

$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal [1974Bu22,1990Bo52,1986RoZM](#)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 126, 151 (2015)	1-Feb-2015

[1974Bu22](#): 83.6% enriched ^{179}Hf target. Measured $E\gamma$, $I\gamma$ using bent crystal spectrometer for $E\gamma=40\text{-}1300$ keV, Ge(Li) anti-Compton spectrometer for $E\gamma=400\text{-}2100$ keV, and Ge(Li) pair spectrometer for $E\gamma=4.7\text{-}7.3$ MeV. $S(\text{n})=7387.7$ keV 3.

[1990Bo52](#): Target: ^{179}Hf . Measured $E\gamma$, total $I\gamma\gamma$ for γ -ray cascades. Measured $\gamma\gamma$ coin for γ -rays with fixed energy sum feeding the 93 (2^+), 309 (4^+), 641 (6^+), and 1374 (3^-) levels using two Ge(Li) detectors.

[1986RoZM](#): Measured conversion coefficients; deduced multipolarities.

Others: [1966Na03](#), [1967Pr08](#), [1975Ma19](#), [1984Pr03](#), [1985GrZR](#), [1990BoZN](#), [2008Ng01](#), [2009No12](#), [2011Bu08](#).

[Additional information 1](#).

 ^{180}Hf Levels

E(level) [†]	J^π [‡]	$T_{1/2}$	Comments
0.0 ^a	0^+		
93.3240 ^a 20	2^+		
308.576 ^a 3	4^+		
640.850 ^a 11	6^+		
1083.93 ^a 4	8^+		
1107.24 5	0^+		$E(\text{level}), J^\pi$: original assignment by 1974Bu22 has been reassigned to 1102 level in the Adopted Levels.
1141.48 5	8^-		
1164.08 ^b 5	0^+		
1192.63 6	6^+		
1199.68 5	2^+		
1260.67 ^b 4	2^+		
1290.99 6	4^+		
1300.35 5	2^+		J^π : adopted (E1) 1300 γ to 0^+ suggests $J^\pi=(1^-)$ while population by (E2) 6088 γ suggests $\pi=(+)$.
1369.57 8	4^+		
1374.33 4	3^-	$0.57 \mu\text{s}$ 2	$T_{1/2}$: from 1990GrZS .
1381.55 5	3^+		
1409.24 6	4^+		
1420.5 ^{&} 7			
1429.77 4	3^-		
1472.23 7	$6^+, (7^+)$		J^π : γ -rays to 4^+ states favor the $J^\pi=6^+$ assignment.
1482.63 4	3^-		
1484.43 ^b 6	4^+		
1532.9 ^{&c} 5			
1539.25 4	3^-		
1557.28 23			
1559.26 4	4^+		
1597.48 7	$6^+, (3^+)$		J^π : tentatively placed 956 γ to 6^+ favors the $J^\pi=6^+$ assignment.
1607.62 4	$3^+, (4^+)$		
1609.35 4	3^-		
1613.05 4	$4^-, (5^-)$		
1637.16 14	2^+		
1657.96 ^{&} 10			
1666.2 ^{&c} 7			
1680.4 ^{&c} 10			
1700.81 4	5^+		
1709.5 3	$4^-, (5^-)$		
1724.77 9	$2^+, 3^+$		

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$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM (continued) ^{180}Hf Levels (continued)

E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]	E(level) [†]	J ^π [‡]
1727.4 ^{&c} 7		2275.6 ^{&} 4		3049.3 ^{&} 5	3605.9 ^{&} 6	
1738.4 ^{&} 7		2292.6 ^{&} 7		3058.0 ^{&} 7	3625.0 ^{&} 7	
1743.33 6	2 ⁺	2316.64 9	(4 ⁻),5 ⁻	3083.2 ^{&} 7	3640.3 ^{&} 7	
1786.5 ^{&} 7		2320.9 ^{&} 4		3089.7 ^{&} 5	3653.5 ^{&} 7	
1813.90 8	3 ⁻	2334.90 ^{&} 20		3100.5 ^{&} 7	3672.0 ^{&} 6	
1818.56 4	(3 ⁻ ,6 ⁻)	2341.0 ^{&} 7		3123.8 ^{&} 7	3683.5 ^{&} 7	
1828.0 ^{&} 7		2368.7 ^{&} 7		3131.5 ^{&} 6	3751.1 ^{&} 6	
1861.61 ^{&c} 9		2413.1 ^{&} 7		3152.8 ^{&} 7	3848.2 ^{&} 5	
1909.68 9	4 ⁺ ,5 ⁺	2465.3 ^{&} 7		3163.1 ^{&} 7	3855.3 ^{&} 7	
1932.2 ^{&} 7		2472.5 ^{&} 6		3174.2 ^{&} 7	3869.2 ^{&} 6	
1936.9 ^{&} 7		2477.04 10	5 ⁻	3183.8 ^{&} 6	3880.1 ^{&} 7	
1945.22 13	2 ⁺	2504.3 ^{&} 7		3200.2 ^{&} 7	3908.2 ^{&} 7	
1959.46 ^{&c} 8		2549.0 ^{&} 7		3215.2 ^{&} 7	3926.2 ^{&} 6	
2018.2 ^{&c}		2560.7 ^{&} 5		3252.9 ^{&} 7	3957.3 ^{&} 6	
2022.2 ^{&} 7		2679.97 13	4,5 ⁻	3258.1 ^{&} 7	3974.8 ^{&} 6	
2034.37 7	4 ⁺ ,5 ⁺	2682.1 ^{&} 6		3303.4 ^{&} 7	3987.3 ^{&} 7	
2058.4 ^{&} 7		2706.0 ^{&} 7		3316.9 ^{&} 5	3992.1 ^{&} 7	
2077.82 ^{&} 10		2741.3 ^{&} 5		3330.2 6	4002.9 ^{&} 6	
2146.7 ^{&} 7		2771.6 ^{&} 7		3338.4 ^{&} 7	4137.4 ^{&} 7	
2151.46 6	3 ⁻ ,(4 ⁻)	2783.7 ^{&} 7		3416.9 5	4331.7 ^{&} 7	
2153.3 ^{&c} 7		2797.1 ^{&} 5		3428.4 ^{&} 7	4355.7 ^{&} 7	
2174.0 ^{&} 3		2805.7 ^{&} 7		3442.6 ^{&} 7	4422.9 ^{&} 6	
2187.56 ^c 20		2839.9 ^{&} 5		3468.4 ^{&} 7	4808.6 ^{&} 6	
2200.6 ^{&} 7		2849.8 ^{&} 5		3483.0 ^{&} 7	4852.9 ^{&} 6	
2215.5 ^{&} 7		2858.5 ^{&} 6		3488.9 ^{&} 7	4916.1 ^{&} 5	
2242.2 ^{&} 7		2873.0 ^{&} 7		3499.5 ^{&} 7	4964.9 ^{&} 5	
2245.7 ^{&} 7		2913.3 ^{&} 7		3515.4 ^{&} 7	5048.0 ^{&} 6	
2252.4 ^{&} 7		2999.7 ^{&} 7		3526.4 ^{&} 7	5057.6 ^{&} 6	
2261.5 ^{&} 6		3022.2 ^{&} 5		3596.2 ^{&} 7	7387.60 [#] 8	4 ⁺ ,5 ⁺ @

[†] From a least-squares fit to secondary γ -rays of 1974Bu22 by evaluator.

[‡] As proposed by 1974Bu22 based on decay properties, feeding from primary transitions and data from $^{179}\text{Hf}(\text{n},\gamma)$, E=res:Av.

Capture state.

@ Most of the contribution to the capture state is from $J^\pi=5^+$ thermal-neutron resonances (1990Bo50,1990Bo52).

& From $\gamma\gamma$ coin, observed by 1990Bo52 only.

^a $K^\pi=0^+$ g.s. rotational band.

^b $K^\pi=0^+$ rotational band.

^c Level energy is not definite because order of γ -ray cascade is unknown (1990Bo52). Level is not included in Adopted Levels.

 $\gamma(^{180}\text{Hf})$

γ -ray energies, unless otherwise specified, are from 1974Bu22, as follows: 1. From combined bent crystal and Ge(Li) anti-Compton measurements for energies below 1300 keV. 2. From Ge(Li) anti-Compton spectrometer for energies between 1300 and 2300 keV. 3. From Ge(Li) pair spectrometer for energies greater than 4500 keV (primary γ -rays). Evaluator has increased values from bent crystal measurements by 17 ppm to make them consistent with 59.31922 keV 7 (1980De40) for the K-L3 tungsten x-ray standard.

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$^{179}\text{Hf}(n,\gamma)$ E=thermal **1974Bu22,1990Bo52,1986RoZM** (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.#	$\delta^\#$	Comments
$^{x45.755}_{53.799}$ 7 1	0.30 6 0.32 3	1613.05	$4^-, (5^-)$	1559.26	4^+	M1		ce(L1):ce(L2):ce(L3) exp= $\leq 30:\leq 30:\leq 25$ (1967Pr08).
55.448 3	0.17 4	1429.77	3^-	1374.33	3^-			ce(L1):ce(L2):ce(L3) exp= $\leq 25:35:25$ (1967Pr08).
57.554 17		1141.48	8^-	1083.93	8^+			I_γ : $I_\gamma=82\%$ 2, relative intensity de-exciting the 5.5-h ^{180}Hf isomer measured following reactor shut down (1974Bu22).
$^{x65.24}_{76.623}$ 4 3	0.15 10 0.48 5	1559.26	4^+	1482.63	3^-	D		$\alpha(\text{L2})\text{exp}<0.2$ (1986RoZM).
81.21 2	0.15 1	1381.55	3^+	1300.35	2^+			
92.44 1	0.014 8	1199.68	2^+	1107.24	0^+			
$^{x92.50}_{x92.56}$ 1 1	0.015 8 0.016 8							
$^{x92.797}_{93.324}$ 8 2	0.060 8 9.85 10	93.3240	2^+	0.0	0^+	E2		$\alpha(\text{K})\text{exp}=1.05$ 5, $\alpha(\text{L1}+\text{L2})\text{exp}=1.26$ 7, $\alpha(\text{L3})\text{exp}=1.20$ 7, $\alpha(\text{M})\text{exp}=0.62$ 6, $\alpha(\text{N}+\text{O})\text{exp}=0.184$ 16 (1986RoZM). ce(L):ce(M):ce(N) exp= $<2300:<730:<100$ (1967Pr08).
96.589 10	0.017 5	1260.67	2^+	1164.08	0^+			
$^{x104.604}_{x104.692}$ 10 10	0.008 5 0.008 5							
$^{x105.433}_{108.308}$ 10 2	0.039 5 1.90 8	1482.63	3^-	1374.33	3^-	M1+E2	0.80 12	$\alpha(\text{L1})\text{exp}=0.33$ 4, $\alpha(\text{M})\text{exp}=0.21$ 2 (1986RoZM). ce(K):ce(L1):ce(L2):ce(L3):ce(M) exp= $\leq 30:20:20:\leq 20:20$ (1967Pr08). ce(K):ce(L1):ce(L2) exp= $\leq 25:\leq 20:\leq 20$ (1967Pr08).
109.474 3	0.62 6	1539.25	3^-	1429.77	3^-			
113.66 2	0.05 1	1374.33	3^-	1260.67	2^+			
$^{x113.71}_{x115.91}$ 1 2	0.13 9 0.14 2							
$^{x123.930}_{125.26}$ 3 3	0.54 5 0.07 4	1597.48	$6^+, (3^+)$	1472.23	$6^+, (7^+)$	M1+E2	0.9 3	
$^{x130.260}_{x135.09}$ 3 1	0.65 6 0.48 5					M1 M1+E2	0.71 22	
$^{x138.05}_{141.55}$ 3 1	0.08 4 0.17 4	1700.81	5^+	1559.26	4^+	M1+E2	1.2 +16-6	$\alpha(\text{K})\text{exp}=0.77$ 25 (1986RoZM).
$^{x152.05}_{x155.06}$ 3 6	0.135 11 0.050 8							
$^{x155.60}_{x158.33}$ 6 6	0.030 5 0.03 2							
160.40 3	0.12 3	2477.04	5^-	2316.64	$(4^-), 5^-$			
$^{x161.67}_{x163.07}$ 8 4	0.04 3 0.05 4							
$^{x163.41}_{x167.10}$ 2 1	0.11 4 0.30 4					M1		
$^{x168.80}_{177.71}$ 5 3	0.06 1 0.17 3	1559.26	4^+	1381.55	3^+			$\alpha(\text{K})\text{exp}(178\gamma \text{ doublet})=0.67$ 20 (1986RoZM).
177.86 3	0.19 4	1607.62	$3^+, (4^+)$	1429.77	3^-			$\alpha(\text{K})\text{exp}(178\gamma \text{ doublet})=0.67$ 20 (1986RoZM).

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$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ [†]	I_γ [‡]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	δ [#]	Comments
181.26 4	0.06 3	1472.23	6 ⁺ , (7 ⁺)	1290.99	4 ⁺			
^x 185.25 4	0.06 3							
^x 186.04 2	0.19 4					M1		
^x 188.14 2	0.17 3					M1		
^x 192.83 2	0.24 4					M1		
198.35 ^m 7	0.04 ^m 3	1607.62	3 ⁺ , (4 ⁺)	1409.24	4 ⁺			
198.35 ^{mn} 7	0.04 ^m 3	1680.4		1482.63	3 ⁻			
^x 203.27& 8	0.07& 3							
205.51 1	1.35 5	1818.56	(3 ⁻ , 6 ⁻)	1613.05	4 ⁻ , (5 ⁻)	M1		$\alpha(\text{L})\text{exp}=0.068$ 9 (1986RoZM). $\alpha(\text{L1}+\text{L2})\text{exp}=0.48$ 4 must be a misprint in 1986RoZM and could correspond to $\alpha(\text{K})\text{exp}$. $\text{ce}(\text{K})/\text{ce}(\text{L12}) \text{exp}=5.4$ (1967Pr08).
207.0 ^j		1813.90	3 ⁻	1607.62	3 ⁺ , (4 ⁺)			
^x 207.98 2	0.59 4					M1		
209.51 7	0.04 3	1409.24	4 ⁺	1199.68	2 ⁺			
215.252 2	34.5 2	308.576	4 ⁺	93.3240	2 ⁺	E2		$\alpha(\text{K})\text{exp}=0.113$ 9, $\alpha(\text{L1}+\text{L2})\text{exp}=0.0481$ 9, $\alpha(\text{L3})\text{exp}=0.0246$ 9, $\alpha(\text{M})\text{exp}=0.0171$ 12, $\alpha(\text{N}+\text{O})\text{exp}=0.0039$ 4 (1986RoZM). $\text{ce}(\text{K}):\text{ce}(\text{L2}):\text{ce}(\text{L3}):\text{ce}(\text{M}):\text{ce}(\text{N})\text{exp}=<650:170:60:60:15$ (1967Pr08).
^x 219.7 1	0.040 8							
223.76 6	0.06 4	1484.43	4 ⁺	1260.67	2 ⁺			
233.33 8	0.22 5	1607.62	3 ⁺ , (4 ⁺)	1374.33	3 ⁻			
235.020 6	4.46 11	1609.35	3 ⁻	1374.33	3 ⁻	M1+E2	0.4 3	$\alpha(\text{K})\text{exp}=0.271$ 24, $\alpha(\text{L})\text{exp}=0.039$ 4, $\alpha(\text{M})\text{exp}=0.0092$ 4 (1986RoZM). $\text{ce}(\text{K}):\text{ce}(\text{L2}):\text{ce}(\text{M}) \text{exp}=100:20:7$ (1967Pr08).
238.56 5	0.79 6	1613.05	4 ⁻ , (5 ⁻)	1374.33	3 ⁻	(E2)		$\alpha(\text{K})\text{exp}\leq 0.06$ (1986RoZM). Mult.: E1 from $\alpha(\text{K})\text{exp}$. Decay scheme requires E2.
243.40 10	0.10 5	1613.05	4 ⁻ , (5 ⁻)	1369.57	4 ⁺			
245.0 ⁱ		1727.4		1482.63	3 ⁻			
254.61 9	0.19 1	1813.90	3 ⁻	1559.26	4 ⁺			
255.34 ⁿ 3	0.08 1	1637.16	2 ⁺	1381.55	3 ⁺			
256.1 ⁱ		1738.4		1482.63	3 ⁻			
^x 258.21 6	0.045 10							
258.90 ^m 3	0.10 ^m 1	1559.26	4 ⁺	1300.35	2 ⁺			
258.90 ^m 3	0.10 ^m 1	1743.33	2 ⁺	1484.43	4 ⁺			
^x 260.08 3	0.080 12							
^x 261.18 3	0.13 1							
^x 265.27 6	0.060 13							
^x 266.07 2	0.190 13							
274.6 1	0.16 2	1813.90	3 ⁻	1539.25	3 ⁻			
282.28 8	0.42 6	2316.64	(4 ⁻), 5 ⁻	2034.37	4 ⁺ , 5 ⁺			
^x 284.60 10	0.23 7							
^x 291.01 8	0.32 7							
302.06 8	0.23 7	1909.68	4 ⁺ , 5 ⁺	1607.62	3 ⁺ , (4 ⁺)			
303.2 ⁱ		1786.5		1482.63	3 ⁻			
306.40 10	0.15 2	1597.48	6 ⁺ , (3 ⁺)	1290.99	4 ⁺			
^x 310.4 1	0.060 9							
313.50 10	0.13 1	1743.33	2 ⁺	1429.77	3 ⁻			I_γ : includes undetermined contribution from ¹⁷⁸ Hf.

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$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal **1974Bu22,1990Bo52,1986RoZM** (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.#	Comments
316.61 6	0.64 8	1607.62	$3^+, (4^+)$	1290.99	4^+	E2	$\alpha(\text{K})\text{exp}=0.042$ 11, $\alpha(\text{L})\text{exp}=0.014$ 5 (1986RoZM).
^x 319.25	0.06						
322.5 ^j		1932.2		1609.35	3^-		
329.5 ^j		1936.9		1607.62	$3^+, (4^+)$		
331.1 ⁱ		1813.90	3^-	1482.63	3^-		
332.271 10	9.25 20	640.850	6^+	308.576	4^+	E2	$\alpha(\text{K})\text{exp}=0.042$ 3, $\alpha(\text{L})\text{exp}=0.0131$ 14, $\alpha(\text{M})\text{exp}=0.0051$ 6 (1986RoZM). ce(K)/ce(L2) exp=3.0 (1967Pr08).
^x 344.1 1	0.060 9						
346.25 14	0.37 9	1637.16	2^+	1290.99	4^+		
355.2 1	0.10 3	1724.77	$2^+, 3^+$	1369.57	4^+		
^x 358.2 1	0.030 15						
363.32 10	0.16 3	2679.97	$4, 5^-$	2316.64	$(4^-), 5^-$		
^x 365.58 3	0.28 3						
^x 367.36 7	0.17 3						
385.84 14	0.19 4	1945.22	2^+	1559.26	4^+		
388.45 14	0.25 4	1472.23	$6^+, (7^+)$	1083.93	8^+		I_γ : includes possible contribution from ^{178}Hf .
^x 389.95 7	0.39 3						
^x 391.06 & 13	0.13 & 3						
^x 392.4 4	0.14 3						
407.94 2	1.57 3	1607.62	$3^+, (4^+)$	1199.68	2^+	E2	$\alpha(\text{K})\text{exp}=0.032$ 5 (1986RoZM). I_γ : may include weak ^{178}Hf line. E_γ : 1990Bo52 place a 408.5 γ from a level at 2017.8 keV.
409.61 8	0.18 3	1609.35	3^-	1199.68	2^+		
^x 410.5 1	0.060 24						
^x 420.96 10	0.33 3					M1	
433.71 12	0.34 3	1724.77	$2^+, 3^+$	1290.99	4^+		
^x 440.87 20	0.20 3						
443.09 4	1.69 3	1083.93	8^+	640.850	6^+	E2	$\alpha(\text{K})\text{exp}=0.0183$ 24 (1986RoZM).
^x 446.87 5	0.56 3						
^x 451.64 8	0.35 2						
452.53 16	0.16 3	1743.33	2^+	1290.99	4^+		
465.25 11	0.35 3	2077.82		1613.05	$4^-, (5^-)$		E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
476.86 7	0.57 4	1959.46		1482.63	3^-		E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
487.29 8	0.55 4	1861.61		1374.33	3^-		E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
500.64 18		1141.48	8^-	640.850	6^+		I_γ : $I_\gamma=18\%$ 2, relative intensity de-exciting the 5.5-h ^{180}Hf isomer, measured following reactor shut down (1974Bu22).
^x 527.08 3	0.73 4						
^x 530.10 8	0.24 5						
^x 534.52 4	0.60 4						
535.2 ⁱ		2018.2		1482.63	3^-		
536.2 ^h		1909.68	$4^+, 5^+$	1374.33	3^-		
538.39 4	0.65 4	2151.46	$3^-, (4^-)$	1613.05	$4^-, (5^-)$		
551.75 ^m 6	0.24 ^m 4	1192.63	6^+	640.850	6^+		
551.75 ^m 6	0.24 ^m 4	2034.37	$4^+, 5^+$	1482.63	3^-		
576.3 ⁱ		2058.4		1482.63	3^-		
^x 577.56 8	0.14 4						
583.4 5	0.13 8	1959.46		1374.33	3^-		E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.

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$^{179}\text{Hf}(n,\gamma) \text{ E=thermal } \textbf{1974Bu22,1990Bo52,1986RoZM (continued)}$						
$\gamma(^{180}\text{Hf}) \text{ (continued)}$						
E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
$^{x585.0}_{\text{5}}$	0.15 9					
$^{x586.9}_{\text{6}}$	0.14 8					
$^{x588.6}_{\text{5}}$	0.13 8					
$^{x595.6}_{\text{5}}$	0.07 6					
$^{x621.3}_{\text{4}}$	0.41 6					
643.5 j		2252.4		1609.35	3 $^-$	
644.3 6	0.280 17	2018.2		1374.33	3 $^-$	I_γ : possible contribution from ^{178}Hf . E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
654.9 6	0.13 2	1945.22	2 $^+$	1290.99	4 $^+$	I_γ : includes contribution from ^{179}Hf .
$^{x659.1}_{\text{5}}$	0.26 13					
$^{x664.1}_{\text{6}}$	0.18 9					
667.9 4	0.17 7	2275.6		1607.62	3 $^+,(4^+)$	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
$^{x680.1}_{\text{5}}$	0.09 $\&$ 5					
$^{x681.8}_{\text{5}}$	0.10 $\&$ 5					
$^{x683.7}_{\text{4}}$	0.12 $\&$ 6					
$^{x686.9}_{\text{3}}$	0.14 $\&$ 6					
$^{x690.1}_{\text{6}}$	0.12 $\&$ 7					
$^{x691.4}_{\text{5}}$	0.13 5					
703.3 $\&$ 5	0.11 $\&$ 6	2316.64	(4 $^-$),5 $^-$	1613.05	4 $^-,(5^-)$	E_γ : 1990Bo52 place a 704.0 γ from a level at 2078.3 keV.
706.4 i		2187.56		1482.63	3 $^-$	
707.3 $\&$ 5	0.09 $\&$ 5	2316.64	(4 $^-$),5 $^-$	1609.35	3 $^-$	
709.8 4	0.16 8	1909.68	4 $^+,5^+$	1199.68	2 $^+$	
$^{x714.6}_{\text{3}}$	0.10 $\&$ 6					
$^{x716.1}_{\text{3}}$	0.16 $\&$ 6					
725.6 2	0.42 6	2334.90		1609.35	3 $^-$	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
728.1 l 3	0.23 8	1369.57	4 $^+$	640.850	6 $^+$	
$^{x729.9}_{\text{3}}$	0.28 8					
$^{x741.9}_{\text{4}}$	0.14 7					
743.4 l 2	0.24 5	2034.37	4 $^+,5^+$	1290.99	4 $^+$	
745.4 4	0.14 6	1945.22	2 $^+$	1199.68	2 $^+$	I_γ : $I_\gamma \leq 0.05$ from ^{178}Hf .
$^{x758.1}_{\text{4}}$	0.20 8					
759.6 j		2368.7		1609.35	3 $^-$	
$^{x761.1}_{\text{3}}$	0.09 5					
$^{x763.3}_{\text{5}}$	0.11 4					
$^{x764.8}_{\text{5}}$	0.13 5					
768.1 6	0.12 4	1409.24	4 $^+$	640.850	6 $^+$	I_γ : $I_\gamma = 0.06$ from ^{178}Hf .
777.3 h		2153.3		1374.33	3 $^-$	
$^{x784.5}_{\text{5}}$	0.08 5					
$^{x786.1}_{\text{5}}$	0.10 5					
$^{x787.6}_{\text{5}}$	0.14 5					
$^{x792.1}_{\text{5}}$	0.11 6					
$^{x794.0}_{\text{5}}$	0.10 5					
799.9 3	0.38 8	2174.0		1374.33	3 $^-$	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
$^{x803.6}_{\text{7}}$	0.09 5					
$^{x809.9}_{\text{3}}$	0.20 4					
$^{x811.8}_{\text{7}}$	0.07 5					
$^{x819.7}_{\text{6}}$	0.10 5					
826.6 h		2200.6		1374.33	3 $^-$	
830.8 4	0.18 5	1472.23	6 $^+,(7^+)$	640.850	6 $^+$	
$^{x844.8}_{\text{7}}$	0.07 6					
$^{x846.2}_{\text{6}}$	0.15 5					
$^{x847.3}_{\text{7}}$	0.06 5					

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$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
$^x853.8$ 5	0.09 5					
$^x856.2$ 5	0.09 5					
856.3 j		2465.3		1609.35	3 ⁻	
$^x857.5$ 5	0.11 7					
864.2 3	0.14 4	2477.04	5 ⁻	1613.05	4 ⁻ , (5 ⁻)	
865.2 j		2472.5		1607.62	3 ⁺ , (4 ⁺)	
868.2 h		2242.2		1374.33	3 ⁻	
$^x880.8$ 7	0.12 6					
884.7 l 7	0.10 7	1192.63	6 ⁺	308.576	4 ⁺	
$^x888.5$ 7	0.08 7					
890.9 m 4	0.28 m 4	1199.68	2 ⁺	308.576	4 ⁺	
890.9 m 4	0.28 m 4	2151.46	3 ⁻ , (4 ⁻)	1260.67	2 ⁺	
892.4 5	0.20 8	1532.9		640.850	6 ⁺	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
900.5 gn		1539.25	3 ⁻	640.850	6 ⁺	
$^x913.8$ l 5	0.09 7					
915.8 4	0.49 7	1557.28		640.850	6 ⁺	E_γ : peak exhibits triplet structure. E_γ : unplaced by 1974Bu22. Placement by evaluator on basis of (n,n' γ) data.
917.4 5	0.25 8	2477.04	5 ⁻	1559.26	4 ⁺	
$^x921.0$ l 5	0.14 4					
$^x928.4$ 5	0.13 7					
$^x930.8$ 5	0.13 7					
$^x935.4$ 5	0.14 10					
937.8 5	0.16 8	2477.04	5 ⁻	1539.25	3 ⁻	
946.6 l 6	0.15 9	2320.9		1374.33	3 ⁻	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
952.2 m 7	0.05 m	1260.67	2 ⁺	308.576	4 ⁺	
952.2 m 7	0.05 m	2151.46	3 ⁻ , (4 ⁻)	1199.68	2 ⁺	
956.3 l 5	0.16 8	1597.48	6 ⁺ , (3 ⁺)	640.850	6 ⁺	
$^x965.8$ 5	0.14 7					
$^x968.8$ 4	0.40 8					
$^x973.0$ 5	0.18 5					
$^x977.9$ 7	0.12 5					
979.7 7	0.11 11	2679.97	4,5 ⁻	1700.81	5 ⁺	
982.1 3	0.85 5	1290.99	4 ⁺	308.576	4 ⁺	
$^x1003.0$ 4	0.54 5					
$^x1011.7$ 4	0.13 4					
1014.3 6	0.10 8	1107.24	0 ⁺	93.3240	2 ⁺	
1017.1 1	1.00 6	1657.96		640.850	6 ⁺	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
$^x1019.3$ l 5	0.11 8					
$^x1022.9$ 5	0.16 6					
1025.7 g		1666.2		640.850	6 ⁺	
$^x1030.5$ l 10	0.07 7					
$^x1034.9$ 5	0.10 7					
$^x1041.7$ 5	0.13 5					
$^x1054.6$ 4	0.28 7					
1061.0 m 3	2.65 m 13	1369.57	4 ⁺	308.576	4 ⁺	
1061.0 mn 3	2.65 m 13	1700.81	5 ⁺	640.850	6 ⁺	
1065.77 5	23.75 a 24	1374.33	3 ⁻	308.576	4 ⁺	
1070.7 5	0.36 15	1164.08	0 ⁺	93.3240	2 ⁺	
1072.6 5	0.14 10	1381.55	3 ⁺	308.576	4 ⁺	
1073.3 j		2682.1		1609.35	3 ⁻	
$^x1077.4$ 2	0.30 15					
1079.4 i		2560.7		1482.63	3 ⁻	
$^x1083.2$ 4	0.44 18					

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$^{179}\text{Hf}(\text{n},\gamma) \text{E=thermal}$ 1974Bu22,1990Bo52,1986RoZM (continued)						
$\gamma(^{180}\text{Hf})$ (continued)						
E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
$^{x1085.6\ 5}$	0.08 6					
$^{x1097.6\ 7}$	0.14 8					
1100.60 15	2.43 12	1409.24	4 ⁺	308.576	4 ⁺	
1106.00 15	2.48 12	1199.68	2 ⁺	93.3240	2 ⁺	
$^{x1110.5\ 6}$	0.13 5					
1112 ^f		1420.5		308.576	4 ⁺	$E_\gamma=1099.6$ in 1990Bo52 (Table I) is probably a typo.
$^{x1117.0\ 6}$	0.12 4					
1121.7 5	0.36 6	1429.77	3 ⁻	308.576	4 ⁺	
$^{x1123.0\ l\ 10}$	0.05 4					
$^{x1127.6\ l\ 8}$	0.08 6					
1131.0 ^j		2741.3		1609.35	3 ⁻	
$^{x1138.4\ 10}$	0.12 5					
1140.8 8	0.21 6	2679.97	4,5 ⁻	1539.25	3 ⁻	
$^{x1151.7\ 5}$	0.28 4					
1163.9 10	0.13 7	1472.23	6 ⁺ , (7 ⁺)	308.576	4 ⁺	I_γ : possible contribution from chlorine contamination.
1167.0 ⁿ 10	<0.14	1260.67	2 ⁺	93.3240	2 ⁺	
1175.0 ^h		2549.0		1374.33	3 ⁻	
$^{x1181.8\ 10}$	0.10 7					
1185.8 6	0.12 6	2477.04	5 ⁻	1290.99	4 ⁺	
1185.9 ^h		2560.7		1374.33	3 ⁻	
1197.8 3	4.27 30	1290.99	4 ⁺	93.3240	2 ⁺	
1199.4 ⁱ		2682.1		1482.63	3 ⁻	
1199.7 4	2.77 28	1199.68	2 ⁺	0.0	0 ⁺	
$^{x1206.9\ 3}$	1.60 24					
$^{x1211.9\ 6}$	0.15 6					
$^{x1226.5\ 5}$	0.20 6					
1231.6 ^j		2839.9		1607.62	3 ⁺ , (4 ⁺)	
1231.9 5	0.34 6	1539.25	3 ⁻	308.576	4 ⁺	
1239.7 ^j		2849.8		1609.35	3 ⁻	
1249.1 3	2.32 7	1557.28		308.576	4 ⁺	E_γ : unplaced by 1974Bu22 . Placement by evaluator on basis of (n,n' γ) data.
1249.3 ^j		2858.5		1609.35	3 ⁻	
1260.8 3	3.8 5	1260.67	2 ⁺	0.0	0 ⁺	
1262.0 ⁱ		2741.3		1482.63	3 ⁻	
1276.5 ^l 4	0.27 5	1369.57	4 ⁺	93.3240	2 ⁺	
1281.7 2	1.05 ^a 5	1374.33	3 ⁻	93.3240	2 ⁺	
$^{x1286.9\ l\ 10}$	0.09 6					
1288.7 ^m 5	0.32 ^m 8	1381.55	3 ⁺	93.3240	2 ⁺	
1288.7 ^m 5	0.32 ^m 8	1597.48	6 ⁺ , (3 ⁺)	308.576	4 ⁺	
1299.0 6	0.50 3	1607.62	3 ⁺ , (4 ⁺)	308.576	4 ⁺	
1300.5 4	1.85 11	1300.35	2 ⁺	0.0	0 ⁺	
1301.3 ⁱ		2783.7		1482.63	3 ⁻	
$^{x1302.0\ 5}$	1.10 7					
1316.4 3	1.70 5	1409.24	4 ⁺	93.3240	2 ⁺	
1316.9 ⁱ		2797.1		1482.63	3 ⁻	E_γ : 1315.1 from level energy difference.
1328.4 10	0.23 5	1637.16	2 ⁺	308.576	4 ⁺	
1336.8 10	0.22 9	1429.77	3 ⁻	93.3240	2 ⁺	
$^{x1338.3\ 10}$	0.12 11					
$^{x1350.7\ 5}$	0.11 2					
$^{x1352.2\ \&\ 8}$	0.04 ^{&} 4					
1356.4 ⁱ		2839.9		1482.63	3 ⁻	
$^{x1359.4\ l\ 10}$	0.07 5					
1365.4 ⁱ		2849.8		1484.43	4 ⁺	

Continued on next page (footnotes at end of table)

$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal **1974Bu22,1990Bo52,1986RoZM (continued)** $\gamma(^{180}\text{Hf})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
1367.1 10	0.09 6	2741.3		1374.33	3 ⁻	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
^x 1386.5 10	0.09 7					
1389.0 7	0.15 6	1482.63	3 ⁻	93.3240	2 ⁺	
1391.1 ^m 10	0.08 ^m 7	1484.43	4 ⁺	93.3240	2 ⁺	
1391.1 ^m 10	0.08 ^m 7	1700.81	5 ⁺	308.576	4 ⁺	
^x 1394.5 3	0.72 5					
1397.5 ^h		2771.6		1374.33	3 ⁻	
1400.5 5	0.16 6	1709.5	4 ⁻ , (5 ⁻)	308.576	4 ⁺	I_γ : 25% may be due to ^{178}Hf .
1416.7 3	0.51 6	1724.77	2 ⁺ , 3 ⁺	308.576	4 ⁺	
1419.4 ^h		2797.1		1374.33	3 ⁻	E_γ : 1423.4 from level energy difference.
1431.6 ^h		2805.7		1374.33	3 ⁻	
1437.4 ^j		3049.3		1613.05	4 ⁻ , (5 ⁻)	
^x 1440.5 10	0.07 6					
1446.9 10	0.07 6	1539.25	3 ⁻	93.3240	2 ⁺	I_γ : $I_\gamma=0.035$ may be due to ^{178}Hf .
^x 1449.5 7	0.10 6					
^x 1456.4 10	0.08 5					
1469.6 7	0.09 5	2839.9		1369.57	4 ⁺	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
1488.0 10	0.06 5	2679.97	4, 5 ⁻	1192.63	6 ⁺	
^x 1490.7 10	0.04 4					
^x 1493.9 10	0.06 5					
^x 1499.9 10	0.08 6					
^x 1503.3 6	0.08 6					
1510.5 7	0.11 6	1818.56	(3 ⁻ , 6 ⁻)	308.576	4 ⁺	
1515.4 ⁿ 4	0.27 4	1607.62	3 ⁺ , (4 ⁺)	93.3240	2 ⁺	
1516.5 4	0.21 6	1609.35	3 ⁻	93.3240	2 ⁺	
1519.8 ^f		1828.0		308.576	4 ⁺	
1521.7 ^j		3131.5		1609.35	3 ⁻	
1540.5 ⁱ		3022.2		1482.63	3 ⁻	
1543.8 5	0.10 5	1637.16	2 ⁺	93.3240	2 ⁺	
^x 1550.2 7	0.08 6					
^x 1552.2 7	0.07 6					
1553.8 10	0.06 5	1861.61		308.576	4 ⁺	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
^x 1570.3 10	0.05 4					
^x 1572.0 10	0.07 6					
1575.0 ^g		2215.5		640.850	6 ⁺	
^x 1577.0 4	0.15 6					
^x 1578.7 7	0.08 6					
^x 1580.8 10	0.06 5					
^x 1603.0 4	0.09 5					
^x 1614.7 4	0.11 5					
1620.5 ^g		2261.5		640.850	6 ⁺	
^x 1623.9 4	0.10 5					
1631.4 7	0.12 5	1724.77	2 ⁺ , 3 ⁺	93.3240	2 ⁺	
^x 1633.8 7	0.13 5					
1636.8 ^m 5	0.14 ^m 6	1637.16	2 ⁺	0.0	0 ⁺	
1636.8 ^m 5	0.14 ^m 6	1945.22	2 ⁺	308.576	4 ⁺	
^x 1642.2 5	0.19 8					
1650.2 7	0.14 7	1743.33	2 ⁺	93.3240	2 ⁺	
^x 1657.7 5	0.07 6					
1670.4 ⁱ		3152.8		1482.63	3 ⁻	
^x 1672.8 7	0.09 7					
^x 1675.6 4	0.22 9					
1694.3 ^j		3303.4		1609.35	3 ⁻	
1714.0 ^f		2022.2		308.576	4 ⁺	

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$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal **1974Bu22,1990Bo52,1986RoZM (continued)** $\gamma(^{180}\text{Hf})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
1715.6 7	0.14 7	3089.7		1374.33	3 ⁻	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
1721.0 7	0.07 6	1813.90	3 ⁻	93.3240	2 ⁺	
^x 1727.8 2	0.17 7					
1729.3 ^j		3338.4		1609.35	3 ⁻	I_γ : $I_\gamma \approx 0.07$ is due to ^{178}Hf .
1743.2 2	0.21 6	1743.33	2 ⁺	0.0	0 ⁺	
^x 1746.3 3	0.23 7					
^x 1759.9 4	0.15 8					E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
1767.6 2	0.35 9	2077.82		308.576	4 ⁺	
^x 1769.8 5	0.12 7					
^x 1771.8 3	0.23 9					
^x 1800.8 ^{&} 10	0.06 ^{&} 5					
1804.2 ^j		3416.9		1613.05	4 ⁻ , (5 ⁻)	
1809.9 ^h		3183.8		1374.33	3 ⁻	
^x 1813.8 ^{&} 10	0.06 ^{&} 5					
^x 1833.9 7	0.11 4					
1835.8 10	0.07 6	2477.04	5 ⁻	640.850	6 ⁺	
1836.6		3316.9		1482.63	3 ⁻	
1838.5 ^f		2146.7		308.576	4 ⁺	
^x 1841.5 3	0.28 7					
1846.4 ^f		2153.3		308.576	4 ⁺	
1853.0 ^{&} 7	0.08 ^{&} 7	1945.22	2 ⁺	93.3240	2 ⁺	E_γ : placement from 1990Bo52. Unplaced in 1974Bu22.
1864.8 5	0.10 6	2174.0		308.576	4 ⁺	
1879.0 2	0.23 7	2187.56		308.576	4 ⁺	
^x 1881.3 ^{&} 8	0.06 ^{&} 6					
^x 1890.0 ^l 7	0.10 6					
^x 1892.5 5	0.17 7					
^x 1895.5 7	0.10 6					
^x 1898.2 10	0.09 6					
^x 1909.0 7	0.15 6					
^x 1911.4 7	0.13 6					
^x 1920.9 10	0.06 5					
^x 1923.8 10	0.07 6					
1936.3 ⁱ		3416.9		1482.63	3 ⁻	E_γ : 1933.5 from level energy difference.
1937.5 ^f		2245.7		308.576	4 ⁺	
^x 1938.5 5	0.16 6					
1941.0 7	0.10 6	2034.37	4 ⁺ , 5 ⁺	93.3240	2 ⁺	
^x 1942.9 7	0.10 6					
1946.0 ⁱ		3428.4		1482.63	3 ⁻	
1946.5 7	0.44 5	1945.22	2 ⁺	0.0	0 ⁺	
1947.1 ^h		3316.9		1369.57	4 ⁺	
1953.6 ^f		2261.5		308.576	4 ⁺	
^x 1954.8 7	0.13 8					
1956.6 ^h		3330.2		1374.33	3 ⁻	
^x 1977.7 16	0.14 6					
1984.4 ^f		2292.6		308.576	4 ⁺	
1986.7 ^e		2077.82		93.3240	2 ⁺	
1988.4 ^j		3605.9		1613.05	4 ⁻ , (5 ⁻)	
2008.3 17	0.15 6	2316.64	(4 ⁻), 5 ⁻	308.576	4 ⁺	
2012.1 ^f		2320.9		308.576	4 ⁺	
2032.8 ^f		2341.0		308.576	4 ⁺	
^x 2051.7 17	0.10 6					
2058.3 17	0.10 6	2151.46	3 ⁻ , (4 ⁻)	93.3240	2 ⁺	

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¹⁷⁹ Hf(n,γ) E=thermal 1974Bu22,1990Bo52,1986RoZM (continued)						
γ(¹⁸⁰ Hf) (continued)						
E _γ †	I _γ ‡	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
^x 2085.1 17	0.09 7					
^x 2089.1 10	0.10 8					
2104.9 ^f		2413.1		308.576	4 ⁺	
^x 2106.4 17	0.14 6					
2109.0 ^h		3483.0		1374.33	3 ⁻	
^x 2118.7 19	0.15 6					
^x 2160.0 19	0.14 6					
2163.4 ^f		2472.5		308.576	4 ⁺	
^x 2183.5 19	0.89 7					
2196.2 ^f		2504.3		308.576	4 ⁺	
^x 2199.2 18	0.17 5					
2222.1 ^h		3596.2		1374.33	3 ⁻	
^x 2238.5 18	0.08 6					
2246.2 ^j		3855.3		1609.35	3 ⁻	
2272.7 ^g		2913.3		640.850	6 ⁺	
2317.7 ^j		3926.2		1607.62	3 ⁺ , (4 ⁺)	
2330.5 ^k		7387.60	4 ⁺ , 5 ⁺	5057.6		
2340.2 ^k		7387.60	4 ⁺ , 5 ⁺	5048.0		
2382.9 ^j		3992.1		1609.35	3 ⁻	
2388.0 ⁱ		3869.2		1482.63	3 ⁻	
2397.6 ^f		2706.0		308.576	4 ⁺	
2406.9 ^g		3049.3		640.850	6 ⁺	
2424.1 ^k		7387.60	4 ⁺ , 5 ⁺	4964.9		
2430.1 ^f		2741.3		308.576	4 ⁺	
2442.7 ^g		3083.2		640.850	6 ⁺	
2472.2 ^k		7387.60	4 ⁺ , 5 ⁺	4916.1		
2489.4 ^f		2797.1		308.576	4 ⁺	
2489.5 ⁱ		3974.8		1484.43	4 ⁺	
2504.9 ⁱ		3987.3		1482.63	3 ⁻	
2534.5 ^k		7387.60	4 ⁺ , 5 ⁺	4852.9		
2542.9 ^g		3183.8		640.850	6 ⁺	
2543.2 ^f		2849.8		308.576	4 ⁺	
2550.2 ^f		2858.5		308.576	4 ⁺	
2564.8 ^f		2873.0		308.576	4 ⁺	
2578.8 ^k		7387.60	4 ⁺ , 5 ⁺	4808.6		
2616.8 ^g		3258.1		640.850	6 ⁺	
2627.9 ^h		4002.9		1374.33	3 ⁻	
2672.9 ^g		3316.9		640.850	6 ⁺	E _γ : 2676.4 from level energy difference.
2691.5 ^f		2999.7		308.576	4 ⁺	
2711.5 ^f		3022.2		308.576	4 ⁺	
2722.5 ^j		4331.7		1609.35	3 ⁻	
2742.1 ^f		3049.3		308.576	4 ⁺	
2746.6 ^j		4355.7		1609.35	3 ⁻	
2750.0 ^f		3058.0		308.576	4 ⁺	
2763.3 ^j		4137.4		1374.33	3 ⁻	
2775.9 ^g		3416.9		640.850	6 ⁺	
2781.2 ^f		3089.7		308.576	4 ⁺	
2792.2 ^f		3100.5		308.576	4 ⁺	

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$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π
2813.9 ^j	4422.9		1609.35	3 ⁻	3539.7 ^f	3848.2		308.576	4 ⁺
2815.5 ^f	3123.8		308.576	4 ⁺	3539.7 ^k	7387.60	4 ⁺ ,5 ⁺	3848.2	
2823.8 ^f	3131.5		308.576	4 ⁺	3541.9 ^h	4916.1		1374.33	3 ⁻
2827.7 ^g	3468.4		640.850	6 ⁺	3560.4 ^e	3653.5		93.3240	2 ⁺
2854.6 ^f	3163.1		308.576	4 ⁺	3566.6 ⁱ	5048.0		1482.63	3 ⁻
2891.8 ^f	3200.2		308.576	4 ⁺	3576.0 ⁱ	5057.6		1482.63	3 ⁻
2906.7 ^f	3215.2		308.576	4 ⁺	3579.0 ^e	3672.0		93.3240	2 ⁺
2931.1 ^e	3022.2		93.3240	2 ⁺	3590.4 ^h	4964.9		1374.33	3 ⁻
2965.1 ^k	7387.60	4 ⁺ ,5 ⁺	4422.9		3617.2 ^f	3926.2		308.576	4 ⁺
3009.6 ^f	3316.9		308.576	4 ⁺	3636.8 ^k	7387.60	4 ⁺ ,5 ⁺	3751.1	
3021.0 ^f	3330.2		308.576	4 ⁺	3648.6 ^f	3957.3		308.576	4 ⁺
3032.1 ^k	7387.60	4 ⁺ ,5 ⁺	4355.7		3658.3 ^e	3751.1		93.3240	2 ⁺
3056.0 ^k	7387.60	4 ⁺ ,5 ⁺	4331.7		3667.9 ^f	3974.8		308.576	4 ⁺
3081.0 ^e	3174.2		93.3240	2 ⁺	3695.4 ^f	4002.9		308.576	4 ⁺
3107.2 ^f	3416.9		308.576	4 ⁺	3701.7 ^k	7387.60	4 ⁺ ,5 ⁺	3683.5	
3134.3 ^f	3442.6		308.576	4 ⁺	3716.0 ^k	7387.60	4 ⁺ ,5 ⁺	3672.0	
3159.7 ^e	3252.9		93.3240	2 ⁺	3734.4 ^k	7387.60	4 ⁺ ,5 ⁺	3653.5	
3180.6 ^f	3488.9		308.576	4 ⁺	3747.6 ^k	7387.60	4 ⁺ ,5 ⁺	3640.3	
3191.3 ^f	3499.5		308.576	4 ⁺	3753.6 ^e	3848.2		93.3240	2 ⁺
3201.2 ^j	4808.6		1607.62	3 ⁺ , (4 ⁺)	3762.9 ^k	7387.60	4 ⁺ ,5 ⁺	3625.0	
3207.1 ^f	3515.4		308.576	4 ⁺	3780.0 ^k	7387.60	4 ⁺ ,5 ⁺	3605.9	
3208.6 ^g	3848.2		640.850	6 ⁺	3791.6 ^k	7387.60	4 ⁺ ,5 ⁺	3596.2	
3218.1 ^f	3526.4		308.576	4 ⁺	3861.5 ^k	7387.60	4 ⁺ ,5 ⁺	3526.4	
3226.9 ^g	3869.2		640.850	6 ⁺	3864.6 ^e	3957.3		93.3240	2 ⁺
3239.4 ^g	3880.1		640.850	6 ⁺	3872.5 ^k	7387.60	4 ⁺ ,5 ⁺	3515.4	
3245.2 ^j	4852.9		1607.62	3 ⁺ , (4 ⁺)	3888.4 ^k	7387.60	4 ⁺ ,5 ⁺	3499.5	
3250.4 ^k	7387.60	4 ⁺ ,5 ⁺	4137.4		3899.0 ^k	7387.60	4 ⁺ ,5 ⁺	3488.9	
3267.6 ^g	3908.2		640.850	6 ⁺	3904.8 ^k	7387.60	4 ⁺ ,5 ⁺	3483.0	
3300.1 ^f	3605.9		308.576	4 ⁺	3919.3 ^k	7387.60	4 ⁺ ,5 ⁺	3468.4	
3316.8 ^f	3625.0		308.576	4 ⁺	3945.3 ^k	7387.60	4 ⁺ ,5 ⁺	3442.6	
3332.1 ^f	3640.3		308.576	4 ⁺	3959.4 ^k	7387.60	4 ⁺ ,5 ⁺	3428.4	
3363.4 ^f	3672.0		308.576	4 ⁺	3972.0 ^k	7387.60	4 ⁺ ,5 ⁺	3416.9	
3372.6 ^f	3683.5		308.576	4 ⁺	4049.5 ^k	7387.60	4 ⁺ ,5 ⁺	3338.4	
3385.1 ^k	7387.60	4 ⁺ ,5 ⁺	4002.9		4057.5 ^k	7387.60	4 ⁺ ,5 ⁺	3330.2	
3395.7 ^k	7387.60	4 ⁺ ,5 ⁺	3992.1		4070.8 ^k	7387.60	4 ⁺ ,5 ⁺	3316.9	
3400.5 ^k	7387.60	4 ⁺ ,5 ⁺	3987.3		4084.4 ^k	7387.60	4 ⁺ ,5 ⁺	3303.4	
3413.6 ^k	7387.60	4 ⁺ ,5 ⁺	3974.8		4129.0 ^k	7387.60	4 ⁺ ,5 ⁺	3258.1	
3430.7 ^k	7387.60	4 ⁺ ,5 ⁺	3957.3		4134.8 ^k	7387.60	4 ⁺ ,5 ⁺	3252.9	
3437.3 ⁱ	4916.1		1482.63	3 ⁻	4172.4 ^k	7387.60	4 ⁺ ,5 ⁺	3215.2	
3442.4 ^f	3751.1		308.576	4 ⁺	4187.6 ^k	7387.60	4 ⁺ ,5 ⁺	3200.2	
3461.7 ^k	7387.60	4 ⁺ ,5 ⁺	3926.2		4204.2 ^k	7387.60	4 ⁺ ,5 ⁺	3183.8	
3479.3 ⁱ	4964.9		1484.43	4 ⁺	4213.4 ^k	7387.60	4 ⁺ ,5 ⁺	3174.2	
3479.7 ^k	7387.60	4 ⁺ ,5 ⁺	3908.2		4224.6 ^k	7387.60	4 ⁺ ,5 ⁺	3163.1	
3507.7 ^k	7387.60	4 ⁺ ,5 ⁺	3880.1		4235.0 ^k	7387.60	4 ⁺ ,5 ⁺	3152.8	
3518.5 ^k	7387.60	4 ⁺ ,5 ⁺	3869.2		4256.5 ^k	7387.60	4 ⁺ ,5 ⁺	3131.5	
3532.6 ^k	7387.60	4 ⁺ ,5 ⁺	3855.3		4264.0 ^k	7387.60	4 ⁺ ,5 ⁺	3123.8	

Continued on next page (footnotes at end of table)

$^{179}\text{Hf}(\text{n},\gamma) \text{E=thermal}$ **1974Bu22,1990Bo52,1986RoZM (continued)** $\gamma(^{180}\text{Hf})$ (continued)

E_γ [†]	I_γ [‡]	$E_i(\text{level})$	J_i^π	E_f	J_f^π
4272.8 ^g		4916.1		640.850	6 ⁺
4287.4 ^k		7387.60	4 ⁺ ,5 ⁺	3100.5	
4298.5 ^k		7387.60	4 ⁺ ,5 ⁺	3089.7	
4304.8 ^k		7387.60	4 ⁺ ,5 ⁺	3083.2	
4329.6 ^e		4422.9		93.3240	2 ⁺
4330.1 ^k		7387.60	4 ⁺ ,5 ⁺	3058.0	
4339.1 ^k		7387.60	4 ⁺ ,5 ⁺	3049.3	
4366.5 ^k		7387.60	4 ⁺ ,5 ⁺	3022.2	
4388.3 ^k		7387.60	4 ⁺ ,5 ⁺	2999.7	
4474.6 ^k		7387.60	4 ⁺ ,5 ⁺	2913.3	
4499.5 ^f		4808.6		308.576	4 ⁺
4514.9 ^k		7387.60	4 ⁺ ,5 ⁺	2873.0	
4529.5 ^k		7387.60	4 ⁺ ,5 ⁺	2858.5	
4539.0 ^k		7387.60	4 ⁺ ,5 ⁺	2849.8	
4547.9 ^k		7387.60	4 ⁺ ,5 ⁺	2839.9	
4582.1 ^k		7387.60	4 ⁺ ,5 ⁺	2805.7	
4590.4 ^k		7387.60	4 ⁺ ,5 ⁺	2797.1	
4604.1 ^k		7387.60	4 ⁺ ,5 ⁺	2783.7	
4606.5 ^f		4916.1		308.576	4 ⁺
4616.2 ^k		7387.60	4 ⁺ ,5 ⁺	2771.6	
4646.1 ^k		7387.60	4 ⁺ ,5 ⁺	2741.3	
4659.0 ^f		4964.9		308.576	4 ⁺
4681.7 ^k		7387.60	4 ⁺ ,5 ⁺	2706.0	
4705.8 ^k		7387.60	4 ⁺ ,5 ⁺	2682.1	
4707.8 5	1120 @	7387.60	4 ⁺ ,5 ⁺	2679.97	4,5 ⁻
^x 4738.3 5	280 @				
4748.5 ^f		5057.6		308.576	4 ⁺
4759.3 ^e		4852.9		93.3240	2 ⁺
4827.2 6	350 @	7387.60	4 ⁺ ,5 ⁺	2560.7	
4838.8 ^k		7387.60	4 ⁺ ,5 ⁺	2549.0	
^x 4852.7 5	450 @				
4883.8 ^k		7387.60	4 ⁺ ,5 ⁺	2504.3	
4910.6 5	990 @	7387.60	4 ⁺ ,5 ⁺	2477.04	5 ⁻
4914.8 ^k		7387.60	4 ⁺ ,5 ⁺	2472.5	
4922.6 ^k		7387.60	4 ⁺ ,5 ⁺	2465.3	
4953.8 ^e		5048.0		93.3240	2 ⁺
4974.8 ^k		7387.60	4 ⁺ ,5 ⁺	2413.1	
5019.1 ^k		7387.60	4 ⁺ ,5 ⁺	2368.7	
5046.9 ^k		7387.60	4 ⁺ ,5 ⁺	2341.0	
5053.8 ^k		7387.60	4 ⁺ ,5 ⁺	2334.90	
5066.6 5	150 @	7387.60	4 ⁺ ,5 ⁺	2320.9	
5071.1 4	580 @	7387.60	4 ⁺ ,5 ⁺	2316.64	(4 ⁻),5 ⁻
^x 5074.5 & 6	150 @ &				
5095.3 ^k		7387.60	4 ⁺ ,5 ⁺	2292.6	
5111.8 ^k		7387.60	4 ⁺ ,5 ⁺	2275.6	

Continued on next page (footnotes at end of table)

$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ [†]	I_γ [‡]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]
5126.6 ^k		7387.60	4 ⁺ ,5 ⁺	2261.5		
5135.6 ^k		7387.60	4 ⁺ ,5 ⁺	2252.4		
5142.2 ^k		7387.60	4 ⁺ ,5 ⁺	2245.7		
5145.6 ^k		7387.60	4 ⁺ ,5 ⁺	2242.2		
5172.4 ^k		7387.60	4 ⁺ ,5 ⁺	2215.5		
5187.2 ^k		7387.60	4 ⁺ ,5 ⁺	2200.6		
5202.2 ^k		7387.60	4 ⁺ ,5 ⁺	2187.56		
5214.2 ^k		7387.60	4 ⁺ ,5 ⁺	2174.0		
5234.4 4	550 @	7387.60	4 ⁺ ,5 ⁺	2151.46	3 ⁻ ,(4 ⁻)	
5241.2 ^k		7387.60	4 ⁺ ,5 ⁺	2146.7		
5311.0 ^k		7387.60	4 ⁺ ,5 ⁺	2077.82		
5329.7 ^k		7387.60	4 ⁺ ,5 ⁺	2058.4		
5353.3 4	140 @	7387.60	4 ⁺ ,5 ⁺	2034.37	4 ⁺ ,5 ⁺	
5365.6 ^k		7387.60	4 ⁺ ,5 ⁺	2022.2		
5370.3 ^k		7387.60	4 ⁺ ,5 ⁺	2018.2		
5428.8 ^k		7387.60	4 ⁺ ,5 ⁺	1959.46		
5450.9 ^k		7387.60	4 ⁺ ,5 ⁺	1936.9		
5454.9 ^k		7387.60	4 ⁺ ,5 ⁺	1932.2		
5477.9 3	440 @	7387.60	4 ⁺ ,5 ⁺	1909.68	4 ⁺ ,5 ⁺	
5527.8 ^k		7387.60	4 ⁺ ,5 ⁺	1861.61		
5559.9 ^k		7387.60	4 ⁺ ,5 ⁺	1828.0		
5572.4 4	1490 @ ^b	7387.60	4 ⁺ ,5 ⁺	1813.90	3 ⁻	
5602.1 ^k		7387.60	4 ⁺ ,5 ⁺	1786.5		
5649.4 ^k		7387.60	4 ⁺ ,5 ⁺	1738.4		
5660.4 ^k		7387.60	4 ⁺ ,5 ⁺	1727.4		
5663.0 7	25 @	7387.60	4 ⁺ ,5 ⁺	1724.77	2 ⁺ ,3 ⁺	(E2) ^c
5677.8 3	310 @	7387.60	4 ⁺ ,5 ⁺	1709.5	4 ⁻ ,(5 ⁻)	
5686.8 ^k		7387.60	4 ⁺ ,5 ⁺	1700.81	5 ⁺	
5707.1 ^k		7387.60	4 ⁺ ,5 ⁺	1680.4		
5721.6 ^k		7387.60	4 ⁺ ,5 ⁺	1666.2		
5729.1 ^k		7387.60	4 ⁺ ,5 ⁺	1657.96		
5751.3 7	22 @	7387.60	4 ⁺ ,5 ⁺	1637.16	2 ⁺	(E2) ^c
5774.5 4	390 @	7387.60	4 ⁺ ,5 ⁺	1613.05	4 ⁻ ,(5 ⁻)	
5778.1 4	1050 @ ^d	7387.60	4 ⁺ ,5 ⁺	1609.35	3 ⁻	
5830.4 6	30 @	7387.60	4 ⁺ ,5 ⁺	1557.28		
5847.4 2	1000 @	7387.60	4 ⁺ ,5 ⁺	1539.25	3 ⁻	
5856.0 ^k		7387.60	4 ⁺ ,5 ⁺	1532.9		
5904.6 3	80 @	7387.60	4 ⁺ ,5 ⁺	1482.63	3 ⁻	
5956.9 3	290 @	7387.60	4 ⁺ ,5 ⁺	1429.77	3 ⁻	
5967.0 ^k		7387.60	4 ⁺ ,5 ⁺	1420.5		
5975.9 ^k		7387.60	4 ⁺ ,5 ⁺			
5978.8 4	95 @	7387.60	4 ⁺ ,5 ⁺	1409.24	4 ⁺	
6013.0 4	110 @	7387.60	4 ⁺ ,5 ⁺	1374.33	3 ⁻	
6018.8 4	140 @	7387.60	4 ⁺ ,5 ⁺	1369.57	4 ⁺	
6087.9 ^c	21 @ ^c 6	7387.60	4 ⁺ ,5 ⁺	1300.35	2 ⁺	(E2) ^c

Continued on next page (footnotes at end of table)

$^{179}\text{Hf}(\text{n},\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM (continued) $\gamma(^{180}\text{Hf})$ (continued)

E_γ [†]	I_γ [‡]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]
6096.6 4	64 [@]	7387.60	4 ⁺ ,5 ⁺	1290.99	4 ⁺	
6192.1 6	13 [@]	7387.60	4 ⁺ ,5 ⁺	1192.63	6 ⁺	
6747.0 7	24 [@]	7387.60	4 ⁺ ,5 ⁺	640.850	6 ⁺	
7079.3 3	194 [@]	7387.60	4 ⁺ ,5 ⁺	308.576	4 ⁺	
7295.4 ^c	3.4 ^{@c} 14	7387.60	4 ⁺ ,5 ⁺	93.3240	2 ⁺	(E2) ^c

[†] Energies are from 1974Bu22. Evaluator increased values from bent crystal measurements by 17 ppm to make them consistent with 59.31922 keV 7 (1980De40) for the K-L3 tungsten x-ray standard.

[‡] Intensities of secondary γ -rays from 1974Bu22 are per 100 neutron captures. Uncertainties do not include the uncertainty in the neutron-capture cross section or in the ^{179}Hf isotopic abundance (83.6% 2). Intensities of primary γ -rays are relative to 1000 for 5847.4 γ (1974Bu22).

[#] From ce data of 1986RoZM.

[@] Intensities of primary γ -rays are relative to 1000 for 5847.4 γ (1974Bu22).

[&] Uncertain isotopic assignment (1974Bu22).

^a $I_\gamma(1066\gamma)/I_\gamma(1282\gamma)=23$ disagrees with ≈ 6 from ^{180}Lu β^- decay. Careful examination of different diffraction settings suggests the 1066 γ is a singlet or very closely spaced doublet. See 1974Bu22 for further discussion.

^b Doublet with ^{178}Hf line.

^c From 1984Pr03. Intensities are normalized to $I_\gamma(5663\gamma)=25$ from 1974Bu22.

^d Doublet.

^e From $\gamma\gamma$ coin with energy sum=7294.8 keV; final level energy=93.4 (1990Bo52).

^f From $\gamma\gamma$ coin with energy sum=7079.5 keV; final level energy=308.7 (1990Bo52).

^g From $\gamma\gamma$ coin with energy sum=6747.2 keV; final level energy=641.0 (1990Bo52).

^h From $\gamma\gamma$ coin with energy sum=6013.8 keV; final level energy=1374.5 (1990Bo52).

ⁱ From $\gamma\gamma$ coin with energy sum=5905 keV; final level energy=1482.6 (1990Bo52).

^j From $\gamma\gamma$ coin with energy sum=5779 keV; final level energy=1609.3 (1990Bo52).

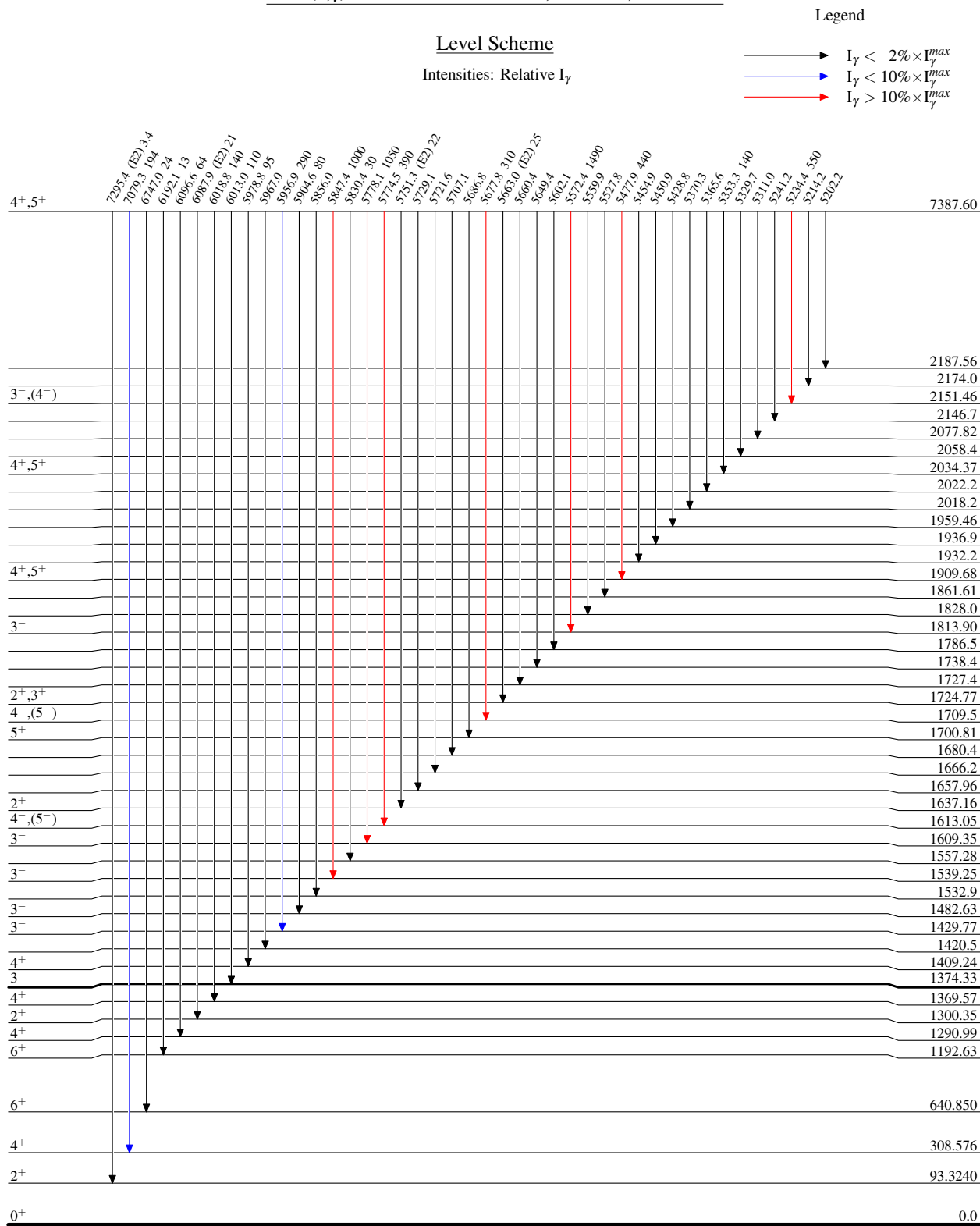
^k From 1990Bo52.

^l Assignment to ^{180}Hf is probable.

^m Multiply placed with undivided intensity.

ⁿ Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM0.57 μs 2

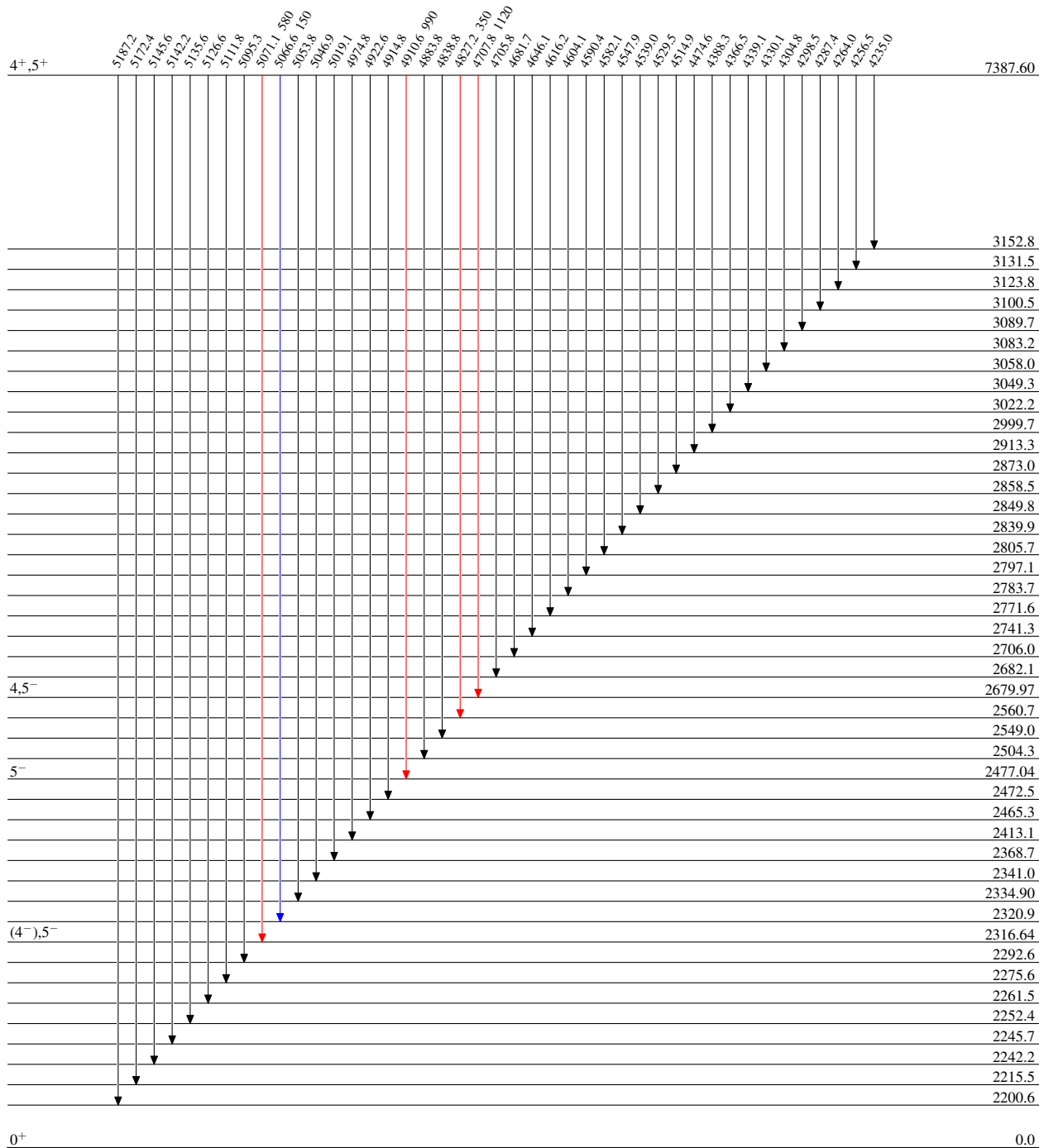
$^{179}\text{Hf}(n,\gamma) \text{ E=thermal}$ 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Intensities: Relative I_γ

Legend

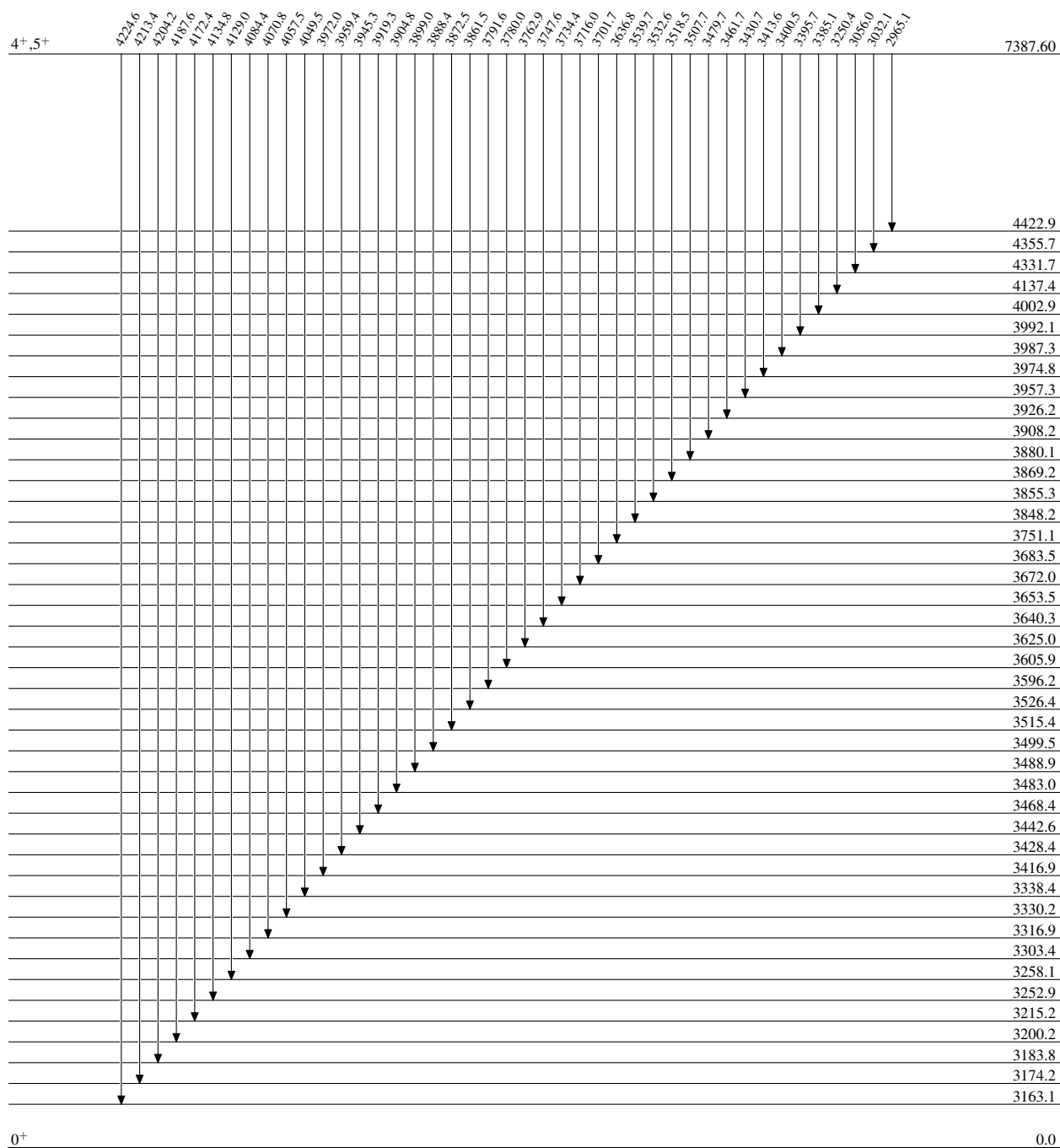
- $I_\gamma < 2\% \times I_\gamma^{\max}$
→ $I_\gamma < 10\% \times I_\gamma^{\max}$
→ $I_\gamma > 10\% \times I_\gamma^{\max}$



$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Intensities: Relative I_γ

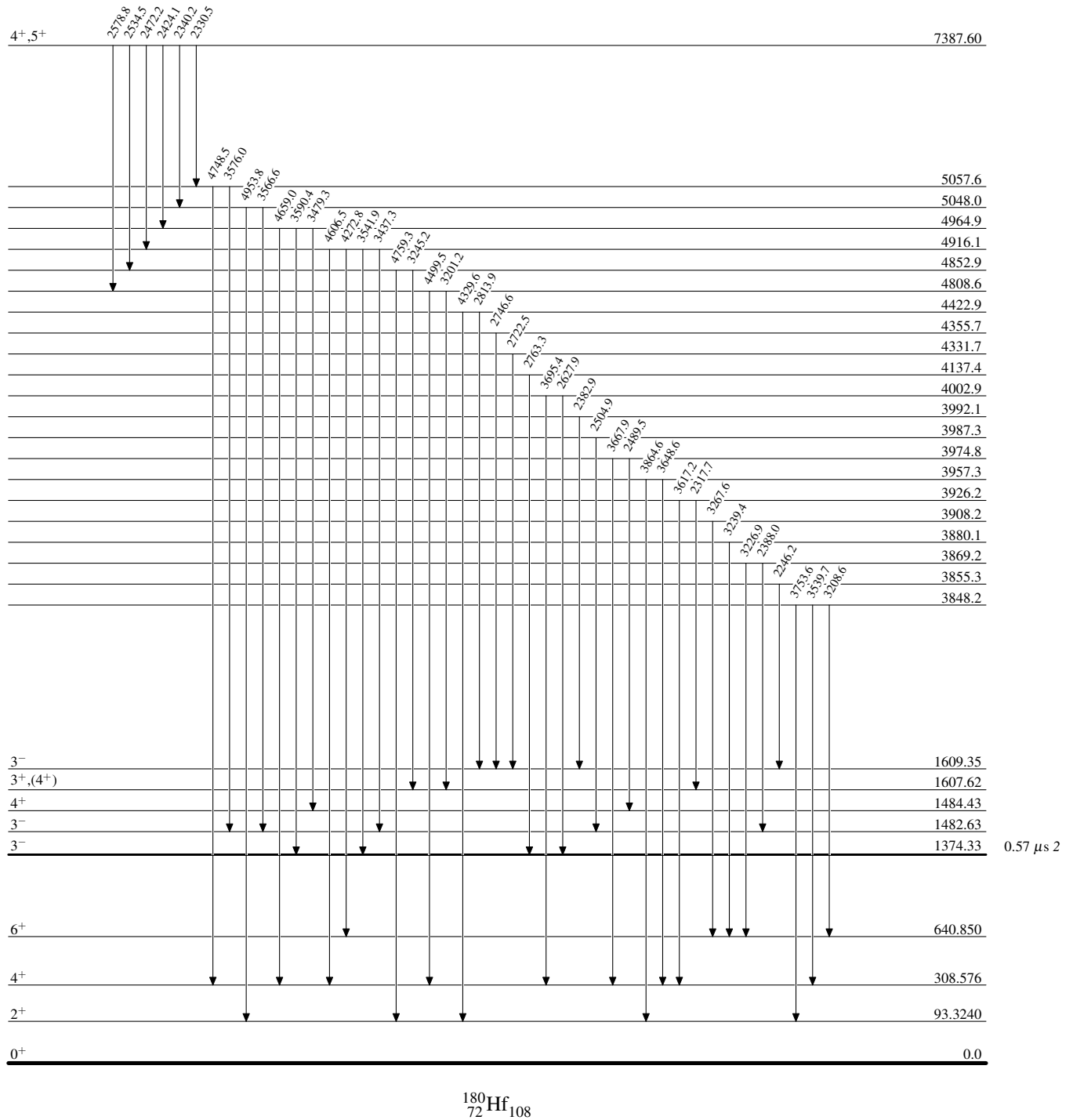


$^{180}_{72}\text{Hf}_{108}$

$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

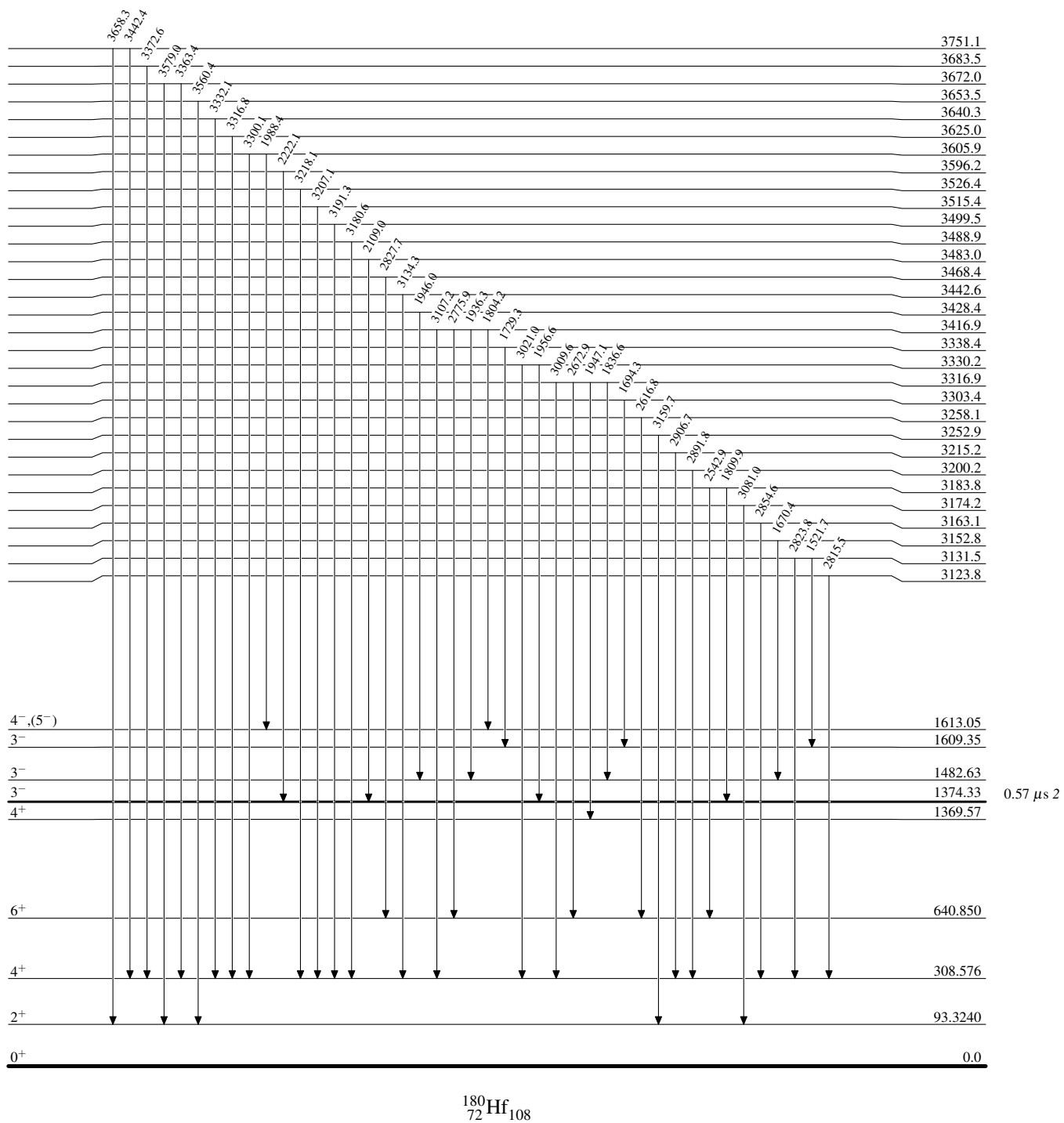
Intensities: Relative I_γ



$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Intensities: Relative I_γ



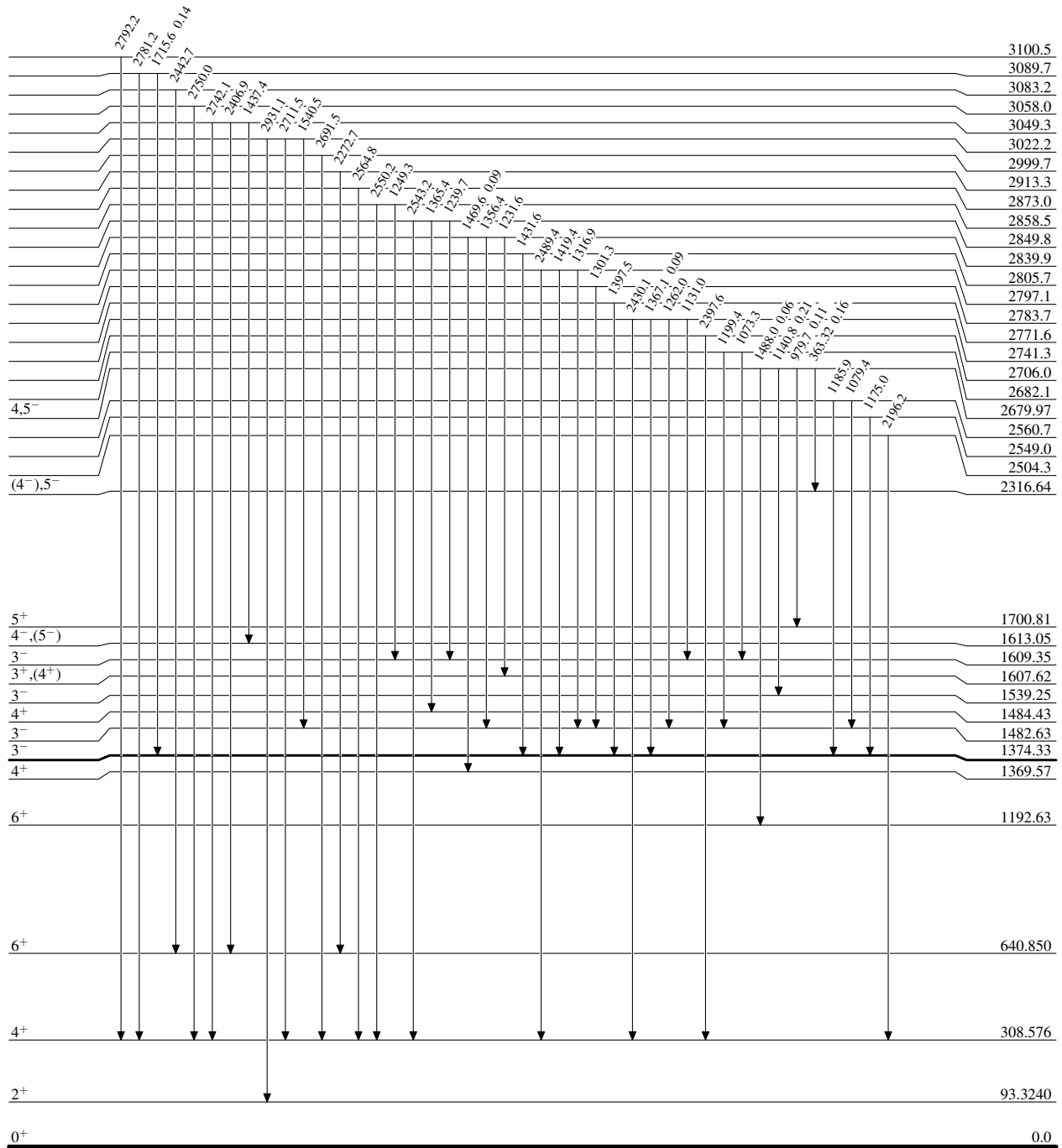
$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Intensities: Relative I_γ

Legend

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

 $^{180}_{72}\text{Hf}_{108}$

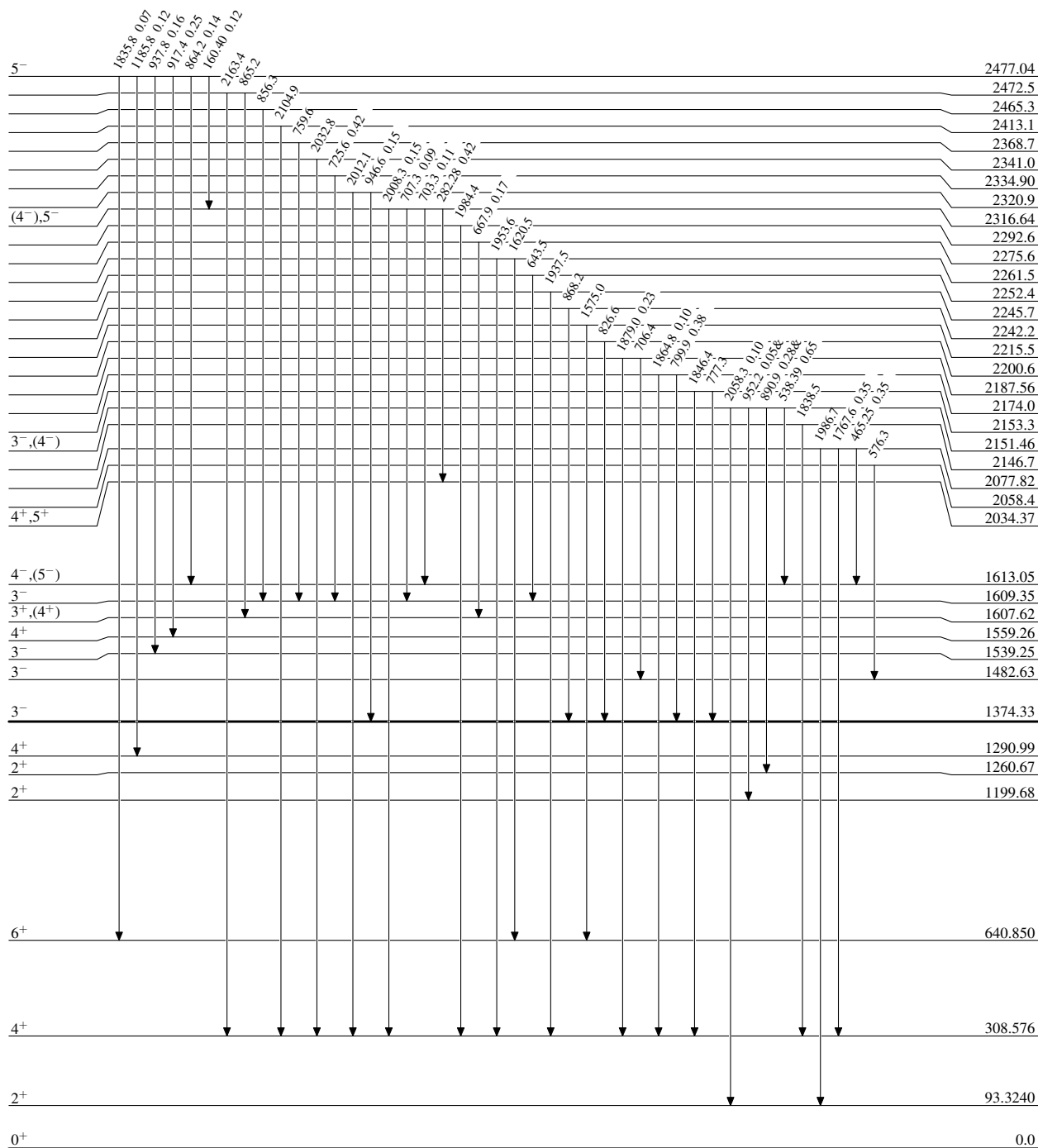
$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Legend

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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



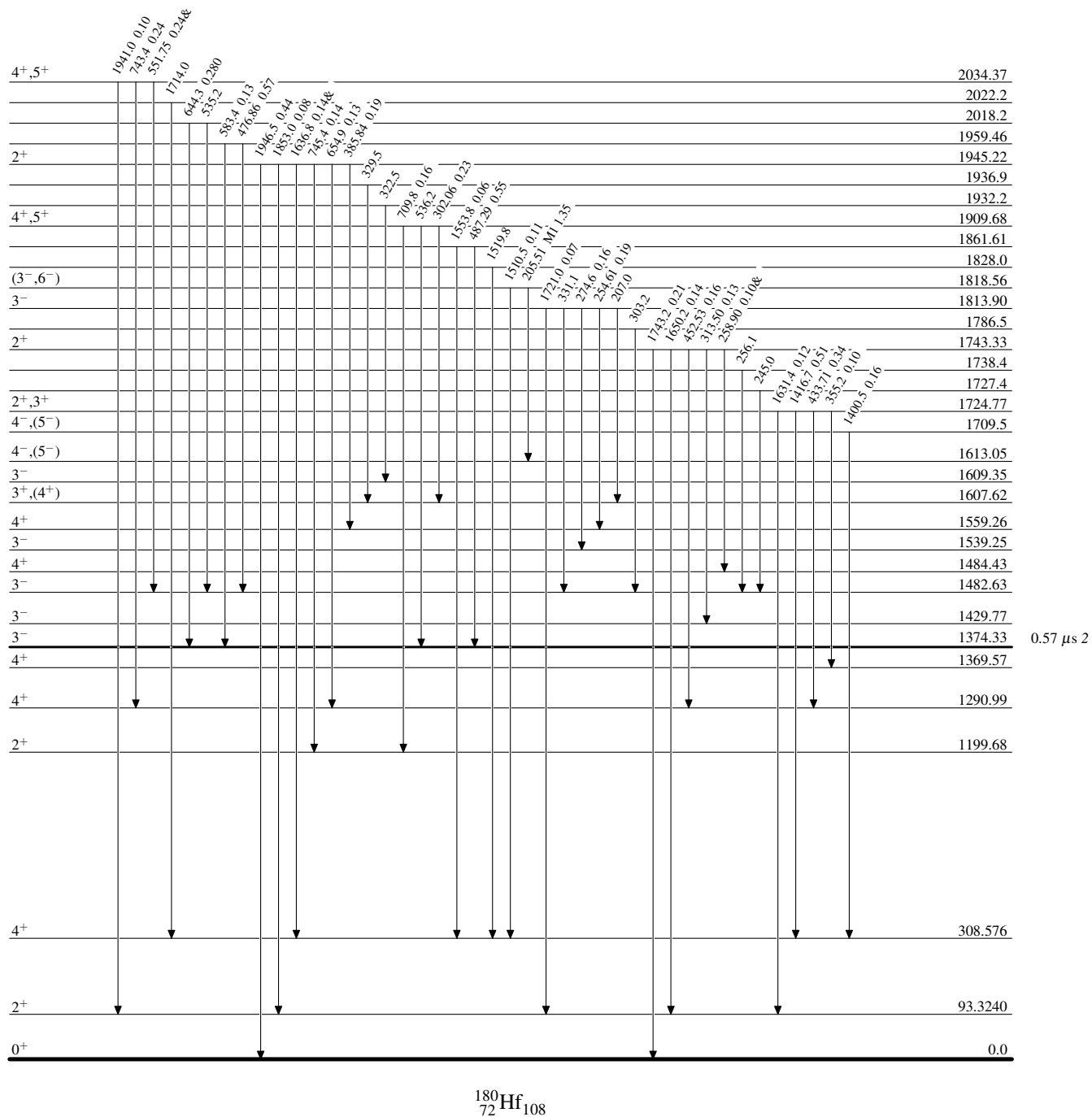
$^{179}\text{Hf}(n,\gamma)$ E=thermal 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend

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

 $^{180}_{72}\text{Hf}_{108}$

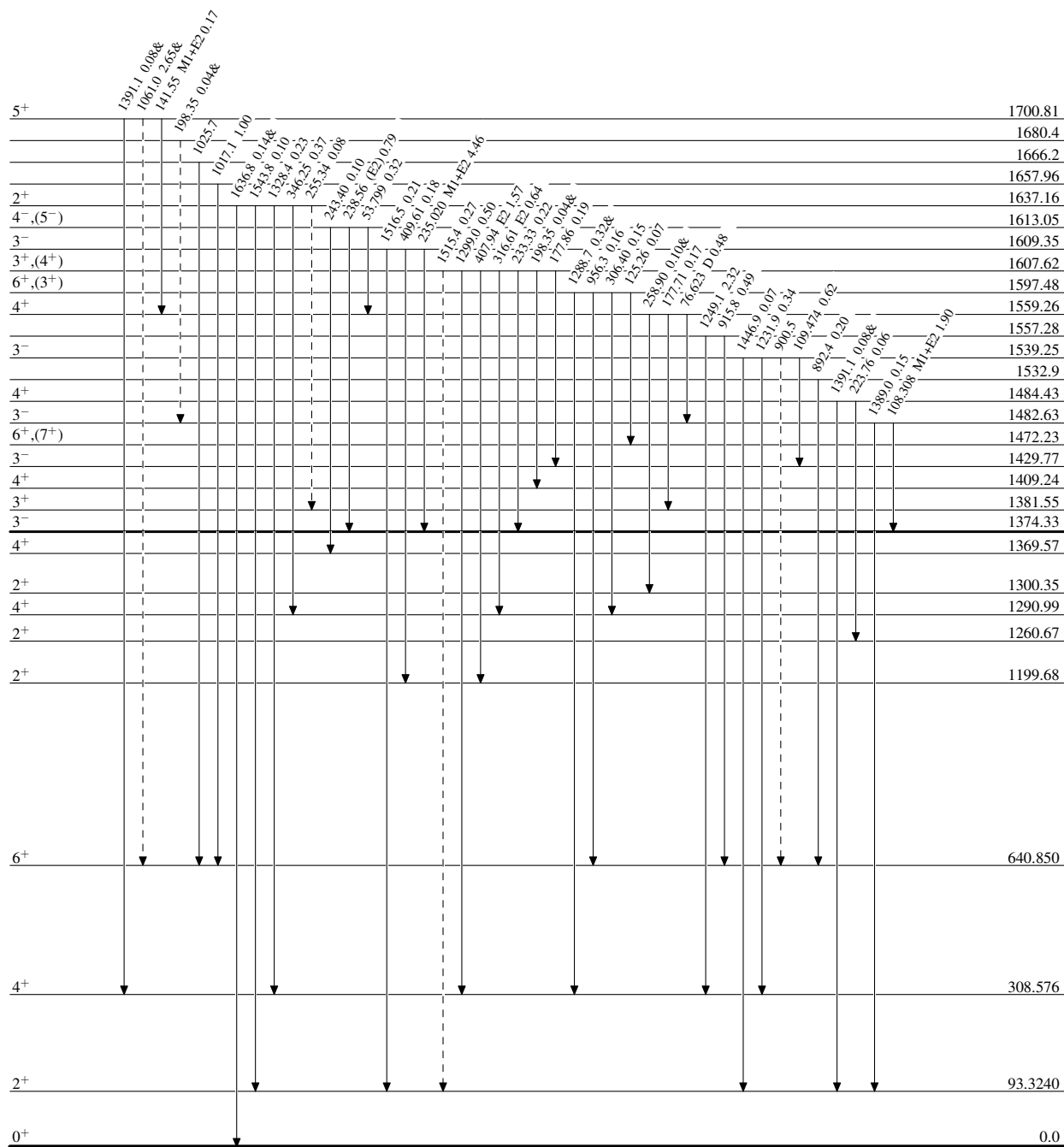
$^{179}\text{Hf}(n,\gamma) \text{ E=thermal}$ 1974Bu22,1990Bo52,1986RoZM

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend

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

0.57 μs 2

$^{179}\text{Hf}(n,\gamma) \text{ E=thermal}$ 1974Bu22,1990Bo52,1986RoZM

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)

