		
x138 *1*	44 *15*						
155.6		2119.0	9^-	1963.4	8^-		
163[@] *1*	25[#] *8*	1062.5	4^+	900.4	2^+		
164.3		1713.5	6^-	1549.3	6^+		
176.7		2295.7	10^-	2119.0	9^-		
188.1	50[#] *10*	1737.4	7^+	1549.3	6^+		
192.3	63[#] *6*	2488.0	11^-	2295.7	10^-		
206.5	2050 *62*	297.5	4^+	91.0	2^+	E2	Mult.: from α(exp)=0.26 (1979Ki05).
210.7		1948.1	8^+	1737.4	7^+		
212.8		2700.8	12^-	2488.0	11^-		
230.5	<119[#]	2028.0	9^-	1797.5	8^-		I_γ: Iγ(230.5γ+231.9γ)=119 *8*.
231.9	<119[#]	2180.0	9^+	1948.1	8^+		
232.5		2932.7	13^-	2700.3	11^+		
233.8		3545.5	15^+	3311.7	14^+		
245[@] *1*	10 *3*	1307.4	6^+	1062.5	4^+		
247.3		3180.7	14^-	2932.7	13^-		
248.2	20[#] *6*	1797.5	8^-	1549.3	6^+		
250.1		3795.6	16^+	3545.5	15^+		
251.0		2431.2	10^+	2180.0	9^+		
251.4		2279.2	10^-	2028.0	9^-		
267[a]		4331?	(17^+)	4065.7	(17^+)		
267.7		3449.7	15^-	3180.7	14^-		
269.1		2700.3	11^+	2431.2	10^+		
269.5		4065.7	(17^+)	3795.6	16^+		
275.4		2554.6	11^-	2279.2	10^-		
282.9		2983.3	12^+	2700.3	11^+		
285.7		3269.0	13^+	2983.3	12^+		

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^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)

γ(^{174}Hf) (continued)

E_γ[‡]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
289.8	25 *8*	1798.0	(7$^+$)	1508.2	(5$^+$)		
292.4[&]	90[&] *30*	2119.0	9$^-$	1827.4	7$^-$		
292.4[&]	90[&] *30*	2847.4	(12$^-$)	2554.6	11$^-$		
293.0		4358.1	(18$^+$)	4065.7	(17$^+$)		
293.9		1928.4	8$^-$	1634.4	6$^-$		
298[@] *1*	5 *3*	1307.4	6$^+$	1009.6	8$^+$		
310.5[a]		3157.9?	(13$^-$)	2847.4	(12$^-$)		
310.7	1000 *30*	608.2	6$^+$	297.5	4$^+$	E2	Mult.: A_2=+0.28 *17* from $\gamma(\theta)$ is consistent with stretched E2 (1973Re16).
318[a]		4676?	(19$^+$)	4358.1	(18$^+$)		
323.1		1630.5	8$^+$	1307.4	6$^+$		
328.3		3311.7	14$^+$	2983.3	12$^+$		
332.2		2295.7	10$^-$	1963.4	8$^-$		
[x]358 *1*	49 *7*						
369.1		2167.1	(9$^+$)	1798.0	(7$^+$)		
369.1		2488.0	11$^-$	2119.0	9$^-$		
371.0		2299.4	10$^-$	1928.4	8$^-$		
375.2		2319.2	11$^-$	1943.9	9$^-$		
394.8		2992.5	14$^+$	2597.5	14$^+$		
395.9		2026.3	10$^+$	1630.5	8$^+$		
399.4	30 *12*	1948.1	8$^+$	1549.3	6$^+$		
401.4	290 *15*	1009.6	8$^+$	608.2	6$^+$	E2	Mult.: A_2=+0.32 *3* from $\gamma(\theta)$ is consistent with stretched E2 (1973Re16).
404.7		2700.8	12$^-$	2295.7	10$^-$		
404.7		2959.1	(11$^-$)	2554.6	11$^-$		
442.4[&]	<20[&]	2180.0	9$^+$	1737.4	7$^+$		I_γ: doublet, Iγ=20 *10*.
442.4[&]	<20[&]	2609.5	(11$^+$)	2167.1	(9$^+$)		I_γ: doublet, Iγ=20 *10*.
444.8		2744.2	12$^-$	2299.4	10$^-$		
445.0		2932.7	13$^-$	2488.0	11$^-$		
452.9		2772.0	13$^-$	2319.2	11$^-$		
454[@] *1*	14 *4*	1062.5	4$^+$	608.2	6$^+$		
462.6		2488.9	12$^+$	2026.3	10$^+$		
468.4		2488.9	12$^+$	2020.5	12$^+$		
476.4	48 *5*	1485.9	10$^+$	1009.6	8$^+$		
479.7		3180.7	14$^-$	2700.8	12$^-$		
481[a]		2279.2	10$^-$	1797.5	8$^-$		
483.4		2431.2	10$^+$	1948.1	8$^+$		
483.4[a]		3795.6	16$^+$	3311.7	14$^+$		
503.6		2992.5	14$^+$	2488.9	12$^+$		
507.9		3117.4	(13$^+$)	2609.5	(11$^+$)		
507.9		3500.4	(16$^+$)	2992.5	14$^+$		
514.4		3449.7	15$^-$	2932.7	13$^-$		
516.0		3260.2	14$^-$	2744.2	12$^-$		
519.7[a]		4065.7	(17$^+$)	3545.5	15$^+$		
520.2		2700.3	11$^+$	2180.0	9$^+$		
524.3		3296.3	15$^-$	2772.0	13$^-$		
527[a]		2554.6	11$^-$	2028.0	9$^-$		
534.6		2020.5	12$^+$	1485.9	10$^+$	(E2)	Mult.: A_2=+0.14 *10* from $\gamma(\theta)$ is consistent with stretched E2 (1973Re16).
535.5[a]		4331?	(17$^+$)	3795.6	16$^+$		
540.3	28 *6*	2026.3	10$^+$	1485.9	10$^+$		
552.1		2983.3	12$^+$	2431.2	10$^+$		
563.1		3680.5	(15$^+$)	3117.4	(13$^+$)		
568.4		3269.0	13$^+$	2700.3	11$^+$		

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^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)

γ(^{174}Hf) (continued)

E_γ ‡	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ	$I_{(\gamma+ce)}$	Comments
569[a]	38 *13*	2847.4	(12$^-$)	2279.2	10$^-$				
577.0		2597.5	14$^+$	2020.5	12$^+$				
589.6		3885.9	(17$^-$)	3296.3	15$^-$				
602.8	36 *5*	900.4	2$^+$	297.5	4$^+$				
611.4		3208.9	16$^+$	2597.5	14$^+$				
620.9	29 *10*	1630.5	8$^+$	1009.6	8$^+$				
648.3		3857.3	18$^+$	3208.9	16$^+$				
[x]669 *1*	22 *4*								
679.6		2959.1	(11$^-$)	2279.2	10$^-$				
693.5		4550.8	20$^+$	3857.3	18$^+$				
698.4		3296.3	15$^-$	2597.5	14$^+$				
699.1	47 *9*	1307.4	6$^+$	608.2	6$^+$	D+Q	−0.92 *18*		δ: from $\gamma(\theta)$ if D+Q and ΔJ=0 (1971Ej01). α(K)exp=0.09 *2*, deduced by evaluator from data of 1971Ej01, suggests M1(+E2)+E0.
[x]724 *1*	24 *4*								
736.4	30 *4*	827.4	0$^+$	91.0	2$^+$				
751.5		2772.0	13$^-$	2020.5	12$^+$				
764.8	63.0 *44*	1062.5	4$^+$	297.5	4$^+$	E0+M1+E2	−2.9 *10*		δ: from $\gamma(\theta)$ if D+Q and ΔJ=0 (1971Ej01). α(K)exp=0.09 *1*, deduced by evaluator from data of 1971Ej01, suggests M1(+E2)+E0.
786.6[a]		4331?	(17$^+$)	3545.5	15$^+$				
[x]804 *1*	20 *6*								
809	46 *3*	900.4	2$^+$	91.0	2$^+$	E0+M1+E2	−2 *+2−2*		δ: from $\gamma(\theta)$ if D+Q and ΔJ=0 (1971Ej01). α(K)exp=0.10 *1*, deduced by evaluator from data of 1971Ej01, suggests M1(+E2)+E0.
828[@] *1*		827.4	0$^+$	0.0	0$^+$	E0		0.58 *20*	$I_{(\gamma+ce)}$: from Ice(K) relative to Iγ=1000 for 310.7γ.
833.4		2319.2	11$^-$	1485.9	10$^+$				
[x]859 *1*	20 *5*								
[x]869 *1*	27 *5*								
900.0	48.5 *6*	1508.2	(5$^+$)	608.2	6$^+$				
918.8		1928.4	8$^-$	1009.6	8$^+$				
934.3		1943.9	9$^-$	1009.6	8$^+$				
941.1	62 *9*	1549.3	6$^+$	608.2	6$^+$				
971.5	285 *14*	1062.5	4$^+$	91.0	2$^+$				
1006.3[a]	25 *10*	1303.6	(3$^+$)	297.5	4$^+$				
1010.1	23 *9*	1307.4	6$^+$	297.5	4$^+$				
1022.1	80 *24*	1630.5	8$^+$	608.2	6$^+$				
1026.2		1634.4	6$^-$	608.2	6$^+$				
1042.4		1650.6	7$^-$	608.2	6$^+$				
1097.3		1394.8	(4$^+$)	297.5	4$^+$				
1105.1		1713.5	6$^-$	608.2	6$^+$				
1128.0		1425.5	(4$^-$)	297.5	4$^+$				
1210.8		1508.2	(5$^+$)	297.5	4$^+$				
1212.6		1303.6	(3$^+$)	91.0	2$^+$				
1251.8	58 *10*	1549.3	6$^+$	297.5	4$^+$				I_γ: from ^{174}Yb(α,4nγ) (1972Fe08).
1303.8		1394.8	(4$^+$)	91.0	2$^+$				

† From (α,2nγ) at θ=55° (1971Ej01).
‡ From 1983Wa21, unless otherwise specified.

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^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)

$\gamma(^{174}Hf)$ (continued)

Contains contribution from impurities.
@ From 1971Ej01.
& Multiply placed with undivided intensity.
a Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

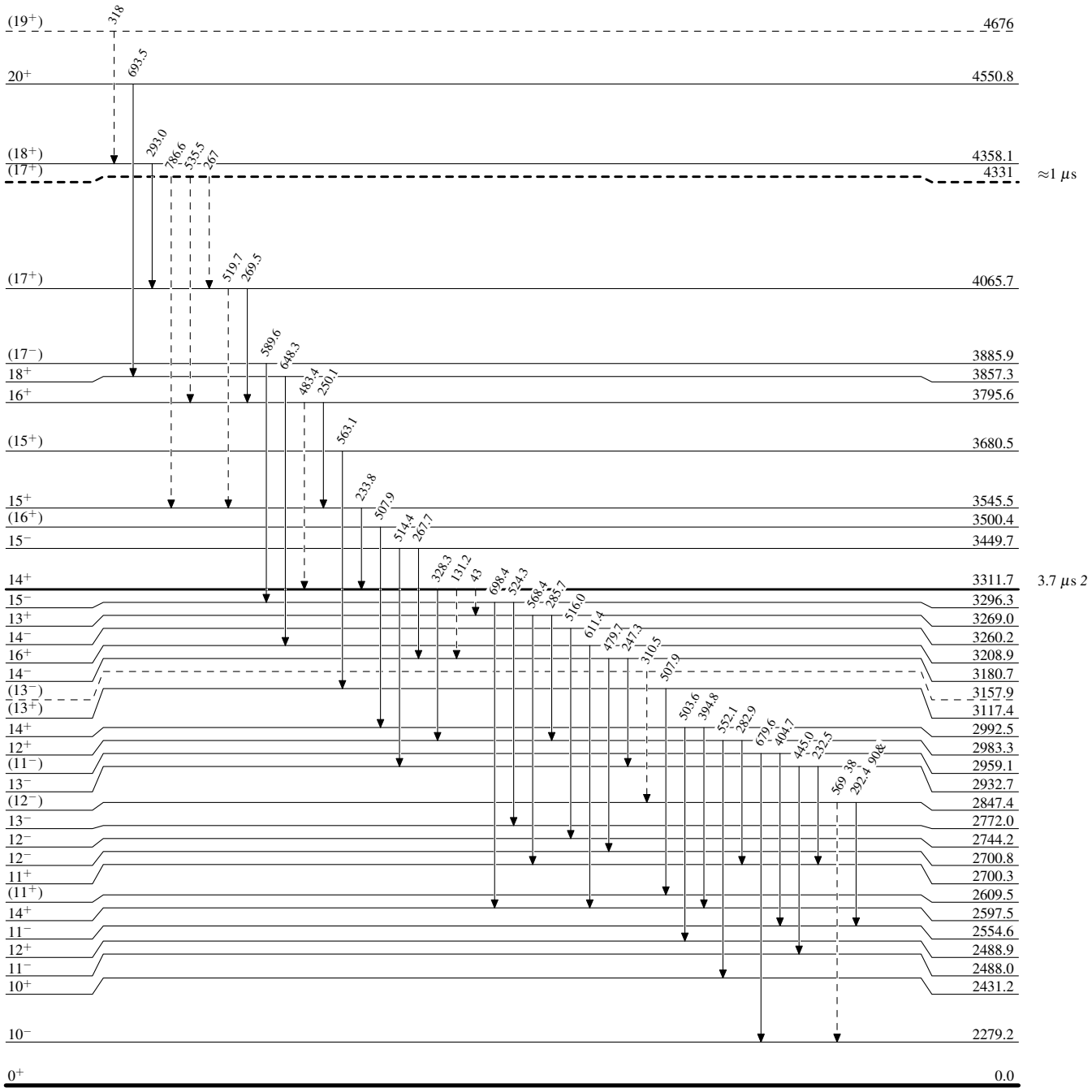
^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01

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 I_γ
& Multiply placed: undivided intensity given



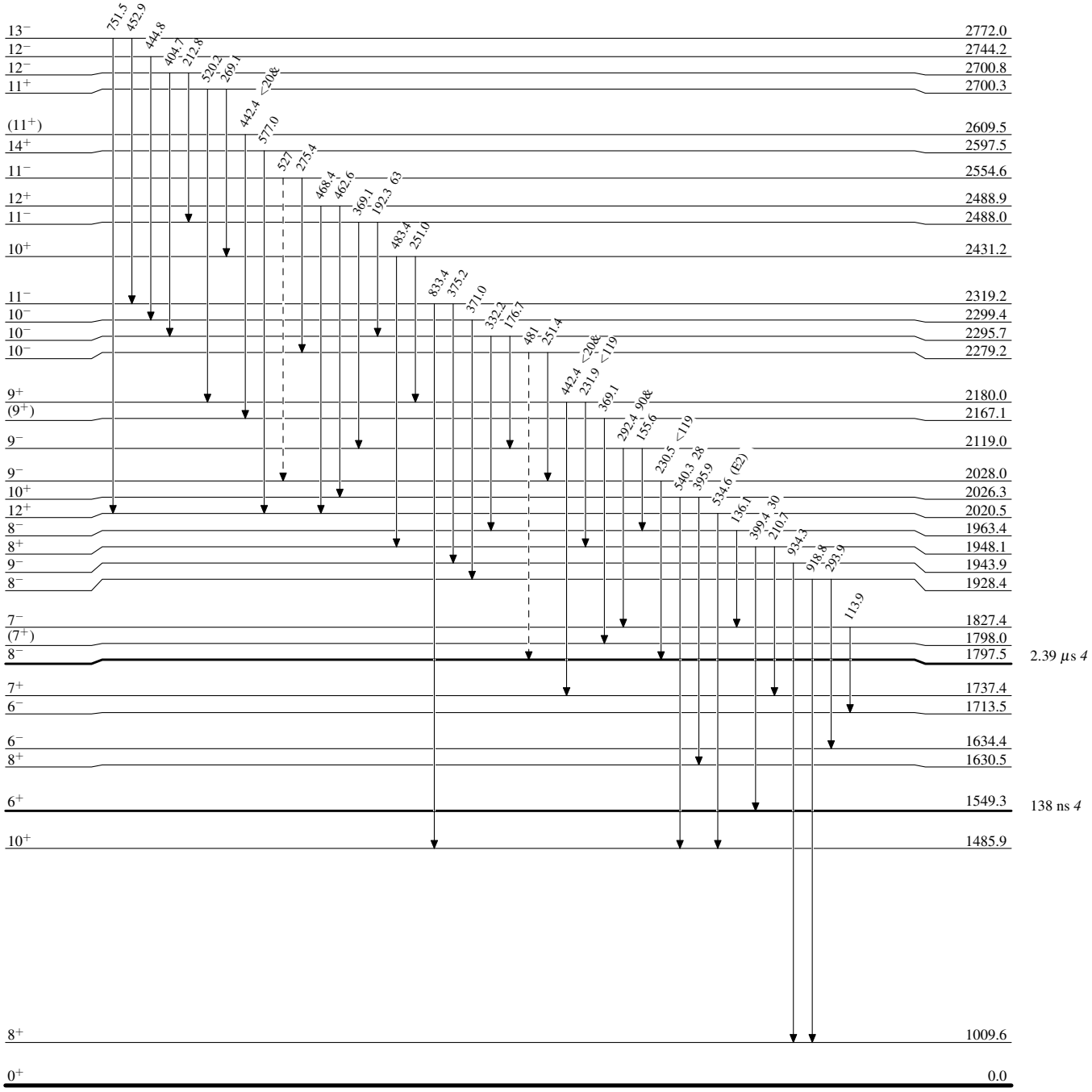
$^{174}_{72}Hf_{102}$

^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)

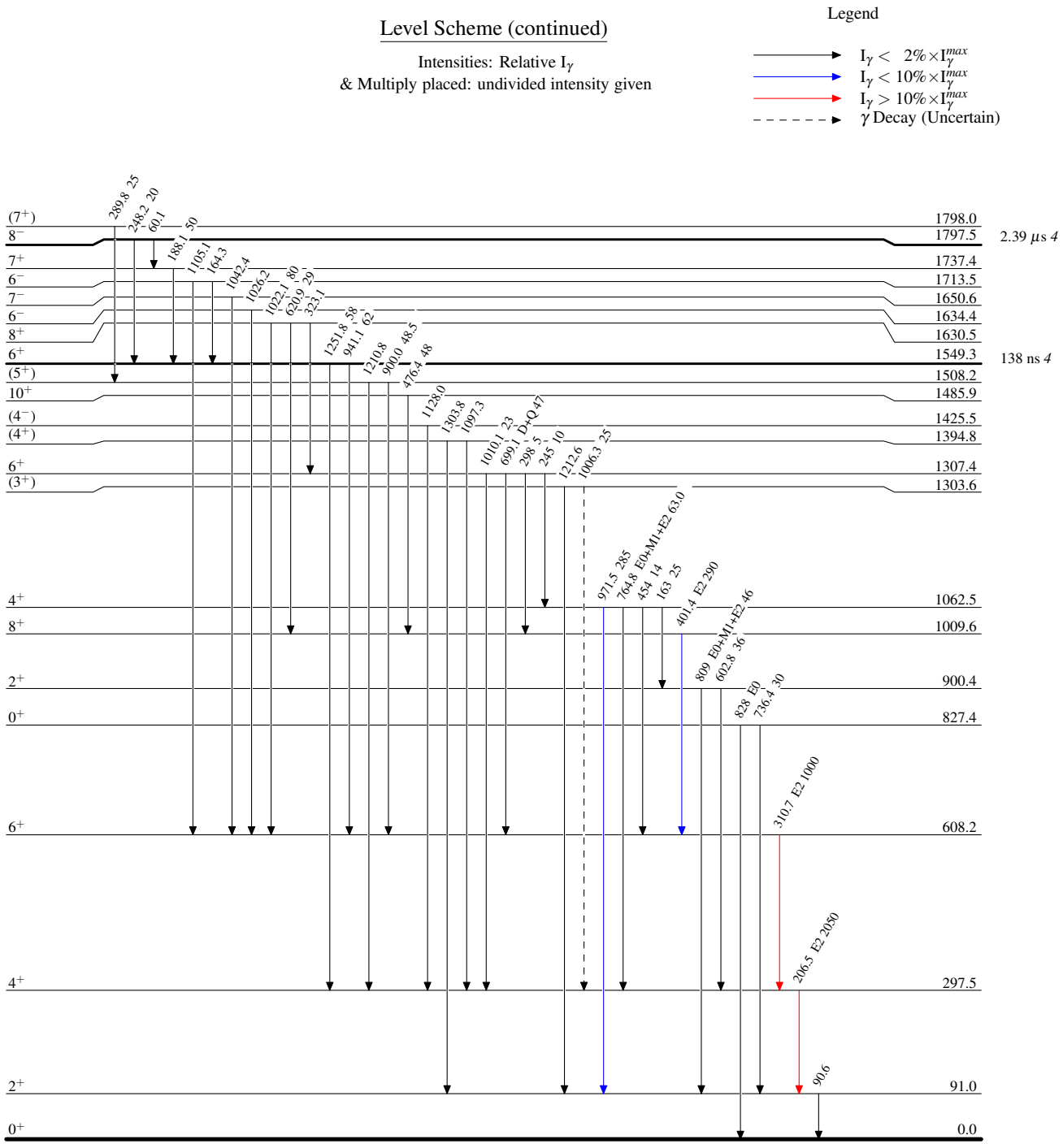


$^{174}_{72}Hf_{102}$

^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01

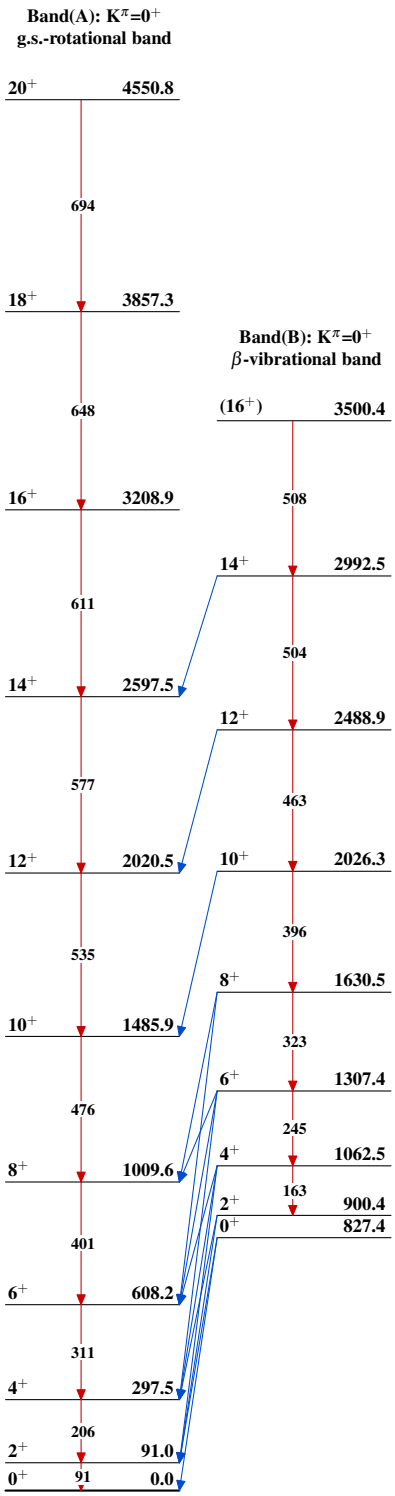
Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



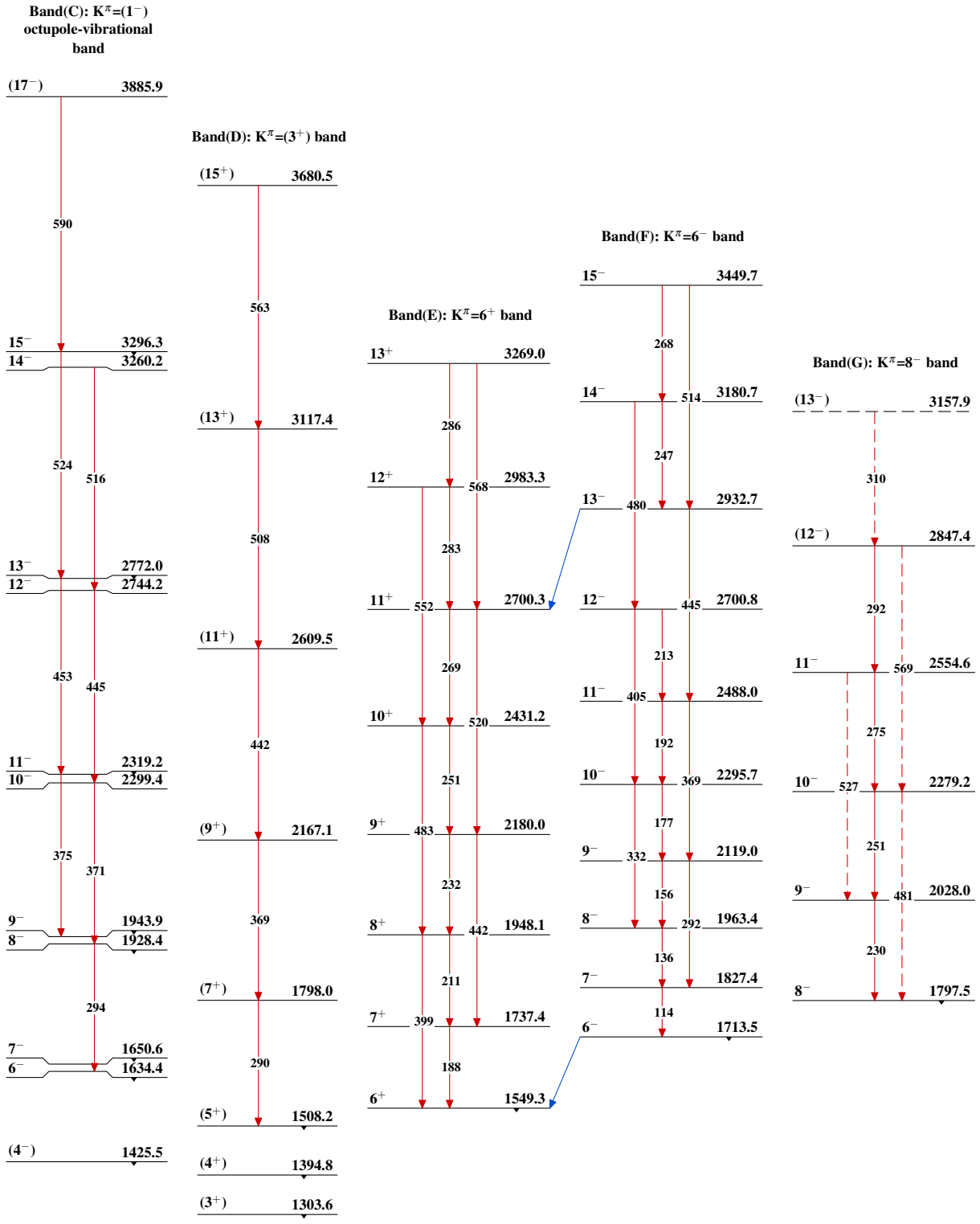
$^{174}_{72}Hf_{102}$

^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01



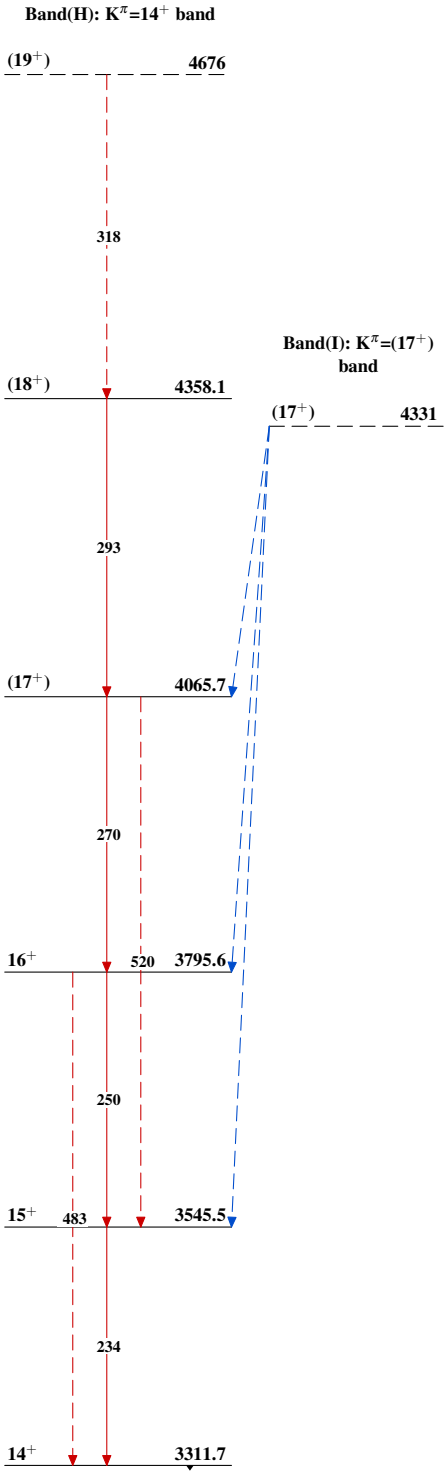
$^{174}_{72}Hf_{102}$

^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)



$^{174}_{72}Hf_{102}$

^{172}Yb(α,2nγ),^{160}Gd(^{18}O,4nγ) 1983Wa21,1971Ej01 (continued)



$^{174}_{72}Hf_{102}$