

Energy levels and branching ratios [95Sh21].

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	$T_{1/2}$ or Γ_{cm}
[keV]		
0.0	1^-	23.6(1) h
69.73(4)	3^-	
81.49(5)	5^-	
107.16(5)	5^-	180(8) ns
197.23(10)	7^-	
197.47(10)	7^+	160(40) ns
241.90(7)	7^-	
255.51(11)	9^+	
262.14(8)	9^-	
312.27(11)	9^-	
336.0(3)	11^+	
435.4(3)	13^+	
451.5(2)	11^-	
508.6(2)	11^-	
536.0(3)	13^-	
567.4(3)	15^+	
613.7(2)	13^-	
635.8(2)	$5^+, 7, 9^+$	
704.2(3)	17^+	
775.2(2)	$5^-, 7$	
785.3(2)	$7^-, 9^-$	
797.5(3)	$\langle 15^- \rangle$	
811.7(1)	5^-	
862.2(3)	15^-	
895.0(4)	17^-	
896.0(3)	19^+	
927.5(1)	$3^-, 5, 7^-$	
942.8(1)	7^-	
958.3(1)	$3, 5^-$	
1002.6(3)	$\langle 17^- \rangle$	
1020.1(1)	$5^-, 7^-$	
1060.0(3)	21^+	
1078.3(4)	$\langle 13^+ \rangle$	
1111.4(1)	7^+	
1126.9(1)	5^-	
1192.6(2)	$3^-, 5, 7$	
1208.4(3)	$\langle 15^+ \rangle$	
1225.8(3)	$\langle 19^- \rangle$	
1248.5(1)	7^-	
1294.4(4)	19^-	
1317.5(4)	23^+	
1330.5(4)	21^-	
1355.2(3)	$\langle 17^+ \rangle$	
1450.2(1)	9^+	
1467.2(3)	$\langle 21^- \rangle$	

(continued)

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	$T_{1/2}$ or Γ_{cm}
[keV]		
1473.2(4)	$\langle 17^- \rangle$	
1498.1(4)	25^+	
1521(1)	$\langle 19^+ \rangle$	
1574.1(2)	$3^-, 5^-$	
1655.5(2)	$5^-, 7^-$	
1667.3(2)	$5^-, 7^-$	
1694.5(2)	$5^-, 7$	
1700.5(3)	19^+	≤ 5 ns
1722.3(4)	$\langle 23^- \rangle$	
1796.4(5)	$\langle 23^- \rangle$	
1812.9(4)	$\langle 21^- \rangle$	
1817.3(4)	21^+	
1822.4(4)	27^+	
1832.5(4)	$\langle 25^- \rangle$	
1982.1(5)	$\langle 23^- \rangle$	19.5(6) ns
1989.5(4)	$\langle 25^- \rangle$	
2006.5(5)	$\langle 23^+ \rangle$	
2014.3(4)	29^+	
2145.3(6)	$\langle 25^- \rangle$	
2191.0(4)	$\langle 25^- \rangle$	
2223.1(5)	$\langle 25^+ \rangle$	
2263.6(5)	$\langle 27^- \rangle$	
2263.6(3)	$5^-, 7$	
2354.2(6)	$\langle 27^- \rangle$	
2357.9(6)	$\langle 27^- \rangle$	
2392.7(5)	$\langle 29^- \rangle$	
2397.8(5)	31^+	
2464.8(5)	$\langle 27^+ \rangle$	
2539.4(4)	$\langle 29^- \rangle$	
2596.2(6)	$\langle 29^- \rangle$	
2601.6(5)	33^+	
2617.6(5)	$\langle 29^- \rangle$	
2729.3(5)	$\langle 29^+ \rangle$	
2814.7(7)	$\langle 29^- \rangle$	≤ 3.5 ns
2818.3(6)	$\langle 31^- \rangle$	
2865.5(6)	$\langle 31^- \rangle$	
2969.6(7)	$\langle 31^- \rangle$	
3001.5(5)	$\langle 33^- \rangle$	
3015.0(6)	$\langle 31^+ \rangle$	
3028.2(5)	35^+	
3070.5(7)	$\langle 31^- \rangle$	
3094.7(5)	$\langle 33^- \rangle$	
3105.2(4)	$\langle 33^- \rangle$	
3159.4(6)	$\langle 33^- \rangle$	
3251.5(6)	37^+	

(continued)

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	$T_{1/2}$ or Γ_{cm}
[keV]		
3320.0(6)	$\langle 33^+ \rangle$	
3346.9(7)	$\langle 33^- \rangle$	
3382.7(6)	$\langle 35^- \rangle$	
3474.8(6)	$\langle 35^- \rangle$	
3625.5(7)	$\langle 35^- \rangle$	
3640.0(5)	$\langle 37^- \rangle$	
3642.2(7)	$\langle 35^- \rangle$	
3643.1(6)	$\langle 35^+ \rangle$	
3660.9(5)	$\langle 37^- \rangle$	
3685.5(5)	$\langle 37^- \rangle$	
3701.9(6)	39^+	
3811.1(7)	$\langle 37^- \rangle$	
3954.5(6)	$\langle 41^+ \rangle$	
3959.0(7)	$\langle 37^- \rangle$	
3976.6(7)	$\langle 39^- \rangle$	
3982.6(6)	$\langle 37^+ \rangle$	
4166.1(7)	$\langle 39^- \rangle$	
4256.4(5)	$\langle 41^- \rangle$	
4298.9(8)	$\langle 39^- \rangle$	
4314.0(6)	$\langle 41^- \rangle$	
4324.6(8)	$\langle 39^- \rangle$	
4342.6(6)	$\langle 39^+ \rangle$	
4414.6(7)	$\langle 43^+ \rangle$	
4616.2(8)	$\langle 43^- \rangle$	
4661(2)	$\langle 41^- \rangle$	
4703.5(7)	$\langle 45^+ \rangle$	
4717(1)	$\langle 41^+ \rangle$	
4930.4(6)	$\langle 45^- \rangle$	
4985(1)	$\langle 45^- \rangle$	
5070(2)	$\langle 43^- \rangle$	
5166.7(7)	$\langle 47^+ \rangle$	
5312.8(8)	$\langle 47^- \rangle$	
5493.7(8)	$\langle 49^+ \rangle$	
5664(1)	$\langle 49^- \rangle$	
5970.2(8)	$\langle 51^+ \rangle$	
6070.2(9)	$\langle 51^- \rangle$	
6330.1(8)	$\langle 53^+ \rangle$	
6826.3(8)	$\langle 55^+ \rangle$	
6885(2)	$\langle 55^- \rangle$	
7204(2)	$\langle 57^+ \rangle$	

Additional data on this isotope can be found in [91Fa06].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [95Sh21]. Part 2

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*:$ $2J_f^\pi:$	0.0 1 ⁻	69.73 3 ⁻	81.49 5 ⁻	107.16 5 ⁻	197.23 7 ⁻	197.47 7 ⁺	241.90 7 ⁻	255.51 9 ⁺	262.14 9 ⁻	312.27 9 ⁻
69.73(4)	3 ⁻		100									
81.49(5)	5 ⁻		100	x								
107.16(5)	5 ⁻		x	90(10)	10(3)							
197.23(10)	7 ⁻					100						
197.47(10)	7 ⁺					100						
241.90(7)	7 ⁻			91(9)	8.5(9)							
255.51(11)	9 ⁺							100				
262.14(8)	9 ⁻				100				x			
312.27(11)	9 ⁻					34(8)	66(12)					
336.0(3)	11 ⁺							27(3)		73(4)		
435.4(3)	13 ⁺									45(3)		
451.5(2)	11 ⁻						51(16)					49(14)
508.6(2)	11 ⁻								75(1)		25(10)	
536.0(3)	13 ⁻										100	
613.7(2)	13 ⁻											65(2)
635.8(2)	5 ⁺ , 7, 9 ⁺							85(25)		15(4)		
775.2(2)	5 ⁻ , 7					84(22)		9(3)				6.6(18)
785.3(2)	7 ⁻ , 9 ⁻							32(8)		68(18)		
811.7(1)	5 ⁻		26(7)	≈7	38(10)				5(1)		24(7)	
927.5(1)	3 ⁻ , 5, 7 ⁻			33(8)	53(14)				14(4)			
942.8(1)	7 ⁻			34(8)	4.2(11)				55(4)		4.2(11)	
958.3(1)	3, 5 ⁻		44(12)	16(4)	30(7)	10(3)						
1020.1(1)	5 ⁻ , 7 ⁻			20(6)	9(2)		26(7)		41(12)			4(1)
1111.4(1)	7 ⁺				65(8)			13(3)				20(6)
1126.9(1)	5 ⁻		14(3)	7(2)	38(11)						42(11)	
1192.6(2)	3 ⁻ , 5, 7					53(15)	47(13)					
1248.5(1)	7 ⁻			24(7)	8(2)				51(13)		7(2)	
1450.2(1)	9 ⁺			14(3)	10(3)	<4.4	4.0(14)		68(7)			
1574.1(2)	3 ⁻ , 5 ⁻			[25(6)]	[44(11)]				[31(8)]			
1655.5(2)	5 ⁻ , 7 ⁻			<13	<39				15(3)		85(23)	<21
1667.3(2)	5 ⁻ , 7 ⁻			53(13)	<20				26(7)		21(5)	
1694.5(2)	5 ⁻ , 7				46(12)				x		54(14)	
2263.6(5)	<27 ⁻ >				25(6)				x		37(9)	

Energy levels and branching ratios [95Sh21]. Part 3

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*:$ $2J_f^\pi:$	336.0 11 ⁺	435.4 13 ⁺	451.5 11 ⁻	508.6 11 ⁻	536.0 13 ⁻	567.4 15 ⁺	613.7 13 ⁻	704.2 17 ⁺	797.5 <15 ⁻ >	862.2 15 ⁻
435.4(3)	13 ⁺		55(2)									
567.4(3)	15 ⁺		60(3)	40(2)								
613.7(2)	13 ⁻				35(5)							

(continued)

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	336.0 11 ⁺	435.4 13 ⁺	451.5 11 ⁻	508.6 11 ⁻	536.0 13 ⁻	567.4 15 ⁺	613.7 13 ⁻	704.2 17 ⁺	797.5 15 ⁻	862.2 15 ⁻
704.2(3)	17 ⁺			76.5(5)				23.5(13)				
797.5(3)	15 ⁻				74.6(13)				25(3)			
862.2(3)	15 ⁻					74(1)	26.4(18)					
895.0(4)	17 ⁻						100					
896.0(3)	19 ⁺							75(5)		25(2)		
942.8(1)	7 ⁻					2.5(7)						
1002.6(3)	17 ⁻								79(2)		21(8)	
1060.0(3)	21 ⁺									88.5(5)		
1078.3(4)	13 ⁺		x					x				
1111.4(1)	7 ⁺				1.6(4)							
1208.4(3)	15 ⁺							≤38		≤38		
1225.8(3)	19 ⁻										86.2(13)	
1248.5(1)	7 ⁻					≈10						
1294.4(4)	19 ⁻											100
1355.2(3)	17 ⁺									20(1)		
1450.2(1)	9 ⁺					4.4(14)						
1700.5(3)	19 ⁺							3(1)		47(4)		

Energy levels and branching ratios [95Sh21]. Part 4

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	895.0 17 ⁻	896.0 19 ⁺	1002.6 17 ⁻	1060.0 21 ⁺	1078.3 13 ⁺	1208.4 15 ⁺	1225.8 19 ⁻	1294.4 19 ⁻	1317.5 23 ⁺	1330.5 21 ⁻
1060.0(3)	21 ⁺			11.5(10)								
1208.4(3)	15 ⁺						100					
1225.8(3)	19 ⁻				14(4)							
1294.4(4)	19 ⁻	≤2.6										
1317.5(4)	23 ⁺			84(4)		16.3(20)						
1330.5(4)	21 ⁻	100										
1355.2(3)	17 ⁺			43(7)			≤9	37(33)				
1467.2(3)	21 ⁻				87(2)				13(4)			
1473.2(4)	17 ⁻	100										
1498.1(4)	25 ⁺					96.0(6)					4.0(23)	
1700.5(3)	19 ⁺			15(4)		21(6)		2.1(3)			1.6(10)	
1722.3(4)	23 ⁻								89.3(21)			
1796.4(5)	23 ⁻									100		
1812.9(4)	21 ⁻											52(9)
1822.4(4)	27 ⁺										90(6)	
1832.5(4)	25 ⁻											100

Energy levels and branching ratios [95Sh21]. Part 5

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	1355.2 $\langle 17^+ \rangle$	1467.2 $\langle 21^- \rangle$	1473.2 $\langle 17^- \rangle$	1498.1 25^+	1700.5 19^+	1722.3 $\langle 23^- \rangle$	1796.4 $\langle 23^- \rangle$	1812.9 $\langle 21^- \rangle$	1817.3 21^+	1822.4 27^+
1521(1)	$\langle 19^+ \rangle$		100									
1700.5(3)	19^+		10(2)									
1722.3(4)	$\langle 23^- \rangle$			11(5)								
1812.9(4)	$\langle 21^- \rangle$				48(6)							
1817.3(4)	21^+						100					
1822.4(4)	27^+					10(4)						
1982.1(5)	$\langle 23^- \rangle$										100	
1989.5(4)	$\langle 25^- \rangle$			93(3)				7(4)				
2006.5(5)	$\langle 23^+ \rangle$						≤ 4.2				100	
2014.3(4)	29^+					98(6)						2.2(17)
2191.0(4)	$\langle 25^- \rangle$									77(7)		
2223.1(5)	$\langle 25^+ \rangle$										15(5)	
2263.6(5)	$\langle 27^- \rangle$							37(1)				
2357.9(6)	$\langle 27^- \rangle$								100			
2397.8(5)	31^+											95(10)

Energy levels and branching ratios [95Sh21]. Part 6

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	1832.5 $\langle 25^- \rangle$	1982.1 $\langle 23 \rangle^-$	1989.5 $\langle 25^- \rangle$	2006.5 $\langle 23^+ \rangle$	2014.3 29^+	2145.3 $\langle 25^- \rangle$	2191.0 $\langle 25^- \rangle$	2223.1 $\langle 25^+ \rangle$	2263.6 $\langle 27^- \rangle$	2354.2 $\langle 27^- \rangle$
2145.3(6)	$\langle 25^- \rangle$			100								
2191.0(4)	$\langle 25^- \rangle$		23(9)									
2223.1(5)	$\langle 25^+ \rangle$					85(8)						
2263.6(5)	$\langle 27^- \rangle$				2(1)							
2354.2(6)	$\langle 27^- \rangle$			7(3)				93(12)				
2392.7(5)	$\langle 29^- \rangle$	100										
2397.8(5)	31^+						5.2(22)					
2464.8(5)	$\langle 27^+ \rangle$					44(7)				56(16)		
2539.4(4)	$\langle 29^- \rangle$				100							
2596.2(6)	$\langle 29^- \rangle$							18(3)				82(16)
2601.6(5)	33^+						98(10)					
2617.6(5)	$\langle 29^- \rangle$								100			
2729.3(5)	$\langle 29^+ \rangle$									47(8)		
2814.7(7)	$\langle 29^- \rangle$											100
2818.3(6)	$\langle 31^- \rangle$										100	
2865.5(6)	$\langle 31^- \rangle$											24(4)

Energy levels and branching ratios [95Sh21]. Part 7

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	2357.9 $\langle 27^- \rangle$	2392.7 $\langle 29^- \rangle$	2397.8 31^+	2464.8 $\langle 27^+ \rangle$	2539.4 $\langle 29^- \rangle$	2596.2 $\langle 29^- \rangle$	2601.6 33^+	2617.6 $\langle 29^- \rangle$	2729.3 $\langle 29^+ \rangle$	2814.7 $\langle 29^- \rangle$
2601.6(5)	33^+				1.9(17)							
2729.3(5)	$\langle 29^+ \rangle$					53(9)						
2865.5(6)	$\langle 31^- \rangle$								76(15)			
2969.6(7)	$\langle 31^- \rangle$	100										
3001.5(5)	$\langle 33^- \rangle$			100								
3015.0(6)	$\langle 31^+ \rangle$					67(9)					33(6)	
3028.2(5)	35^+				93(15)				7(3)			
3070.5(7)	$\langle 31^- \rangle$											100
3094.7(5)	$\langle 33^- \rangle$						100					
3105.2(4)	$\langle 33^- \rangle$						61(14)			39(5)		
3159.4(6)	$\langle 33^- \rangle$							31(5)				
3251.5(6)	37^+								100			
3320.0(6)	$\langle 33^+ \rangle$										59(20)	
3346.9(7)	$\langle 33^- \rangle$											22(5)

Energy levels and branching ratios [95Sh21]. Part 8

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	2818.3 $\langle 31^- \rangle$	2865.5 $\langle 31^- \rangle$	2969.6 $\langle 31^- \rangle$	3001.5 $\langle 33^- \rangle$	3015.0 $\langle 31^+ \rangle$	3028.2 35^+	3070.5 $\langle 31^- \rangle$	3094.7 $\langle 33^- \rangle$	3105.2 $\langle 33^- \rangle$	3159.4 $\langle 33^- \rangle$
3159.4(6)	$\langle 33^- \rangle$			69(19)								
3320.0(6)	$\langle 33^+ \rangle$						41(11)					
3346.9(7)	$\langle 33^- \rangle$								78(13)			
3382.7(6)	$\langle 35^- \rangle$	100										
3474.8(6)	$\langle 35^- \rangle$			43(7)								57(19)
3625.5(7)	$\langle 35^- \rangle$				100							
3640.0(5)	$\langle 37^- \rangle$					84(11)				16(7)	≤ 5	
3642.2(7)	$\langle 35^- \rangle$								40(7)			
3643.1(6)	$\langle 35^+ \rangle$						59(14)					
3660.9(5)	$\langle 37^- \rangle$					100						
3685.5(5)	$\langle 37^- \rangle$									58(17)	42(14)	
3701.9(6)	39^+							100				
3811.1(7)	$\langle 37^- \rangle$											42(9)

Energy levels and branching ratios [95Sh21]. Part 9

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	3251.5 37^+	3320.0 $\langle 33^+ \rangle$	3346.9 $\langle 33^- \rangle$	3382.7 $\langle 35^- \rangle$	3474.8 $\langle 35^- \rangle$	3625.5 $\langle 35^- \rangle$	3640.0 $\langle 37^- \rangle$	3642.2 $\langle 35^- \rangle$	3643.1 $\langle 35^+ \rangle$	3660.9 $\langle 37^- \rangle$
3642.2(7)	$\langle 35^- \rangle$				60(17)							
3643.1(6)	$\langle 35^+ \rangle$			41(19)								
3811.1(7)	$\langle 37^- \rangle$						58(17)					
3954.5(6)	$\langle 41^+ \rangle$	100										
3959.0(7)	$\langle 37^- \rangle$				≤ 17					100		
3976.6(7)	$\langle 39^- \rangle$					100						
3982.6(6)	$\langle 37^+ \rangle$			61(26)							39(13)	
4166.1(7)	$\langle 39^- \rangle$						53(15)					
4256.4(5)	$\langle 41^- \rangle$								72(22)			28(6)
4324.6(8)	$\langle 39^- \rangle$							100				
4342.6(6)	$\langle 39^+ \rangle$										32(16)	

Energy levels and branching ratios [95Sh21]. Part 10

 $^{173}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	3685.5 $\langle 37^- \rangle$	3701.9 39^+	3811.1 $\langle 37^- \rangle$	3954.5 $\langle 41^+ \rangle$	3959.0 $\langle 37^- \rangle$	3976.6 $\langle 39^- \rangle$	3982.6 $\langle 37^+ \rangle$	4256.4 $\langle 41^- \rangle$	4298.9 $\langle 39^- \rangle$	4314.0 $\langle 41^- \rangle$
4166.1(7)	$\langle 39^- \rangle$				47(22)							
4298.9(8)	$\langle 39^- \rangle$						100					
4314.0(6)	$\langle 41^- \rangle$	100										
4342.6(6)	$\langle 39^+ \rangle$								68(20)			
4414.6(7)	$\langle 43^+ \rangle$			100								
4616.2(8)	$\langle 43^- \rangle$							100				
4661(2)	$\langle 41^- \rangle$										100	
4703.5(7)	$\langle 45^+ \rangle$					100						
4717(1)	$\langle 41^+ \rangle$								100			
4930.4(6)	$\langle 45^- \rangle$									100		
4985(1)	$\langle 45^- \rangle$											100

Energy levels and branching ratios [95Sh21]. Part 11

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage											
		E_f^* :	4324.6	4414.6	4616.2	4703.5	4930.4	5166.7	5312.8	5493.7	5970.2	6070.2	6330.1
[keV]		$2J_f^\pi$:	$\langle 39^- \rangle$	$\langle 43^+ \rangle$	$\langle 43^- \rangle$	$\langle 45^+ \rangle$	$\langle 45^- \rangle$	$\langle 47^+ \rangle$	$\langle 47^- \rangle$	$\langle 49^+ \rangle$	$\langle 51^+ \rangle$	$\langle 51^- \rangle$	$\langle 53^+ \rangle$
5070(2)	$\langle 43^- \rangle$		100										
5166.7(7)	$\langle 47^+ \rangle$			100									
5312.8(8)	$\langle 47^- \rangle$				100								
5493.7(8)	$\langle 49^+ \rangle$					100							
5664(1)	$\langle 49^- \rangle$						100						

(continued)

 $^{173}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage											
		E_f^* :	4324.6	4414.6	4616.2	4703.5	4930.4	5166.7	5312.8	5493.7	5970.2	6070.2	6330.1
[keV]		$2J_f^\pi$:	$\langle 39^- \rangle$	$\langle 43^+ \rangle$	$\langle 43^- \rangle$	$\langle 45^+ \rangle$	$\langle 45^- \rangle$	$\langle 47^+ \rangle$	$\langle 47^- \rangle$	$\langle 49^+ \rangle$	$\langle 51^+ \rangle$	$\langle 51^- \rangle$	$\langle 53^+ \rangle$
5970.2(8)	$\langle 51^+ \rangle$							100					
6070.2(9)	$\langle 51^- \rangle$								100				
6330.1(8)	$\langle 53^+ \rangle$									100			
6826.3(8)	$\langle 55^+ \rangle$										100		
6885(2)	$\langle 55^- \rangle$											100	
7204(2)	$\langle 57^+ \rangle$												100

Energy levels and branching ratios [99Br24].

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	$T_{1/2}$ or Γ_{cm}
0.0	0^+	$2.0(4) \cdot 10^{15}$ yr
90.99(2)	2^+	1.66(7) ns
297.38(4)	4^+	
608.26(5)	6^+	
828.1(2)	0^+	
900.24(4)	2^+	2.2(5) ps
1009.6	8^+	
1062.17(4)	4^+	
1226.77(7)	2^+	0.36(6) ps
1303.36(8)	$\langle 3^+ \rangle$	
1307.4	6^+	
1308.69(10)	$\langle 2^- \rangle$	
1319.40(5)	2^+	≤ 5 ns
1321	$\langle 3^- \rangle$	
1336.48(7)	$\langle 3 \rangle^+$	
1394.60(8)	$\langle 4 \rangle^+$	
1425.24(8)	$\langle 4 \rangle^-$	
1442.66(11)	$\langle 5^- \rangle$	
1448.85(6)	4^+	
1485.9	$\langle 10^+ \rangle$	
1496.36(11)	2^+	
1503.29(5)	$\langle 4 \rangle^+$	≤ 5 ns
1508.2	$\langle 5^+ \rangle$	
1549.3	$\langle 6^+ \rangle$	138(4) ns
1561.72(14)	4^-	
1626.0(3)	4^+	
1627.4(3)	5^-	
1630.5	$\langle 8^+ \rangle$	
1634.4	$\langle 6^- \rangle$	
1642.15(9)	6^+	

(continued)

 $^{174}_{72}\text{Hf}$

E^*	J^π	$T_{1/2}$ or
[keV]		Γ_{cm}
1648.33(18)	4^-	
1650.6	$\langle 7^- \rangle$	
1658.41(7)	$\langle 5^+ \rangle$	
1713.5	$\langle 6^- \rangle$	0.45(10) ns
1722.43(19)	6^-	
1737.4	$\langle 7^+ \rangle$	
1767.66(11)	5^-	
1779.9(2)	$\langle 2^+, 3, 4^+ \rangle$	
1797.5	$\langle 8^- \rangle$	2.39(4) μs
1798.0	$\langle 7^+ \rangle$	
1827.4	$\langle 7^- \rangle$	
1838.14(17)	7^-	
1861.78(15)	$\langle 2^+, 3, 4^+ \rangle$	
1904.4(3)	$\langle 6^+ \rangle$	
1910.0(3)	$\langle 6^- \rangle$	
1928.4	$\langle 8^- \rangle$	
1937.46(14)	6^-	
1943.9	$\langle 9^- \rangle$	
1948.1	$\langle 8^+ \rangle$	
1963.4	$\langle 8^- \rangle$	
1972.06(10)	8^+	
1981.50(21)	8^-	
2016.7(3)	6^-	
2020.5	$\langle 12^+ \rangle$	
2026.3	$\langle 10^+ \rangle$	
2028.0	$\langle 9^- \rangle$	0.5(3) ps
2030.25(15)	$4^{(+)}$	
2084.35(9)	7^-	
2119.0	$\langle 9^- \rangle$	
2124.56(20)	$\langle 8^- \rangle$	
2135.43(25)	9^-	
2167.1	$\langle 9^+ \rangle$	
2180.0	$\langle 9^+ \rangle$	
2276.87(9)	8^-	
2279.2	$\langle 10^- \rangle$	
2295.7	$\langle 10^- \rangle$	
2299.4	$\langle 10^- \rangle$	
2319.2	$\langle 11^- \rangle$	
2331.5(4)	10^-	
2338.51(13)	$\langle 2^+, 3, 4^+ \rangle$	
2353.99(25)	$\langle 3, 4^+ \rangle$	
2379.22(10)	10^+	
2402.80(7)	2^+	
2421.98(10)	$\langle 3 \rangle^-$	
2429.6(3)	$\langle 10^- \rangle$	

(continued)

 $^{174}_{72}\text{Hf}$

E^*	J^π	$T_{1/2}$ or Γ_{cm}
[keV]		
2431.2	$\langle 10^+ \rangle$	
2441.85(23)	$\langle 2^+, 3, 4^+ \rangle$	
2447.41(14)	9^-	
2486.1(4)	$2^{\langle + \rangle}$	
2487.73(10)	11^-	
2489.35(8)	12^+	
2491.7(3)	$\langle 2^+, 3, 4^+ \rangle$	
2505.25(15)	$2^{\langle + \rangle}$	
2515.6(3)	11^-	
2529.97(17)	2^+	
2554.6	$\langle 11^- \rangle$	
2592.21(20)	$\langle 3, 4^+ \rangle$	
2597.5	$\langle 14^+ \rangle$	
2609.5	$\langle 11^+ \rangle$	
2641.0(4)	$4^{\langle + \rangle}$	
2653.82(8)	10^-	
2684.85(9)	$\langle 12^+ \rangle$	
2700.3	$\langle 11^+ \rangle$	
2700.8	$\langle 12^- \rangle$	
2729.84(12)		
2744.2	$\langle 12^- \rangle$	
2767.9(5)	12^-	
2772.0	$\langle 13^- \rangle$	
2791.42(17)	$\langle 2^+, 3, 4^+ \rangle$	
2792.98(8)	10^-	
2823.6(4)	$\langle 12^- \rangle$	
2847.4	$\langle 12^- \rangle$	
2854.35(10)	12^+	
2859.21(16)	11^-	
2931.76(25)	$2^{\langle + \rangle}$	
2932.7	$\langle 13^- \rangle$	
2958.72(7)	$\langle 11^- \rangle$	
2972.4(3)	13^-	
2983.3	$\langle 12^+ \rangle$	
2992.5	$\langle 14^+ \rangle$	
3046.24(11)	$\langle 11^- \rangle$	
3087.9(3)	$4^{\langle + \rangle}$	
3090.16(7)	12^-	
3106.0(5)	$\langle 2, 3, 4 \rangle$	
3117.4	$\langle 13^+ \rangle$	
3157.02(11)	$\langle 13^- \rangle$	
3180.7	$\langle 14^- \rangle$	
3191.1(5)	$\langle 2, 3, 4 \rangle$	
3208.9	$\langle 16^+ \rangle$	
3230.06(16)	12^-	

(continued)		¹⁷⁴ ₇₂ Hf
E^*	J^π	$T_{1/2}$ or
[keV]		Γ_{cm}
3248.01(16)		
3260.2	$\langle 14^- \rangle$	
3269.0	$\langle 13^+ \rangle$	
3280.2(4)	14^-	
3296.3	$\langle 15^- \rangle$	
3300.24(13)	13^-	
3301.8(5)	$\langle 14^- \rangle$	
3311.7	$\langle 14^+ \rangle$	3.7(2) μs
3449.7	$\langle 15^- \rangle$	
3500.4	$\langle 16^+ \rangle$	
3545.5	$\langle 15^+ \rangle$	
3680.5	$\langle 15^+ \rangle$	
3795.6	$\langle 16^+ \rangle$	
3857.3	$\langle 18^+ \rangle$	
3885.9	$\langle 17^- \rangle$	
4048	$\langle 18^+ \rangle$	
4065.7	$\langle 17^+ \rangle$	
4358.1	$\langle 18^+ \rangle$	
4550.8	$\langle 20^+ \rangle$	
4656	$\langle 20^+ \rangle$	
5291	$\langle 22^+ \rangle$	
5359	$\langle 22^+ \rangle$	
6062.7(15)	$\langle 24^+ \rangle$	
6164.7(15)	$\langle 24^+ \rangle$	
6890	$\langle 26^+ \rangle$	
7027	$\langle 26^+ \rangle$	
0+X	$J > 23$	
726+X	$J+2$	
1490+X	$J+4$	
2310+X	$J+6$	
3177+X	$J+8$	
4095+X	$J+10$	
5065+X	$J+12$	
6090+X	$J+14$	
7172+X	$J+16$	
8313+X	$J+18$	
9515+X	$J+20$	
10779+X	$J+22$	
12105+X	$J+24$	
0+Y	$J_1 > 24$	
755+Y	J_1+2	
1548+Y	J_1+4	
2394+Y	J_1+6	
3293+Y	J_1+8	
4248+Y	J_1+10	

(continued)

 $^{174}_{72}\text{Hf}$

E^*	J^π	$T_{1/2}$ or Γ_{cm}
[keV]		
5263+Y	J_1+12	
6340+Y	J_1+14	
7480+Y	J_1+16	
8684+Y	J_1+18	
9953+Y	J_1+20	
11288+Y	J_1+22	
0+Z	$J_2>22$	
702+Z	J_2+2	
1456+Z	J_2+4	
2237+Z	J_2+6	
3078+Z	J_2+8	
3968+Z	J_2+10	
4909+Z	J_2+12	
5905+Z	J_2+14	
6960+Z	J_2+16	
8065+Z	J_2+18	
0+U	$J_3>28$	
855+U	J_3+2	
1759+U	J_3+4	
2708+U	J_3+6	
3703+U	J_3+8	
4748+U	J_3+10	
5846+U	J_3+12	
7001+U	J_3+14	
8219+U	J_3+16	

Additional data on this isotope can be found in [00Ya22, 90Wa09].

Abundance: 0.16(1) %.

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [99Br24]. Part 2

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E^*_f : J^π_f :	0.0 0 ⁺	90.98 2 ⁺	297.4 4 ⁺	608 6 ⁺	828 0 ⁺	900 2 ⁺	1009.6 8 ⁺	1062.17 4 ⁺	1226.77 2 ⁺	1303.36 <3 ⁺ >
90.99(2)	2 ⁺		100									
297.38(4)	4 ⁺			100								
608.26(5)	6 ⁺				100							
828.1(2)	0 ⁺	x		100								
900.24(4)	2 ⁺	31(3)		43(3)	25(3)							
1009.6	8 ⁺					100						
1062.17(4)	4 ⁺			36(3)	41(2)	7(1)		16(5)				
1226.77(7)	2 ⁺		49(22)	51(4)								

(continued)

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	0.0 0 ⁺	90.98 2 ⁺	297.4 4 ⁺	608 6 ⁺	828 0 ⁺	900 2 ⁺	1009.6 8 ⁺	1062.17 4 ⁺	1226.77 2 ⁺	1303.36 <3 ⁺ >
1303.36(8)	<3 ⁺ >			90(45)	10(5)							
1307.4	6 ⁺				30(8)	55			5(3)	10(2)		
1308.69(10)	<2 ⁻ >			90(12)				10(4)				
1319.40(5)	2 ⁺	34.4(5)		38(9)	22(2)		1.1(3)	4.6(6)				
1336.48(7)	<3 ⁺ >			80(7)	20(3)							
1394.60(8)	<4 ⁺ >			42(14)	58(4)							
1425.24(8)	<4 ⁻ >				93(8)					7.3(19)		
1442.66(11)	<5 ⁻ >				58(8)	42(8)						
1448.85(6)	4 ⁺			42(8)	54(6)	4(2)					≤0.9	
1485.9	<10 ⁺ >								100			
1496.36(11)	2 ⁺	26(10)		17(6)	56(11)		≤48					
1503.29(5)	<4 ⁺ >			4.0(7)	92(5)					4.0(5)		
1508.2	<5 ⁺ >				31(2)	6(6)						12(7)
1549.3	<6 ⁺ >				39.5(6)	55.1(4)			1.21(8)	0.3(2)		
1561.72(14)	4 ⁻				100							
1626.0(3)	4 ⁺			40(8)	19(5)	40						
1627.4(3)	5 ⁻				54(8)	46(7)						
1630.5	<8 ⁺ >					74			26(10)			
1634.4	<6 ⁻ >					91(8)						
1642.15(9)	6 ⁺				14(6)	11(4)						
1648.33(18)	4 ⁻				100							
1650.6	<7 ⁻ >					100						
1658.41(7)	<5 ⁺ >				84(8)	16(3)				≤13		
1713.5	<6 ⁻ >					42(3)						
1722.43(19)	6 ⁻					92(15)						
1767.66(11)	5 ⁻					91(27)				9(9)		
1779.9(2)	<2 ⁺ ,3,4 ⁺ >			29(11)	53(13)							
1797.5	<8 ⁻ >								0.11(5)			
1827.4	<7 ⁻ >					4(1)			6(2)			
1838.14(17)	7 ⁻					26(9)			16(3)			
1861.78(15)	<2 ⁺ ,3,4 ⁺ >			53(10)	44(7)							
1904.4(3)	<6 ⁺ >				72(14)	28(4)						
1910.0(3)	<6 ⁻ >					76(6)						
1928.4	<8 ⁻ >								x			
1937.46(14)	6 ⁻					47(4)						
1943.9	<9 ⁻ >								x			
1981.50(21)	8 ⁻								44(10)			
2016.7(3)	6 ⁻					50(20)						
2030.25(15)	4 ⁽⁺⁾			≤77	93(12)	≤7.7						
2084.35(9)	7 ⁻					8(3)			38(19)			
2124.56(20)	<8 ⁻ >								53(53)			
2135.43(25)	9 ⁻								10(4)			
2276.87(9)	8 ⁻								20(4)			
2338.51(13)	<2 ⁺ ,3,4 ⁺ >			18(6)	37(15)						5(2)	
2353.99(25)	<3,4 ⁺ >			15(4)	21(9)					36(9)		

(continued)

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	0.0 0 ⁺	90.98 2 ⁺	297.4 4 ⁺	608 6 ⁺	828 0 ⁺	900 2 ⁺	1009.6 8 ⁺	1062.17 4 ⁺	1226.77 2 ⁺	1303.36 <3 ⁺ >
2402.80(7)	2 ⁺							≤10			52(5)	
2421.98(10)	<3> ⁻			1.8(5)	18(2)							
2441.85(23)	<2 ⁺ ,3,4 ⁺ >			28(6)	43(10)							18(3)
2486.1(4)	2 ^{<+>}		47(26)		53(26)							
2491.7(3)	<2 ⁺ ,3,4 ⁺ >			42(7)	58(8)			≤11		≤9		
2505.25(15)	2 ^{<+>}	9(4)		5.3(16)	11(2)							
2529.97(17)	2 ⁺	3(1)		31(4)	17(2)			24(4)				
2592.21(20)	<3,4 ⁺ >			54	37(10)							10(3)
2641.0(4)	4 ^{<+>}			13(3)	21(7)	≤43						
2729.84(12)								62(6)			≤21	
2791.42(17)	<2 ⁺ ,3,4 ⁺ >			57(17)	43(7)							
2931.76(25)	2 ^{<+>}	15(3)		9(2)	7(1)		10(2)	≤22				
3087.9(3)	4 ^{<+>}			5(2)	14(2)	45(10)						≤10
3106.0(5)	<2,3,4>			9(3)	40(12)							
3191.1(5)	<2,3,4>			6(2)	17(4)							22(9)
3248.01(16)											4(1)	42(6)

Energy levels and branching ratios [99Br24]. Part 3

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	1307.4 6 ⁺	1308.69 <2 ⁻ >	1319.40 2 ⁺	1321 <3 ⁻ >	1336.48 <3> ⁺	1394.60 <4> ⁺	1425.24 <4> ⁻	1442.66 <5 ⁻ >	1448.85 4 ⁺	1485.9 <10 ⁺ >
1508.2	<5 ⁺ >							51(16)				
1549.3	<6 ⁺ >	0.59(12)						1.9(7)			1.4(7)	
1630.5	<8 ⁺ >	x										
1634.4	<6 ⁻ >								9(5)			
1642.15(9)	6 ⁺							37(15)				
1648.33(18)	4 ⁻								≤10			
1779.9(2)	<2 ⁺ ,3,4 ⁺ >			17(4)								
2020.5	<12 ⁺ >											100
2026.3	<10 ⁺ >											x
2084.35(9)	7 ⁻	15(15)										
2319.2	<11 ⁻ >											x
2338.51(13)	<2 ⁺ ,3,4 ⁺ >			4(3)								
2353.99(25)	<3,4 ⁺ >								≤10			
2402.80(7)	2 ⁺				26(5)		22(4)					
2421.98(10)	<3> ⁻				5.0(9)				38(5)	24(3)		
2431.2	<10 ⁺ >											x
2441.85(23)	<2 ⁺ ,3,4 ⁺ >						11(3)					
2486.1(4)	2 ^{<+>}				≤34							
2505.25(15)	2 ^{<+>}				75(7)							
2529.97(17)	2 ⁺			4(1)	21(3)							

(continued)

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1307.4 6 ⁺	1308.69 2 ⁻	1319.40 2 ⁺	1321 3 ⁻	1336.48 3 ⁺	1394.60 4 ⁺	1425.24 4 ⁻	1442.66 5 ⁻	1448.85 4 ⁺	1485.9 10 ⁺
2592.21(20)	3,4 ⁺								≤14			
2641.0(4)	4 ⁽⁺⁾										52(16)	
2653.82(8)	10 ⁻											3(4)
2729.84(12)		≤4.0										
2958.72(7)	11 ⁻											0.20(7)
3046.24(11)	11 ⁻											1.0(3)
3106.0(5)	2,3,4					≤18						
3191.1(5)	2,3,4										37(9)	
3248.01(16)			≤42		13(5)			12(3)				

Energy levels and branching ratios [99Br24]. Part 4

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1496.36 2 ⁺	1503.29 (4) ⁺	1508.2 (5 ⁺)	1549.3 (6 ⁺)	1561.72 4 ⁻	1627.4 5 ⁻	1630.5 (8 ⁺)	1634.4 (6 ⁻)	1642.15 6 ⁺	1648.33 4 ⁻
1642.15(9)	6 ⁺				37(37)							
1713.5	(6 ⁻)				49(2)	9(4)						
1722.43(19)	6 ⁻					8(8)						
1737.4	(7 ⁺)				100							
1797.5	(8 ⁻)				12(2)							
1798.0	(7 ⁺)			x							x	
1838.14(17)	7 ⁻						58(17)					
1861.78(15)	(2 ⁺ ,3,4 ⁺)	3(2)										
1910.0(3)	(6 ⁻)											24(6)
1928.4	(8 ⁻)									x		
1937.46(14)	6 ⁻											53(12)
1948.1	(8 ⁺)				x							
1972.06(10)	8 ⁺										83(21)	
2016.7(3)	6 ⁻											50(10)
2026.3	(10 ⁺)								x			
2338.51(13)	(2 ⁺ ,3,4 ⁺)			37(7)								
2447.41(14)	9 ⁻								22(12)			
2729.84(12)		38(3)										
2931.76(25)	2 ⁽⁺⁾	18(5)										
3087.9(3)	4 ⁽⁺⁾	≤16										37(11)
3248.01(16)												28(5)

Energy levels and branching ratios [99Br24]. Part 5

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	1650.6 $\langle 7^- \rangle$	1658.41 $\langle 5^+ \rangle$	1713.5 $\langle 6^- \rangle$	1722.43 6^-	1737.4 $\langle 7^+ \rangle$	1767.66 5^-	1779.9	1797.5 $\langle 8^- \rangle$	1798.0 $\langle 7^+ \rangle$	1827.4 $\langle 7^- \rangle$
1797.5	$\langle 8^- \rangle$						88(4)					
1827.4	$\langle 7^- \rangle$				89(17)							
1943.9	$\langle 9^- \rangle$	x										
1948.1	$\langle 8^+ \rangle$						x					
1963.4	$\langle 8^- \rangle$				22(2)							78(9)
1972.06(10)	8^+									17(7)		
1981.50(21)	8^-					56(28)						
2028.0	$\langle 9^- \rangle$									100		
2030.25(15)	$4^{\langle + \rangle}$			7(3)								
2084.35(9)	7^-							38(15)				
2119.0	$\langle 9^- \rangle$											x
2167.1	$\langle 9^+ \rangle$									84(28)		
2180.0	$\langle 9^+ \rangle$						x					
2276.87(9)	8^-	7(2)										
2279.2	$\langle 10^- \rangle$									7.9(9)		
2353.99(25)	$\langle 3,4^+ \rangle$							28(5)				
2592.21(20)	$\langle 3,4^+ \rangle$			≤ 10								
2792.98(8)	10^-									25(3)		
3087.9(3)	$4^{\langle + \rangle}$			≤ 14								

Energy levels and branching ratios [99Br24]. Part 6

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	1838.14 7^-	1861.78	1910.0 $\langle 6^- \rangle$	1928.4 $\langle 8^- \rangle$	1937.46 6^-	1943.9 $\langle 9^- \rangle$	1948.1 $\langle 8^+ \rangle$	1963.4 $\langle 8^- \rangle$	1972.06 8^+	1981.50 8^-
2119.0	$\langle 9^- \rangle$									x		
2124.56(20)	$\langle 8^- \rangle$				47(32)							
2135.43(25)	9^-		90(21)									
2167.1	$\langle 9^+ \rangle$										16(8)	
2180.0	$\langle 9^+ \rangle$							x				
2276.87(9)	8^-				1.2(6)	16(3)	35(7)					
2295.7	$\langle 10^- \rangle$									13(3)		
2299.4	$\langle 10^- \rangle$					100						
2319.2	$\langle 11^- \rangle$							x				
2331.5(4)	10^-											100
2379.22(10)	10^+										72(14)	
2421.98(10)	$\langle 3 \rangle^-$			12(2)								
2431.2	$\langle 10^+ \rangle$								x			
2653.82(8)	10^-							7(3)				
2791.42(17)	$\langle 2^+, 3,4^+ \rangle$			≤ 33								
3046.24(11)	$\langle 11^- \rangle$							2.6(19)				

Energy levels and branching ratios [99Br24]. Part 7

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	2016.7 6 ⁻	2020.5 ⟨12 ⁺ ⟩	2026.3 ⟨10 ⁺ ⟩	2028.0 ⟨9 ⁻ ⟩	2084.35 7 ⁻	2119.0 ⟨9 ⁻ ⟩	2124.56 ⟨8 ⁻ ⟩	2135.43 9 ⁻	2167.1 ⟨9 ⁺ ⟩	2180.0 ⟨9 ⁺ ⟩
2276.87(9)	8 ⁻		5(1)				15(4)					
2279.2	⟨10 ⁻ ⟩					89(4)		3.2(6)				
2295.7	⟨10 ⁻ ⟩					53(5)		34(4)				
2379.22(10)	10 ⁺										28(10)	
2429.6(3)	⟨10 ⁻ ⟩								100			
2431.2	⟨10 ⁺ ⟩											x
2447.41(14)	9 ⁻						78(22)					
2487.73(10)	11 ⁻							41(9)				
2489.35(8)	12 ⁺			60(4)	40(4)							
2515.6(3)	11 ⁻									100		
2554.6	⟨11 ⁻ ⟩					17(2)						
2597.5	⟨14 ⁺ ⟩			100								
2609.5	⟨11 ⁺ ⟩										57(2)	
2684.85(9)	⟨12 ⁺ ⟩			83(9)								
2700.3	⟨11 ⁺ ⟩											x
2772.0	⟨13 ⁻ ⟩		x									
2792.98(8)	10 ⁻					36(3)						
2859.21(16)	11 ⁻				47(16)							
2958.72(7)	⟨11 ⁻ ⟩				1.3(4)							
2983.3	⟨12 ⁺ ⟩			0.4(2)								
3046.24(11)	⟨11 ⁻ ⟩				12(3)							
3311.7	⟨14 ⁺ ⟩			0.19(8)								

Energy levels and branching ratios [99Br24]. Part 8

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	2276.87 8 ⁻	2279.2 ⟨10 ⁻ ⟩	2295.7 ⟨10 ⁻ ⟩	2299.4 ⟨10 ⁻ ⟩	2319.2 ⟨11 ⁻ ⟩	2331.5 10 ⁻	2338.51	2379.22 10 ⁺	2402.80 2 ⁺	2429.6 ⟨10 ⁻ ⟩
2487.73(10)	11 ⁻				59(5)							
2554.6	⟨11 ⁻ ⟩			78(4)	5(2)							
2609.5	⟨11 ⁺ ⟩									43(26)		
2641.0(4)	4 ⁽⁺⁾								14(4)			
2653.82(8)	10 ⁻		64(5)			7(3)						
2700.8	⟨12 ⁻ ⟩				x							
2744.2	⟨12 ⁻ ⟩					100						
2767.9(5)	12 ⁻							100				
2772.0	⟨13 ⁻ ⟩						x					
2792.98(8)	10 ⁻			33(2)	3.7(4)							
2823.6(4)	⟨12 ⁻ ⟩											100
2847.4	⟨12 ⁻ ⟩			34(11)								
2854.35(10)	12 ⁺									85(21)		
2958.72(7)	⟨11 ⁻ ⟩			29(1)	5.5(5)							

(continued)

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E^*_f : J^π_f :	2276.87 8 ⁻	2279.2 ⟨10 ⁻ ⟩	2295.7 ⟨10 ⁻ ⟩	2299.4 ⟨10 ⁻ ⟩	2319.2 ⟨11 ⁻ ⟩	2331.5 10 ⁻	2338.51	2379.22 10 ⁺	2402.80 2 ⁺	2429.6 ⟨10 ⁻ ⟩
3046.24(11)	⟨11 ⁻ ⟩						6.1(14)					
3090.16(7)	12 ⁻			1.9(5)			0.38(14)					
3106.0(5)	⟨2,3,4⟩										26(7)	

Energy levels and branching ratios [99Br24]. Part 9

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E^*_f : J^π_f :	2431.2 ⟨10 ⁺ ⟩	2447.41 9 ⁻	2487.73 11 ⁻	2489.35 12 ⁺	2491.7	2515.6 11 ⁻	2554.6 ⟨11 ⁻ ⟩	2592.21 ⟨3,4 ⁺ ⟩	2597.5 ⟨14 ⁺ ⟩	2609.5 ⟨11 ⁺ ⟩
2653.82(8)	10 ⁻			19.2(15)								
2684.85(9)	⟨12 ⁺ ⟩					17(6)						
2700.3	⟨11 ⁺ ⟩	x										
2700.8	⟨12 ⁻ ⟩				x							
2792.98(8)	10 ⁻								1.7(5)			
2847.4	⟨12 ⁻ ⟩								66(7)			
2854.35(10)	12 ⁺											15(9)
2859.21(16)	11 ⁻			53(12)								
2931.76(25)	2 ^{⟨+} +									41(6)		
2932.7	⟨13 ⁻ ⟩				x							
2958.72(7)	⟨11 ⁻ ⟩								21.4(9)			
2972.4(3)	13 ⁻							100				
2983.3	⟨12 ⁺ ⟩		44(1)									
2992.5	⟨14 ⁺ ⟩					x					x	
3090.16(7)	12 ⁻								7.3(6)			
3106.0(5)	⟨2,3,4⟩						24(9)					
3117.4	⟨13 ⁺ ⟩											84(56)
3157.02(11)	⟨13 ⁻ ⟩								33(7)			
3208.9	⟨16 ⁺ ⟩										100	
3296.3	⟨15 ⁻ ⟩										x	
3311.7	⟨14 ⁺ ⟩					0.4(1)					0.72(4)	

Energy levels and branching ratios [99Br24]. Part 10

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E^*_f : J^π_f :	2653.82 10 ⁻	2684.85 ⟨12 ⁺ ⟩	2700.3 ⟨11 ⁺ ⟩	2700.8 ⟨12 ⁻ ⟩	2744.2 ⟨12 ⁻ ⟩	2767.9 12 ⁻	2772.0 ⟨13 ⁻ ⟩	2792.98 10 ⁻	2823.6 ⟨12 ⁻ ⟩	2847.4 ⟨12 ⁻ ⟩
2932.7	⟨13 ⁻ ⟩				x							
2958.72(7)	⟨11 ⁻ ⟩									43(2)		
2983.3	⟨12 ⁺ ⟩				55(1)							

(continued)

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E^*_f :	2653.82	2684.85	2700.3	2700.8	2744.2	2767.9	2772.0	2792.98	2823.6	2847.4
		J^π_f :	10 ⁻	⟨12 ⁺ ⟩	⟨11 ⁺ ⟩	⟨12 ⁻ ⟩	⟨12 ⁻ ⟩	12 ⁻	⟨13 ⁻ ⟩	10 ⁻	⟨12 ⁻ ⟩	⟨12 ⁻ ⟩
3090.16(7)	12 ⁻		9.3(8)				0.44(12)			1.4(4)		2.9(5)
3157.02(11)	⟨13 ⁻ ⟩											67(7)
3180.7	⟨14 ⁻ ⟩				x							
3260.2	⟨14 ⁻ ⟩					100						
3269.0	⟨13 ⁺ ⟩				x							
3280.2(4)	14 ⁻							100				
3296.3	⟨15 ⁻ ⟩								x			
3301.8(5)	⟨14 ⁻ ⟩										100	
3311.7	⟨14 ⁺ ⟩			0.49(6)					0.09(3)			

Energy levels and branching ratios [99Br24]. Part 11

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
		E_f^* :	2854.35	2859.21	2931.76	2932.7	2958.72	2972.4	2983.3	2992.5	3046.24	3090.16
[keV]		J_f^π :	12 ⁺	11 ⁻	2 ⁽⁺⁾	⟨13 ⁻ ⟩	⟨11 ⁻ ⟩	13 ⁻	⟨12 ⁺ ⟩	⟨14 ⁺ ⟩	⟨11 ⁻ ⟩	12 ⁻
3046.24(11)	⟨11 ⁻ ⟩							78(31)				
3090.16(7)	12 ⁻			1.17(14)				75(4)				
3117.4	⟨13 ⁺ ⟩		16(12)									
3180.7	⟨14 ⁻ ⟩					x						
3191.1(5)	⟨2,3,4⟩				18(3)							
3230.06(16)	12 ⁻							34(7)			66(12)	
3269.0	⟨13 ⁺ ⟩								x			
3300.24(13)	13 ⁻											100
3311.7	⟨14 ⁺ ⟩		0.5(2)			2.2(2)		0.07(7)	25.1(3)	0.2(2)		17.2(7)
3449.7	⟨15 ⁻ ⟩					x						
3500.4	⟨16 ⁺ ⟩									100		

Energy levels and branching ratios [99Br24]. Part 12

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		$E^*_{\rm f}$: $J^\pi_{\rm f}$:	3117.4 $\langle 13^+ \rangle$	3157.02 $\langle 13^- \rangle$	3180.7 $\langle 14^- \rangle$	3208.9 $\langle 16^+ \rangle$	3230.06 12 $^-$	3260.2 $\langle 14^- \rangle$	3269.0 $\langle 13^+ \rangle$	3280.2 14 $^-$	3296.3 $\langle 15^- \rangle$	3300.24 13 $^-$
3311.7	$\langle 14^+ \rangle$		0.02(2)	0.90(9)	0.24(7)		0.05(3)	0.05(6)	38.6(4)	0.05(3)	0.10(5)	12.7(5)
3449.7	$\langle 15^- \rangle$				x							
3680.5	$\langle 15^+ \rangle$		100									
3857.3	$\langle 18^+ \rangle$					100						
3885.9	$\langle 17^- \rangle$										100	

Energy levels and branching ratios [99Br24]. Part 13

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E^*_f : J^π_f :	3301.8 $\langle 14^- \rangle$	3311.7 $\langle 14^+ \rangle$	3500.4 $\langle 16^+ \rangle$	3545.5 $\langle 15^+ \rangle$	3795.6 $\langle 16^+ \rangle$	3857.3 $\langle 18^+ \rangle$	4048 $\langle 18^+ \rangle$	4065.7 $\langle 17^+ \rangle$	4550.8 $\langle 20^+ \rangle$	4656 $\langle 20^+ \rangle$
3311.7	$\langle 14^+ \rangle$		0.05(3)									
3545.5	$\langle 15^+ \rangle$			100								
3795.6	$\langle 16^+ \rangle$					100						
4048	$\langle 18^+ \rangle$				100							
4065.7	$\langle 17^+ \rangle$					x	x					
4358.1	$\langle 18^+ \rangle$									100		
4550.8	$\langle 20^+ \rangle$							100				
4656	$\langle 20^+ \rangle$								100			
5291	$\langle 22^+ \rangle$										100	
5359	$\langle 22^+ \rangle$										x	x

Energy levels and branching ratios [99Br24]. Part 14

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	5291 $\langle 22^+ \rangle$	5359 $\langle 22^+ \rangle$	6062.7 $\langle 24^+ \rangle$	6164.7 $\langle 24^+ \rangle$	0+X $J>23$	726+X $J+2$	1490+X $J+4$	2310+X $J+6$	3177+X $J+8$	4095+X $J+10$
6062.7(15)	$\langle 24^+ \rangle$		100									
6164.7(15)	$\langle 24^+ \rangle$			100								
6890	$\langle 26^+ \rangle$				100							
7027	$\langle 26^+ \rangle$					100						
726+X	$J+2$						100					
1490+X	$J+4$							100				
2310+X	$J+6$								100			
3177+X	$J+8$									100		
4095+X	$J+10$										100	
5065+X	$J+12$											100

Energy levels and branching ratios [99Br24]. Part 15

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage									
[keV]	$E^*_\text{f}:$ $J^\pi_\text{f}:$	5065+X $J+12$	6090+X $J+14$	7172+X $J+16$	8313+X $J+18$	9515+X $J+20$	10779+X $J+22$	0+Y $J_1>24$	755+Y J_1+2	1548+Y J_1+4	2394+Y J_1+6
6090+X	$J+14$	100									
7172+X	$J+16$		100								
8313+X	$J+18$			100							
9515+X	$J+20$				100						
10779+X	$J+22$					100					
12105+X	$J+24$						100				
755+Y	J_1+2							100			

(continued)

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
		E_f^* :	5065+X	6090+X	7172+X	8313+X	9515+X	10779+X	0+Y	755+Y	1548+Y	2394+Y
[keV]		J_f^π :	$J+12$	$J+14$	$J+16$	$J+18$	$J+20$	$J+22$	$J_1>24$	J_1+2	J_1+4	J_1+6
1548+Y	J_1+4									100		
2394+Y	J_1+6										100	
3293+Y	J_1+8											100

Energy levels and branching ratios [99Br24]. Part 16

 $^{174}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	3293+Y J_1+8	4248+Y J_1+10	5263+Y J_1+12	6340+Y J_1+14	7480+Y J_1+16	8684+Y J_1+18	9953+Y J_1+20	0+Z $J_2>22$	702+Z J_2+2	1456+Z J_2+4
4248+Y	J_1+10	100										
5263+Y	J_1+12			100								
6340+Y	J_1+14				100							
7480+Y	J_1+16					100						
8684+Y	J_1+18						100					
9953+Y	J_1+20							100				
11288+Y	J_1+22								100			
702+Z	J_2+2									100		
1456+Z	J_2+4										100	
2237+Z	J_2+6											100

Energy levels and branching ratios [99Br24]. Part 17

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage							
		E_f^* : J_f^π :	2237+Z J_2+6	3078+Z J_2+8	3968+Z J_2+10	4909+Z J_2+12	5905+Z J_2+14	6960+Z J_2+16	0+U $J_3>28$
3078+Z	J_2+8		100						
3968+Z	J_2+10			100					
4909+Z	J_2+12				100				
5905+Z	J_2+14					100			
6960+Z	J_2+16						100		
8065+Z	J_2+18							100	
855+U	J_3+2								100

Energy levels and branching ratios [99Br24]. Part 18

 $^{174}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage							
		$E_f^*:$ $J_f^\pi:$	855+U J_3+2	1759+U J_3+4	2708+U J_3+6	3703+U J_3+8	4748+U J_3+10	5846+U J_3+12	7001+U J_3+14
1759+U	J_3+4		100						
2708+U	J_3+6			100					
3703+U	J_3+8				100				
4748+U	J_3+10					100			
5846+U	J_3+12						100		
7001+U	J_3+14							100	
8219+U	J_3+16								100

Energy levels and branching ratios [04Ba89].

 $^{175}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	σ (d,t) <i>rel.</i>	$T_{1/2}$ or Γ_{cm}	Ref.
0.0	5^-	0.02	70(2) d	73Za08
81.40(6)	7^-	0.50		73Za08
125.89(12)	1^-	1.00	53.7(15) μs	73Za08
185.75(10)	9^-			
196.40(13)	3^-	0.10		73Za08
207.41(5)	7^+		1.55(9) ns	
213.37(11)	5^-	0.10		
257.97(10)	9^+	0.04		
312.35(10)	11^-			
334.83(11)	11^+			
348.19(10)	7^-	0.02		
375.47(16)	7^-	0.13		
406.0(3)	9^-	0.01		
435.75(11)	13^+	0.04		
460.6(1)	13^-			04Ba89
474.81(13)	9^-	0.01		73Za08
566.2(1)	15^+			04Ba89
629.1(4)	11^-			04Ba89
629.8(1)	15^-			04Ba89
643.93(20)	9^+			04Ba89
654.6(1)	11^-			04Ba89
698.4(1)	13^-			
711.2(1)	17^+			
732.5(4)	5^+			
797.42(21)	11^+			
807.3(4)	7^+			
818.7(3)	17^-			
866.8(4)	1^-			
896.98(15)	19^+			

(continued)

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	σ (d,t)	$T_{1/2}$ or	Ref.
[keV]		<i>rel.</i>	Γ_{cm}	
910.2(5)	$\langle 3^- \rangle$			
941(2)	$\langle 3^- \rangle$	0.27		73Za08
962(2)*		0.02		73Za08
965.7(4)		0.02		73Za08
997.7(9)	$\langle 1^-, 3^- \rangle$	0.03		73Za08
1025.1(15)	$\langle 15^- \rangle$			04Ba89
1027.4(3)	$\langle 19^- \rangle$			04Ba89
1056(3)	$\langle 7^- \rangle$	0.05		04Ba89
1060.2(4)	$\langle 5-9 \rangle$			04Ba89
1066(3)		0.06		73Za08
1076.0(2)	$\langle 21^+ \rangle$			04Ba89
1081(2)	$\langle 7^- \rangle$	0.07		73Za08
1082.2(2)	$\langle 17^- \rangle$			04Ba89
1124.1(3)	$\langle 7, 9 \rangle$			04Ba89
1139(2)	$\langle 9^- \rangle$	0.06		73Za08
1155.96(22)	$\langle 15^+ \rangle$			04Ba89
1205.81(13)	$\langle 9^- \rangle$			04Ba89
1224.88(19)	$\langle 7^- \rangle$			04Ba89
1248.53(21)	$\langle 9^- \rangle$	0.01		73Za08
1253.6(3)	$\langle 21^- \rangle$			04Ba89
1322.7(8)	$\langle 23^+ \rangle$			04Ba89
1338.9(3)	$\langle 17^+ \rangle$			04Ba89
1375.0(11)	$\langle 1, 3 \rangle$			04Ba89
1433.4(1)	$\langle 19^+ \rangle$		1.10(8) μs	04Ba89
1455.7(5)	$\langle 1, 3 \rangle$			04Ba89
1466.1(2)	$\langle 7^+ \rangle$			04Ba89
1468.5(4)	$\langle 5^- \rangle$			04Ba89
1477.0(2)	$\langle 19^- \rangle$			04Ba89
1497.3(7)	$\langle 23^- \rangle$			04Ba89
1523.3(1)	$\langle 25^+ \rangle$			04Ba89
1545.6(2)	$\langle 21^+ \rangle$			04Ba89
1547.4(2)	$\langle 21^- \rangle$			04Ba89
1584(2)		0.15		04Ba89
1606.04(21)	$\langle 9^+ \rangle$			04Ba89
1635(2)		0.12		73Za08
1642.8(13)	$\langle 1, 3 \rangle$			04Ba89
1646.9(3)	$\langle 21^+ \rangle$			04Ba89
1658.87(24)	$\langle 5^+, 7^+ \rangle$			04Ba89
1671(2)		0.02		73Za08
1735.6(7)	$\langle 23^+ \rangle$			04Ba89
1746.6(5)	$\langle 5^+ - 9^+ \rangle$	0.03		73Za08
1757.3(3)	$\langle 25^- \rangle$			04Ba89
1766.3(2)	$\langle 23^- \rangle$		1.16(11) ns	04Ba89
1793.34(20)	$\langle 5^+ \rangle$			04Ba89
1802.8(3)	$\langle 9^- \rangle$			04Ba89

(continued)

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	σ (d,t)	$T_{1/2}$ or	Ref.
[keV]		<i>rel.</i>	Γ_{cm}	
1818.14(21)	$\langle 9^+ \rangle$			04Ba89
1825.71(23)	$\langle 7^+ \rangle$			04Ba89
1836.8(13)	$\langle 27^+ \rangle$			04Ba89
1887.8(4)				04Ba89
1893.88(21)	$\langle 9^+ \rangle$			04Ba89
1904.4(3)	$\langle 25^- \rangle$			04Ba89
1954.1(8)	$\langle 25^+ \rangle$			04Ba89
1998.4(20)	$\langle 23^- \rangle$			04Ba89
2033.3(11)	$\langle 27^- \rangle$			04Ba89
2046.4(15)	$\langle 29^+ \rangle$			04Ba89
2081.8(20)	$\langle 25^- \rangle$			04Ba89
2114.2(3)	$\langle 27^- \rangle$			04Ba89
2195.7(9)	$\langle 27^+ \rangle$			04Ba89
2322.4(4)	$\langle 29^- \rangle$			04Ba89
2360.1(3)	$\langle 29^- \rangle$			04Ba89
2432.3(2)	$\langle 31^+ \rangle$			04Ba89
2458.7(10)	$\langle 29^+ \rangle$			04Ba89
2578.2(23)	$\langle 27^- \rangle$			04Ba89
2627.6(11)	$\langle 31^- \rangle$			04Ba89
2634.3(3)	$\langle 31^- \rangle$			04Ba89
2638.6(18)	$\langle 33^+ \rangle$			04Ba89
2677.8(20)	$\langle 29^- \rangle$			04Ba89
2742.0(11)	$\langle 31^+ \rangle$			04Ba89
2932.9(3)	$\langle 33^- \rangle$			04Ba89
2941.2(3)	$\langle 33^- \rangle$			04Ba89
3015.6(4)	$\langle 35^- \rangle$		1.21(15) μs	04Ba89
3044.4(12)	$\langle 33^+ \rangle$			04Ba89
3292.3(21)	$\langle 37^+ \rangle$			04Ba89
3305.7(9)	$\langle 37^- \rangle$			04Ba89
3629.7(10)	$\langle 39^- \rangle$			04Ba89
3819.6(9)	$\langle 39^+ \rangle$		≈ 10 ns	04Ba89
3977.9(11)	$\langle 41^- \rangle$			04Ba89
4157.4(12)	$\langle 41^+ \rangle$			04Ba89
4345.0(11)	$\langle 43^- \rangle$			04Ba89
4505.4(12)	$\langle 43^+ \rangle$			04Ba89
4636.3(12)	$\langle 45^+ \rangle$			04Ba89
4727.9(12)	$\langle 45^- \rangle$			04Ba89
5124.0(13)	$\langle 47^- \rangle$			04Ba89
5531.9(14)	$\langle 49^- \rangle$			04Ba89
5949.0(15)	$\langle 51^- \rangle$			04Ba89
6371.8(18)	$\langle 53^- \rangle$			04Ba89
6510.1(17)	$\langle 53^+ \rangle$		≤ 10 ns	04Ba89
6794.3(16)	$\langle 55^- \rangle$			04Ba89

(continued)

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	σ (d,t)	$T_{1/2}$ or	Ref.
[keV]		<i>rel.</i>	Γ_{cm}	
7455.2(17)	$\langle 57^- \rangle$	73Za08	>10 ns	04Ba89 Ref.

Additional data on this isotope can be found in [05Ha24, 90Gj01].

* Not included in Adopted Levels [04Ba89].

Measured at 45° , data for 65° and 90° can be found in [73Za08].

12 bands of levels are shown in the level scheme [04Ba89].

 $T_{1/2}$ and uncertainties in E^* are given in Supplement.

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [04Ba89]. Part 2

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
		E^*_f :	0.0	81.50	125.93	185.92	196.43	207.48	213.42	258.00	312.53	335.30
[keV]		$2J^\pi_f$:	5 ⁻	7 ⁻	1 ⁻	9 ⁻	3 ⁻	$\langle 7^+ \rangle$	5 ⁻	$\langle 9^+ \rangle$	$\langle 11^- \rangle$	$\langle 11^+ \rangle$
81.40(6)	7 ⁽⁻⁾		100									
125.89(12)	1 ⁻		100									
185.75(10)	9 ⁽⁻⁾		18(2)	82(3)								
196.40(13)	3 ⁻		55(9)	13(2)	32(4)							
207.41(5)	$\langle 7^+ \rangle$		70(2)	30(6)								
213.37(11)	5 ⁻		<40	x	100							
257.97(10)	$\langle 9^+ \rangle$			x		8.2(23)		92(51)				
312.35(10)	$\langle 11^- \rangle$			61(4)		39(4)						
334.83(11)	$\langle 11^+ \rangle$									100		
348.19(10)	7 ⁻		44(2)	40(4)		5.5(10)		8.6(10)		1.5(4)	x	
375.47(16)	$\langle 7^- \rangle$			8(2)			63(8)		29(3)			
406.0(3)	$\langle 9^- \rangle$								100			
435.75(11)	$\langle 13^+ \rangle$									49(4)		51(2)
460.6(1)	$\langle 13^- \rangle$										[100]	
474.81(13)	$\langle 9^- \rangle$		30(3)	32(3)		22(3)		7(3)		2.8(3)	2.6(5)	
629.1(4)	$\langle 11^- \rangle$					100						
629.8(1)	$\langle 15^- \rangle$										67(3)	
643.93(20)	$\langle 9^+ \rangle$							82(8)		13.1(12)	1.2(5)	3.5(10)
732.5(4)	$\langle 5^+ \rangle$							100				
797.42(21)	$\langle 11^+ \rangle$									57(7)	9(2)	14(3)
807.3(4)	$\langle 7^+ \rangle$							76(14)		24(11)		
866.8(4)	$\langle 1^- \rangle$		30(6)				70(13)					
910.2(5)	$\langle 3^- \rangle$				52(10)		48(9)					
997.7(9)	$\langle 1^-, 3^- \rangle$		100									
1060.2(4)	$\langle 5-9 \rangle$							59(39)		41(22)		
1124.1(3)	$\langle 7, 9 \rangle$							10(6)		74(7)		17(6)
1205.81(13)	$\langle 9^- \rangle$		6(2)	1.8(4)		5(2)		32(4)	2.9(10)	2(2)	1.9(6)	
1224.88(19)	$\langle 7^- \rangle$		46(7)	21(6)						4(1)		

(continued)

 $^{175}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*:$ $2J_f^\pi:$	0.0 5 ⁻	81.50 7 ⁻	125.93 1 ⁻	185.92 9 ⁻	196.43 3 ⁻	207.48 ⟨7 ⁺ ⟩	213.42 5 ⁻	258.00 ⟨9 ⁺ ⟩	312.53 ⟨11 ⁻ ⟩	335.30 ⟨11 ⁺ ⟩
1248.53(21)	⟨9 ⁻ ⟩		23(8)			<9			31(5)	<22		
1375.0(11)	⟨1,3⟩		100									
1455.7(5)	⟨1,3⟩		62(12)	<56								
1466.1(2)	⟨7 ⁺ ⟩		7(4)	4(1)				17(4)		20(4)		
1468.5(4)	⟨5 ⁻ ⟩		41(12)					15(6)		44(9)		
1606.04(21)	⟨9 ⁺ ⟩			3(1)		2(1)		7.7(6)		7(3)	11(1)	15(4)
1642.8(13)	⟨1,3⟩		69(14)				31(6)					
1658.87(24)	⟨5 ⁺ ,7 ⁺ ⟩		49(5)	6(2)			13(3)	16(3)	<15			
1793.34(20)	⟨5 ⁺ ⟩		62(8)	16(2)				22(3)				
1802.8(3)	⟨9 ⁻ ⟩			50(7)		16(8)					34(5)	
1818.14(21)	⟨9 ⁺ ⟩			34(4)		13(7)		10(2)		<15	18(4)	13(2)
1825.71(23)	⟨7 ⁺ ⟩		30(5)	33(4)				32(4)				
1887.8(4)			61(11)					39(10)				
1893.88(21)	⟨9 ⁺ ⟩			7(1)		9(2)		2.2(11)		31(4)	<5	<8

Energy levels and branching ratios [04Ba89]. Part 3

 $^{175}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*:$ $2J_f^\pi:$	348.35 7 ⁻	375.52 ⟨7 ⁻ ⟩	406.1 ⟨9 ⁻ ⟩	436.10 ⟨13 ⁺ ⟩	460.6 ⟨13 ⁻ ⟩	474.97 ⟨9 ⁻ ⟩	566.4 ⟨15 ⁺ ⟩	629.0 ⟨11 ⁻ ⟩	629.8 ⟨15 ⁻ ⟩	644.12 ⟨9 ⁺ ⟩
474.81(13)	⟨9 ⁻ ⟩		4(2)									
566.2(1)	⟨15 ⁺ ⟩					[100]						
629.1(4)	⟨11 ⁻ ⟩		x									
629.8(1)	⟨15 ⁻ ⟩						33.2(15)					
654.6(1)	⟨11 ⁻ ⟩			100								
698.4(1)	⟨13 ⁻ ⟩				100							
711.2(1)	⟨17 ⁺ ⟩								[100]			
797.42(21)	⟨11 ⁺ ⟩					20(2)						
818.7(3)	⟨17 ⁻ ⟩						62(6)				38(3)	
896.98(15)	⟨19 ⁺ ⟩								65(2)			
1027.4(3)	⟨19 ⁻ ⟩										[100]	
1205.81(13)	⟨9 ⁻ ⟩		40(4)					6(1)				1.8(4)
1224.88(19)	⟨7 ⁻ ⟩		14(1)	9.2(11)	0.9(7)			4.5(8)				
1248.53(21)	⟨9 ⁻ ⟩		26(3)	12(2)	5(2)			1.6(8)		<21		
1433.4(1)	⟨19 ⁺ ⟩								15.4(5)			
1466.1(2)	⟨7 ⁺ ⟩		28(7)	6(1)				<20				
1468.5(4)	⟨5 ⁻ ⟩		<24									
1606.04(21)	⟨9 ⁺ ⟩											35(5)
1658.87(24)	⟨5 ⁺ ,7 ⁺ ⟩			9(3)								
1793.34(20)	⟨5 ⁺ ⟩		<4									
1818.14(21)	⟨9 ⁺ ⟩											7(3)
1893.88(21)	⟨9 ⁺ ⟩											45(11)

Energy levels and branching ratios [04Ba89]. Part 4

 $^{175}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	654.4 $\langle 11^- \rangle$	698.6 $\langle 13^- \rangle$	711.2 $\langle 17^+ \rangle$	732.6 $\langle 5^+ \rangle$	797.59 $\langle 11^+ \rangle$	819.0 $\langle 17^- \rangle$	866.8 $\langle 1^- \rangle$	897.0 $\langle 19^+ \rangle$	1024.9 $\langle 15^- \rangle$	1027.2 $\langle 19^- \rangle$
896.98(15)	$\langle 19^+ \rangle$				≈ 35							
1025.1(15)	$\langle 15^- \rangle$		100									
1076.0(2)	$\langle 21^+ \rangle$				100					< 50		
1082.2(2)	$\langle 17^- \rangle$			100								
1253.6(3)	$\langle 21^- \rangle$							55(2)				45(2)
1322.7(8)	$\langle 23^+ \rangle$									79(3)		
1433.4(1)	$\langle 19 \rangle^+$				41(2)			17.5(4)		< 22		
1455.7(5)	$\langle 1, 3 \rangle$								38(8)			
1477.0(2)	$\langle 19^- \rangle$										100	
1497.3(7)	$\langle 23^- \rangle$											88(4)
1606.04(21)	$\langle 9^+ \rangle$						15(2)					
1658.87(24)	$\langle 5^+, 7^+ \rangle$					5(2)						
1818.14(21)	$\langle 9^+ \rangle$					4(3)	0.7(7)					
1893.88(21)	$\langle 9^+ \rangle$						6(1)					

Energy levels and branching ratios [04Ba89]. Part 5

 $^{175}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	1060.1 $\langle 5, 7, 9 \rangle$	1075.7 $\langle 21^+ \rangle$	1082.4 $\langle 17^- \rangle$	1124.3 $\langle 7, 9 \rangle$	1205.94 $\langle 9^- \rangle$	1253.5 $\langle 21^- \rangle$	1322.6 $\langle 23^+ \rangle$	1433.5 $\langle 19 \rangle^+$	1466.3 $\langle 7^+ \rangle$	1476.8 $\langle 19^- \rangle$
1322.7(8)	$\langle 23^+ \rangle$			21(3)								
1433.4(1)	$\langle 19 \rangle^+$			≈ 26								
1466.1(2)	$\langle 7^+ \rangle$						18(4)					
1497.3(7)	$\langle 23^- \rangle$							12(3)				
1523.3(1)	$\langle 25^+ \rangle$			100								
1545.6(2)	$\langle 21^+ \rangle$									100		
1547.4(2)	$\langle 21^- \rangle$				100							
1606.04(21)	$\langle 9^+ \rangle$	3.1(7)					0.6(6)					
1646.9(3)	$\langle 21^+ \rangle$									100		
1735.6(7)	$\langle 23^+ \rangle$									< 38		
1746.6(5)	$\langle 5^+, 9^+ \rangle$										100	
1757.3(3)	$\langle 25^- \rangle$							100				
1825.71(23)	$\langle 7^+ \rangle$					5(3)	< 14					
1836.8(13)	$\langle 27^+ \rangle$								100			
1998.4(20)	$\langle 23^- \rangle$											100

Energy levels and branching ratios [04Ba89]. Part 6

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	1497.3 $\langle 23^- \rangle$	1523.0 $\langle 25^+ \rangle$	1545.7 $\langle 21^+ \rangle$	1547.6 $\langle 21^- \rangle$	1647.1 $\langle 21 \rangle$	1735.6 $\langle 23^+ \rangle$	1756.8 $\langle 25^- \rangle$	1766.4 $\langle 23^- \rangle$	1836.7 $\langle 27^+ \rangle$	1904.7 $\langle 25^- \rangle$
1646.9(3)	$\langle 21^+ \rangle$				x							
1735.6(7)	$\langle 23^+ \rangle$				100							
1766.3(2)	$\langle 23^- \rangle$				80(3)		20(3)					
1904.4(3)	$\langle 25^- \rangle$									100		
1954.1(8)	$\langle 25^+ \rangle$				<64			100				
2033.3(11)	$\langle 27^- \rangle$	100										
2046.4(15)	$\langle 29^+ \rangle$			100								
2081.8(20)	$\langle 25^- \rangle$					100						
2114.2(3)	$\langle 27^- \rangle$									<12		100
2195.7(9)	$\langle 27^+ \rangle$							11(11)				
2322.4(4)	$\langle 29^- \rangle$								100			
2360.1(3)	$\langle 29^- \rangle$											<10
2432.3(2)	$\langle 31^+ \rangle$										100	

Energy levels and branching ratios [04Ba89]. Part 7

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	1954.2 $\langle 25^+ \rangle$	1999.3 $\langle 23^- \rangle$	2033.0 $\langle 27^- \rangle$	2046.1 $\langle 29^+ \rangle$	2081.8 $\langle 25^- \rangle$	2114.4 $\langle 27^- \rangle$	2195.8 $\langle 27^+ \rangle$	2321.7 $\langle 29^- \rangle$	2360.2 $\langle 29^- \rangle$	2458.8 $\langle 29^+ \rangle$
2195.7(9)	$\langle 27^+ \rangle$		89(11)									
2360.1(3)	$\langle 29^- \rangle$							100				
2458.7(10)	$\langle 29^+ \rangle$		24(8)						76(5)			
2578.2(23)	$\langle 27^- \rangle$			100								
2627.6(11)	$\langle 31^- \rangle$				100							
2638.6(18)	$\langle 33^+ \rangle$					100						
2677.8(20)	$\langle 29^- \rangle$						100					
2742.0(11)	$\langle 31^+ \rangle$											[100]
2932.9(3)	$\langle 33^- \rangle$										38(3)	
2941.2(3)	$\langle 33^- \rangle$									100		
3044.4(12)	$\langle 33^+ \rangle$											x

Energy levels and branching ratios [04Ba89]. Part 8

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
		E_f^* :	2634.4	2638.3	2742.1	2933.1	3015.8	3305.7	3629.6	3819	3977.9	4157
[keV]		$2J_f^\pi$:	$\langle 31^- \rangle$	$\langle 33^+ \rangle$	$\langle 31^+ \rangle$	$\langle 33^- \rangle$	$\langle 35 \rangle$	$\langle 37 \rangle$	$\langle 39 \rangle$	$\langle 39 \rangle$	$\langle 41 \rangle$	$\langle 41 \rangle$
2932.9(3)	$\langle 33^- \rangle$		62(4)									
3015.6(4)	$\langle 35^- \rangle$					100						
3044.4(12)	$\langle 33^+ \rangle$				x							

(continued)

 $^{175}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	2634.4 $\langle 31^- \rangle$	2638.3 $\langle 33^+ \rangle$	2742.1 $\langle 31^+ \rangle$	2933.1 $\langle 33^- \rangle$	3015.8 $\langle 35 \rangle$	3305.7 $\langle 37 \rangle$	3629.6 $\langle 39 \rangle$	3819 $\langle 39 \rangle$	3977.9 $\langle 41 \rangle$	4157 $\langle 41 \rangle$
3292.3(21)	$\langle 37^+ \rangle$			100								
3305.7(9)	$\langle 37^- \rangle$					100						
3629.7(10)	$\langle 39^- \rangle$					<39		100				
3819.6(9)	$\langle 39^+ \rangle$					x		x	x			
3977.9(11)	$\langle 41^- \rangle$							x	x			
4157.4(12)	$\langle 41^+ \rangle$									x		
4345.0(11)	$\langle 43^- \rangle$								x		x	
4505.4(12)	$\langle 43^+ \rangle$									x		x
4636.3(12)	$\langle 45^+ \rangle$											x
4727.9(12)	$\langle 45^- \rangle$										x	

Energy levels and branching ratios [04Ba89]. Part 9

 $^{175}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage									
		E_f^* : $2J_f^\pi$:	4344 $\langle 43 \rangle$	4505 $\langle 43 \rangle$	4727 $\langle 45 \rangle$	5123 $\langle 47 \rangle$	5531 $\langle 49 \rangle$	5948 $\langle 51 \rangle$	6371 $\langle 53 \rangle$	6510 $\langle 53 \rangle$	6794 $\langle 55 \rangle$
4636.3(12)	$\langle 45^+ \rangle$		x	x							
4727.9(12)	$\langle 45^- \rangle$		x								
5124.0(13)	$\langle 47^- \rangle$		x		x						
5531.9(14)	$\langle 49^- \rangle$				x	x					
5949.0(15)	$\langle 51^- \rangle$					x	x				
6371.8(18)	$\langle 53^- \rangle$						x	x			
6510.1(17)	$\langle 53^+ \rangle$							x			
6794.3(16)	$\langle 55^- \rangle$							x	x		
7455.2(17)	$\langle 57^- \rangle$									x	x

Energy levels and branching ratios [98Br13, 06Ba16].

 $^{176}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,t)	$I_{s,0}$	Γ_o	Γ_o^{red}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	<i>rel.</i>	[eVb]	[meV]	[meV']	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
0.0	0^+	0	813(15)	24						Stable	73Oo01
88.349(24)	2^+	$\langle 2 \rangle$	219(9)	88						1.43(4) ns	73Oo01
290.18(3)	4^+		44(4)	54							73Oo01
596.82(5)	6^+		8.3(15)	2							73Oo01
997.73(6)	8^+										
1149.94(6)	0^+	0	95(5)								73Oo01
1226.63(5)	2^+	$\langle 2 \rangle$	28.7(30)							0.8(1) ps	73Oo01
1247.70(4)	2^-			21						4.66(17) ns	72Za04

(continued)

 $^{176}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,t)	$I_{s,0}$	Γ_o	Γ_o^{red}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	<i>rel.</i>	[eVb]	[meV]	[meV']	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
1293.12(8)	0^+	0	64(5)								73Oo01
1313.31(4)	3^-		32(3)								73Oo01
1333.07(7)	6^+			220							72Za04
1341.31(4)	2^+	$\langle 2 \rangle$	55(4)		7.5(9)	1.4(1)	0.31(3)		1952(166)*	9.6(3) μs 0.29(3) ps	72Za04 03Sc15
1362(10)											
1379.38(5)	2^+	$\langle 2 \rangle$	6.7(25)								73Oo01
1390.19(14)	4^+		19.2(25)								73Oo01
1404.56(4)	4^-										
1412.93(8)											
1445.79(5)	3^+										
1481.06(8)	10^+										
1505.81(8)	7^+										
1508.61(7)	5^-		5.6(11)	128							73Oo01
1532.6(5)											
1540.3(4)	$\langle 4^+ \rangle$		15.4(19)								73Oo01
1559.31(9)	8^-									9.9(2) μs	72Za04
1577.61(5)	$\langle 3^+ \rangle$			872							72Za04
1591.51(5)	$\langle 4^+ \rangle$										
1609.3			3.7(21)								73Oo01
1628.55(14)	6^+										
1643.43(5)	1^-				13.0(9)	7.5(4)	1.68(8)		4.82(23)		03Sc15
1653.11(6)	$\langle 6 \rangle^-$										
1672.34(4)	$\langle 1 \rangle^+$										
1675.96(16)	$\langle 4^+ \rangle$		15.3(18)	402							73Oo01
1692.0(10)	$\langle 2^+ \rangle$				1.6(3)	0.2(1)	0.017(3)		106(21)*		06Ba16
1699.92(8)	$\langle 8^+ \rangle$										
1704.60(6)	$\langle 2^+ \rangle$			192	1.7(3)	0.5(1)	0.035(4)		218(42)*		72Za04
1710.44(5)	$\langle 3^- \rangle$										
1722.05(5)	1^-				3.0(4)	1.5(2)	0.29(3)		0.82(8)		03Sc15
1727.80(19)	$\langle 5^+ \rangle$			23							72Za04
1732.46(10)	$\langle 5^+ - 7^+ \rangle$										
1749(10)	0^+	0	41.9(36)								73Oo01
1761.47(10)	$\langle 6^+ \rangle$			259							72Za04
1766.89(21)	$\langle 3-5 \rangle^+$										
1767.52(7)	$2^-, 3^-$										
1783.8(1)	$\langle 7 \rangle^-$										
1785.09(12)	$\langle 9 \rangle^-$										
1786.11(9)											
1793.61(5)			14.7(22)								73Oo01
1797.99(9)	$\langle 7 \rangle^-$			376							72Za04
1798.5(6)	$\langle 5^+ \rangle$										
1815.2(4)											
1818.92(6)	$\langle 0 \rangle^-$										
1830.4	5			682							
1833.64**	$\langle 2,3 \rangle^+$										

(continued)

 $^{176}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,t)	$I_{s,0}$	Γ_o	Γ_o^{red}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	<i>rel.</i>	[eVb]	[meV]	[meV']	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
1853.96(7)	$\langle 3^+-5^+ \rangle$		22.3(26)								73Oo01
1856.99(5)	$\langle 2 \rangle^-$			368							72Za04
1860.08(11)	$\langle 8 \rangle^-$										
1862.0(5)	$\langle 6^+ \rangle$										
1862.80(4)	1^+										
1866.5(5)											
1878(1)	$\langle 5^+-7^+ \rangle$										
1886(3)				1000							72Za04
1902.28(9)	$\langle 3^--5^- \rangle$										
1912.02(4)	$\langle 2 \rangle^+$										
1914.13(9)	$\langle 9^+ \rangle$										
1924.56(5)	$\langle 2,3 \rangle^-$			264							72Za04
1926.68(11)	$\langle 7^+ \rangle$										
1930.78(9)	$\langle 8^- \rangle$										
1932.7(3)	$\langle 8 \rangle^+$										
1944.48(16)	$\langle 6^+ \rangle$			76							72Za04
1949.71(5)											
1958.18(5)	2^-		5.9(23)	221							73Oo01
1964.2(3)	$\langle 5-7 \rangle^-$										
1978.0(10)				143	3.1(3)	1.1(1)	0.14(2)	0.036(4)	0.39(4)		72Za04
1984(3)	$\langle 6^+ \rangle$										
1992.7(1)	$\langle 8 \rangle^-$										
2014.24(13)	$\langle 9 \rangle^-$										
2023.92(21)	$X^{(+)}$			161							72Za04
2031.05(12)	10^-										
2034.66(13)	$\langle 12^+ \rangle$										
2044.78(6)	$\langle 1^+ \rangle$		17.4(23)	152	7.5(6)	4.3(3)	0.50(3)	0.130(8)			73Oo01
2048.48(8)	$\langle 2-4^- \rangle$										
2066.25(7)	$\langle 1-3 \rangle^+$		12.0(18)	232							73Oo01
2085.68(10)	$\langle 9^- \rangle$		10.7(16)	102							73Oo01
2085.83(20)	$\langle 5-7 \rangle^+$		incl	incl							73Oo01
2096.8(5)	$\langle 5-7 \rangle^+$										
2106.5(5)	$\langle 7 \rangle^+$			142							72Za04
2112.89(20)	$\langle 8^+ \rangle$										
2116.8(3)	$\langle 7^+ \rangle$										
2136.42(24)	$\langle 9 \rangle^-$		18.4(26)	106							73Oo01
2147.62(11)	$\langle 10^+ \rangle$			incl							72Za04
2160.5(6)											
2172.9(6)				116							72Za04
2173.8(8)	$\langle 7^+ \rangle$			incl							
2194.02(20)	$\langle 10^- \rangle$										
2258.7(5)	$\langle 6^--8^- \rangle$										
2261.55(12)	$\langle 10^- \rangle$										
2265.27(5)	$\langle 2 \rangle^-$										
2280.83(10)	$\langle 2 \rangle$			118	2.1(5)	1.0(2)	0.016(3)		98(18)*		72Za04

(continued)

 $^{176}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,t)	$I_{s,0}$	Γ_o	Γ_o^{red}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	<i>rel.</i>	[eVb]	[meV]	[meV']	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
2284.8(5)	$\langle 8^+ \rangle$		22.7(27)								73Oo01
2293.85(14)	11^-										
2294.8(3)	$\langle 10 \rangle^+$										
2304.7(8)	$\langle 8^+ \rangle$		6.9(30)								73Oo01
2307.76(6)											
2308.34(5)	$1^- - 3^-$										
2318.7(5)	$\langle 9^+ \rangle$										
2361.0(10)	$\langle 1 \rangle$		20.5(19)		3.8(7)	1.1(2)	0.08(2)	0.036(7)	0.40(7)		73Oo01
2389(10)			25.4(24)								73Oo01
2398.97(13)	$\langle 11^+ \rangle$										
2399.01(19)	$\langle 11^- \rangle$										
2405.35(7)	1				4.0(6)	2.0(3)	0.14(2)	0.037(5)	0.41(6)		03Sc15
2415(10)			14.1(18)								73Oo01
2432.34(7)	X^-										
2446.9(6)											
2452.47(10)			15.1(18)								73Oo01
2470.84(5)	2^-										
2482.87(6)	$\langle 1 \rangle$				2.6(6)	0.8(2)	0.05(1)	0.023(6)	0.26(6)		03Sc15
2510.0**	$\langle 2^+ \rangle$										
2514.0(7)	$1^{\langle + \rangle}$				12.6(12)	9.2(8)	0.58(5)	0.150(13)			03Sc15
2530.0(7)	1				4.6(6)	4.7(5)	0.29(3)	0.076(8)			03Sc15
2534.2**	$\langle 1^- \rangle$										
2540.9(5)	$\langle 10^+ \rangle$										
2548.0(7)	1				3.8(7)	4.6(6)	0.28(3)		0.80(10)		03Sc15
2548.3**	2^+										
2563.54(22)	12^-										
2568.45(22)	$[2,3^+]$										
2594.65**	$\langle 2^+ \rangle$										
2602.16(9)											
2638.1(5)	$\langle 12^- \rangle$										
2646.6(4)	$\langle 14^+ \rangle$										
2660.1**	$\langle 1,2 \rangle$										
2690.0(7)	1				8.9(9)	10.8(8)	0.56(4)		1.59(12)		03Sc15
2705.3**	$\langle 1^- \rangle$										
2722.0(7)	$1^{\langle + \rangle}$				43.3(33)	39.2(23)	1.95(12)	0.504(30)			03Sc15
2762.51(8)											
2769.6**	$\langle 1,2^+ \rangle$										
2791.62(7)											
2817.55(5)	$\langle 2 \rangle^+$										
2827.0(5)	13^-										
2831.0(10)	1				3.3(6)	2.3(4)	0.10(2)	0.026(5)	0.29(5)		03Sc15
2832.8**	$\langle 1,2 \rangle$										
2843.7**	$\langle 1,2 \rangle$										
2861.98**	$\langle 2^+ \rangle$										
2865.8(7)	14^-									401(6) μs	

(continued)

 $^{176}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,t)	$I_{s,0}$	Γ_o	Γ_o^{red}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	$rel.$	[eVb]	[meV]	[meV']	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
2878.21(7)											
2885.52(7)	$1^{(+)}$				7.8(8)	9.7(8)	0.40(4)	0.104(9)			03Sc15
2905.67(7)											
2912.26(6)	0^-										
2920.26(7)	1^-										
2921.03(8)	$1^+, 2^+$										
2933.5**	$\langle 0^{+-}2 \rangle$										
2940.0(7)	$1^{(+)}$				13.7(12)	14.0(10)	0.55(4)	0.143(10)			03Sc15
2944.17(5)	2^-										
2952.19**	$\langle 1^- \rangle$										
2969.07(6)	$\langle 2^- \rangle$										
2971.3**	$\langle 1^- \rangle$										
2978.66**	$\langle 1^- \rangle$										
2994.0(7)	$1^{(+)}$				6.8(7)	8.5(7)	0.32(3)	0.082(7)			03Sc15
3029.0**	$\langle 1, 2^+ \rangle$										
3044.0(7)	$1^{(-)}$				6.2(8)	15.9(12)	0.56(4)		1.61(12)		03Sc15
3059.0(10)	1				3.9(6)	3.2(5)	0.11(2)	0.029(4)	0.32(5)		03Sc15
3080.2(12)	15^+									0.20(+12-8) ns	
3098.0(10)	$\langle 1 \rangle$				3.5(6)	2.9(5)	0.10(2)	0.026(4)	0.28(5)		03Sc15
3107.0(7)	$1^{(+)}$				12.4(11)	15.5(12)	0.52(4)	0.134(10)			03Sc15
3115.0(7)	$1^{(-)}$				11.8(11)	27.6(17)	0.91(6)		2.61(16)		03Sc15
3159.0(7)	$1^{(+)}$				11.8(11)	15.4(12)	0.49(4)	0.127(10)			03Sc15
3160.7(10)	15^-										
3200.0(10)	1				5.3(7)	4.7(6)	0.14(2)	0.037(5)	0.41(6)		03Sc15
3218.0(10)	1				7.6(9)	6.8(8)	0.21(2)	0.053(6)	0.59(7)		03Sc15
3222.0(7)	$1^{(+)}$				4.1(7)	6.0(8)	0.18(2)	0.046(6)			03Sc15
3232.0(7)	$1^{(+)}$				4.8(6)	7.0(8)	0.21(3)	0.053(6)			03Sc15
3261.0(7)	$1^{(+)}$				33.1(26)	52.2(29)	1.51(9)	0.390(22)			03Sc15
3266.2(14)	16^+										
3306.0(10)	$\langle 1 \rangle$				2.9(7)	2.8(7)	0.08(2)	0.020(5)	0.22(5)		03Sc15
3307.7(11)	$\langle 16^+ \rangle$										
3322.0(10)	1				18.0(17)	17.3(17)	0.47(5)	0.122(12)	1.35(13)		03Sc15
3343.0(7)	1				7.0(9)	13.7(14)	0.37(4)		1.05(11)		03Sc15
3361.0(7)	$1^{(-)}$				7.8(10)	21.7(16)	0.57(4)		1.64(12)		03Sc15
3372.0(7)	$1^{(-)}$				4.2(7)	10.9(11)	0.29(3)		0.82(8)		03Sc15
3385.0(7)	1				4.5(8)	7.8(10)	0.20(3)	0.052(7)			03Sc15
3406.0(10)	$\langle 1 \rangle$				5.3(9)	5.4(9)	0.14(2)	0.035(6)	0.39(6)		03Sc15
3438.0(10)	1				8.5(10)	8.7(11)	0.22(3)	0.056(7)	0.62(8)		03Sc15
3454.0(10)	1				10.4(12)	10.8(12)	0.26(3)	0.068(8)	0.75(8)		03Sc15
3467.4(10)	16^-										
3485.0(7)	1				11.5(16)	27.9(31)	0.66(7)		1.89(21)		03Sc15
3490.0(10)	1				4.3(11)	4.5(11)	0.11(3)	0.028(7)	0.30(8)		03Sc15
3519.0(10)	$\langle 1 \rangle$				4.2(13)	4.5(14)	0.10(3)	0.027(8)	0.30(9)		03Sc15
3540.1(10)	17^+										
3550.0(7)	$1^{(+)}$				19.0(23)	30.1(28)	0.67(6)	0.174(16)			06Ba16

(continued)

¹⁷⁶Hf
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E^*	J^π	L	σ (p,t)	σ (d,t)	$I_{s,0}$	Γ_o	Γ_o^{red}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	<i>rel.</i>	[eVb]	[meV]	[meV']	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
3580.0(10)	$\langle 1 \rangle$				11.0(15)	12.2(17)	0.27(4)	0.069(10)	0.77(11)		03Sc15
3602.0(7)	1				8.1(12)	15.6(18)	0.33(4)	0.086(10)			03Sc15
3608.0(10)	1				4.9(11)	5.5(12)	0.12(3)	0.030(7)	0.34(7)		03Sc15
3627.0(7)	$1^{(+)}$				7.0(10)	12.6(14)	0.26(3)	0.068(8)			03Sc15
3662.0(7)	$1^{(+)}$				30.0(34)	45.3(42)	0.92(9)	0.239(22)			03Sc15
3671.0(7)	$1^{(+)}$				15.6(15)	25.8(24)	0.52(5)	0.135(12)			03Sc15
3689.0(10)	$\langle 1 \rangle$				7.3(13)	8.6(15)	0.17(3)	0.045(8)	0.49(8)		03Sc15
3695.0(10)	$\langle 2 \rangle$				5.8(9)	4.1(6)	0.006(1)		37(6)*		03Sc15
3722.0(10)	$\langle 1 \rangle$				5.2(10)	6.3(12)	0.12(2)	0.032(6)	0.35(7)		03Sc15
3746.0(7)	1				13.4(18)	28.9(38)	0.55(7)	0.143(19)			03Sc15
3767.0(7)	$1^{(+)}$				18.3(19)	35.0(29)	0.66(5)	0.170(14)			03Sc15
3774.0(10)	1				9.2(12)	11.4(15)	0.21(3)	0.055(7)	0.61(8)		03Sc15
3787.4(12)	$\langle 17^- \rangle$										
3805.0(7)	$1^{(+)}$				10.3(13)	19.2(21)	0.35(4)	0.090(10)			03Sc15
3816.0(7)	$1^{(+)}$				27.9(26)	47.9(39)	0.86(7)	0.224(18)			03Sc15
3824.0(10)	$\langle 1 \rangle$				5.9(11)	7.5(14)	0.14(3)	0.035(6)			03Sc15
3838.0(7)	$1^{(-)}$				10.6(15)	33.9(35)	0.60(6)		1.72(18)		03Sc15
3844.0(10)	$\langle 1 \rangle$				6.3(12)	8.1(15)	0.14(3)	0.037(7)	0.41(8)		03Sc15
3847.4(16)	18^+										
3856.0(10)	$\langle 1 \rangle$				8.8(16)	11.4(21)	0.20(4)	0.051(9)	0.57(10)		03Sc15
3916.0(10)	$\langle 1 \rangle$				11.5(19)	15(3)	0.25(4)	0.066(11)	0.73(12)		03Sc15
4010.5(15)	$\langle 18^+ \rangle$										
4120.3(14)	18^-										
4179.3(17)	19^+										
4376.6(16)	$\langle 19^+ \rangle$									34 ns	
4466.6(16)	$\langle 19^- \rangle$										
4532.2(20)	20^+										
4766.4(16)	$\langle 20^- \rangle$										
4826.4(15)	$\langle 20^- \rangle$										
4863.5(16)	$\langle 22^- \rangle$									43 μs	
			73Oo01	72Za04	03Sc15	03Sc15	03Sc15	03Sc15	03Sc15		Ref.

Additional data on this isotope can be found in [04Ol05, 01Ch89, 00Ya22, 73Kh08, 73Kh03, 73Kh02].

Abundance: 5.26(7) %.

* $B(E2)$ in units $[e^2fm^4]$, corresponding Γ_o^{red} is given in units (meV/MeV⁵) [03Sc15].

** Introduced in [06Gr04].

17 bands of levels are considered in [06Ba16].

Data on the (α, t) , (τ, d) , (τ, α) reactions from [73Kh08] are considered in [06Ba16].

Intensities of additional transitions were calculated and given in [06Ba16].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [98Br13, 06Ba16]. Part 2

 $^{176}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	0.0 0 ⁺	88.3 2 ⁺	290 4 ⁺	597 6 ⁺	998 8 ⁺	1149.94 0 ⁺	1226.63 2 ⁺	1247.68 2 ⁻	1293.12 0 ⁺	1313.35 3 ⁻
88.349(24)	2 ⁺		100									
290.18(3)	4 ⁺			100								
596.82(5)	6 ⁺				100							
997.73(6)	8 ⁺					100						
1149.94(6)	0 ⁺	x		100								
1226.63(5)	2 ⁺	23(3)		42(3)	35(3)							
1247.70(4)	2 ⁻	1.8(2)		96(8)	2.2(2)							
1293.12(8)	0 ⁺	x		100								
1313.31(4)	3 ⁻			68(5)	32(3)							
1333.07(7)	6 ⁺				40	60						
1341.31(4)	2 ⁺	50(4)		48(4)	1.7(3)							
1379.38(5)	2 ⁺	3.4(10)		84(7)	12.5(10)							
1390.19(14)	4 ⁺			37	46	17						
1404.56(4)	4 ⁻				42(8)				50(3)			8(1)
1412.93(8)					[100]							
1445.79(5)	3 ⁺			75(6)	23(2)				1.40(12)			
1481.06(8)	10 ⁺						100					
1508.61(7)	5 ⁻				71	26(6)						≈3
1532.6(5)						100						
1540.3(4)	⟨4 ⁺ ⟩				100							
1577.61(5)	⟨3 ⁺ ⟩			81(6)	9.6(6)							7.8(6)
1591.51(5)	⟨4 ⁺ ⟩				100							
1628.55(14)	6 ⁺				48	38	5.4					
1643.43(5)	1 ⁻	37(3)		63(5)								
1653.11(6)	⟨6 ⁻ ⟩					7.2						
1672.34(4)	⟨1 ⁺ ⟩	18.1(16)		81(6)					≤0.8	0.76(8)		
1675.96(16)	⟨4 ⁺ ⟩			21	76							
1704.60(6)	⟨2 ⁺ ⟩	52(4)		48(4)								
1710.44(5)	⟨3 ⁻ ⟩			44(11)	55(4)							
1722.05(5)	1 ⁻	53(4)		47(4)							0.23(4)	
1727.80(19)	⟨5 ⁺ ⟩				76	24						
1766.89(21)	⟨3-5 ⁺ ⟩				100							
1767.52(7)	2 ⁻ , 3 ⁻			96(9)								
1783.8(1)	⟨7 ⁻ ⟩					78	19					
1786.11(9)				63(5)	37(3)							
1793.61(5)				25(25)	16(16)							
1798.5(6)	⟨5 ⁺ ⟩				80	16						
1815.2(4)					44(9)	56(11)						
1818.92(6)	⟨0 ⁻ ⟩								39(3)			
1853.96(7)	⟨3 ⁺ -5 ⁺ ⟩			71(6)	29(5)							
1856.99(5)	⟨2 ⁻ ⟩								11(2)			
1862.0(5)	⟨6 ⁺ ⟩				57	43						
1862.80(4)	1 ⁺	45(4)		18(1)					1.2(2)	1.3(2)		
1902.28(9)	⟨3 ⁻ -5 ⁻ ⟩				44	56						
1912.02(4)	⟨2 ⁺ ⟩	0.19(4)		65(5)	3(1)				1.71(16)			0.36(6)

(continued)

 $^{176}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage										
		$E_f^*:$ $J_f^\pi:$	0.0 0 ⁺	88.3 2 ⁺	290 4 ⁺	597 6 ⁺	998 8 ⁺	1149.94 0 ⁺	1226.63 2 ⁺	1247.68 2 ⁻	1293.12 0 ⁺	1313.35 3 ⁻
1924.56(5)	$\langle 2,3 \rangle^-$			11.3(8)						≤ 16.7		65(6)
1932.7(3)	$\langle 8 \rangle^+$					65	35					
1944.48(16)	$\langle 6^+ \rangle$					87						
1949.71(5)			22(4)	44(11)					22(2)	11.9(9)		≤ 8.7
1958.18(5)	2 ⁻			1.0(1)						66(5)		12(1)
2023.92(21)	$X^{\langle + \rangle}$					100						
2044.78(6)	$\langle 1^+ \rangle$		60(5)	39(2)								
2066.25(7)	$\langle 1-3 \rangle^+$		≤ 7.1	88(5)								
2085.83(20)	$\langle 5-7 \rangle^+$					69	31					
2096.8(5)	$\langle 5-7 \rangle^+$					77	23					
2106.5(5)	$\langle 7 \rangle^+$					70	30					
2116.8(3)	$\langle 7^+ \rangle$					100						
2136.42(24)	$\langle 9 \rangle^-$						76(15)					
2172.9(6)						100						
2265.27(5)	$\langle 2 \rangle^-$									8.4(11)		5.0(8)
2280.83(10)	$\langle 2 \rangle$		44(4)	56(4)								
2284.8(5)	$\langle 8^+ \rangle$						100					
2294.8(3)	$\langle 10 \rangle^+$						56					
2304.7(8)	$\langle 8^+ \rangle$						100					
2307.76(6)			35(3)	51(4)								≤ 9.5
2405.35(7)	1		59(5)	30(2)					4.6(8)			
2432.34(7)	X^-									5.7(9)		
2452.47(10)					[100]							
2470.84(5)	2 ⁻									29(2)		49(4)
2482.87(6)	$\langle 1 \rangle$		[21(1)]	[30(2)]				[9(2)]				
2602.16(9)			33(4)	64(5)								
2762.51(8)			11(2)	44(4)				41(4)				
2791.62(7)										32(3)		
2817.55(5)	$\langle 2 \rangle^+$											43(6)
2878.21(7)												45(4)
2885.52(7)	1 $^{\langle + \rangle}$		24(2)	14.5(1)						18(4)		
2905.67(7)			8(1)	18(2)								
2912.26(6)	0 ⁻		0.35(5)	0.90(18)								
2920.26(7)	1 ⁻		30(2)	58(4)					6.9(5)			
2921.03(8)	1 ⁺ , 2 ⁺									54(13)		
2944.17(5)	2 ⁻			0.17(6)						65(5)		25(3)
2969.07(6)	$\langle 2^- \rangle$									x		

Energy levels and branching ratios [98Br13, 06Ba16]. Part 3

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1333.06 6 ⁺	1341.31 2 ⁺	1379.37 2 ⁺	1390.19 4 ⁺	1404.56 $\langle 4 \rangle^-$	1445.80 3 ⁺	1481.07 $\langle 10 \rangle^+$	1505.81 $\langle 7^+ \rangle$	1508.57 $\langle 5 \rangle^-$	1559.30 8 ⁻
1505.81(8)	7 ⁺	100										
1559.31(9)	8 ⁻	24(5)								76		
1577.61(5)	$\langle 3^+ \rangle$						1.5(2)					
1628.55(14)	6 ⁺					9						
1653.11(6)	$\langle 6 \rangle^-$						89				4.0	
1672.34(4)	$\langle 1 \rangle^+$				0.60(6)							
1675.96(16)	$\langle 4^+ \rangle$						3.3					
1699.92(8)	$\langle 8^+ \rangle$	33								67		
1732.46(10)	$\langle 5^+ - 7^+ \rangle$	88								12		
1761.47(10)	$\langle 6^+ \rangle$	100										
1767.52(7)	2 ⁻ , 3 ⁻				2.45(22)		1.6(4)					
1783.8(1)	$\langle 7 \rangle^-$										2.7	
1785.09(12)	$\langle 9 \rangle^-$											100
1793.61(5)				≤ 7.4	23(2)							
1797.99(9)	$\langle 7 \rangle^-$	100										
1798.5(6)	$\langle 5^+ \rangle$										4.4	
1853.96(7)	$\langle 3^+ - 5^+ \rangle$				≤ 12.9							
1856.99(5)	$\langle 2 \rangle^-$						≤ 3.5					
1860.08(11)	$\langle 8 \rangle^-$											100
1862.80(4)	1 ⁺			27(14)	0.31(4)							
1866.5(5)							100					
1912.02(4)	$\langle 2 \rangle^+$			≤ 6	3.5(5)			16.4(16)				
1914.13(9)	$\langle 9^+ \rangle$									55		
1924.56(5)	$\langle 2, 3 \rangle^-$			0.68(11)			17(8)					
1926.68(11)	$\langle 7^+ \rangle$	19								81		
1930.78(9)	$\langle 8^- \rangle$									90		
1958.18(5)	2 ⁻			13(1)	0.73(6)		0.26(4)	4.9(5)				
2014.24(13)	$\langle 9 \rangle^-$											38
2031.05(12)	10 ⁻											12
2034.66(13)	$\langle 12^+ \rangle$								100			
2112.89(20)	$\langle 8^+ \rangle$									47		
2136.42(24)	$\langle 9 \rangle^-$								≈ 11			
2265.27(5)	$\langle 2 \rangle^-$			54(4)			≤ 2.9	18(2)				
2294.8(3)	$\langle 10 \rangle^+$								33			
2308.34(5)	1 ⁻ - 3 ⁻			29(4)								
2432.34(7)	X ⁻			4.0(5)	2.3(3)							
2470.84(5)	2 ⁻						9.3(7)					
2791.62(7)				45(4)				9(2)				
2817.55(5)	$\langle 2 \rangle^+$			27(2)	1.7(4)		≤ 6.5	8.7(6)				
2878.21(7)				42(4)				9.5(6)				
2920.26(7)	1 ⁻				4.6(3)							
2921.03(8)	1 ⁺ , 2 ⁺			34(3)								

Energy levels and branching ratios [98Br13, 06Ba16]. Part 4

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1577.56 $\langle 3^+ \rangle$	1591.50 $\langle 4^+ \rangle$	1643.43 1^-	1653.06 $\langle 6 \rangle^-$	1672.34 $\langle 1 \rangle^+$	1675.95 $\langle 4^+ \rangle$	1699.91 $\langle 8^+ \rangle$	1704.60 $\langle 2^+ \rangle$	1710.43 $\langle 3^- \rangle$	1722.05 1^-
1710.44(5)	$\langle 3^- \rangle$			1.4(3)								
1793.61(5)			36(3)									
1818.92(6)	$\langle 0 \rangle^-$				61(5)							
1856.99(5)	$\langle 2 \rangle^-$				60(11)						30(2)	
1862.80(4)	1^+						4.6(4)			2.6(2)		
1912.02(4)	$\langle 2 \rangle^+$						7.8(8)			0.6(6)		
1914.13(9)	$\langle 9^+ \rangle$								45			
1924.56(5)	$\langle 2,3 \rangle^-$		5.9(6)									
1944.48(16)	$\langle 6^+ \rangle$							13				
1958.18(5)	2^-		1.6(1)									1.0(1)
1964.2(3)	$\langle 5-7 \rangle^-$					100						
1992.7(1)	$\langle 8 \rangle^-$					100						
2044.78(6)	$\langle 1^+ \rangle$				0.87(10)							
2048.48(8)	$\langle 2-4 \rangle^-$										49	
2066.25(7)	$\langle 1-3 \rangle^+$			8.8(5)						3.4(5)		
2085.68(10)	$\langle 9^- \rangle$								[100]			
2112.89(20)	$\langle 8^+ \rangle$								53			
2147.62(11)	$\langle 10^+ \rangle$								71			
2265.27(5)	$\langle 2 \rangle^-$										1.0(2)	5.7(4)
2308.34(5)	1^-3^-		7(1)		13(4)							
2318.7(5)	$\langle 9^+ \rangle$								56			
2470.84(5)	2^-		0.37(9)				0.68(12)				0.24(4)	
2791.62(7)					5.8(10)							
2817.55(5)	$\langle 2 \rangle^+$		≤ 6.5		11.7(9)					2.9(3)		
2885.52(7)	$1^{(+)}$						33(2)					
2912.26(6)	0^-				22.5(18)		≤ 1.89					76(6)
2920.26(7)	1^-											0.86(15)
2944.17(5)	2^-		3.0(3)									
2969.07(6)	$\langle 2^- \rangle$				10(1)						23(3)	

Energy levels and branching ratios [98Br13, 06Ba16]. Part 5

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* :	1767.53	1784.9	1785.06	1786.12	1793.60	1797.98	1818.92	1853.96	1856.99	1860.06
		J_f^π :	$2^-, 3^-$	$\langle 7 \rangle^-$	$\langle 9 \rangle^-$			$\langle 7 \rangle^-$	$\langle 0 \rangle^-$		$\langle 2 \rangle^-$	$\langle 8 \rangle^-$
1912.02(4)	$\langle 2 \rangle^+$					1.6(16)						
1924.56(5)	$\langle 2, 3 \rangle^-$						≤ 1.1					
1930.78(9)	$\langle 8 \rangle^-$							10.2				
1949.71(5)									≤ 3.7			
2014.24(13)	$\langle 9 \rangle^-$				62							≤ 9
2031.05(12)	10^-				88							
2048.48(8)	$\langle 2-4 \rangle^-$			32								

(continued)

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1767.53 2 ⁻ ,3 ⁻	1784.9 ⟨7⟩ ⁻	1785.06 ⟨9⟩ ⁻	1786.12	1793.60	1797.98 ⟨7⟩ ⁻	1818.92 ⟨0⟩ ⁻	1853.96	1856.99 ⟨2⟩ ⁻	1860.06 ⟨8⟩ ⁻
2136.42(24)	⟨9⟩ ⁻			≈14								
2194.02(20)	⟨10⟩ ⁻				66							13
2258.7(5)	⟨6 ⁻ –8 ⁻ ⟩							100				
2265.27(5)	⟨2⟩ ⁻					2.1(3)						
2293.85(14)	11 ⁻			28(6)								
2307.76(6)		10(2)									2.9(5)	
2405.35(7)	1									2.3(4)		
2432.34(7)	X ⁻						10.6(9)					
2470.84(5)	2 ⁻						≤4.6					
2482.87(6)	⟨1⟩								[21(3)]		[4(1)]	
2568.45(22)	[2,3 ⁺]			22								
2817.55(5)	⟨2⟩ ⁺										4.3(6)	
2878.21(7)											4(2)	
2921.03(8)	1 ⁺ ,2 ⁺										10.4(13)	
2969.07(6)	⟨2⟩ ⁻	43(3)								7(2)		

Energy levels and branching ratios [98Br13, 06Ba16]. Part 6

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1862.80 1 ⁺	1902.42	1912.02 $\langle 2 \rangle^+$	1914.12 $\langle 9^+ \rangle$	1924.57 $\langle 2,3 \rangle^-$	1930.77 $\langle 8^- \rangle$	1932.7 $\langle 8 \rangle^+$	1949.71	1958.19 2 ⁻	1964.2 X ⁻
2048.48(8)	$\langle 2-4^- \rangle$			19								
2085.68(10)	$\langle 9^- \rangle$							≤ 91				
2147.62(11)	$\langle 10^+ \rangle$				29							
2160.5(6)												100
2261.55(12)	$\langle 10^- \rangle$							100				
2265.27(5)	$\langle 2 \rangle^-$									5.7(8)		
2294.8(3)	$\langle 10 \rangle^+$								11			
2308.34(5)	1 ⁻ -3 ⁻	≤ 12					11(1)			22(1)	18(1)	
2318.7(5)	$\langle 9^+ \rangle$				44							
2398.97(13)	$\langle 11^+ \rangle$				36							
2405.35(7)	1						3.5(5)					
2432.34(7)	X ⁻						77(5)					
2470.84(5)	2 ⁻						7.6(6)			4(2)		
2482.87(6)	$\langle 1 \rangle$									[16(6)]		
2540.9(5)	$\langle 10^+ \rangle$				100							
2791.62(7)										5(1)	≤ 9.5	
2905.67(7)							19(8)					
2912.26(6)	0 ⁻									≤ 0.90		
2921.03(8)	1 ⁺ ,2 ⁺										≤ 6.5	
2944.17(5)	2 ⁻									≤ 0.75		
2969.07(6)	$\langle 2^- \rangle$										3.7(13)	

Energy levels and branching ratios [98Br13, 06Ba16]. Part 7

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	2014.24 $\langle 9 \rangle^-$	2031.02 $\langle 10^- \rangle$	2034.67 $\langle 12^+ \rangle$	2044.78 $\langle 1^+ \rangle$	2066.25 $X^{(+)}$	2147.61 $\langle 10^+ \rangle$	2265.28 $\langle 2 \rangle^-$	2280.83	2293.80 $\langle 11^- \rangle$	2307.77
2194.02(20)	$\langle 10^- \rangle$		7.9	13								
2293.85(14)	11^-			72(14)								
2398.97(13)	$\langle 11^+ \rangle$			36				19			9	
2563.54(22)	12^-			48							52	
2568.45(22)	$[2,3^+]$	39	39									
2638.1(5)	$\langle 12^- \rangle$										100	
2646.6(4)	$\langle 14^+ \rangle$				100							
2762.51(8)												4.1(7)
2827.0(5)	13^-										63	
2878.21(7)						≤ 8.2						
2885.52(7)	$1^{\langle + \rangle}$									≤ 5.8		
2905.67(7)						≤ 16	27(4)					
2912.26(6)	0^-					0.57(8)						≤ 0.43
2944.17(5)	2^-								2.8(3)			≤ 0.71

Energy levels and branching ratios [98Br13, 06Ba16]. Part 8

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	2308.33	2398.96 $\langle 11^- \rangle$	2405.36	2470.85 2^-	2482.87	2563.48 $\langle 12^- \rangle$	2602.17	2638.1 $\langle 12^- \rangle$	2646.6 $\langle 14^+ \rangle$	2826.9 $\langle 13^- \rangle$
2602.16(9)					2.4(6)							
2791.62(7)					3.0(4)							
2827.0(5)	13^-			21				4.6		11.5		
2865.8(7)	14^-							23		51		26
2885.52(7)	$1^{(+)}$		10(1)									
2905.67(7)						19(2)			9(1)			
2921.03(8)	$1^+, 2^+$								1.4(3)			
2944.17(5)	2^-					3.8(3)	0.83(15)					
2969.07(6)	$\langle 2^- \rangle$		14(1)									
3307.7(11)	$\langle 16^+ \rangle$										100	

Energy levels and branching ratios [98Br13, 06Ba16]. Part 9

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage									
[keV]		E_f^* : J_f^π :	2866.0 $\langle 14^- \rangle$	3080.4 $\langle 15^+ \rangle$	3160.7 $\langle 15^- \rangle$	3266.4 16^+	3308.0 $\langle 16^+ \rangle$	3467.7 $\langle 16^- \rangle$	3540.4 $\langle 17^+ \rangle$	3787.4 $\langle 17^- \rangle$	3847.6 $\langle 18^+ \rangle$
3080.2(12)	15^+		100								
3160.7(10)	15^-		100								
3266.2(14)	16^+			100							

(continued)

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage									
[keV]		E_f^* : J_f^π :	2866.0 $\langle 14^- \rangle$	3080.4 $\langle 15^+ \rangle$	3160.7 $\langle 15^- \rangle$	3266.4 16^+	3308.0 $\langle 16^+ \rangle$	3467.7 $\langle 16^- \rangle$	3540.4 $\langle 17^+ \rangle$	3787.4 $\langle 17^- \rangle$	3847.6 $\langle 18^+ \rangle$
3467.4(10)	16^-		x		x						
3540.1(10)	17^+					100					
3787.4(12)	$\langle 17^- \rangle$				x			x			
3847.4(16)	18^+					x			x		
4010.5(15)	$\langle 18^+ \rangle$						100				
4120.3(14)	18^-							x		x	
4179.3(17)	19^+								x		x
4376.6(16)	$\langle 19^+ \rangle$								x		x
4466.6(16)	$\langle 19^- \rangle$									x	

Energy levels and branching ratios [98Br13, 06Ba16]. Part 10

 $^{176}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage					
[keV]		$E_f^*:$ $J_f^\pi:$	4120.6 $\langle 18^- \rangle$	4179.4 $\langle 19 \rangle^+$	4376.7 $\langle 19 \rangle^+$	4467.0 $\langle 19^- \rangle$	4766.5 $\langle 20 \rangle^-$
4466.6(16)	$\langle 19^- \rangle$		x				
4532.2(20)	20^+			100			
4766.4(16)	$\langle 20 \rangle^-$				100		
4826.4(15)	$\langle 20^- \rangle$					100	
4863.5(16)	$\langle 22 \rangle^-$						100

Energy levels and branching ratios [03Ko33].

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	L	U^2	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
[keV]		(d,p)		Γ_{cm}		E_{f}^* : $2J_{\text{f}}^\pi$:	0.0 7^-	112.9 9^-	249.7 11^-	321 9^+	409 13^-
0.0	7^-	$\langle 3 \rangle$	0.427	Stable	68Ri07						
112.9500(3)	9^-	5		0.537(8) ns	68Ri07		100				
249.6745(4)	11^-			105(9) ps			81.4(2)	18.6(7)			
321.3163(4)	9^+		0.706	0.663(16) ns			2.14(11)	96.3(18)	1.58(6)		
375											
390											
409.4086(5)	13^-							91(3)	9.4(5)		
426.6753(4)	11^+							7.4(3)	20.1(7)	72.5(14)	
459											
508.12(5)	5^-		≈ 0.3				93(7)	7.0(7)			
555.1781(4)	13^+								7.6(3)	23.4(6)	3.8(2)
559.4(10)	1^-	1	0.10		68Ri07						
567	$\langle 1^- \rangle$		0.921								

(continued)

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	L (d,p)	U^2	$T_{1/2}$ or Γ_{cm}	Ref.	Branching ratios in percentage					
						$E_f^*:$ $2J_f^\pi:$	0.0 7 ⁻	112.9 9 ⁻	249.7 11 ⁻	321 9 ⁺	409 13 ⁻
591.3182(7)	15 ⁻								93(4)		6.9(7)
604.48(5)	7 ⁻						34(4)	48(4)	2.9(4)	0.9(1)	
607	$\langle 3^- \rangle$										
624	$\langle 3^- \rangle$						100				
652	$\langle 5^- \rangle$										
665	$\langle 5^- \rangle$	3			68Ri07						
703	$\langle 7^- \rangle$	3			68Ri07						
708.4624(5)	15 ⁺										5.4(2)
726.9(3)	$\langle 9^- \rangle$										
739	$\langle 1^-, 3^- \rangle$	$\langle 1 \rangle$			68Ri07						
745.89(6)	7 ⁺						61(5)	8.5(8)		30(3)	
780	$\langle 7^- \rangle$	3			68Ri07						
794.4397(9)	17 ⁻										96(4)
805.74(7)	3 ⁻	1			68Ri07		68(7)				
840.10(20)	$\langle 7^- \rangle$										
841.50(20)	$\langle 9^- \rangle$										
845.60(20)	$\langle 9^- \rangle$										
847.38(6)	9 ⁺		0.01				22(2)	32(3)	8(6)	14(2)	
872.96(7)	$\langle 5^- \rangle$	3			68Ri07		48(5)	37(4)			
882.8615(5)	17 ⁺										
919	$\langle 1^-, 3^- \rangle$	$\langle 1 \rangle$			68Ri07						
948.08(15)											
979	$\langle 7^- \rangle$	3			68Ri07						
1002.82(5)	$\langle 7^- \rangle$						9.1(8)			6.6(8)	
1016	$\langle 5^-, 7^- \rangle$	3			68Ri07						
1017.7915(20)	19 ⁻										
1057.73(6)	7 ⁻	3	0.94		68Ri07		78(8)	14.7(12)		4.3(5)	
1086.9667(6)	19 ⁺										
1101											
1113.5(3)	$\langle 13^- \rangle$										
1143.3(3)	$\langle 13^- \rangle$										
1157.9(3)	$\langle 11^- \rangle$										
1260.2820(14)	21 ⁻										
1294	$\langle 1^-, 3^- \rangle$	1			68Ri07						
1301.4008(6)	21 ⁺										
1315.4504(8)	23 ⁺			1.09(5) s							
1342.38(20)	$\langle 19^- \rangle$			55.9(12) μs							
1350											
1434	$\langle 3^- \rangle$	1	[1]		68Ri07						
1475	$\langle 5^- \rangle$										
1477.2(4)	$\langle 17^- \rangle$										
1485	$\langle 9^+ \rangle$										
1502	$\langle 3^- \rangle$	$\langle 1 \rangle$	[1]		68Ri07						
1520.5(3)	23 ⁻										
1534.9(4)	$\langle 17^- \rangle$										

(continued)

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	L	U^2	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
[keV]		(d,p)		Γ_{cm}		$E_{\text{f}}^*:$ $2J_{\text{f}}^\pi:$	0.0 7 ⁻	112.9 9 ⁻	249.7 11 ⁻	321 9 ⁺	409 13 ⁻
1535	$\langle 7 \rangle^-$	3			68Ri07						
1560.8(3)	23^+										
1565	$\langle 5 \rangle^-$	$\langle 3 \rangle$			68Ri07						
1565.6(4)	$\langle 15 \rangle^-$										
1582.91(16)	$\langle 21 \rangle^-$										
1592.75(14)	25^+										
≈ 1609	13^+										
1634	$\langle 1 \rangle^-$	1	[1]		68Ri07						
1666	$\langle 3 \rangle^-$	$\langle 1 \rangle$	[1]		68Ri07						
1701	$\langle 3 \rangle^-$	1			68Ri07						
1713.15(16)	25^-			<1 ns							
1743											
1779	$\langle 5 \rangle^-$	3			68Ri07						
1797.9(4)	25^-										
1802.5(3)	25^+										
1845.85(16)	$\langle 23 \rangle^-$										
1847											
1882	$\langle 1 \rangle^-$	1	[1]		68Ri07						
1887.68(18)	27^+										
1925.3(4)	$\langle 21 \rangle^-$										
1932	$\langle 3 \rangle^-$	1			68Ri07						
1968.02(20)	27^-										
1969	$\langle 5 \rangle^-$	3			68Ri07						
2005.1(4)	$\langle 21 \rangle^-$										
2007	$\langle 5^-, 7^- \rangle$	3			68Ri07						
2049.2(4)	$\langle 19 \rangle^-$										
2070.22(22)	$\langle 23 \rangle^-$										
2071	$\langle 7 \rangle^-$	3			68Ri07						
2090.9(4)	27^-										
2114	$\langle 5^-, 7^- \rangle$	3			68Ri07						
2123.92(19)	$\langle 25 \rangle^-$										
2127.9(3)	27^+										
2199.16(18)	29^+										
2249.34(21)	29^-										
2335.90(20)	$\langle 25 \rangle^-$										
2377.4(3)	29^+										
2398.8(4)	29^-										
2409.59(20)	$\langle 27 \rangle^-$										
2416.47(21)	$\langle 27 \rangle^-$										
2417.97(24)	$\langle 27 \rangle^-$										
2451.4(5)	$\langle 25 \rangle^-$										
2525.54(20)	31^+										
2539.1(5)	$\langle 25 \rangle^-$										
2554.70(23)	31^-										
2590.8(5)	$\langle 23 \rangle^-$										

(continued)

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	L	U^2	$T_{1/2}$ or	Ref.	Branching ratios in percentage				
[keV]		(d,p)		Γ_{cm}		$E^*_f:$	0.0	112.9	249.7	321
						$2J^\pi_f:$	7 ⁻	9 ⁻	11 ⁻	9 ⁺
2615.33(24)	$\langle 27^- \rangle$									
2700.14(21)	$\langle 29^- \rangle$									
2719.8(5)	31 ⁻									
2724.35(23)	$\langle 29^- \rangle$									
2740.02(15)	37 ⁻			51.4(5) m						
2782.5(4)	31 ⁺									
2865.48(22)	33 ⁺									
2873.36(21)	$\langle 29^+ \rangle$									
2882.00(25)	33 ⁻									
2896.7(3)	$\langle 31^- \rangle$									
2908.9(3)	$\langle 29^- \rangle$									
2936.52(20)	$\langle 33^- \rangle$									
3015.2(4)	33 ⁺									
3047.26(25)	$\langle 31^- \rangle$									
3053.4(5)	33 ⁻									
3105.72(20)	39 ⁺			<1 ns						
3133.5(5)	$\langle 29^- \rangle$									
3141.64(16)	39 ⁻									
3217.37(24)	35 ⁺									
3217.6(3)	$\langle 31^- \rangle$									
3222.0(3)	$\langle 31^+ \rangle$									
3228.8(3)	35 ⁻									
3237.3(4)	$\langle 33^- \rangle$									
3303.0(3)	$\langle 35^- \rangle$									
3398.6(5)	35 ⁻									
3465.5(3)	41 ⁺									
3517.2(4)	35 ⁺									
3562.70(16)	41 ⁻									
3579.1(3)	37 ⁺									
3582.1(4)	$\langle 33^+ \rangle$									
3593.4(3)	37 ⁻									
3686.3(4)	$\langle 37^- \rangle$									
3702.8(5)	37 ⁺									
3753.4(5)	37 ⁻									
3840.6(3)	43 ⁺									
3948.5(4)	$\langle 39^+ \rangle$									
4002.30(19)	43 ⁻									
4120.8(5)	$\langle 39^- \rangle$									
4231.9(3)	45 ⁺									
4460.05(22)	$\langle 45^- \rangle$									
4497.5(6)	$\langle 41^- \rangle$									
4640.3(3)	$\langle 47^+ \rangle$									

(continued)

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	L	U^2	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
[keV]		(d,p)		Γ_{cm}		E^*_f :	0.0	112.9	249.7	321	409
						$2J^\pi_f$:	7 ⁻	9 ⁻	11 ⁻	9 ⁺	13 ⁻
5064.7(3)	$\langle 49^+ \rangle$	68Ri07	68Ri07		Ref.						

Additional data on this isotope can be found in [91De24, 66Ri10].

Abundance: 18.60(9) %.Data from the (d,p) and (d,t) reactions were expressed in [68Ri07] as many components of C^2S and as given here $U^2=1-V^2$ with V^2 — the occupation probability.

Assignment of levels to eight configurations and three K-bands can be found in [03Ko33].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [03Ko33]. Part 2

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E^*_f :	427	508	555	591.318	604.48	624	652	665	708.462	745.89
		$2J^\pi_f$:	11 ⁺	5 [−]	13 ⁺	15 [−]	7 [−]	⟨3 [−] ⟩	⟨5 [−] ⟩	⟨5⟩ [−]	15 ⁺	7 ⁺
555.1781(4)	13 ⁺		65.1(12)									
559.4(10)	1 [−]			100								
604.48(5)	7 [−]			14(2)								
708.4624(5)	15 ⁺		42.8(9)		51.2(9)	0.56(7)						
726.9(3)	⟨9 [−] ⟩			60(22)			40(14)					
745.89(6)	7 ⁺		0.69(8)									
794.4397(9)	17 [−]					3.8(4)						
805.74(7)	3 [−]			32(3)								
840.10(20)	⟨7 [−] ⟩							100				
841.50(20)	⟨9 [−] ⟩									100		
845.60(20)	⟨9 [−] ⟩								100			
847.38(6)	9 ⁺		25(2)									
872.96(7)	⟨5⟩ [−]			9(2)			7(2)					
882.8615(5)	17 ⁺				57(2)	3.2(2)					39.8(7)	
948.08(15)				39(9)								
1002.82(5)	⟨7 [−] ⟩			37(3)			4.9(7)					7.7(7)
1017.7915(20)	19 [−]					97(3)						
1057.73(6)	7 [−]			1.60(12)			0.60(8)					0.13(2)
1086.9667(6)	19 ⁺										67(3)	
1342.38(20)	⟨19 [−] ⟩					x						

Energy levels and branching ratios [03Ko33]. Part 3

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	794.440 17 ⁻	805.74 3 ⁻	840.10 ⟨7 ⁻ ⟩	841.50 ⟨9 ⁻ ⟩	845.60 ⟨9 ⁻ ⟩	847.38 9 ⁺	872.96 ⟨5⟩ ⁻	882.862 17 ⁺	1017.79 19 ⁻	1086.97 19 ⁺
882.8615(5)	17 ⁺		0.11(3)									
948.08(15)				61(10)								
1002.82(5)	⟨7 ⁻ ⟩			26(3)					9(1)			
1017.7915(20)	19 ⁻		2.6(3)									
1057.73(6)	7 ⁻							1.2(6)				
1086.9667(6)	19 ⁺		1.85(12)							31.2(7)	0.02(1)	
1113.5(3)	⟨13 ⁻ ⟩					100						
1143.3(3)	⟨13 ⁻ ⟩						100					
1157.9(3)	⟨11 ⁻ ⟩				100							
1260.2820(14)	21 ⁻		98(5)								1.6(5)	
1301.4008(6)	21 ⁺									75(3)	1.4(2)	23.4(7)
1315.4504(8)	23 ⁺											95.0(17)
1342.38(20)	⟨19 ⁻ ⟩		100								x	
1520.5(3)	23 ⁻										100	
1560.8(3)	23 ⁺											84(3)

Energy levels and branching ratios [03Ko33]. Part 4

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		E_f^* : $2J_f^\pi$:	1113.5 $\langle 13^- \rangle$	1143.3 $\langle 13^- \rangle$	1157.9 $\langle 11^- \rangle$	1260.28 21^-	1301.40 21^+	1315.45 23^+	1342.38 $\langle 19^- \rangle$	1477.2 $\langle 17^- \rangle$	1520.5 23^-	1534.9 $\langle 17^- \rangle$
1315.4504(8)	23^+					4.6(3)	0.39(2)					
1342.38(20)	$\langle 19^- \rangle$					x						
1477.2(4)	$\langle 17^- \rangle$		100									
1534.9(4)	$\langle 17^- \rangle$			100								
1560.8(3)	23^+						16.2(9)					
1565.6(4)	$\langle 15^- \rangle$				100							
1582.91(16)	$\langle 21^- \rangle$								100			
1592.75(14)	25^+							100				
1713.15(16)	25^-							9(1)				
1797.9(4)	25^-					100						
1802.5(3)	25^+						89(4)					
1845.85(16)	$\langle 23^- \rangle$								12(6)			
1887.68(18)	27^+							11.3(13)				
1925.3(4)	$\langle 21^- \rangle$									100		
2005.1(4)	$\langle 21^- \rangle$											100
2090.9(4)	27^-										100	

Energy levels and branching ratios [03Ko33]. Part 5

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	1560.8 23 ⁺	1565.6 ⟨15 ⁻ ⟩	1582.91 ⟨21 ⁻ ⟩	1592.75 25 ⁺	1713.15 25 ⁻	1797.9 25 ⁻	1802.5 25 ⁺	1845.85 ⟨23 ⁻ ⟩	1887.68 27 ⁺	1925.3 ⟨21 ⁻ ⟩
1713.15(16)	25 ⁻					91(3)						
1802.5(3)	25 ⁺		11(3)									
1845.85(16)	⟨23 ⁻ ⟩				88(5)							
1887.68(18)	27 ⁺					89(4)						
1968.02(20)	27 ⁻						100					
2049.2(4)	⟨19 ⁻ ⟩			100								
2070.22(22)	⟨23 ⁻ ⟩						100					
2123.92(19)	⟨25 ⁻ ⟩				29(5)					71(6)		
2127.9(3)	27 ⁺		89(4)						10.9(21)			
2199.16(18)	29 ⁺					25.6(17)					74(3)	
2249.34(21)	29 ⁻						12.2(10)					
2335.90(20)	⟨25 ⁻ ⟩						22.7(19)					
2377.4(3)	29 ⁺								91(5)			
2398.8(4)	29 ⁻							100				
2409.59(20)	⟨27 ⁻ ⟩						27(3)					
2416.47(21)	⟨27 ⁻ ⟩									46(7)		
2451.4(5)	⟨25 ⁻ ⟩											100
2525.54(20)	31 ⁺										28(2)	
2873.36(21)	⟨29 ⁺ ⟩										72(10)	

Energy levels and branching ratios [03Ko33]. Part 6

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	1968.02 27 ⁻	2005.1 ⟨21 ⁻ ⟩	2049.2 ⟨19 ⁻ ⟩	2070.22 ⟨23 ⁻ ⟩	2090.9 27 ⁻	2123.92 ⟨25 ⁻ ⟩	2127.9 27 ⁺	2199.16 29 ⁺	2249.34 29 ⁻	2335.90 ⟨25 ⁻ ⟩
2249.34(21)	29 ⁻		88(3)									
2335.90(20)	⟨25 ⁻ ⟩		77(4)			x						
2377.4(3)	29 ⁺								9.3(17)			
2409.59(20)	⟨27 ⁻ ⟩		43(3)			21(2)						9.4(10)
2416.47(21)	⟨27 ⁻ ⟩							54(6)				
2417.97(24)	⟨27 ⁻ ⟩											100
2525.54(20)	31 ⁺									72(3)		
2539.1(5)	⟨25 ⁻ ⟩			100								
2554.70(23)	31 ⁻		28(1)								72(3)	
2590.8(5)	⟨23 ⁻ ⟩				100							
2615.33(24)	⟨27 ⁻ ⟩		38(3)								62(4)	x
2700.14(21)	⟨29 ⁻ ⟩		x								8(2)	24(2)
2719.8(5)	31 ⁻						100					
2724.35(23)	⟨29 ⁻ ⟩							53(6)				
2782.5(4)	31 ⁺								100			
2865.48(22)	33 ⁺										30(3)	
2873.36(21)	⟨29 ⁺ ⟩										28(6)	

(continued)

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E^*_f : $2J^\pi_f$:	1968.02 27 ⁻	2005.1 ⟨21 ⁻ ⟩	2049.2 ⟨19 ⁻ ⟩	2070.22 ⟨23 ⁻ ⟩	2090.9 27 ⁻	2123.92 ⟨25 ⁻ ⟩	2127.9 27 ⁺	2199.16 29 ⁺	2249.34 29 ⁻	2335.90 ⟨25 ⁻ ⟩
2882.00(25)	33 ⁻										45(3)	
2908.9(3)	⟨29 ⁻ ⟩										100	

Energy levels and branching ratios [03Ko33]. Part 7

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E^*_f : $2J^\pi_f$:	2377.4 29 ⁺	2398.8 29 ⁻	2409.59 ⟨27 ⁻ ⟩	2416.47 ⟨27 ⁻ ⟩	2417.97 ⟨27 ⁻ ⟩	2525.54 31 ⁺	2539.1 ⟨25 ⁻ ⟩	2554.70 31 ⁻	2615.33 ⟨27 ⁻ ⟩	2700.14 ⟨29 ⁻ ⟩
2700.14(21)	⟨29 ⁻ ⟩				62(2)		5.6(13)					
2724.35(23)	⟨29 ⁻ ⟩					47(5)						
2740.02(15)	37 ⁻							100				
2865.48(22)	33 ⁺							70(4)				
2882.00(25)	33 ⁻									55(3)		
2896.7(3)	⟨31 ⁻ ⟩											100
2908.9(3)	⟨29 ⁻ ⟩										x	
3015.2(4)	33 ⁺	100										
3047.26(25)	⟨31 ⁻ ⟩					50(12)						
3053.4(5)	33 ⁻			100								
3133.5(5)	⟨29 ⁻ ⟩								100			
3217.37(24)	35 ⁺							27(4)				
3217.6(3)	⟨31 ⁻ ⟩									88(9)		
3228.8(3)	35 ⁻									54(4)		

Energy levels and branching ratios [03Ko33]. Part 8

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E^*_f : $2J^\pi_f$:	2719.8 31 ⁻	2724.35 ⟨29 ⁻ ⟩	2740.02 37 ⁻	2782.5 31 ⁺	2865.48 33 ⁺	2873.36 ⟨29 ⁺ ⟩	2882.00 33 ⁻	2896.7 ⟨31 ⁻ ⟩	2908.9 ⟨29 ⁻ ⟩	2936.52 ⟨33 ⁻ ⟩
2936.52(20)	⟨33 ⁻ ⟩				100							
3047.26(25)	⟨31 ⁻ ⟩			50(9)								
3105.72(20)	39 ⁺				100							
3141.64(16)	39 ⁻				100							
3217.37(24)	35 ⁺						73(4)					
3217.6(3)	⟨31 ⁻ ⟩										12(6)	
3222.0(3)	⟨31 ⁺ ⟩							100				
3228.8(3)	35 ⁻								46(3)			
3237.3(4)	⟨33 ⁻ ⟩									100		
3303.0(3)	⟨35 ⁻ ⟩											100
3398.6(5)	35 ⁻	100										

(continued)

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	2719.8 31 ⁻	2724.35 ⟨29 ⁻ ⟩	2740.02 37 ⁻	2782.5 31 ⁺	2865.48 33 ⁺	2873.36 ⟨29 ⁺ ⟩	2882.00 33 ⁻	2896.7 ⟨31 ⁻ ⟩	2908.9 ⟨29 ⁻ ⟩	2936.52 ⟨33 ⁻ ⟩
3517.2(4)	35 ⁺					100						
3562.70(16)	41 ⁻				22(12)							
3579.1(3)	37 ⁺						26(5)					
3582.1(4)	⟨33 ⁺ ⟩							<34				
3593.4(3)	37 ⁻								53(6)			
3686.3(4)	⟨37 ⁻ ⟩											<15

Energy levels and branching ratios [03Ko33]. Part 9

 $^{177}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	3015.2 33 ⁺	3053.4 33 ⁻	3105.72 39 ⁺	3141.64 39 ⁻	3217.37 35 ⁺	3217.6 ⟨31 ⁻ ⟩	3222.0 ⟨31 ⁺ ⟩	3228.8 35 ⁻	3303.0 ⟨35 ⁻ ⟩	3398.6 35 ⁻
3465.5(3)	41 ⁺				100							
3562.70(16)	41 ⁻					78(6)						
3579.1(3)	37 ⁺						74(5)					
3582.1(4)	⟨33 ⁺ ⟩								100			
3593.4(3)	37 ⁻									47(6)		
3686.3(4)	⟨37 ⁻ ⟩										100	
3702.8(5)	37 ⁺	100										
3753.4(5)	37 ⁻			100								
3840.6(3)	43 ⁺				19(3)							
3948.5(4)	⟨39 ⁺ ⟩							33(7)				
4002.30(19)	43 ⁻					38(9)						
4120.8(5)	⟨39 ⁻ ⟩											100

Energy levels and branching ratios [03Ko33]. Part 10

 $^{177}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage								
[keV]	$E_f^*:$ $2J_f^\pi:$	3465.5 41 ⁺	3562.70 41 [−]	3579.1 37 ⁺	3753.4 37 [−]	3840.6 43 ⁺	4002.30 43 [−]	4231.9 45 ⁺	4640.3 ⟨47 ⁺ ⟩	
3840.6(3)	43 ⁺	81(4)								
3948.5(4)	⟨39 ⁺ ⟩			67(7)						
4002.30(19)	43 [−]		62(9)							
4231.9(3)	45 ⁺	34(5)				66(5)				
4460.05(22)	⟨45 [−] ⟩		12(12)				88(30)			
4497.5(6)	⟨41 [−] ⟩				100					
4640.3(3)	⟨47 ⁺ ⟩					39(7)		61(7)		
5064.7(3)	⟨49 ⁺ ⟩							79(24)	21(17)	

Energy levels and branching ratios [94Br18, 88Br21].

 $^{178}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,d')	σ (d,p)	σ (d,t)	σ (p, α)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	
0.0**	0^+	0	863(10)	$45 \cdot 10^3$	≈ 1		0.46				73Oo01
93.180(1)	2^+	$\langle 2 \rangle$	220(7)	4400	8	≈ 3	0.94				73Oo01
306.619(3)	4^+		68.5(41)	72	5	7	0.61				73Oo01
632.177(4)	6^+		9.0(10)	≈ 6	3	5	0.13				73Oo01
1058.556(5)	8^+										
1147.423(5)	8^-				≈ 3	5	2.36				93Sh30
1174.630(4)	2^+	$\langle 2 \rangle$	39.3(53)	120	29			7.9(31)	1.0(4)		73Oo01
1199.39(1)**	0^+				$\langle 3 \rangle$		0.49				94Bu02
1260.250(4)	2^-					25					93Sh30
1268.536(4)	3^+		3.3(11)		21						73Oo01
1276.688(6)	2^+		incl	[9]			1.28				73Oo01
1310.068(4)	1^-							3.5(17)	0.6(3)		
1322.464(4)	3^-		41(3)	62		30					73Oo01
1362.550(4)	2^-				5						93Sh30
1364.091(8)	9^-					20	2.05				94Bu02
1384.461(4)	4^+		11.4(16)	15	14						73Oo01
1409.441(4)	4^-					30					93Sh30
1433.624(4)	$\langle 3 \rangle^-$			20	4	23					93Sh30
1434.21(5)**	0^+										
1443.94(1)**	0^+	0	23.4(16)								73Oo01
1450.361(6)	4^+		incl		≈ 2		0.54				73Oo01
1479.036(10)	8^-				5	5	2.75				94Bu02
1496.42(5)	2^+			[13]			≤ 0.7				94Bu02
1512.593(4)	$\langle 5 \rangle^-$					$\langle 13 \rangle$	incl				93Sh30
1513.610(10)	2^+	$\langle 2 \rangle$	14.4(16)	[17]			incl				73Oo01
1513.832(4)	4^+		incl		150		incl				73Oo01
1533.151(6)	5^+				23						93Sh30
1538.790(4)	4^-					10					93Sh30
1553.998(4)	6^+				12		3.0				94Bu02
1561.533(7)	2^+			28			incl				93Sh30
1566.667(4)	2^-						incl				
1571.0(10)	10^+										
1601.473(10)	10^-				9		0.3				94Bu02
1635.602(6)	4^+										
1636.729(4)	5^-					180					93Sh30
1639.757(4)	3^-						3.34				94Bu02
1640.452(4)	5^+		4.5(7)		100						73Oo01
1648.840(5)	$\langle 6 \rangle^-$					≈ 10					93Sh30
1651.460(4)	$\langle 5 \rangle^-$										
1654.1(6)	$\langle 4^+ \rangle$										
1691.076(11)	6^+										
1697.5(10)	$\langle 9^- \rangle$				6		2.74				94Bu02
1731.064(4)	$\langle 6^+ \rangle$										
1741.7(10)	$\langle 7^+ \rangle$										
1747.101(4)	4^-						2.8				94Bu02

(continued)

 **^{178}Hf
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E^*	J^π	L	σ (p,t)	σ (d,d')	σ (d,p)	σ (d,t)	σ (p, α)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	
1758.145(4)	3^+				12		incl				93Sh30
1772.2(1)**	0^+	0	42.3(30)								73Oo01
1781.261(5)	$\langle 6 \rangle^-$		incl			257					93Sh30
1788.598(4)	6^+				[17]						93Sh30
1803.388(4)	3^-			42			0.34				94Bu02
1808.272(5)	$\langle 2 \rangle^+$				29	20	incl				
1818.281(8)	2^+	$\langle 2+ \rangle$	39.3(31)				incl				73Oo01
1857.149(5)	$\langle 2 \rangle^-$										
1859.112(12)	$\langle 11 \rangle^-$										
1862.203(5)	3^+				150	40	1.7				94Bu02
1863.711(4)	$\langle 5 \rangle^-$						incl				
1869.842(4)	4^+		23.3(20)				incl				73Oo01
1875(5)	$[3^-]$			24							93Sh30
1891.306(8)	2^+				33						93Sh30
1913.617(4)	4^-				15						93Sh30
1917.436(4)	3^-										
1939.1(7)	$\langle 10 \rangle^-$						1.25				94Bu02
1942.009(6)	$1^+, 2^+, 3^+$						incl				
1947.949(5)	$\langle 7 \rangle^-$		11.3(12)								73Oo01
1952.1(13)	$\langle 8 \rangle^+$										
1953.134(5)	4^+				150						93Sh30
1953.683(5)	$\langle 7 \rangle^+$										
1956.420(5)	4^+										
1986.452(4)	$1^+ - 3^+$		11.1(1,2)								73Oo01
1997.460(8)	3^+		incl								73Oo01
2007.563(5)	$4^+, 3^+$						1.4				94Bu02
2013.547(5)	$3^+ - 5^+$										
2021.185(5)	$1^+ - 3^+$										
2025.8(17)	0^+	0	42.3(21)								73Oo01
2027.568(5)	4^-										
2050.484(10)	3^+										
2056	$\langle 2 \rangle^+$	$\langle 2 \rangle$	10.1(12)								73Oo01
2068.037(5)	5^+				58						93Sh30
2099.870(6)	$3^+, 4^+$										
2118.6(12)			14.5(16)				2.1				73Oo01
2136.513(16)	$\langle 12 \rangle^-$										
2137.4(10)	$\langle 8 \rangle^-$										
2150.7(14)	12^+										
2155.6(7)			10.5(14)								73Oo01
2183.4(13)	$\langle 9 \rangle^+$						1.4				94Bu02
2202.4(7)	$\langle 11 \rangle^-$										
2203(10)			20.8(20)				1.1				73Oo01
2227(10)			23.9(21)				2.8				73Oo01
2247.8(20)	1							3.6(12)	3.7(15)	0.084(34)	97Pi08
2255(1)							1.2				94Bu02

(continued)

 ^{178}Hf
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E^*	J^π	L	σ (p,t)	σ (d,d')	σ (d,p)	σ (d,t)	σ (p, α)	$I_{s,0}$	Γ_{γ_0}	$B(M1)$	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	
2272.6(6)			19.2(21)								73Oo01
2310(1)							7.0				94Bu02
2316(10)	$\langle 0^+ \rangle$	$\langle 0 \rangle$	44.2(31)								73Oo01
2334.4(20)	1							13.6(13)	13.7(17)	0.281(34)	
2354(1)							6.1				94Bu02
2365.5(7)	$\langle 2^+ \rangle$	$\langle 2 \rangle$	42.0(32)								73Oo01
2393(10)			18.5(21)				7.5				73Oo01
2420	$\langle 6^+ \rangle$										
2432.5(20)	1,2							3.4(11)	1.8(6)	0.032(10)	
2433.326(17)	$\langle 13 \rangle^-$										
2433.9(14)	$\langle 10^+ \rangle$										
2438.8(20)	1		14.2(16)					5.7(13)	6.3(17)	0.112(30)	73Oo01
2446.05(15)	16^+										
2463(1)							2.2				94Bu02
2474.7(17)			16.8(15)								73Oo01
2485.2(7)	$\langle 12^- \rangle$										
2508(1)							2.9				94Bu02
2537(1)							3.6				94Bu02
2552.6(12)											
2557.8(9)											
2572(10)			6.8(13)				1.6				73Oo01
2573.5	$\langle 14 \rangle^-$										
2600	$\langle 7^+ \rangle$						1.5				94Bu02
2612.7(20)	1							36.2(19)	31.6(19)	0.459(28)	97Pi08
2631.4(10)			6.3(11)				2.7				73Oo01
2668(10)	$\langle 2^+ \rangle$	$\langle 2 \rangle$	14.1(20)								73Oo01
2700.5(15)	$\langle 11^+ \rangle$										
2707(10)			6.9(13)								73Oo01
2737.5(10)											
2749.1(10)	$\langle 14^- \rangle$										
2777.6(17)	14^+										
2803*	$[17^+]$										96De11
2827.5(20)	1							4.1(12)	7.8(28)	0.090(32)	97Pi08
2839.6(20)	1							25.3(16)	26.2(20)	0.297(22)	97Pi08
2865.8(14)											
2894.1(20)	1							9.7(12)	11.5(18)	0.123(19)	97Pi08
2898.7(8)											
2915.7(20)	1							11.1(12)	13.8(19)	0.144(20)	97Pi08
2957.6(18)											
3018.8(20)	1							12.4(12)	18.1(22)	0.170(21)	97Pi08
3100.5(14)											
3112.8(16)											
3144.4(20)	1							13.2(14)	33.0(44)	0.275(37)	97Pi08
3183*	$[18^+]$										96De11
3293.4(20)	1							4.9(15)	6.6(23)	0.048(17)	97Pi08

(continued)

 $^{178}_{72}\text{Hf}$

E^*	J^π	L	σ (p,t)	σ (d,d')	σ (d,p)	σ (d,t)	σ (p, α)	$I_{s,0}$	Γ_{γ_0}	$B(M1)$	Ref.
[keV]		(p,t)	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	
3410.0(20)	1							6.5(16)	10.4(31)	0.068(20)	97Pi08
3436.2(20)	16^+										
3453***								6.1(23)	15.1(69)	0.095(43)	
3546.0(20)	1							18.4(18)	29.4(31)	0.171(18)	97Pi08
3572.5(20)	1							5.7(12)	16.5(45)	0.094(26)	97Pi08
3577.7(20)	1							11.9(16)	21.0(36)	0.119(20)	97Pi08
3589.3(20)	1							22.5(22)	37.3(42)	0.209(24)	97Pi08
3609.9(20)	1							17.3(19)	30.1(41)	0.165(22)	97Pi08
3625.6(20)	1,2							6.7(16)	13.1(39)	0.071(21)	97Pi08
3710.8(20)	1							12.4(18)	14.9(22)	0.076(11)	97Pi08
3773.2(20)	1							9.4(18)	19.6(47)	0.095(23)	97Pi08
3823.9(20)	1							10.7(23)	20.8(54)	0.096(25)	97Pi08
3890.0(20)	1,2							6.4(24)	27(13)	0.120(57)	97Pi08
3909.5(17)											
3925.2(20)	1							20.1(37)	27.2(49)	0.116(21)	97Pi08
3932.2(20)	1							17(3)	34(8)	0.143(33)	97Pi08
4120.6	$\langle 18^+ \rangle$										
4210.4(2)											
4325.1(15)											
4377.9(13)											
4593.1(19)											
4781.8(17)											
4873.6(9)											
4914.7(12)											
5010.0(13)											
5282.8(20)											
5388.5(9)											
			73Oo01	93Sh30	93Sh30	93Sh30	94Bu02		97Pi08	97Pi08	Ref.

Additional data on this isotope can be found in [02Ro15, 00Ko01, 00De26, 00Ya22, 96Lu07, 94Bu02, 93Re06, 93Sh15, 91Bo43, 89Bo50, 88Bo44, 87Bo52, 87Bo53, 69Pr14].

Abundance: 27.28(7) %.

* Possible members of rotational band (built on 16^+ isomeric state at $E^*=2446$ keV) which were determined in the inelastic deuteron scattering experiment [96De11].

** The first members of 5 bands ($K^\pi=0^+$) for which τ -measurements were performed in [02Ap02].

*** Possible doublet [97Pi08].

Cross sections of the (d,d'), (d,p) and (d,t) reactions were measured at 100° , 65° and 95° [93Sh30].

Cross section of the (p, α) reaction was measured at 10° [94Bu02].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [94Br18, 88Br21]. Part 2

 $^{178}_{72}\text{Hf}$

E^*	J^π	$B(E1)$	$T_{1/2}$ or	Ref.	E_f^* :	0.0	Branching ratios in percentage				
[keV]		$[10^{-3}e^2fm^2]$	Γ_{cm}		J_f^π :	0 ⁺	93.2	307	632	1058	
							2 ⁺	4 ⁺	6 ⁺	8 ⁺	
0.0**	0 ⁺		Stable	73Oo01							
93.180(1)	2 ⁺		1.48(2) ns	73Oo01		100					
306.619(3)	4 ⁺			73Oo01			100				
632.177(4)	6 ⁺		11.2(6) ps	73Oo01				100			
1058.556(5)	8 ⁺		2.77(6) ps						100		
1147.423(5)	8 ⁻		4.0(2) s	93Sh30							100
1174.630(4)	2 ⁺		0.62(2) ps	73Oo01		57(5)	42.5(4)	0.83(5)			
1199.39(1)**	0 ⁺			94Bu02		x	100				
1260.250(4)	2 ⁻			93Sh30			92.9(9)				
1268.536(4)	3 ⁺			73Oo01			84(9)	16.1(7)			
1276.688(6)	2 ⁺		6.1(24) ps	73Oo01		12.7(5)	68(1)	19.7(10)			
1310.068(4)	1 ⁻	0.77(37)				85(2)	14.7(14)				
1322.464(4)	3 ⁻			73Oo01			91(1)	3.5(5)			
1362.550(4)	2 ⁻			93Sh30			98(3)				
1364.091(8)	9 ⁻			94Bu02							
1384.461(4)	4 ⁺			73Oo01			31.1(7)	68.4(7)			
1409.441(4)	4 ⁻			93Sh30				86.8(9)			
1433.624(4)	$\langle 3 \rangle^-$			93Sh30			90(3)	6.62(20)			
1434.21(5)**	0 ⁺					x					
1443.94(1)**	0 ⁺			73Oo01		x	100				
1450.361(6)	4 ⁺			73Oo01			5.54(16)	86.8(10)	6.9(3)		
1479.036(10)	8 ⁻			94Bu02							
1496.42(5)	2 ⁺		0.9(2) ps	94Bu02		35(2)	61(1)	3.3(3)			
1512.593(4)	$\langle 5 \rangle^-$			93Sh30				91(4)			
1513.610(10)	2 ⁺			73Oo01		88(5)					
1513.832(4)	4 ⁺			73Oo01			23.0(7)	44(2)	2.1(2)		
1533.151(6)	5 ⁺			93Sh30				82(2)	15.8(10)		
1538.790(4)	4 ⁻			93Sh30				73.0(14)			
1553.998(4)	6 ⁺		77.5(7) ns	94Bu02				31.7(8)	61(3)		
1561.533(7)	2 ⁺			93Sh30		17(1)	20.7(5)	60(2)			
1566.667(4)	2 ⁻						23.8(13)				
1571.0(10)	10 ⁺		1.03(3) ps								100
1601.473(10)	10 ⁻			94Bu02							
1635.602(6)	4 ⁺						97(4)				
1636.729(4)	5 ⁻		0.4(1) ns	93Sh30				60(2)			
1639.757(4)	3 ⁻			94Bu02							
1640.452(4)	5 ⁺			73Oo01				55(2)	11.3(2)		
1648.840(5)	$\langle 6 \rangle^-$			93Sh30					60(3)		
1651.460(4)	$\langle 5 \rangle^-$							70(2)			
1654.1(6)	$\langle 4^+ \rangle$						≤ 35	100			
1691.076(11)	6 ⁺							32.5(13)	55(2)		
1697.5(10)	$\langle 9^- \rangle$			94Bu02							
1731.064(4)	$\langle 6^+ \rangle$								20.8(10)	2.8(3)	
1741.7(10)	$\langle 7^+ \rangle$										
1747.101(4)	4 ⁻			94Bu02				12(1)			

(continued)

¹⁷⁸Hf
72

E^* [keV]	J^π	$B(E1)$ [$10^{-3}e^2fm^2$]	$T_{1/2}$ or Γ_{cm}	Ref.	Branching ratios in percentage					
					E_f^* : J_f^π :	0.0 0 ⁺	93.2 2 ⁺	307 4 ⁺	632 6 ⁺	1058 8 ⁺
1758.145(4)	3 ⁺			93Sh30						
1772.2(1)**	0 ⁺			73Oo01		x	100			
1781.261(5)	⟨6⟩ ⁻			93Sh30						
1788.598(4)	6 ⁺			93Sh30				10.4(5)	45(1)	
1803.388(4)	3 ⁻			94Bu02						
1808.272(5)	⟨2⟩ ⁺						81(10)	x		
1818.281(8)	2 ⁺			73Oo01			67(6)	27(3)		
1857.149(5)	⟨2⟩ ⁻									
1859.112(12)	⟨11⟩ ⁻									
1862.203(5)	3 ⁺			94Bu02						
1863.711(4)	⟨5⟩ ⁻									
1869.842(4)	4 ⁺			73Oo01			14(3)	x		
1875(5)	[3 ⁻]			93Sh30						
1891.306(8)	2 ⁺			93Sh30			32(4)			
1913.617(4)	4 ⁻			93Sh30				3.6(6)		
1917.436(4)	3 ⁻									
1939.1(7)	⟨10⟩ ⁻			94Bu02						
1942.009(6)	1 ⁺ , 2 ⁺ , 3 ⁺						66(6)	x		
1947.949(5)	⟨7⟩ ⁻			73Oo01					30(3)	
1952.1(13)	⟨8 ⁺ ⟩									
1953.134(5)	4 ⁺			93Sh30				69(4)		
1953.683(5)	⟨7⟩ ⁺								72(4)	22.7(15)
1956.420(5)	4 ⁺							63(4)	11.7(9)	
1986.452(4)	1 ⁺ -3 ⁺			73Oo01			66(4)			
1997.460(8)	3 ⁺			73Oo01			x	83(12)		
2007.563(5)	4 ⁺ , 3 ⁺			94Bu02						
2013.547(5)	3 ⁺ -5 ⁺						53(5)	x		
2021.185(5)	1 ⁺ -3 ⁺						38(3)			
2025.8(17)	0 ⁺			73Oo01			x			
2027.568(5)	4 ⁻									
2050.484(10)	3 ⁺						57(5)	39(3)		
2056	⟨2 ⁺ ⟩			73Oo01						
2068.037(5)	5 ⁺			93Sh30						
2099.870(6)	3 ⁺ , 4 ⁺							34(6)		
2118.6(12)				73Oo01		x	x			
2136.513(16)	⟨12⟩ ⁻									
2137.4(10)	⟨8 ⁻ ⟩									
2150.7(14)	12 ⁺		0.56(2) ps							
2155.6(7)				73Oo01			x	x		
2183.4(13)	⟨9 ⁺ ⟩			94Bu02						
2202.4(7)	⟨11 ⁻ ⟩									
2203(10)				73Oo01						
2227(10)				73Oo01						
2247.8(20)	1	0.92(38)		97Pi08						
2255(1)				94Bu02						

(continued)

 $^{178}_{72}\text{Hf}$

E^*	J^π	$B(E1)$	$T_{1/2}$ or	Ref.		Branching ratios in percentage				
[keV]		$[10^{-3}e^2fm^2]$	Γ_{cm}		$E^*_\text{f}:$ $J^\pi_\text{f}:$	0.0 0 ⁺	93.2 2 ⁺	307 4 ⁺	632 6 ⁺	1058 8 ⁺
2272.6(6)				73Oo01			x	x		
2310(1)				94Bu02						
2316(10)	$\langle 0^+ \rangle$			73Oo01						
2334.4(20)	1	3.10(38)								
2354(1)				94Bu02						
2365.5(7)	$\langle 2^+ \rangle$			73Oo01			x	x		
2393(10)				73Oo01						
2420	$\langle 6^+ \rangle$									
2432.5(20)	1,2	0.35(12)								
2433.326(17)	$\langle 13 \rangle^-$									
2433.9(14)	$\langle 10^+ \rangle$									
2438.8(20)	1	1.24(33)		73Oo01						
2446.05(15)	16 ⁺		31(1) yr							
2463(1)				94Bu02						
2474.7(17)				73Oo01			x		x	
2485.2(7)	$\langle 12^- \rangle$									
2508(1)				94Bu02						
2537(1)				94Bu02						
2552.6(12)						x				
2557.8(9)							x		x	
2572(10)				73Oo01						
2573.5	$\langle 14 \rangle^-$		68(2) μs							
2600	$\langle 7^+ \rangle$			94Bu02						
2612.7(20)	1	5.08(31)		97Pi08						
2631.4(10)				73Oo01			x		x	
2668(10)	$\langle 2^+ \rangle$			73Oo01						
2700.5(15)	$\langle 11^+ \rangle$									
2707(10)				73Oo01						
2737.5(10)							x		x	
2749.1(10)	$\langle 14^- \rangle$									
2777.6(17)	14 ⁺		0.33(7) ps							
2803*	[17 ⁺]			96De11						
2827.5(20)	1	0.99(35)		97Pi08						
2839.6(20)	1	3.28(24)		97Pi08						
2865.8(14)							x		x	
2894.1(20)	1	1.36(21)		97Pi08						
2898.7(8)							x		x	
2915.7(20)	1	1.59(22)		97Pi08						
2957.6(18)						x	x			
3018.8(20)	1	1.88(23)		97Pi08						
3100.5(14)							x		x	
3112.8(16)							x		x	
3144.4(20)	1	3.04(41)		97Pi08						
3183*	[18 ⁺]			96De11						
3293.4(20)	1	0.53(19)		97Pi08						

(continued)

 $^{178}_{72}\text{Hf}$

E^*	J^π	$B(E1)$	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
[keV]		$[10^{-3}e^2fm^2]$	Γ_{cm}		$E_f^*:$ $J_f^\pi:$	0.0 0 ⁺	93.2 2 ⁺	307 4 ⁺	632 6 ⁺	1058 8 ⁺
3410.0(20)	1	0.75(23)		97Pi08						
3436.2(20)	16 ⁺									
3453***		1.05(48)								
3546.0(20)	1	1.89(20)		97Pi08						
3572.5(20)	1	1.04(29)		97Pi08						
3577.7(20)	1	1.31(22)		97Pi08						
3589.3(20)	1	2.31(26)		97Pi08						
3609.9(20)	1	1.83(25)		97Pi08						
3625.6(20)	1,2	0.79(24)		97Pi08						
3710.8(20)	1	0.84(12)		97Pi08						
3773.2(20)	1	1.05(25)		97Pi08						
3823.9(20)	1	1.06(28)		97Pi08						
3890.0(20)	1,2	1.33(63)		97Pi08						
3909.5(17)									x	
3925.2(20)	1	1.29(23)		97Pi08						
3932.2(20)	1	1.58(36)		97Pi08						
4120.6	⟨18 ⁺ ⟩									
4210.4(2)							x		x	
4325.1(15)							x			
4377.9(13)									x	
4593.1(19)						x				
4781.8(17)							x			
4873.6(9)							x		x	
4914.7(12)									x	
5010.0(13)							x		x	
5282.8(20)									x	x
5388.5(9)									x	
		97Pi08		Ref.						

Energy levels and branching ratios [94Br18, 88Br21]. Part 3

 $^{178}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E^*_f : J^π_f	1147 8 [−]	1175 2 ⁺	1199.39 0 ⁺	1260.25 2 [−]	1268.54 3 ⁺	1276.69 2 ⁺	1310.07 1 [−]	1322.46 3 [−]	1362.55 2 [−]	1364.09 9 [−]
1260.250(4)	2 [−]			7.1(5)								
1322.464(4)	3 [−]			5.34(16)								
1362.550(4)	2 [−]			0.40(4)		0.36(4)			1.06(18)			
1364.091(8)	9 [−]	100										
1384.461(4)	4 ⁺			0.42(2)								
1409.441(4)	4 [−]				5.18(15)	8.0(3)						
1433.624(4)	⟨3⟩ [−]				2.67(8)			0.20(3)	0.36(3)	0.36(4)		
1450.361(6)	4 ⁺							0.82(7)				

(continued)

 ^{178}Hf
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E^* [keV]	J^π	Branching ratios in percentage									
		E_f^* : 1147 J_f^π : 8 ⁻	1175 2 ⁺	1199.39 0 ⁺	1260.25 2 ⁻	1268.54 3 ⁺	1276.69 2 ⁺	1310.07 1 ⁻	1322.46 3 ⁻	1362.55 2 ⁻	1364.09 9 ⁻
1479.036(10)	8 ⁻	100									
1512.593(4)	⟨5⟩ ⁻								8.4(4)		
1513.832(4)	4 ⁺		21.2(8)			8.6(5)					
1533.151(6)	5 ⁺					1.68(12)					
1538.790(4)	4 ⁻								11.1(6)	4.7(2)	
1553.998(4)	6 ⁺	2.44(10)									
1561.533(7)	2 ⁺		0.8(2)			0.69(4)					
1566.667(4)	2 ⁻				10.5(7)			37(1)	7(5)	12	
1601.473(10)	10 ⁻	64(1)									36(1)
1635.602(6)	4 ⁺					1.17(21)					
1639.757(4)	3 ⁻				20.4(8)	1.83(9)				52(3)	
1640.452(4)	5 ⁺					0.79(4)					
1654.1(6)	⟨4 ⁺ ⟩								≤59		
1697.5(10)	⟨9 ⁻ ⟩										100
1747.101(4)	4 ⁻								24(2)		
1758.145(4)	3 ⁺		2.4(3)		58.3(6)	0.92(6)			8.1(2)		
1803.388(4)	3 ⁻		16.2(4)		8.0(2)					0.45(6)	
1808.272(5)	⟨2⟩ ⁺					6.3(4)	5.8(6)				
1818.281(8)	2 ⁺			0.9(3)			4.5(3)			0.23(9)	
1857.149(5)	⟨2⟩ ⁻		25.2(8)		48(1)				9.1(6)	16.2(3)	
1859.112(12)	⟨11⟩ ⁻										81(2)
1862.203(5)	3 ⁺		9.1(4)				2.47(20)				
1869.842(4)	4 ⁺					1.3(2)			46.2(10)		
1891.306(8)	2 ⁺		39(2)	4.5(6)	5.2(2)	9.4(3)	6.6(7)				
1913.617(4)	4 ⁻					20(1)			2.8(2)		
1917.436(4)	3 ⁻				15.3(5)	21(3)			9.7(2)		
1939.1(7)	⟨10 ⁻ ⟩										58
1942.009(6)	1 ⁺ , 2 ⁺ , 3 ⁺						5.8(3)				
1953.134(5)	4 ⁺								2.4(7)		
2007.563(5)	4 ⁺ , 3 ⁺					26.4(6)					
2013.547(5)	3 ⁺ –5 ⁺					27(4)					
2021.185(5)	1 ⁺ –3 ⁺		17(2)				21(1)				
2025.8(17)	0 ⁺		x								
2027.568(5)	4 ⁻								23(3)		
2050.484(10)	3 ⁺						2.7(2)				
2099.870(6)	3 ⁺ , 4 ⁺								44(2)		
2118.6(12)							x				
2272.6(6)			x								
2552.6(12)						x					
3909.5(17)			x								
4325.1(15)					x						
4377.9(13)						x					
4593.1(19)							x				
4781.8(17)						x					

(continued)

 **^{178}Hf
72**

E^*	J^π	Branching ratios in percentage									
[keV]	$E_f^*:$ $J_f^\pi:$	1147 8 ⁻	1175 2 ⁺	1199.39 0 ⁺	1260.25 2 ⁻	1268.54 3 ⁺	1276.69 2 ⁺	1310.07 1 ⁻	1322.46 3 ⁻	1362.55 2 ⁻	1364.09 9 ⁻
4914.7(12)			x								
5388.5(9)						x					

Energy levels and branching ratios [94Br18, 88Br21]. Part 4

 **^{178}Hf
72**

E^*	J^π	Branching ratios in percentage									
[keV]	$E_f^*:$ $J_f^\pi:$	1384.46 4 ⁺	1409.44 4 ⁻	1433.62 <3> ⁻	1434.21 0 ⁺	1443.94 0 ⁺	1450.36 4 ⁺	1496.42 2 ⁺	1512.59 <5> ⁻	1513.61 2 ⁺	1513.83 4 ⁺
1496.42(5)	2 ⁺				1.1(2)						
1512.593(4)	<5> ⁻		0.54(5)								
1513.610(10)	2 ⁺					12(5)					
1513.832(4)	4 ⁺	0.76(2)									
1538.790(4)	4 ⁻	0.26(6)	3.40(10)	7.46(8)							
1553.998(4)	6 ⁺	4.4(2)									
1566.667(4)	2 ⁻			10							
1635.602(6)	4 ⁺						1.48(11)				
1636.729(4)	5 ⁻		8.2(8)	3.68(14)					0.78(2)		16.4(5)
1639.757(4)	3 ⁻		9.1(5)	7.8(3)							
1640.452(4)	5 ⁺	11.1(4)	0.15(2)				4.7(2)				11.5(2)
1648.840(5)	<6> ⁻		36(2)						3.54(12)		
1651.460(4)	<5> ⁻		14.9(7)	8.2(4)					1.03(8)		
1691.076(11)	6 ⁺	3.2(4)									
1731.064(4)	<6> ⁺						76(5)				
1747.101(4)	4 ⁻		13(1)	25(1)							
1758.145(4)	3 ⁺										30(2)
1781.261(5)	<6> ⁻								3.87(21)		
1788.598(4)	6 ⁺										11(3)
1803.388(4)	3 ⁻		0.81(6)								75(4)
1808.272(5)	<2> ⁺							6.5(6)			
1862.203(5)	3 ⁺	0.81(8)									84(3)
1863.711(4)	<5> ⁻		34(1)						14.9(6)		
1869.842(4)	4 ⁺			4.7(2)							
1913.617(4)	4 ⁻		8.4(5)						1.7(1)		24.3(7)
1917.436(4)	3 ⁻										26(1)
1942.009(6)	1 ⁺ ,2 ⁺ ,3 ⁺	1.52(11)									
1953.134(5)	4 ⁺						3.5(3)				11.8(5)
1956.420(5)	4 ⁺						13.3(9)			1.12(5)	
1986.452(4)	1 ⁺ -3 ⁺						5.6(3)				
1997.460(8)	3 ⁺	14.1(15)									
2027.568(5)	4 ⁻	8.8(4)	39(1)	5.3(2)					7.8(9)		
2068.037(5)	5 ⁺										15.1(10)
2099.870(6)	3 ⁺ ,4 ⁺	8.4(3)					10.5(11)				

Energy levels and branching ratios [94Br18, 88Br21]. Part 5

 $^{178}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage									
		E_f^* : 1533.15 J_f^π : 5^+	1538.79 4^-	1554.00 6^+	1561.53 2^+	1566.67 2^-	1571.0 10^+	1601.47 10^-	1635.60 4^+	1636.73 5^-	1639.76 3^-
1636.729(4)	5^-		1.98(5)	9.2(4)							
1639.757(4)	3^-		2.23(9)			6.8(4)					
1640.452(4)	5^+	5.83(12)									
1651.460(4)	$\langle 5 \rangle^-$		5.7(2)								
1691.076(11)	6^+	9.3(2)									
1741.7(10)	$\langle 7^+ \rangle$			100							
1747.101(4)	4^-		1.9(1)			4.0(2)					20.2(4)
1781.261(5)	$\langle 6 \rangle^-$		1.93(13)							89.8(21)	
1788.598(4)	6^+			21(3)							
1857.149(5)	$\langle 2 \rangle^-$					0.9(1)					
1859.112(12)	$\langle 11 \rangle^-$							19.0(4)			
1862.203(5)	3^+				0.77(8)						
1863.711(4)	$\langle 5 \rangle^-$		21(2)								8.9(5)
1869.842(4)	4^+	1.1(6)	0.6(2)								
1891.306(8)	2^+				2.8(2)						
1917.436(4)	3^-									22(1)	3.9(3)
1939.1(7)	$\langle 10^- \rangle$							42			
1942.009(6)	$1^+, 2^+, 3^+$								23.0(17)		
1947.949(5)	$\langle 7 \rangle^-$			6.9(5)						39(2)	
1956.420(5)	4^+								1.43(15)		
1986.452(4)	$1^+ - 3^+$				5.0(4)						
2007.563(5)	$4^+, 3^+$								6.3(3)		
2013.547(5)	$3^+ - 5^+$								1.61(13)		
2021.185(5)	$1^+ - 3^+$				7.3(2)						
2027.568(5)	4^-		8.9(2)								3.5(3)
2136.513(16)	$\langle 12 \rangle^-$							87(3)			
2150.7(14)	12^+						100				
2202.4(7)	$\langle 11^- \rangle$							62			

Energy levels and branching ratios [94Br18, 88Br21]. Part 6

 $^{178}_{72}\text{Hf}$

E^* [keV]	J^π	Branching ratios in percentage									
		E_f^* : 1640.45 J_f^π : 5^+	1648.84 $\langle 6 \rangle^-$	1651.46 $\langle 5 \rangle^-$	1731.06 $\langle 6 \rangle^+$	1741.7 $\langle 7^+ \rangle$	1747.10 4^-	1758.15 3^+	1781.26 $\langle 6 \rangle^-$	1788.60 6^+	1803.39 3^-
1781.261(5)	$\langle 6 \rangle^-$	4.4(3)									
1788.598(4)	6^+	10.2(5)			2.6(3)						
1862.203(5)	3^+	0.32(8)									
1863.711(4)	$\langle 5 \rangle^-$						21.7(5)				
1869.842(4)	4^+	20.3(8)						11.9(1)			
1913.617(4)	4^-	37(2)						0.79(7)			1.42(7)
1917.436(4)	3^-							1.41(5)			1.0(1)
1942.009(6)	$1^+, 2^+, 3^+$	1.07(17)		1.12(17)							1.1(3)

(continued)

 $^{178}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1640.45 5 ⁺	1648.84 6 ⁻	1651.46 5 ⁻	1731.06 6 ⁺	1741.7 7 ⁺	1747.10 4 ⁻	1758.15 3 ⁺	1781.26 6 ⁻	1788.60 6 ⁺	1803.39 3 ⁻
1947.949(5)	7 ⁻			8.6(5)						15.7(7)		
1952.1(13)	8 ⁺					100						
1953.134(5)	4 ⁺		13.2(8)									
1953.683(5)	7 ⁺										5.1(4)	
2007.563(5)	4 ⁺ ,3 ⁺								31(1)		14.1(6)	
2027.568(5)	4 ⁻				3.2(2)							
2068.037(5)	5 ⁺		54(4)								27(2)	
2099.870(6)	3 ⁺ ,4 ⁺											3.4(4)
2137.4(10)	8 ⁻									100		
2183.4(13)	9 ⁺					40						

Energy levels and branching ratios [94Br18, 88Br21]. Part 7

 $^{178}_{72}\text{Hf}$

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1808.27 $\langle 2 \rangle^+$	1818.28 2^+	1859.11 $\langle 11 \rangle^-$	1862.20 3^+	1869.84 4^+	1952.1 $\langle 8^+ \rangle$	1953.13 4^+	1997.46 3^+	2136.51 $\langle 12 \rangle^-$	2150.7 12^+
1857.149(5)	$\langle 2 \rangle^-$	0.5(1)										
1862.203(5)	3^+	2.0(3)										
1956.420(5)	4^+	9.4(4)										
1986.452(4)	$1^+ - 3^+$						23.7(5)					
1997.460(8)	3^+			3.2(3)								
2007.563(5)	$4^+, 3^+$						22.3(7)					
2013.547(5)	$3^+ - 5^+$					18.2(6)						
2021.185(5)	$1^+ - 3^+$						16.3(5)					
2050.484(10)	3^+									1.1(5)		
2068.037(5)	5^+								3.8(6)			
2136.513(16)	$\langle 12 \rangle^-$				12.8(6)							
2183.4(13)	$\langle 9^+ \rangle$							60				
2202.4(7)	$\langle 11^- \rangle$				38							
2433.326(17)	$\langle 13 \rangle^-$				90(3)						9.9(2)	
2433.9(14)	$\langle 10^+ \rangle$							52				
2446.05(15)	16^+										100	
2485.2(7)	$\langle 12^- \rangle$				73						27	
2573.5	$\langle 14^- \rangle$										36	
2749.1(10)	$\langle 14^- \rangle$										100	
2777.6(17)	14^+											100

Energy levels and branching ratios [94Br18, 88Br21]. Part 8

 **^{178}Hf
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E^* [keV]	J^π	Branching ratios in percentage						
		$E_f^*:$ $J_f^\pi:$	2183.4 $\langle 9^+ \rangle$	2433.33 $\langle 13 \rangle^-$	2433.9 $\langle 10^+ \rangle$	2446.05 16^+	2777.6 14^+	3436.2 16^+
2433.9(14)	$\langle 10^+ \rangle$		48					
2446.05(15)	16^+			0.03813(1)				
2573.5	$\langle 14 \rangle^-$			53		11		
2700.5(15)	$\langle 11^+ \rangle$		57		43			
3436.2(20)	16^+						100	
4120.6	$\langle 18^+ \rangle$							x

Energy levels and branching ratios [94Ba52].

 **^{179}Hf
72**

E^*	$2J^\pi$	L	σ (t,p)	[Nn Λ]	L	C^2S	I_p	I_p	I_t	L	σ (τ, α)	σ (d,t)	Ref.
[keV]		(t,p)	$\mu\text{b/sr}$		(d,p)	(d,p)	(d,p)	rel.	rel.	(τ, α)	mbarn	$\mu\text{b/sr}$	
0.0	9^+					0.078		0.112(13)	0.137(12)	4	3	12	68Ri07
122.791(2)	11^+					0.023		0.041(8)	0.020(4)	6	7	1	68Ri07
214.341(2)	7^-	0	133(4)	[514]		0.016			0.042(6)			3	68Ri07
268.85(8)	13^+				6		105	0.42(3)	0.41(3)	6	214	115	89Ri03
337.718(2)	9^-		9(1)	[514]		0.58		0.254(24)	0.299(21)	5	77	37	68Ri07
375.037(3)	1^-		≤ 2	[510]	0,1	0.019		0.64(5)	0.119(11)				68Ri07
420.895(3)	3^-		≤ 2	[510]	0,1	0.62	1000	10.0(6)	1.0(6)				68Ri07
438.64(10)	15^+							0.24(5)	0.014(4)	$\langle 8 \rangle$	6		81Th05
476.335(3)	5^-				2-5	0.76	520	4.0(3)	0.375(24)		21	39	68Ri07
487.710(5)	$\langle 11^- \rangle$		8(1)	[514]		0.93			0.038(7)		incl		68Ri07
518.330(2)	5^-					0.014		0.09(3)	0.240(19)		incl	18	68Ri07
582.231(3)	$\langle 7^- \rangle$					0.24	175	1.13(9)	0.057(8)			7	68Ri07
614.205(3)	1^-						390	2.80(18)	8.2(4)			700	
616.757(3)	7^-		≤ 2	[510]						$\langle 3 \rangle$	76		81Th05
631.33(12)	17^+							0.071(2)		$\langle 8 \rangle$	9		81Th05
665.0(15)	$\langle 13^- \rangle$		4(1)	[514]					0.013(7)				05Bu07
679.518(3)	3^-					0.014	230	1.71(11)	0.54(3)				68Ri07
681.037(3)	$\langle 9^- \rangle$		3(1)	[510]								35	05Bu07
701.056(3)	5^-					0.081	215	1.47(12)	0.78(5)	3	33	87	68Ri07
720.614(3)	3^-				0,1	0.13	230	2.00(14)	0.017(4)				68Ri07
732.2(6)								0.14(3)	0.021(4)				
742.711(3)	$\langle 9^- \rangle$							0.10(3)	0.040(6)			2	
788.186(3)	5^-	≤ 1	[512]	2-5	0.59	480	4.06(24)	0.052(7)	$\langle 3 \rangle$	6	4		68Ri07
848.39(15)	19^+												
849.202(3)	$\langle 7^- \rangle$			2-5	0.057	<330	2.63(15)	0.68(4)	$\langle 3 \rangle$	23	60		68Ri07
860.3(9)	$\langle 15^- \rangle$	≤ 2	[514]						0.014(5)				05Bu07
870.225(8)	7^-					1.34	1220	8.0(4)	0.220(16)			33	68Ri07
889.1(10)								0.037(13)					
896.4(5)								0.085(16)	0.100(9)				
912.5(6)	$\langle 5^-, 7^- \rangle$							0.092(15)	0.054(7)	$\langle 3 \rangle$	22	8	81Th05

(continued)

 $^{179}_{72}\text{Hf}$

E^*	$2J^\pi$	L	σ (t,p)	[Nn Λ]	L	C^2S	I_p	I_p	I_t	L	σ (τ, α)	σ (d,t)	Ref.
[keV]		(t,p)	$\mu\text{b/sr}$		(d,p)	(d,p)	(d,p)	rel.	rel.	(τ, α)	mbarn	$\mu\text{b/sr}$	
935.645(3)	$\langle 7^- \rangle$		≤ 2	[512]			85	0.49(4)	0.260(18)			22	05Bu07
958.6(14)								0.043(11)	0.006(3)				
992.0(15)	$\langle 9^- \rangle$							0.070(13)	0.007(4)				
1003.65(1)	5^+							0.23(3)	0.039(6)				
1024.0(17)									0.006(4)				
1030.8(6)	$\langle 9^- \rangle$		≤ 1	[512]				0.143(23)					05Bu07
1073.56(1)	$\langle 7^- \rangle$	0	14(1)					0.051(41)					05Bu07
1078.35(1)	$\langle 7^+ \rangle$							0.048(16)					
1080.4(14)									0.007(3)				
1084.9(2)	21^+												
1087.8(8)									0.018(5)				
1096.8(12)								0.028(11)					
1105.8(2)	25^-												
1105.91(9)	$\langle 7^+ \rangle$												
1120.78(3)	9^+								0.006(4)				
1138.8(6)								0.160(24)	0.041(7)				
1150.41(1)	1^+				0,1			0.168(25)	0.065(10)				89Ri03
1162.4(7)			≤ 1					0.111(23)			11	31	
1168.96(3)	$\langle 9^+ \rangle$							0.23(4)	0.30(3)	$\langle 4 \rangle$			81Th05
1176.2(9)	$\langle 9^+ \rangle$							0.060(17)		$\langle 4 \rangle$			81Th05
1185.85(1)	3^+		1.4(5)					0.097(19)	0.009(4)				05Bu07
1199.50(14)	$\langle 7^+ \rangle$							0.075(21)	0.24(3)	$\langle 4 \rangle$	11	22	81Th05
1235.44(1)	$\langle 5^+ \rangle$							0.097(19)				46	
1249.55(1)	3^-							0.137(24)	0.66(7)				
1269.44(1)	3^-							0.062(16)	0.75(8)			67	
1282.5(9)	$\langle 11^+ \rangle$							0.086(23)	0.035(8)	$\langle 6 \rangle$	9		81Th05
1296.3(3)													
1313.50(1)	5^-			[514]**				0.19(3)	0.067(11)			6	05Bu07
1344.6(6)	X^+				4,6			0.117(25)					89Ri03
1359.0(5)	$\langle 13^+ \rangle$							0.109(25)	0.27(3)	6	247	50	81Th05
1375(2)	7^-	0	26(2)										05Bu07
1386.5(6)								0.41(6)	0.085(15)			10	
1405.2(6)	$\langle 7^- \rangle$		4(1)	[514]**				0.061(22)	0.124(18)			12	05Bu07
1428.6(5)	$\langle 7^- \rangle$							0.18(4)	0.63(7)			47	
1433.19(1)	3^-												
1436.35(1)	7^-	0	16(2)					0.25(4)	0.150(25)				05Bu07
1437(5)	$11^+, 13^+$									6	72		81Th05
1453.1(7)									0.058(14)				
1459.00(1)	3^-				0,1		1290	10.8(11)	0.153(24)				89Ri03
1482.03(1)	3^+								0.055(14)				
1498(2)	7^-	0	31(2)										05Bu07
1509.2(8)									0.046(12)			6	
1529(2)	7^-	0	9(2)										05Bu07
1530.2(5)	1^+				0		265	1.47(17)				24	89Ri03
1532.27(1)	$\langle 5^+ \rangle$								0.30(4)				

(continued)

¹⁷⁹Hf
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E^*	$2J^\pi$	L	σ (t,p)	[Nn Λ]	L	C^2S	I_p	I_p	I_t	L	σ (τ, α)	σ (d,t)	Ref.
[keV]		(t,p)	$\mu\text{b/sr}$		(d,p)	(d,p)	(d,p)	rel.	rel.	(τ, α)	mbarn	$\mu\text{b/sr}$	
1534.6(5)	$\langle 5^- \rangle$						incl	1.04(13)					
1557.4(5)	$1, 3^-$		≤ 10		0,1			0.65(8)	0.33(4)			39	89Ri03
1570.1(7)	$\langle 9^+ \rangle$							0.081(20)		$\langle 4 \rangle$	32	52	81Th05
1572.56(3)	3^-												
1580.5(5)								0.75(9)					
1582.4(5)							150	1.55(17)	0.39(5)				
1586.0(6)			≤ 2					0.35(5)					05Bu07
1598.4(6)								0.122(24)					
1602.3(9)			4(1)						0.033(12)				05Bu07
1614.12(1)	$3^-, 1^-$							0.12(3)	0.089(17)				
1638.7(6)			6(1)				<190	1.22(20)	0.081(16)				05Bu07
1658.4(5)	$\langle 1^- \rangle$		≤ 2		0-2		2080	15.2(16)					89Ri03
1665.7(5)	1^+				0		incl	6.6(8)					89Ri03
1668.95(1)	$\langle 3 \rangle^+$												
1672(5)	$\langle 11^+, 13^+ \rangle$									$\langle 6 \rangle$	29		81Th05
1687.13(4)	$\langle 3 \rangle^-$							1.47(24)				24	
1689(3)	11^-	2	11(1)	[514]**									05Bu07
1698.6(6)							550	2.2(3)					
1706.07(1)	$\langle 3 \rangle^-$						incl	2.0(3)					
1715.93(1)	$1^+, 5^+$							0.17(8)					
1725.79(1)	3^-							0.32(9)				36	
1731.44(1)	3^-												
1748(5)	$11^+, 13^+$									6	53		81Th05
1755.35(2)	3^-						670	4.4(5)					
1755.8(1)	3^-							3.4(4)					
1757.7(1)	$\langle 3^-, 5^+ \rangle$												
1762.91(4)	$\langle 3 \rangle^-$		4(1)										05Bu07
1771(3)								0.94(15)					
1783.1(1)	$1, 3, 5^+$						240	0.89(15)				23	
1796.5(4)	$1, 3, 5^+$						incl						
1800.5(1)	3^-							0.34(6)					
1811.5(1)	3^-						265	1.69(18)					
1821.2(1)	$\langle 1, 3 \rangle$		3(1)									22	05Bu07
1829(5)											17		
1839(3)								0.45(6)					
1846.3(3)	$\langle 3^-, 5^+ \rangle$						150	0.45(7)					
1851.50(1)	$3^+, 5^+$												
1861.23(1)	5^+												
1877(3)								0.30(8)					
1884(3)								0.66(11)					
1893.9(5)	$1, 3, 5^+$							0.56(9)					
1899.66(24)	$1, 3, 5^+$						165						
1904(3)	$\langle 5^-, 7^- \rangle$						incl	0.61(10)		$\langle 3 \rangle$	24	48	81Th05
1913.47(1)	3^-						<110	1.41(16)					
1928.845(9)	$1^+, 3^+$							0.53(8)					

(continued)

 $^{179}_{72}\text{Hf}$

E^*	$2J^\pi$	L	σ (t,p)	[Nn Λ]	L	C^2S	I_p	I_p	I_t	L	σ (τ, α)	σ (d,t)	Ref.
[keV]		(t,p)	$\mu\text{b/sr}$		(d,p)	(d,p)	(d,p)	rel.	rel.	(τ, α)	mbarn	$\mu\text{b/sr}$	
1945.86(1)	$\langle 1,3 \rangle$												
1957.58(9)	$1,3,5^+$												
1965(3)								0.53(7)					
1977(3)							150	1.62(20)					
1987(3)								0.44(8)					
2009(3)								0.18(8)					
2011(5)	$\langle 13 \rangle^+$							0.41(9)		$\langle 6 \rangle$			81Th05
2021(3)													
2032(3)								0.62(15)					
2043.7(16)	$\langle 1,3 \rangle$							24.6(3)					
2050.8(9)*	$1,3,5^+$							0.55(14)					
2070.7(15)*	$\langle 1,3 \rangle$												
2081.0(3)*	$\langle 1,3 \rangle$												
2088.4(15)	$\langle 1,3 \rangle$												
2092.9(4)*													
2143.4(20)*	$\langle 1,3 \rangle$												
2150.3(15)*	$1,3,5^+$												
2168.2(8)	$1,3,5^+$												
2182.6(8)*	$1,3,5^+$												
2215.6(15)*	$\langle 1,3 \rangle$												
2228.3(2)*	$1,3,5^+$												
2249.6(15)*	$\langle 3^- \rangle$												
2254.2(15)*	$1,3,5^+$												
2282(3)													
2297(3)													
2309.2(15)*	$1,3,5^+$												
2354(3)													
2366.9(15)*	$\langle 1,3 \rangle$												
2394.2(15)*	$1,3,5^+$												
2414.9(15)*	$\langle 1,3 \rangle$												
2425.3(15)*	$\langle 1,3 \rangle$												
2451.0(15)*	$\langle 3^- \rangle$												
2460.3(15)*	$\langle 1,3 \rangle$												
2475.5(15)*	$\langle 3^- \rangle$												
2497(3)	$7^+ - 11^+$												
2509.5(15)*	$\langle 1,3 \rangle$												
2522.7(15)*	$\langle 1,3 \rangle$												
2556(3)	$7^+ - 11^+$												
2590													
2601.2(15)*	$\langle 1,3 \rangle$												
2610.7(15)*	$\langle 1,3 \rangle$												
2638.3(15)*	$\langle 1,3 \rangle$												
2653.1(15)*	$\langle 1,3 \rangle$												
2655(5)	$\langle 13 \rangle^+$									$\langle 6 \rangle$			81Th05
2702.9(15)*	$\langle 1,3 \rangle$												

(continued)

¹⁷⁹Hf
72

E^*	$2J^\pi$	L	σ (t,p)	[Nn Λ]	L	C^2S	I_p	I_p	I_t	L	σ (τ, α)	σ (d,t)	Ref.
[keV]		(t,p)	$\mu\text{b/sr}$		(d,p)	(d,p)	(d,p)	<i>rel.</i>	<i>rel.</i>	(τ, α)	mbarn	$\mu\text{b/sr}$	
2705(15)	7 ⁺ –11 ⁺												
2727													
2742.8(15)*	$\langle 1,3 \rangle$												
2788													
2857	9 ⁺												
2905.2(15)*	$\langle 1,3 \rangle$												
2921(3)													
2950(3)													
2969													
2983.3(15)*	1,3,5 ⁺												
3030(15)													
3077.2(15)*	$\langle 1,3 \rangle$												
3095(15)	9 ⁺												
3149.1(15)*	$\langle 1,3 \rangle$												
3155(15)	7 ⁺ –11 ⁺												
3179.6(15)*	1,3,5 ⁺												
3240(15)	7 ⁺ –11 ⁺												
3345.2(15)*	1,3,5 ⁺												
3347.7(15)*	$\langle 1,3 \rangle$												
3360(15)	7 ⁺ –11 ⁺												
3409.4(15)*	$\langle 1,3 \rangle$												
3490(15)													
			05Bu07	05Bu07		89Ri03	63Ve09		89Ri03		81Th05		Ref.
								89Ri03					Ref.

Additional data on this isotope can be found in [03CaZZ, 02Ko09, 00Mu06, 93Va02, 91Bo43, 91Bo51, 89Bo16, 88Bo19, 88Bo44, 87Bo53, 87BoZE, 87BoZG].

Abundance: 13.62(2) %.

* E_M^* introduced as the intermediate state in ($n_{\text{thermal}}, \gamma\gamma$) measurements [88Bo44].

** Quadrupole excitations are considered in [05Bu07].

For the the (d,p) reaction values $C^2S=\sigma_{\text{exp}}/\sigma_{DWBA}$ are from [68Ri07, 94Ba52]; relative intensities of protons I_p were measured at 7 angles in [63Ve09] and the data for 90° are presented.

Relative intensities I_p , I_t of the combined study of the (d,p) and (d,t) reactions in [89Ri03] were normalized there to 10 and to 1.0 for the population of the 421 keV level, systematic errors are included; proposed Nilsson configuration for levels with energy up to 1.7 MeV can be found in [89Ri03, 94Ba52].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [94Ba52]. Part 2

 $^{179}_{72}\text{Hf}$

E^*	$2J^\pi$	$2K$	$T_{1/2}$ or	Ref.	Branching ratios in percentage						
[keV]			Γ_{cm}		$E^*_\text{f}:$ $2J^\pi_\text{f}:$	0.0 9 ⁺	122.8 11 ⁺	214 7 ⁻	269 13 ⁺	338 9 ⁻	375 1 ⁻
0.0	9 ⁺		Stable	68Ri07							
122.791(2)	11 ⁺		37(3) ps	68Ri07		100					
214.341(2)	7 ⁻	7 ⁻	1.85(4) ns	68Ri07		100					
268.85(8)	13 ⁺		21(3) ps	89Ri03		29.4(18)	71(3)				
337.718(2)	9 ⁻	7 ⁻		68Ri07		10.6(5)	39(2)	50(2)			
375.037(3)	1 ⁻	1 ⁻	18.67(4) s	68Ri07		≈0.2		100			
420.895(3)	3 ⁻	1 ⁻		68Ri07							100
438.64(10)	15 ⁺			81Th05			51		49(2)		
476.335(3)	5 ⁻			68Ri07				0.12(3)			47(3)
487.710(5)	⟨11 ⁻ ⟩	7 ⁻		68Ri07		29(9)		55(3)		16(3)	
518.330(2)	5 ⁻		<0.2 ns	68Ri07				98.0(22)		0.77(4)	0.11(3)
582.231(3)	⟨7 ⁻ ⟩			68Ri07				0.46(8)			
614.205(3)	1 ⁻		0.50(15) ns								14.0(10)
616.757(3)	7 ⁻	1 ⁻		81Th05		9.2(8)		14.9(3)		30.5(3)	
631.33(12)	17 ⁺			81Th05					65		
665.0(15)	⟨13 ⁻ ⟩	7 ⁻		05Bu07							
679.518(3)	3 ⁻			68Ri07							3.7(4)
681.037(3)	⟨9 ⁻ ⟩	1 ⁻		05Bu07							
701.056(3)	5 ⁻			68Ri07				6.2(5)			17.5(7)
720.614(3)	3 ⁻		≤0.3 ns	68Ri07				2.8(9)			5.78(6)
732.2(6)											
742.711(3)	⟨9 ⁻ ⟩						9(4)				
788.186(3)	5 ⁻	3 ⁻		68Ri07				11.2(7)		0.8(1)	11.9(2)
848.39(15)	19 ⁺										
849.202(3)	⟨7 ⁻ ⟩			68Ri07				31(4)			
860.3(9)	⟨15 ⁻ ⟩	7 ⁻		05Bu07							
870.225(8)	7 ⁻			68Ri07		65(1)		29.8(12)		4.9(3)	
889.1(10)											
896.4(5)											
912.5(6)	⟨5 ⁻ , 7 ⁻ ⟩			81Th05							
935.645(3)	⟨7 ⁻ ⟩	3 ⁻		05Bu07							
958.6(14)											
992.0(15)	⟨9 ⁻ ⟩										
1003.65(1)	5 ⁺					95(6)		1.95(12)			
1024.0(17)											
1030.8(6)	⟨9 ⁻ ⟩	3 ⁻		05Bu07							
1073.56(1)	⟨7 ⁻ ⟩			05Bu07				79(2)		21.1(11)	
1078.35(1)	⟨7 ⁺ ⟩					91(4)		6.5(19)			
1080.4(14)											
1084.9(2)	21 ⁺										
1087.8(8)											
1096.8(12)											
1105.8(2)	25 ⁻		25.05(25) d								
1105.91(9)	⟨7 ⁺ ⟩					71	23(5)	6(2)			
1120.78(3)	9 ⁺					73	18(3)	8.2(7)			

(continued)

 $^{179}_{72}\text{Hf}$

E^*	$2J^\pi$	$2K$	$T_{1/2}$ or Γ_{cm}	Ref.	E^*_f : $2J^\pi_f$:	0.0 9 ⁺	Branching ratios in percentage					
[keV]							122.8 11 ⁺	214 7 ⁻	269 13 ⁺	338 9 ⁻	375 1 ⁻	
1138.8(6)												
1150.41(1)	1 ⁺			89Ri03								1.15(15)
1162.4(7)												
1168.96(3)	$\langle 9^+ \rangle$			81Th05		15(5)	42	15(5)		28(1)		
1176.2(9)	$\langle 9^+ \rangle$			81Th05								
1185.85(1)	3 ⁺			05Bu07								34.3(8)
1199.50(14)	$\langle 7^+ \rangle$			81Th05		36(8)	60(12)					
1235.44(1)	$\langle 5^+ \rangle$											
1249.55(1)	3 ⁻							61(4)				
1269.44(1)	3 ⁻							37(2)				
1282.5(9)	$\langle 11^+ \rangle$			81Th05								
1296.3(3)								64				
1313.50(1)	5 ⁻	7 ⁻		05Bu07				31(4)		34(2)		
1344.6(6)	X ⁺			89Ri03								
1359.0(5)	$\langle 13^+ \rangle$			81Th05								
1375(2)	7 ⁻			05Bu07								
1386.5(6)												
1405.2(6)	$\langle 7^- \rangle$	7 ⁻		05Bu07								
1428.6(5)	$\langle 7^- \rangle$											
1433.19(1)	3 ⁻											
1436.35(1)	7 ⁻			05Bu07								
1437(5)	11 ⁺ , 13 ⁺			81Th05								
1453.1(7)												
1459.00(1)	3 ⁻			89Ri03				17				19(1)
1482.03(1)	3 ⁺											
1498(2)	7 ⁻			05Bu07								
1509.2(8)												
1529(2)	7 ⁻			05Bu07								
1530.2(5)	1 ⁺			89Ri03								
1532.27(1)	$\langle 5^+ \rangle$											
1534.6(5)	$\langle 5^- \rangle$											
1557.4(5)	1, 3 ⁻			89Ri03								
1570.1(7)	$\langle 9^+ \rangle$			81Th05								
1572.56(3)	3 ⁻											x
1580.5(5)												
1582.4(5)												
1586.0(6)				05Bu07								
1598.4(6)												
1602.3(9)				05Bu07								
1614.12(1)	3 ⁻ , 1 ⁻											33(12)
1638.7(6)				05Bu07								
1658.4(5)	$\langle 1^- \rangle$			89Ri03								
1665.7(5)	1 ⁺			89Ri03								
1668.95(1)	$\langle 3^+ \rangle$											8
1672(5)	$\langle 11^+, 13^+ \rangle$			81Th05								

(continued)

 $^{179}_{72}\text{Hf}$

E^*	$2J^\pi$	$2K$	$T_{1/2}$ or	Ref.	Branching ratios in percentage						
[keV]			Γ_{cm}		$E^*_\text{f}:$ $2J^\pi_\text{f}:$	0.0 9 ⁺	122.8 11 ⁺	214 7 ⁻	269 13 ⁺	338 9 ⁻	375 1 ⁻
1687.13(4)	$\langle 3 \rangle^-$										
1689(3)	11 ⁻	7-		05Bu07							
1698.6(6)											
1706.07(1)	$\langle 3 \rangle^-$							2.0(9)			37(2)
1715.93(1)	1 ⁺ , 5 ⁺										
1725.79(1)	3 ⁻										13
1731.44(1)	3 ⁻										16(1)
1748(5)	11 ⁺ , 13 ⁺			81Th05							
1755.35(2)	3 ⁻										
1755.8(1)	3 ⁻										30(7)
1757.7(1)	$\langle 3^-, 5^+ \rangle$							55(12)			
1762.91(4)	$\langle 3 \rangle^-$			05Bu07				11			34(3)
1771(3)											
1783.1(1)	1, 3, 5 ⁺										
1796.5(4)	1, 3, 5 ⁺										
1800.5(1)	3 ⁻										25(3)
1811.5(1)	3 ⁻										
1821.2(1)	$\langle 1, 3 \rangle$			05Bu07							x
1829(5)											
1839(3)											
1846.3(3)	$\langle 3^-, 5^+ \rangle$										
1851.50(1)	3 ⁺ , 5 ⁺										
1861.23(1)	5 ⁺										
1877(3)											
1884(3)											
1893.9(5)	1, 3, 5 ⁺										
1899.66(24)	1, 3, 5 ⁺										
1904(3)	$\langle 5^-, 7^- \rangle$			81Th05							
1913.47(1)	3 ⁻										
1928.845(9)	1 ⁺ , 3 ⁺										
1945.86(1)	$\langle 1, 3 \rangle$										34(10)
1957.58(9)	1, 3, 5 ⁺										
1965(3)											
1977(3)											
1987(3)											
2009(3)											
2011(5)	$\langle 13 \rangle^+$			81Th05							
2021(3)											
2032(3)											
2043.7(16)	$\langle 1, 3 \rangle$										56
2050.8(9)*	1, 3, 5 ⁺										
2070.7(15)*	$\langle 1, 3 \rangle$										22
2081.0(3)*	$\langle 1, 3 \rangle$										8
2088.4(15)	$\langle 1, 3 \rangle$										70
2092.9(4)*											

(continued)

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	$2K$	$T_{1/2}$ or Γ_{cm}	Ref.	Branching ratios in percentage						
					E^*_f : $2J^\pi_f$:	0.0 9 ⁺	122.8 11 ⁺	214 7 ⁻	269 13 ⁺	338 9 ⁻	375 1 ⁻
2143.4(20)*	$\langle 1,3 \rangle$										
2150.3(15)*	1,3,5 ⁺										
2168.2(8)	1,3,5 ⁺										
2182.6(8)*	1,3,5 ⁺										
2215.6(15)*	$\langle 1,3 \rangle$										55
2228.3(2)*	1,3,5 ⁺										
2249.6(15)*	$\langle 3^- \rangle$							37			35
2254.2(15)*	1,3,5 ⁺										
2282(3)											
2297(3)											
2309.2(15)*	1,3,5 ⁺										
2354(3)											
2366.9(15)*	$\langle 1,3 \rangle$										13
2394.2(15)*	1,3,5 ⁺										
2414.9(15)*	$\langle 1,3 \rangle$										
2425.3(15)*	$\langle 1,3 \rangle$										
2451.0(15)*	$\langle 3^- \rangle$							11			
2460.3(15)*	$\langle 1,3 \rangle$										42
2475.5(15)*	$\langle 3^- \rangle$							5			35
2497(3)	7 ⁺ -11 ⁺										
2509.5(15)*	$\langle 1,3 \rangle$										46
2522.7(15)*	$\langle 1,3 \rangle$										43
2556(3)	7 ⁺ -11 ⁺										
2590											
2601.2(15)*	$\langle 1,3 \rangle$										45
2610.7(15)*	$\langle 1,3 \rangle$										59
2638.3(15)*	$\langle 1,3 \rangle$										60
2653.1(15)*	$\langle 1,3 \rangle$										28
2655(5)	$\langle 13 \rangle^+$			81Th05							
2702.9(15)*	$\langle 1,3 \rangle$										62
2705(15)	7 ⁺ -11 ⁺										
2727											
2742.8(15)*	$\langle 1,3 \rangle$										
2788											
2857	9 ⁺										
2905.2(15)*	$\langle 1,3 \rangle$										35
2921(3)											
2950(3)											
2969											
2983.3(15)*	1,3,5 ⁺										
3030(15)											
3077.2(15)*	$\langle 1,3 \rangle$										
3095(15)	9 ⁺										
3149.1(15)*	$\langle 1,3 \rangle$										
3155(15)	7 ⁺ -11 ⁺										

(continued)

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	$2K$	$T_{1/2}$ or Γ_{cm}	Ref.	Branching ratios in percentage						
					E_f^* : $2J_f^\pi$:	0.0 9 ⁺	122.8 11 ⁺	214 7 ⁻	269 13 ⁺	338 9 ⁻	375 1 ⁻
3179.6(15)*	1,3,5 ⁺										
3240(15)	7 ⁺ -11 ⁺										
3345.2(15)*	1,3,5 ⁺										
3347.7(15)*	$\langle 1,3 \rangle$										63
3360(15)	7 ⁺ -11 ⁺										
3409.4(15)*	$\langle 1,3 \rangle$										44
3490(15)				Ref. Ref.							

Energy levels and branching ratios [94Ba52]. Part 3

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	421 3 ⁻	439 15 ⁺	476 5 ⁻	518.330 5 ⁻	582.231 $\langle 7 \rangle^-$	614.205 1 ⁻	616.757 7 ⁻	631.33 17 ⁺	679.518 3 ⁻	681.037 $\langle 9 \rangle^-$
476.335(3)	5 ⁻		53(1)									
518.330(2)	5 ⁻		0.87(4)		0.25(6)							
582.231(3)	$\langle 7 \rangle^-$		15.9(6)		84(2)							
614.205(3)	1 ⁻		85.4(18)		0.61(3)							
616.757(3)	7 ⁻		0.82(10)		4.3(3)	40						
631.33(12)	17 ⁺			35(3)								
679.518(3)	3 ⁻		38(3)		8.4(2)	50(2)						
681.037(3)	$\langle 9 \rangle^-$				87.0(19)	13(3)						
701.056(3)	5 ⁻		2.4(7)		3.2(3)	12.4(2)	49(1)	2.7(3)	6.5(4)			
720.614(3)	3 ⁻		23.3(5)		6.4(6)	60(1)		1.59(9)				
742.711(3)	$\langle 9 \rangle^-$					17.3(14)			74(7)			
788.186(3)	5 ⁻				5.8(2)	26(2)	14.5(3)	1.4(1)	27		1.0(2)	
848.39(15)	19 ⁺			70						30(2)		
849.202(3)	$\langle 7 \rangle^-$		4.0(5)		21.9(2)	3.2(2)	11.0(6)		14.6(6)		4.6(3)	4.2(2)
935.645(3)	$\langle 7 \rangle^-$				10.7(9)		27(1)		35.4(9)			
1003.65(1)	5 ⁺					2.6(6)			0.51(4)			
1084.9(2)	21 ⁺									78		
1150.41(1)	1 ⁺		62(2)					1.3(2)			27(2)	
1185.85(1)	3 ⁺		31(1)		3.2(1)			18(1)			≤ 1.5	
1199.50(14)	$\langle 7^+ \rangle$					4(2)						
1235.44(1)	$\langle 5^+ \rangle$				13.8(4)		60(2)				3.9(4)	
1249.55(1)	3 ⁻				3.4(4)	9.5(5)		17.8(8)			5.8(4)	
1269.44(1)	3 ⁻					4.0(2)		34(1)			10.8(7)	
1296.3(3)											15(3)	
1313.50(1)	5 ⁻					4.7(8)	19(1)	1.9(3)	4.2(3)		5.1(5)	
1433.19(1)	3 ⁻		51(4)		20(7)	19.5(8)			6.6(9)		2.3(4)	
1436.35(1)	7 ⁻					71(1)			16.5(10)			

(continued)

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*:$ $2J_f^\pi:$	421 3 ⁻	439 15 ⁺	476 5 ⁻	518.330 5 ⁻	582.231 $\langle 7 \rangle^-$	614.205 1 ⁻	616.757 7 ⁻	631.33 17 ⁺	679.518 3 ⁻	681.037 $\langle 9 \rangle^-$
1459.00(1)	3 ⁻		19(1)								9(1)	
1482.03(1)	3 ⁺							33.5(6)				
1532.27(1)	$\langle 5 \rangle^+$					16(1)					22.0(11)	
1572.56(3)	3 ⁻		26(3)			x			74(7)			
1614.12(1)	3 ⁻ , 1 ⁻				17(3)	36(6)						
1687.13(4)	$\langle 3 \rangle^-$							14(3)			42(6)	
1706.07(1)	$\langle 3 \rangle^-$					26(1)		6.2(9)	4(1)			6
1725.79(1)	3 ⁻							28(4)			7	
1731.44(1)	3 ⁻		23(2)					24(3)			16(1)	
1755.35(2)	3 ⁻		29(3)					30.8(8)				
1755.8(1)	3 ⁻				31(2)	19					12	
1762.91(4)	$\langle 3 \rangle^-$		16(6)			12		7.8(6)				
1783.1(1)	1, 3, 5 ⁺										19(7)	
1800.5(1)	3 ⁻		49(5)		25(3)							
1811.5(1)	3 ⁻		11(1)		21	7		30(4)			6(1)	
1821.2(1)	$\langle 1, 3 \rangle$							26(5)			41(8)	
1846.3(3)	$\langle 3^-, 5^+ \rangle$							10(4)			60(12)	
1913.47(1)	3 ⁻		5(2)									
1928.845(9)	1 ⁺ , 3 ⁺		29(4)									
1945.86(1)	$\langle 1, 3 \rangle$		50(8)					x			x	
2043.7(16)	$\langle 1, 3 \rangle$		44									
2070.7(15)*	$\langle 1, 3 \rangle$		28					24				
2081.0(3)*	$\langle 1, 3 \rangle$		14(3)		18(7)						6	
2088.4(15)	$\langle 1, 3 \rangle$										30	
2092.9(4)*			79(17)									
2143.4(20)*	$\langle 1, 3 \rangle$							64				
2150.3(15)*	1, 3, 5 ⁺		40		43							
2182.6(8)*	1, 3, 5 ⁺										42	
2215.6(15)*	$\langle 1, 3 \rangle$							45				
2228.3(2)*	1, 3, 5 ⁺		47								16	
2254.2(15)*	1, 3, 5 ⁺		50			50						
2309.2(15)*	1, 3, 5 ⁺		52									
2366.9(15)*	$\langle 1, 3 \rangle$		11		48	6		6			6	
2394.2(15)*	1, 3, 5 ⁺		71								14	
2414.9(15)*	$\langle 1, 3 \rangle$		38		23			29				
2425.3(15)*	$\langle 1, 3 \rangle$							52				
2451.0(15)*	$\langle 3^- \rangle$		47					30			11	
2460.3(15)*	$\langle 1, 3 \rangle$		58									
2475.5(15)*	$\langle 3^- \rangle$		40					14				
2509.5(15)*	$\langle 1, 3 \rangle$		40								14	
2522.7(15)*	$\langle 1, 3 \rangle$		24		33							
2601.2(15)*	$\langle 1, 3 \rangle$		42		13							
2610.7(15)*	$\langle 1, 3 \rangle$		17			12		12				
2653.1(15)*	$\langle 1, 3 \rangle$					25						
2702.9(15)*	$\langle 1, 3 \rangle$					38						

(continued)

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	421 3 ⁻	439 15 ⁺	476 5 ⁻	518.330 5 ⁻	582.231 $\langle 7 \rangle^-$	614.205 1 ⁻	616.757 7 ⁻	631.33 17 ⁺	679.518 3 ⁻	681.037 $\langle 9 \rangle^-$
2742.8(15)*	$\langle 1,3 \rangle$		45					28				
2905.2(15)*	$\langle 1,3 \rangle$		32								15	
2983.3(15)*	1,3,5 ⁺				72						28	
3077.2(15)*	$\langle 1,3 \rangle$					56		23			21	
3149.1(15)*	$\langle 1,3 \rangle$							65				
3179.6(15)*	1,3,5 ⁺				53							
3345.2(15)*	1,3,5 ⁺		62									
3347.7(15)*	$\langle 1,3 \rangle$										37	
3409.4(15)*	$\langle 1,3 \rangle$										56	

Energy levels and branching ratios [94Ba52]. Part 4

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage										
		E_f^* : $2J_f^\pi$:	701.056 5 ⁻	720.614 3 ⁻	742.711 $\langle 9 \rangle^-$	788.186 5 ⁻	848.39 19 ⁺	849.202 $\langle 7 \rangle^-$	870.225 7 ⁻	935.645 $\langle 7 \rangle^-$	1003.65 5 ⁺	1073.56 $\langle 7 \rangle^-$
788.186(3)	5 ⁻		0.7(4)									
849.202(3)	$\langle 7 \rangle^-$		2.1(5)		3.8(5)							
935.645(3)	$\langle 7 \rangle^-$				15(1)	12(2)						
1078.35(1)	$\langle 7 \rangle^+$			2.47(20)								
1084.9(2)	21 ⁺						22(1)					
1105.8(2)	25 ⁻						100					
1150.41(1)	1 ⁺			8.9(7)								
1185.85(1)	3 ⁺		6.1(6)	6.4(3)		0.24(4)					0.41(5)	
1235.44(1)	$\langle 5 \rangle^+$		3.7(2)	5(2)				10.4(2)			2.21(15)	
1249.55(1)	3 ⁻		2.9(2)									
1269.44(1)	3 ⁻		3.9(3)	9.6(7)					0.66(5)			
1296.3(3)			22(4)									
1436.35(1)	7 ⁻								3.5(4)		5.0(5)	
1459.00(1)	3 ⁻			5.6(4)		5.8(4)			25(1)			
1482.03(1)	3 ⁺			42(1)		8.7(5)					15(1)	
1532.27(1)	$\langle 5 \rangle^+$			5.7(10)		10.6(6)					46(2)	
1614.12(1)	3 ⁻ , 1 ⁻					9(1)						
1687.13(4)	$\langle 3 \rangle^-$			30(1)					15(2)			
1706.07(1)	$\langle 3 \rangle^-$			16(1)								
1725.79(1)	3 ⁻		9	27(4)		7.7(6)		3.9(4)				
1731.44(1)	3 ⁻		14(3)									
1755.35(2)	3 ⁻		40(2)									
1755.8(1)	3 ⁻			9								
1757.7(1)	$\langle 3^-, 5^+ \rangle$					45(4)						
1762.91(4)	$\langle 3 \rangle^-$		13	5.2(6)								
1783.1(1)	1,3,5 ⁺		49(10)								32(6)	
1811.5(1)	3 ⁻		23(2)						1.8(3)			

(continued)

 $^{179}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage										
[keV]		$E_f^*:$ $2J_f^\pi:$	701.056 5 ⁻	720.614 3 ⁻	742.711 $\langle 9 \rangle^-$	788.186 5 ⁻	848.39 19 ⁺	849.202 $\langle 7 \rangle^-$	870.225 7 ⁻	935.645 $\langle 7 \rangle^-$	1003.65 5 ⁺	1073.56 $\langle 7 \rangle^-$
1821.2(1)	$\langle 1,3 \rangle$		33(7)									
1846.3(3)	$\langle 3^-, 5^+ \rangle$								31(7)			
1851.50(1)	3 ⁺ , 5 ⁺										82(3)	
1861.23(1)	5 ⁺					13(3)				5(2)	41(2)	12.5(9)
1913.47(1)	3 ⁻			54(8)								
2050.8(9)*	1,3,5 ⁺	40		60								
2070.7(15)*	$\langle 1,3 \rangle$			25								
2081.0(3)*	$\langle 1,3 \rangle$	4									50(10)	
2092.9(4)*						21(5)						
2143.4(20)*	$\langle 1,3 \rangle$	36										
2150.3(15)*	1,3,5 ⁺			17								
2182.6(8)*	1,3,5 ⁺			58								
2228.3(2)*	1,3,5 ⁺			37								
2249.6(15)*	$\langle 3^- \rangle$			13		15						
2309.2(15)*	1,3,5 ⁺			48								
2366.9(15)*	$\langle 1,3 \rangle$			10								
2394.2(15)*	1,3,5 ⁺					15						
2414.9(15)*	$\langle 1,3 \rangle$					11						
2425.3(15)*	$\langle 1,3 \rangle$	48										
2475.5(15)*	$\langle 3^- \rangle$	7										
2638.3(15)*	$\langle 1,3 \rangle$			40								
2653.1(15)*	$\langle 1,3 \rangle$			20		27						
2742.8(15)*	$\langle 1,3 \rangle$	27										
2905.2(15)*	$\langle 1,3 \rangle$			18								
3149.1(15)*	$\langle 1,3 \rangle$	35										
3179.6(15)*	1,3,5 ⁺			47								
3345.2(15)*	1,3,5 ⁺	38										

Energy levels and branching ratios [94Ba52]. Part 5

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage									
		E_f^* : $2J_f^\pi$:	1078.35 $\langle 7 \rangle^+$	1084.85 21 ⁺	1120.78 9 ⁺	1150.41 1 ⁺	1185.85 3 ⁺	1235.44 $\langle 5 \rangle^+$	1249.55 3 ⁻	1269.45 3 ⁻	1313.50 5 ⁻
1105.8(2)	25 ⁻			0.239(10)							
1436.35(1)	7 ⁻		3.2(3)		0.8(3)						
1614.12(1)	3 ⁻ , 1 ⁻					4.8(4)					
1668.95(1)	$\langle 3 \rangle^+$					53(5)	31(5)	7.9(4)			
1706.07(1)	$\langle 3 \rangle^-$									0.8(3)	
1715.93(1)	1 ⁺ -5 ⁺					8.0(10)			57(3)		
1725.79(1)	3 ⁻									4.5(2)	
1731.44(1)	3 ⁻									3.1(2)	
1861.23(1)	5 ⁺		7(1)		10(1)						5.7(6)

(continued)

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage									
		E_f^* : $2J_f^\pi$:	1078.35 $\langle 7 \rangle^+$	1084.85 21^+	1120.78 9^+	1150.41 1^+	1185.85 3^+	1235.44 $\langle 5 \rangle^+$	1249.55 3^-	1269.45 3^-	1313.50 5^-
1913.47(1)	3^-							3.1(3)		5.3(8)	26.8(5)
1928.845(9)	$1^+, 3^+$					34(2)	25(2)				
1945.86(1)	$\langle 1, 3 \rangle$									9(2)	

Energy levels and branching ratios [94Ba52]. Part 6

 $^{179}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage									
		E_f^* : $2J_f^\pi$:	1433.19 3^-	1436.35 7^-	1459.00 3^-	1482.03 3^+	1532.28 $\langle 5 \rangle^+$	1572.56 3^-	1668.96 $\langle 3 \rangle^+$	1725.79 3^-	1755.35 3^-
1706.07(1)	$\langle 3 \rangle^-$				1.9(1)						
1715.93(1)	$1^+ - 5^+$					21.9(7)	12.7(6)				
1731.44(1)	3^-			2.9(4)				0.6(3)			
1851.50(1)	$3^+, 5^+$						17.9(7)				
1861.23(1)	5^+						5.8(4)				
1913.47(1)	3^-		5.0(9)								
1928.845(9)	$1^+, 3^+$					2.6(3)		10.2(5)			
1945.86(1)	$\langle 1, 3 \rangle$								4.0(9)	4(2)	

Energy levels and branching ratios [03Wu10].

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

E^* [keV]	J^π	β_L (p,p')	I_p (d,p)	σ (t,p) $\mu\text{b/sr}$	$I_{s,0}$ [eVb]	$\Gamma_{\gamma o}$ [meV]	$B(M1)$ [μ_N^2]	$B(E1)$ [$10^{-3}e^2fm^2$]	$T_{1/2}$ or Γ_{cm}	Ref.
0.0	0^+		0.017	232					Stable	72Za04
93.3243(20)	2^+	0.260	0.010	24					1.522(9) ns	92Pe02
308.579(3)	4^+	-0.050	0.039	17					75.2(13) ps	92Pe02
640.858(11)	6^+	0.004	0.013	≈ 2					9.02(16) ps	92Pe02
1083.94(4)	8^+		0.021						2.11(4) ps	72Za04
1101.9(5)	$\langle 0 \rangle^+$			7						83Bu03
1107.24(4)										
1141.50(5)	8^-		0.004*						5.5(1) h	72Za04
1163.86(4)										
1183.32(13)	2^+	0.047								92Pe02
1192.61(6)	$4^+ - 6^+$									
1199.66(4)	2^+		0.016	obsc					0.51(5) ps	72Za04
1260.46(4)	$\langle 2^+ \rangle$									
1291.04(5)	3^+	0.019								92Pe02
1300.15(4)										
1315.7(5)	0^+			obsc						83Bu03

(continued)

 ^{180}Hf
72

E^*	J^π	β_L	I_p	σ (t,p)	$I_{s,0}$	Γ_{γ_0}	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,p')	(d,p)	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
1354.1(3)	$\langle 1^--3^- \rangle$									
1369.48(8)	$\langle 4^+ \rangle$		1.000							72Za04
1374.15(4)	$\langle 4^- \rangle$	0.026							0.57(2) μs	92Pe02
1381.31(4)	$\langle 2^+, 3, 4^+ \rangle$									
1385.2(8)	9^-									
1409.20(8)	$\langle 2^+ \rangle$		0.079	22						72Za04
1409.25(7)	$\langle 4^+ \rangle$		incl	incl						72Za04
1420.6(10)										
1429.59(4)	$\langle 3, 4^+ \rangle$									
1444(6)	$\langle 5^- \rangle$	0.017								92Pe02
1472.27(6)	$\langle 6^+ \rangle$									
1482.41(4)	$\langle 5^- \rangle$		0.652	6						72Za04
1484.27(6)										
1508			0.405							72Za04
1525			0.090							72Za04
1539.04(4)	$\langle 4^- \rangle$									
1556.81(6)	$\langle 5^+ \rangle$									
1559.02(4)	$\langle 4^+ \rangle$	0.022								92Pe02
1597.42(11)	$\langle 4^+, 5^+ \rangle$									
1607.55(4)	$\langle 4 \rangle^+$		2.231	17						72Za04
1609.13(4)	$\langle 3^-, 4^- \rangle$		incl	incl						72Za04
1612.3(7)	$\langle 6^- \rangle$									
1612.82(4)	$\langle 3^-, 4^+ \rangle$									
1630.4(10)	10^+								0.79(4) ps	
1632.59(5)	$\langle 3 \rangle^+$									
1637.26(14)	$\langle 2^+ \rangle$									
1651(6)	$\langle 3^- \rangle$	0.038	0.024*							92Pe02
1653.8(8)	10^-									
1657.96(10)										
1686.9(8)			0.648							72Za04
1700.59(4)	$\langle 2^+, 3^+ \rangle$									
1702.7(7)	$\langle 6^+ \rangle$									
1709.1(5)	$\langle 5^- \rangle$	0.014		≈ 3						92Pe02
1724.6(4)	$\langle 4^+, 5, 6^+ \rangle$			incl						
1724.71(9)	$\langle 2^+, 3, 4^+ \rangle$									
1738.04(5)	$\langle 4^+ \rangle$									
1740	$[3^-]$	0.019								92Pe02
1742.63(4)	$\langle 5 \rangle^+$									
1743.16(6)	$\langle 2^+, 1^+ \rangle$									
1756(5)										
1764.3(8)	$\langle 7^- \rangle$			5						83Bu03
1786.84(5)			1.105							72Za04
1813.64(8)	3^-	0.026								92Pe02
1818.35(4)	$\langle 3^-, 4^- \rangle$									
1820.21(17)	$\langle 3^- \rangle$		0.710	4						72Za04

(continued)

¹⁸⁰Hf
72

E^*	J^π	β_L	I_p	σ (t,p)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,p')	(d,p)	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
1828.4(10)										
1839(6)	3^-	0.040								92Pe02
1863.28(6)	$\langle 5^+ \rangle$		0.524							72Za04
1889			0.079							72Za04
1894.7(11)	$\langle 7^+ \rangle$									
1904.2(6)				7						83Bu03
1909.60(9)	$\langle 4^+, 3 \rangle$		0.204	incl						72Za04
1926.4(8)	3^-	0.019	0.410							92Pe02
1931.6(10)										
1937.1(10)				obsc						83Bu03
1937.3(9)	$\langle 8^- \rangle$									
1945.08(13)	$\langle 2^+ \rangle$									
1946.5(9)	11^-									
1948.6(8)										
1957.9(5)	$[4^+]$	0.020	0.442							92Pe02
1994.83(5)										
2017.05(4)	$X^{\langle - \rangle}$									
2022.6(10)			0.127							72Za04
2034.17(7)										
2074.95(10)			0.412							72Za04
2075.3(8)			incl							72Za04
2112.7(11)	$\langle 8^+ \rangle$									
2115(5)				9						83Bu03
2120.1(10)	1,2				2.6(13)	1.0(5)	0.027(13)	0.30(15)	0.46(22) ps	
2133.4(10)	$\langle 9^- \rangle$									
2147.1(10)			0.286							72Za04
2151.24(6)										
2153.7(5)										
2173.9(3)	3^-	0.018	0.245							92Pe02
2200.8(10)										
2215.9(10)			0.113*							72Za04
2238			0.795							72Za04
2242.4(10)										
2244.3(10)										
2252.6(10)										
2261.8(7)	4^+	0.018								92Pe02
2263.5(10)	12^-									
2271			0.745							72Za04
2272.4(15)	12^+								0.367(15) ps	
2276.1(10)										
2293.0(10)										
2303(5)										
2316.45(9)	$\langle 3^-, 4, 5^- \rangle$									
2320.7(7)										
2334.1(10)				40						83Bu03

(continued)

¹⁸⁰Hf₇₂

E^*	J^π	β_L	I_p	σ (t,p)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,p')	(d,p)	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
2341.4(10)										
2348(5)				5						83Bu03
2349.4(12)	$\langle 10^- \rangle$									
2353.7(12)	$\langle 9^+ \rangle$									
2368.7(10)										
2377.7(10)	1				3.3(8)	1.6(4)	0.031(7)	0.34(8)	0.29(7) ps	97Pi08
2389.0(6)	4^+	0.015								92Pe02
2413.5(10)										
2425.8(10)	$\langle 10^+ \rangle$								15(5) μs	
2447(6)	5^-	0.027								92Pe02
2465.4(10)										
2472.4(7)										
2476.86(10)	$[3^-]$	0.029								92Pe02
2486.3(9)	12^+								10(1) μs	
2493.5(7)	1				7.5(16)	5.5(13)	0.091(21)	1.01(24)	62(13) fs	97Pi08
2504.8(10)										
2533(20)	3^-	0.018								92Pe02
2538.3(12)	$\langle 14^+ \rangle$								$>10 \mu\text{s}$	
2549.2(10)										
2560.9(7)										
2582.5(7)	1				10.9(12)	16.7(74)	0.252(35)	2.78(39)	10(3) fs	97Pi08
2587.3(14)	$\langle 11^- \rangle$									
2591(20)	4^+	0.022								92Pe02
2616.7(13)	$\langle 10^+ \rangle$									
2617.4(7)	1				36.2(34)	32.2(32)	0.466(46)	5.15(51)	9.5(8) fs	97Pi08
2624.3(12)	$\langle 13^+ \rangle$									
2679.79(13)	$4,5^-$									
2682.2(7)										
2706.2(10)										
2712.5(7)	1				7.4(11)	13.2(26)	0.171(33)	1.89(36)	12.4(24) fs	97Pi08
2741.3(5)										
2771.7(10)										
2783.7(10)										
2797.0(6)										
2805.8(10)										
2808.3(12)	$\langle 14^+ \rangle$									
2812.4(10)	1				4.2(9)	2.9(6)	0.033(7)	0.37(8)	0.16(3) ps	97Pi08
2839.0(5)										
2847.4(15)	$\langle 12^- \rangle$									
2850.1(6)										
2858.6(7)										
2873.4(10)										
2879.8(10)	1,2				2.6(7)	1.8(5)	0.020(6)	0.22(6)	0.25(7) ps	97Pi08
2892.3(7)	1				14.5(15)	15.5(18)	0.166(19)	1.84(21)	20.0(21) fs	97Pi08
2899.7(14)	$\langle 11^+ \rangle$									

(continued)

¹⁸⁰Hf
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E^*	J^π	β_L	I_p	σ (t,p)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,p')	(d,p)	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
2913.6(10)										
2948.0(7)	1				23.9(17)	25.2(19)	0.254(19)	2.81(21)	13.0(9) fs	97Pi08
2993.1(10)	1				12.7(13)	9.8(10)	0.095(10)	1.05(11)	47(5) fs	97Pi08
3000.1(10)										
3011.3(7)	1				6.0(10)	8.4(18)	0.080(17)	0.89(19)	30(6) fs	97Pi08
3022.5(6)										
3049.6(6)										
3058.6(10)										
3068.8(7)	1				12.7(12)	18.3(20)	0.164(18)	1.82(20)	14.1(13) fs	97Pi08
3081.5(10)	1				3.3(9)	2.7(8)	0.024(7)	0.27(8)	0.17(5) ps	97Pi08
3083.6(10)										
3086.0(10)	1				3.9(9)	3.2(7)	0.028(7)	0.31(7)	0.14(3) ps	97Pi08
3089.7(7)										
3100.8(10)										
3102.3(14)	$\langle 15^+ \rangle$									
3122.3(18)	$\langle 13^- \rangle$									
3124.1(10)										
3125.6(7)	1				10.4(12)	11.7(15)	0.099(13)	1.09(14)	29(3) fs	97Pi08
3131.6(7)										
3150.7(7)	1				3.4(9)	11.5(41)	0.095(34)	1.05(38)	10(4) fs	97Pi08
3152.8(10)										
3163.2(10)										
3174.4(10)										
3183.9(7)										
3193.7(15)	$\langle 12^+ \rangle$									
3200.4(10)										
3215.3(10)										
3253.1(10)										
3254.3(7)	1				4.3(11)	7.4(21)	0.056(16)	0.62(18)	32(8) fs	97Pi08
3257.7(10)										
3303.4(10)										
3316.7(5)										
3330.1(10)	1				5.0(10)	4.8(10)	0.034(7)	0.37(8)	95(20) fs	97Pi08
3338.4(10)										
3417.1(5)										
3428.4(10)										
3442.9(10)										
3448.3(14)	$\langle 16^+ \rangle$									
3468.6(10)										
3483.2(10)										
3489.2(10)										
3499.9(10)										
3506.8(10)	1,2				5.5(11)	5.9(12)	0.035(7)	0.39(8)	77(16) fs	97Pi08
3515.7(10)										
3526.7(10)										

(continued)

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

E^*	J^π	β_L	I_p	σ (t,p)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,p')	(d,p)	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
3530.3(14)										
3559.6(7)	1				8.6(15)	18.3(37)	0.105(21)	1.16(24)	12.8(23) fs	97Pi08
3569.5(7)	1				7.3(14)	11.1(26)	0.064(15)	0.70(16)	30(6) fs	97Pi08
3584.2(7)	1				8.8(20)	24.7(69)	0.139(39)	1.54(43)	7.3(19) fs	97Pi08
3592.5(7)	1				6.2(16)	13.9(42)	0.077(24)	0.86(26)	16(4) fs	97Pi08
3596.3(10)										
3599.3(18)	$\langle 18^- \rangle$								90(10) μs	
3605.0(7)										
3615.1(7)	1				23.1(22)	30.4(32)	0.167(18)	1.84(19)	13.0(13) fs	97Pi08
3625.4(10)										
3627.1(10)	1				7.8(17)	8.9(20)	0.048(11)	0.54(12)	51(12) fs	97Pi08
3640.7(10)										
3653.8(10)										
3672.2(7)										
3681.2(10)										
3751.3(7)										
3766.6(7)	1				18.1(23)	31.9(47)	0.155(23)	1.71(25)	10.0(14) fs	97Pi08
3774.3(7)	1				5.2(16)	25(10)	0.120(48)	1.33(53)	4.7(19) fs	97Pi08
3786.2(7)	1				10.8(19)	26.7(59)	0.127(28)	1.41(31)	8.6(18) fs	97Pi08
3804.1(7)	1				11.3(20)	20(4)	0.094(19)	1.04(21)	16(3) fs	97Pi08
3818.0(10)	1				9.0(19)	11(2)	0.053(11)	0.58(12)	40(8) fs	97Pi08
3829.6(10)	1				14.4(27)	18(3)	0.084(16)	0.93(17)	25(5) fs	97Pi08
3836.5(7)	1				15.1(28)	24(5)	0.112(22)	1.24(24)	14.7(24) fs	97Pi08
3848.3(6)										
3851.7(7)	1				14.8(23)	35(7)	0.159(33)	1.76(36)	7.0(14) fs	97Pi08
3855.3(10)										
3862.2(10)	1,2				5.1(16)	6.6(21)	0.030(10)	0.33(11)	69(22) fs	97Pi08
3869.1(7)										
3880.3(10)										
3889.4(10)	1				27.7(36)	36(5)	0.160(21)	1.77(23)	12.6(16) fs	97Pi08
3908.5(10)										
3926.3(7)										
3928.0(10)	1				15.5(31)	21(4)	0.089(18)	0.98(20)	22(4) fs	97Pi08
3948.1(10)	1				13.6(35)	18(5)	0.077(20)	0.86(22)	25(6) fs	97Pi08
3957.6(7)										
3967.8(10)	1				18.2(39)	25(5)	0.103(22)	1.14(24)	18(4) fs	97Pi08
3975.1(7)										
3978.4(7)	1				8.8(34)	55(28)	0.23(12)	2.5(13)	1.8(9) fs	97Pi08
3987.3(10)										
3992.1(10)										
4003.0(7)										
4137.5(10)										
4331.7(10)										
4355.8(10)										
4423.0(7)										

(continued)

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

E^*	J^π	β_L	I_p	σ (t,p)	$I_{s,0}$	$\Gamma_{\gamma o}$	$B(M1)$	$B(E1)$	$T_{1/2}$ or	Ref.
[keV]		(p,p')	(d,p)	$\mu\text{b/sr}$	[eVb]	[meV]	$[\mu_N^2]$	$[10^{-3}e^2fm^2]$	Γ_{cm}	
4808.5(7)										
4852.7(7)										
4916.2(5)										
4965.3(6)										
5048.1(7)										
5057.5(6)										
		92Pe02	72Za04	83Bu03	97Pi08	97Pi08	97Pi08	97Pi08		Ref.

Additional data on this isotope can be found in [01Ch89, 01Ch10, 92Pe02, 91Gr19, 90Bo52, 90Bo50, 90BoZN, 90BoZT].

Abundance: 35.08(16) %.

* Relative $d\sigma/d\Omega$ of the (d,p) reaction at 45°; all other data - for the angle 65° [72Za04].

New isomers are considered in [01Ch10].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [03Wu10]. Part 2

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

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	0.0 0 ⁺	93.3 2 ⁺	309 4 ⁺	641 6 ⁺	1084 8 ⁺	1107	1141 8 ⁻	1164	1183.32 2 ⁺	1192.61
93.3243(20)	2 ⁺		100									
308.579(3)	4 ⁺			100								
640.858(11)	6 ⁺				100							
1083.94(4)	8 ⁺					100						
1101.9(5)	⟨0⟩ ⁺			100								
1107.24(4)				100								
1141.50(5)	8 ⁻					26(6)	74(4)					
1163.86(4)				100								
1183.32(13)	2 ⁺		2.2(5)	83(6)	15(3)							
1192.61(6)	4 ⁺ -6 ⁺				30(20)	70(12)						
1199.66(4)	2 ⁺		52(5)	47(2)	1.5(2)			0.3(2)				
1260.46(4)	⟨2 ⁺ ⟩		97(13)	1.7(17)	1.3(3)					0.43(13)		
1291.04(5)	3 ⁺			83(6)	16.5(10)						0.33(13)	
1300.15(4)			100									
1315.7(5)	0 ⁺			100								
1354.1(3)	⟨1 ⁻ -3 ⁻ ⟩			100								
1369.48(8)	⟨4 ⁺ ⟩			8.5(16)	83(4)	8(2)						
1374.15(4)	⟨4 ⁻ ⟩			4.22(20)	96(1)							
1381.31(4)	⟨2 ⁺ ,3,4 ⁺ ⟩			52(13)	23(16)							
1385.2(8)	9 ⁻								x			
1409.20(8)	⟨2 ⁺ ⟩	≤17		22(4)	78(39)							
1409.25(7)	⟨4 ⁺ ⟩			39.7(12)	57(8)	2.8(9)						
1420.6(10)					100							

(continued)

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

E^* [keV]	J^π	Branching ratios in percentage										
		$E_f^*:$ $J_f^\pi:$	0.0 0 ⁺	93.3 2 ⁺	309 4 ⁺	641 6 ⁺	1084 8 ⁺	1107	1141 8 ⁻	1164	1183.32 2 ⁺	1192.61
1429.59(4)	$\langle 3, 4^+ \rangle$			29(12)	48(8)							
1472.27(6)	$\langle 6^+ \rangle$				21(11)	29(8)	40(6)					
1482.41(4)	$\langle 5^- \rangle$			7(3)								
1484.27(6)				57(50)								
1539.04(4)	$\langle 4^- \rangle$			<19	5.1	3.4						
1556.81(6)	$\langle 5^+ \rangle$				83(2)	17(2)						
1597.42(11)	$\langle 4^+, 5^+ \rangle$				51(13)	25(13)						
1607.55(4)	$\langle 4 \rangle^+$			8(1)	14.4(9)						1.3(2)	
1609.13(4)	$\langle 3^-, 4^- \rangle$				30(4)	7(3)						
1630.4(10)	10 ⁺						100					
1637.26(14)	$\langle 2^+ \rangle$		15(6)	11(6)	25(6)							
1653.8(8)	10 ⁻								x			
1657.96(10)						58(3)						
1686.9(8)				100								
1700.59(4)	$\langle 2^+, 3^+ \rangle$				≤ 93							
1702.7(7)	$\langle 6^+ \rangle$				x	x						
1709.1(5)	$\langle 5^- \rangle$				100							
1724.6(4)	$\langle 4^+, 5, 6^+ \rangle$				50(32)	50(34)						
1724.71(9)	$\langle 2^+, 3, 4^+ \rangle$			11(5)	47(6)							
1742.63(4)	$\langle 5 \rangle^+$				32(3)							
1743.16(6)	$\langle 2^+, 1^+ \rangle$		29(8)	19(9)								
1813.64(8)	3 ⁻			14(12)								
1818.35(4)	$\langle 3^-, 4^- \rangle$				7(4)							
1828.4(10)					x							
1863.28(6)	$\langle 5^+ \rangle$				21(19)							
1904.2(6)			36(18)	64(27)								
1926.4(8)	3 ⁻		100									
1945.08(13)	$\langle 2^+ \rangle$		39(4)	7(2)	13(5)							
1948.6(8)			100									
2022.6(10)					100							
2034.17(7)				17(17)								
2074.95(10)				10	39(10)							
2075.3(8)				100								
2120.1(10)	1,2		100									
2147.1(10)					100							
2151.24(6)				9(5)								
2153.7(5)					32							
2173.9(3)	3 ⁻				29							
2215.9(10)						100						
2244.3(10)					100							
2261.8(7)	4 ⁺				39	61						
2293.0(10)					100							
2316.45(9)	$\langle 3^-, 4, 5^- \rangle$				20(8)							
2320.7(7)					37							
2341.4(10)					100							

(continued)

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

E^* [keV]	J^π	Branching ratios in percentage										
		$E_f^*:$ $J_f^\pi:$	0.0 0 ⁺	93.3 2 ⁺	309 4 ⁺	641 6 ⁺	1084 8 ⁺	1107	1141 8 ⁻	1164	1183.32 2 ⁺	1192.61
2377.7(10)	1		100									
2389.0(6)	4 ⁺		50(34)	50(34)								
2413.5(10)					100							
2472.4(7)					17							
2476.86(10)	[3 ⁻]					8(7)						
2493.5(7)	1		26(13)	74								
2504.8(10)					100							
2582.5(7)	1		62	38(17)								
2617.4(7)	1		33(5)	67								
2679.79(13)	4,5 ⁻											14(12)
2706.2(10)					100							
2712.5(7)	1		64	36(7)								
2741.3(5)					12							
2797.0(6)					19							
2812.4(10)	1		100									
2850.1(6)					20							
2858.6(7)					24							
2873.4(10)					100							
2879.8(10)	1,2		100									
2892.3(7)	1		32(7)	68								
2913.6(10)						100						
2948.0(7)	1		29(4)	71								
2993.1(10)	1		100									
3000.1(10)					100							
3011.3(7)	1		44(14)	56								
3022.5(6)				25	37							
3049.6(6)					43	19						
3058.6(10)					100							
3068.8(7)	1		44(7)	56								
3081.5(10)	1		100									
3083.6(10)						100						
3086.0(10)	1		100									
3089.7(7)					51							
3100.8(10)					100							
3124.1(10)					100							
3125.6(7)	1		25(7)	75								
3131.6(7)					x							
3150.7(7)	1		75	25(9)								
3163.2(10)					100							
3174.4(10)				100								
3183.9(7)						49						
3200.4(10)					100							
3215.3(10)					100							
3253.1(10)				100								
3254.3(7)	1		48(18)	52								

(continued)

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

E^*	J^π	Branching ratios in percentage										
[keV]		$E_f^*:$ $J_f^\pi:$	0.0 0 ⁺	93.3 2 ⁺	309 4 ⁺	641 6 ⁺	1084 8 ⁺	1107	1141 8 ⁻	1164	1183.32 2 ⁺	1192.61
3257.7(10)						100						
3316.7(5)					20	25						
3330.1(10)	1		100									
3417.1(5)					24	20						
3442.9(10)					100							
3468.6(10)						100						
3489.2(10)					100							
3499.9(10)					100							
3506.8(10)	1,2		100									
3515.7(10)					100							
3526.7(10)					100							
3559.6(7)	1		49(15)	51								
3569.5(7)	1		28(14)	72								
3584.2(7)	1		60	40(11)								
3592.5(7)	1		50(22)	50								
3605.0(7)					25							
3615.1(7)	1		14(5)	86								
3625.4(10)					100							
3627.1(10)	1		100									
3640.7(10)					100							
3653.8(10)				100								
3672.2(7)				51	49							
3681.2(10)					100							
3751.3(7)				51	49							
3766.6(7)	1		30(9)	70								
3774.3(7)	1		74	26(10)								
3786.2(7)	1		50(18)	50								
3804.1(7)	1		29(11)	71								
3818.0(10)	1		x									
3829.6(10)	1		x									
3836.5(7)	1		21(6)	79								
3848.3(6)				24	41	36						
3851.7(7)	1		46(16)	54								
3862.2(10)	1,2		100									
3869.1(7)						31						
3880.3(10)						100						
3889.4(10)	1		100									
3908.5(10)						100						
3926.3(7)					29							
3928.0(10)	1		100									
3948.1(10)	1		100									
3957.6(7)				43	57							
3967.8(10)	1		100									
3975.1(7)					35							
3978.4(7)	1		78	22(11)								

(continued)

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

E^*	J^π	Branching ratios in percentage									
[keV]	$E_f^*:$ $J_f^\pi:$	0.0 0 ⁺	93.3 2 ⁺	309 4 ⁺	641 6 ⁺	1084 8 ⁺	1107	1141 8 [−]	1164	1183.32 2 ⁺	1192.61

4003.0(7)				34							
4423.0(7)			33								
4808.5(7)				28							
4852.7(7)			25								
4916.2(5)				29	15						
4965.3(6)				15							
5048.1(7)			29								
5057.5(6)				33							

Energy levels and branching ratios [03Wu10]. Part 3

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

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1199.66 2 ⁺	1260.46 2 ⁺	1291.04 3 ⁺	1300.15	1369.48 4 ⁺	1374.15 4 ⁻	1381.31	1385.2 9 ⁻	1409.20 2 ⁺	1409.25 4 ⁺
1374.15(4)	4 ⁻			0.20(4)								
1381.31(4)	2 ⁺ ,3,4 ⁺					25(2)						
1409.25(7)	4 ⁺	0.9(7)										
1429.59(4)	3,4 ⁺							23(5)				
1472.27(6)	6 ⁺				10(5)							
1482.41(4)	5 ⁻							93(4)				
1484.27(6)				43(29)								
1559.02(4)	4 ⁺					13.4(13)			22(4)			
1597.42(11)	4 ⁺ ,5 ⁺				24(3)							
1607.55(4)	4 ⁺	45.2(9)			19(2)			6(1)			1.1(9)	
1609.13(4)	3 ⁻ ,4 ⁻	2.4(4)						60.2(15)				
1612.3(7)	6 ⁻							x				
1612.82(4)	3 ⁻ ,4 ⁺						8(4)	65(5)				
1632.59(5)	3 ⁺	48(11)			43(5)						10(4)	
1637.26(14)	2 ⁺				40(10)				9(1)			
1653.8(8)	10 ⁻									x		
1657.96(10)					10(2)		19(4)	13(4)				
1724.71(9)	2 ⁺ ,3,4 ⁺				32(3)		9(3)					
1738.04(5)	4 ⁺	49(3)			42(2)							
1742.63(4)	5 ⁺				21(1)							19(2)
1743.16(6)	2 ⁺ ,1 ⁺				21(4)							
1820.21(17)	3 ⁻	26(7)			22(6)		<3	29(7)				
1909.60(9)	4 ⁺ ,3	28(14)						33				
1945.08(13)	2 ⁺	13(5)			12(2)							
1946.5(9)	11 ⁻									x		
1957.9(5)	4 ⁺							19(11)				
2017.05(4)	X ⁽⁻⁾							10(3)				
2034.17(7)					41(9)							

(continued)

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

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1199.66 2 ⁺	1260.46 ⟨2 ⁺ ⟩	1291.04 3 ⁺	1300.15	1369.48 ⟨4 ⁺ ⟩	1374.15 ⟨4 ⁻ ⟩	1381.31	1385.2 9 ⁻	1409.20 ⟨2 ⁺ ⟩	1409.25 ⟨4 ⁺ ⟩
2074.95(10)							12(6)					
2151.24(6)			5(1)	26(5)								
2153.7(5)								68				
2173.9(3)	3 ⁻							71				
2200.8(10)								100				
2242.4(10)								100				
2320.7(7)								63				
2425.8(10)	⟨10 ⁺ ⟩									x		
2476.86(10)	[3 ⁻]				14(7)							
2486.3(9)	12 ⁺									x		
2549.2(10)								100				
2560.9(7)								39				
2741.3(5)								15				
2771.7(10)								100				
2797.0(6)								20				
2805.8(10)								100				
2839.0(5)							19					
3089.7(7)								49				
3183.9(7)								51				
3316.7(5)							22					
3483.2(10)								100				
3596.3(10)								100				
4003.0(7)								66				
4137.5(10)								100				
4916.2(5)								21				
4965.3(6)								30				

Energy levels and branching ratios [03Wu10]. Part 4

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

E^*	J^π	Branching ratios in percentage										
		E_f^* :	1429.59	1482.41	1484.27	1539.04	1556.81	1559.02	1607.55	1609.13	1612.3	1612.82
[keV]		J_f^π :	$\langle 3, 4^+ \rangle$	$\langle 5^- \rangle$		$\langle 4^- \rangle$	$\langle 5^+ \rangle$		$\langle 4 \rangle^+$	$\langle 3^-, 4^- \rangle$	$\langle 6^- \rangle$	$\langle 3^-, 4^+ \rangle$
1539.04(4)	$\langle 4^- \rangle$		91(9)									
1559.02(4)	$\langle 4^+ \rangle$			64(6)								
1607.55(4)	$\langle 4 \rangle^+$		5.5(11)									
1612.3(7)	$\langle 6^- \rangle$			x								
1612.82(4)	$\langle 3^-, 4^+ \rangle$							27(3)				
1700.59(4)	$\langle 2^+, 3^+ \rangle$							100				
1738.04(5)	$\langle 4^+ \rangle$			2.2			4(3)					
1742.63(4)	$\langle 5 \rangle^+$								28(3)			
1743.16(6)	$\langle 2^+, 1^+ \rangle$		18(1)		14(1)							
1764.3(8)	$\langle 7^- \rangle$			x							x	

(continued)

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

E^* [keV]	J^π	Branching ratios in percentage									
		E^*_f : 1429.59 J^π_f : $\langle 3,4^+ \rangle$	1482.41 $\langle 5^- \rangle$	1484.27	1539.04 $\langle 4^- \rangle$	1556.81 $\langle 5^+ \rangle$	1559.02	1607.55 $\langle 4 \rangle^+$	1609.13 $\langle 3^-,4^- \rangle$	1612.3 $\langle 6^- \rangle$	1612.82 $\langle 3^-,4^+ \rangle$
1786.84(5)				16					84		
1813.64(8)	3^-		7		32(4)		38(2)	10			
1818.35(4)	$\langle 3^-,4^- \rangle$										93(4)
1820.21(17)	$\langle 3^- \rangle$									22(9)	
1863.28(6)	$\langle 5^+ \rangle$					53(7)					
1909.60(9)	$\langle 4^+,3 \rangle$							40(12)			
1931.6(10)									x		
1937.1(10)								x			
1937.3(9)	$\langle 8^- \rangle$									x	
1945.08(13)	$\langle 2^+ \rangle$						17(4)				
1957.9(5)	$[4^+]$		81(6)								
2017.05(4)	$X^{(-)}$		37						54(1)		
2034.17(7)			41(7)								
2074.95(10)									39(4)		
2151.24(6)											60(4)
2252.6(10)									100		
2276.1(10)									100		
2316.45(9)	$\langle 3^-,4,5^- \rangle$								11(7)		14(8)
2334.1(10)									100		
2368.7(10)									100		
2465.4(10)									100		
2472.4(7)								83			
2476.86(10)	$[3^-]$				19(9)		29(9)				16(5)
2560.9(7)			61								
2679.79(13)	$4,5^-$				49(14)						
2682.2(7)			56						44		
2741.3(5)			42						31		
2783.7(10)			100								
2797.0(6)			61								
2839.0(5)			35					46			
2850.1(6)				48					32		
2858.6(7)									76		
3022.5(6)			38								
3049.6(6)										38	
3131.6(7)									100		
3152.8(10)			100								
3303.4(10)									100		
3316.7(5)			33								
3338.4(10)									100		
3417.1(5)			22								34
3428.4(10)			100								
3605.0(7)											75
3855.3(10)									100		
3869.1(7)			69								
3926.3(7)									71		

(continued)

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

E^*	J^π	Branching ratios in percentage									
	$E^*_\text{f}:$	1429.59	1482.41	1484.27	1539.04	1556.81	1559.02	1607.55	1609.13	1612.3	1612.82
[keV]	$J^\pi_\text{f}:$	$\langle 3,4^+ \rangle$	$\langle 5^- \rangle$		$\langle 4^- \rangle$	$\langle 5^+ \rangle$		$\langle 4 \rangle^+$	$\langle 3^-,4^- \rangle$	$\langle 6^- \rangle$	$\langle 3^-,4^+ \rangle$
3975.1(7)				65							
3987.3(10)			100								
3992.1(10)									100		
4331.7(10)									100		
4355.8(10)									100		
4423.0(7)									67		
4808.5(7)								72			
4852.7(7)								75			
4916.2(5)			36								
4965.3(6)				56							
5048.1(7)			71								
5057.5(6)			67								

Energy levels and branching ratios [03Wu10]. Part 5

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

E^* [keV]	J^π	Branching ratios in percentage										
		E_f^* : J_f^π :	1630.4 10^+	1632.59 $\langle 3 \rangle^+$	1653.8 10^-	1700.59 $\langle 2^+,3^+ \rangle$	1702.7 $\langle 6^+ \rangle$	1738.04 $\langle 4^+ \rangle$	1764.3 $\langle 7^- \rangle$	1786.84	1894.7 $\langle 7^+ \rangle$	1937.3 $\langle 8^- \rangle$
1738.04(5)	$\langle 4^+ \rangle$			2.9(4)								
1863.28(6)	$\langle 5^+ \rangle$							25(14)				
1894.7(11)	$\langle 7^+ \rangle$						x					
1937.3(9)	$\langle 8^- \rangle$								x			
1946.5(9)	11^-				x							
1994.83(5)										100		
2112.7(11)	$\langle 8^+ \rangle$						x				x	
2133.4(10)	$\langle 9^- \rangle$								x			x
2263.5(10)	12^-				x							
2272.4(15)	12^+		100									
2349.4(12)	$\langle 10^- \rangle$											x
2353.7(12)	$\langle 9^+ \rangle$										x	
2425.8(10)	$\langle 10^+ \rangle$				x							
2486.3(9)	12^+				x							
2679.79(13)	$4,5^-$					<51						

Energy levels and branching ratios [03Wu10]. Part 6

¹⁸⁰Hf
72

E^*	J^π	Branching ratios in percentage										
[keV]		E_f^* : J_f^π :	1946.5 11 ⁻	2034.17	2112.7 ⟨8 ⁺ ⟩	2133.4 ⟨9 ⁻ ⟩	2263.5 12 ⁻	2316.45	2349.4 ⟨10 ⁻ ⟩	2353.7 ⟨9 ⁺ ⟩	2486.3 12 ⁺	2538.3 ⟨14 ⁺ ⟩
2263.5(10)	12 ⁻		x									
2316.45(9)	⟨3 ⁻ ,4,5 ⁻ ⟩			55(8)								
2349.4(12)	⟨10 ⁻ ⟩					x						
2353.7(12)	⟨9 ⁺ ⟩				x							
2425.8(10)	⟨10 ⁺ ⟩		x									
2476.86(10)	[3 ⁻]							14(3)				
2486.3(9)	12 ⁺		x				x					
2538.3(12)	⟨14 ⁺ ⟩										x	
2587.3(14)	⟨11 ⁻ ⟩					x						
2616.7(13)	⟨10 ⁺ ⟩				x					x		
2624.3(12)	⟨13 ⁺ ⟩										x	
2679.79(13)	4,5 ⁻							37(7)				
2808.3(12)	⟨14 ⁺ ⟩										x	x
2847.4(15)	⟨12 ⁻ ⟩								x			
2899.7(14)	⟨11 ⁺ ⟩									x		

Energy levels and branching ratios [03Wu10]. Part 7

¹⁸⁰Hf
72

E^* [keV]	J^π	Branching ratios in percentage							
		E_f^* : J_f^π :	2587.3 ⟨11 ⁻ ⟩	2616.7 ⟨10 ⁺ ⟩	2624.3 ⟨13 ⁺ ⟩	2808.3 ⟨14 ⁺ ⟩	2899.7 ⟨11 ⁺ ⟩	3102.3 ⟨15 ⁺ ⟩	3448.3 ⟨16 ⁺ ⟩
2808.3(12)	⟨14 ⁺ ⟩				x				
2899.7(14)	⟨11 ⁺ ⟩			x					
3102.3(14)	⟨15 ⁺ ⟩					x			
3122.3(18)	⟨13 ⁻ ⟩		x						
3193.7(15)	⟨12 ⁺ ⟩			x			x		
3448.3(14)	⟨16 ⁺ ⟩					x		x	
3530.3(14)						x		x	
3599.3(18)	⟨18 ⁻ ⟩								x

Energy levels and branching ratios [02Bo41, 91Fi01].

¹⁸¹Hf
72

E^*	$2J^\pi$	I_γ	σ (d,p)	$S_{\ell j}$	Ref.	Branching ratios in percentage					
[keV]		%	$\mu\text{b/sr}$	(d,p)		E_f^* : $2J_f^\pi$:	0.0 1 ⁻	45.8 3 ⁻	98.6 5 ⁻	204 7 ⁻	252 3 ⁻
0.0 ^a	1 ⁻	21.3(12)	13	0.015	02Bo41						
45.79(3) ^a	3 ⁻	5.7(3)	283	0.153	02Bo41		100				
68(10)	$\langle 9^+ \rangle$										
98.57(3) ^a	5 ⁻		328	0.204	02Bo41		47(17)	53(12)			

(continued)

¹⁸¹Hf
72

E^* [keV]	$2J^\pi$	I_γ %	σ (d,p) $\mu\text{b/sr}$	$S_{\ell j}$ (d,p)	Ref.	Branching ratios in percentage					
						$E_f^*:$ $2J_f^\pi:$	0.0 1 ⁻	45.8 3 ⁻	98.6 5 ⁻	204 7 ⁻	252 3 ⁻
170(10)											
204.01(3) ^a	7 ⁻		53	0.023	02Bo41			28(12)	72(12)		
252.00(3) ^b	3 ⁻	1.25(5)	123	0.058	02Bo41		9(4)	79(6)	13(6)		
303.84(4) ^a	9 ⁻		31	0.01	02Bo41						
329.34(3) ^b	5 ⁻		265	0.169	02Bo41		61(13)			39(8)	
440.65(4) ^b	7 ⁻		147	0.061	02Bo41				100		
465.90(4) ^a	11 ⁻				02Bo41						
573.8(1)	9 ⁻		15	0.01	02Bo41						
595.23(4)	9 ⁺		5	0.003	02Bo41						
619.9(3) ^a	$\langle 13^- \rangle$		10		02Bo41						
663.8(5) ^c	7 ⁻		530	0.202	02Bo41						
750.7(4) ^b	11 ⁻		16	0.004	02Bo41						
758.6(2)	13 ⁺		135	0.110	02Bo41						
801.2(3) ^c	9 ⁻		20	0.015	02Bo41						
835(1) ^a	$\langle 15^- \rangle$		2		02Bo41						
904.33(6)	7 ⁻		5	0.002	02Bo41			11(3)	13(3)	6(2)	33(2)
931.3(5) ^b	13 ⁻		6		02Bo41						
964.8(3) ^c	11 ⁻		12		02Bo41						
1010.2(4)	$\langle 13^+ \rangle$		20	0.02	02Bo41						
1031.7(4)	9 ⁻		12	0.018	02Bo41						
1045.00(9)	1 ⁻	0.15(5)			02Bo41			100	x		
1055.95(4)	5 ⁻				02Bo41						
1086.1(1)	3 ⁻	0.78(4)			02Bo41		49	29	22		
1117.19(4)	3 ⁻	0.16(3)			02Bo41		88	x	12		
1127	$\langle 13^- \rangle$		3								
1134.62(9)	5 ⁻				02Bo41						
1153.14(9)	1 ⁻	0.60(6)			02Bo41			25	16	≈ 49	10
1157.4(2)	7 ⁻		81	0.026	02Bo41						
1178.2(1)	5 ⁻				02Bo41						
1210.5(1)	5 ⁺				02Bo41						
1229.81(9)	3 ⁻	0.33(3)			02Bo41		50	21	29		
1260.69(9)	5 ⁻				02Bo41						
1285.9(7)	9 ⁻		7		02Bo41						
1321.79(5)	3 ⁻	1.8(3)	346	0.146	02Bo41		40				≈ 60
1328.9(1)	1-5 ⁻				02Bo41		65(20)*	7(3)*			
1347.8(1)	1-5				02Bo41			17(6)*			
1357.0(1)	$\langle 3^- \rangle$	0.24(7)	6	0.006	02Bo41						
1363.0(1)	1-5 ⁻				02Bo41		6(3)*				12(4)*
1396.9(1)	5 ⁻		42	0.021	02Bo41						
1400.7(4)	$\langle 7^- \rangle$		20	$\langle 0.01 \rangle$	02Bo41						
1424.5(2)	5 ⁻		50	0.025	02Bo41			x			
1435.5(4)	$\langle 5^-, 7^- \rangle$		7		02Bo41						
1444.2(6)			7		02Bo41						
1452.0(2)	5 ⁺		583	0.212	02Bo41			42	58		
1453.5(3)	1 ⁺	0.23(7)			02Bo41						

(continued)

 $^{181}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	I_γ %	σ (d,p) $\mu\text{b/sr}$	$S_{\ell j}$ (d,p)	Ref.	Branching ratios in percentage					
						E_f^* : $2J_f^\pi$:	0.0 1 ⁻	45.8 3 ⁻	98.6 5 ⁻	204 7 ⁻	252 3 ⁻
1492.4(1)	7 ⁻				02Bo41						
1494.19(8)	1 ⁻	0.62(3)	105	0.03	02Bo41		56			44	
1497.1(5)			68		02Bo41						
1505.1(2)	1 ⁺	≤ 0.09			02Bo41						
1505.2(2)	5 ⁺		171	0.061	02Bo41						
1520.2(2)	9 ⁺		488	0.338	02Bo41						
1568.4(5)			6		02Bo41						
1574.7(3)	9 ⁺		18	0.014	02Bo41						
1615.7(2)	3 ⁺	0.17(2)	18	0.012	02Bo41						
1629.48(6)	1 ⁻	0.97(10)	198	0.165	02Bo41		100				
1635.8(2)	$\langle 5 \rangle$				02Bo41						4.8(24)*
1641.6(1)	1 ⁻ , 3 ⁺	0.12(3)	9		02Bo41				19(4)*		16(5)*
1656.6(2)	3 ⁺	0.06(3)	28	0.017	02Bo41						
1667.5(11)	$\langle 13^+ \rangle$		3	$\langle 0.003 \rangle$	02Bo41						
1682.9(1)	3 ⁻	0.34(2)	79	0.029	02Bo41				100		
1696.5(3)	9 ⁻		122	0.157	02Bo41						
1705.5(4)	$\langle 1^+ \rangle$		12	0.012	02Bo41						
1712.65(6)	1 ⁻ , $\langle 3^- \rangle$	0.92(18)			02Bo41		26(5)*	5(2)*	23(7)*		13(3)*
1716.99(6)	3 ⁻	2.58(14)			02Bo41		62(12)*	81(10)*	41(8)*	6(2)*	11(4)*
1726.5(3)	$\langle 5^- \rangle$		40	0.03	02Bo41						
1729(10)	$\langle 13^+ \rangle$										
1737.0(1)	3 ⁻	0.77(8)	35	0.012	02Bo41		11(3)*	23(7)*	18(5)*		
1746.6(5)	5 ⁻		25	0.013	02Bo41						
1766.4(4)	$\langle 5^- \rangle$		9		02Bo41						
1770.0(3)	1, 3	0.47(5)			02Bo41		18(5)*	23(7)*			
1774.9(4)	5 ⁻		9	0.002	02Bo41						
1799.8(4)	5 ⁻		21	0.006	02Bo41						
1805.38(8)	1, 3	0.68(7)			02Bo41		58(6)*	12(4)*			
1808.2(4)	3 ⁺		23	0.011	02Bo41						
1813.2(4)			23		02Bo41						
1834.3(4)	5 ⁻		30**	0.017	02Bo41						
1842.55(6)	1 ⁻ , $\langle 3^- \rangle$	1.95(10)			02Bo41		48(5)*	22(3)*	3(1)*		
1847.6(2)	3 ⁻	0.65(14)	135	0.045	02Bo41		9(4)*	12(3)*			
1867.2(2)	1, 3	0.22(4)	15**		02Bo41		27(5)*		10(5)*		
1873.8(3)	5 ⁻		103	0.039	02Bo41						
1885.8(5)	$\langle 7^+ \rangle$		5	$\langle 0.001 \rangle$	02Bo41						
1895.7(1)	1 ⁻ , 3 ⁻	1.29(13)	4	$\langle 0.004 \rangle$	02Bo41		23(5)*	49(16)*	27(5)*		
1908.3(3)	$\langle 5^+ \rangle$		36		02Bo41						
1920.7(3)	$\langle 3^+ \rangle$	≈ 0.03	25**	$\langle 0.01 \rangle$	02Bo41		0.8(4)*	1.4(7)*	1.2(6)*		
1941.3(1)	1, 3	0.49(5)	4		02Bo41		4(2)*	42(13)*	21(7)*		
1951.3(1)	$\langle 1^- \rangle$	0.10(3)	9*		02Bo41		11(3)*	12(4)*			
1955.7(3)	$\langle 5^+ \rangle$		52		02Bo41						
1962.8(2)	1, 3	0.41(4)			02Bo41		8(3)*	20(10)*	8(3)*		28(8)*
1985.2(3)	5 ⁺		63	0.029	02Bo41						
1986.5(2)	1, 3	0.12(3)			02Bo41		7(4)*	5(3)*			

(continued)

 $^{181}_{72}\text{Hf}$

E^*	$2J^\pi$	I_γ	σ (d,p)	$S_{\ell j}$	Ref.	Branching ratios in percentage					
[keV]		%	$\mu\text{b/sr}$	(d,p)		$\begin{smallmatrix} E_f^*: \\ 2J_f^\pi: \end{smallmatrix}$	0.0 1 $^-$	45.8 3 $^-$	98.6 5 $^-$	204 7 $^-$	252 3 $^-$
1998.0(1)	1,3	0.34(7)			02Bo41			13(5)*			11(3)*
2026.0(4)			9		02Bo41						
2032.7(2)	1 $^-$	0.29(3)	73	0.056	02Bo41		7(4)*	21(7)*			10(5)*
2053.2(9)			11	0.009	02Bo41						
2082.3(3)	3 $^-$		25		02Bo41						
2096.6(5)	$\langle 7^+ \rangle$		5	$\langle 0.008 \rangle$	02Bo41						
2109.7(4)			16		02Bo41						
2120.6(4)			7		02Bo41						
2128.8(4)			11		02Bo41						
2140.42(8)	1 $^-$,3 $^-$	1.1(3)			02Bo41		36(5)*	51(10)*	13(10)*		16(5)*
2147.8(10)	1 $^-$,3 $^+$	0.26(3)	18		02Bo41		8(4)*				18(9)*
2162.2(4)	3 $^+$ $\langle 5^- \rangle$	0.09(5)	49		02Bo41			7(6)*	3(2)*		
2175.5(6)	$\langle 11^- \rangle$		6	$\langle 0.01 \rangle$	02Bo41						
2194.9(1)	3 $^-$	0.66(7)	25		02Bo41		16(8)*	11(3)*			8(3)*
2200.6(3)	9 $^+$		156	0.083	02Bo41						
2203.0(2)	$\langle 1 \rangle$,3 $^-$	0.41(4)			02Bo41		5(3)*	1.4(7)*			3.6(18)*
2215.9(5)	1 $^-$	0.10(5)	64	0.055	02Bo41				16(5)*		
2224.0(5)	$\langle 3^-, 5^+ \rangle$		11		02Bo41						
2230.2(4)	$\langle 7^+, 9^+ \rangle$		17		02Bo41						
2247.0(3)	1 $^-$		177	0.141	02Bo41						
2254.5(3)	$\langle 3^+, 5^- \rangle$		176		02Bo41						
2257.9(2)	1 $^-$,3 $^-$	0.55(6)			02Bo41		10(5)*	5(3)*			
2271.3(1)	3 $^-$	0.42(4)	8		02Bo41		9(4)*				
2282.5(5)	$\langle 3^- \rangle$	0.13(3)	35	0.01	02Bo41		6(3)*	7(3)*			
2285.4(3)	1,3	0.12(2)			02Bo41		2(1)*	10(5)*			
2294.1(4)	11 $^-$,13 $^+$		35		02Bo41						
2310.2(4)			25		02Bo41						
2324.2(4)	$\langle 3^- \rangle$	0.28(5)	25		02Bo41		23(5)*	32(21)*			
2341.5(8)	1,3	0.24(5)	47***		02Bo41						
2352.7(5)	$\langle 3^- \rangle$	≈ 0.1	16		02Bo41		26(8)*	9(5)*			
2365.7(1)	$\langle 3^- \rangle$	0.56(5)	17*	$\langle 0.01 \rangle$	02Bo41		4(2)*	3(2)*	10(4)*		3(2)*
2369.7(5)	1,3				02Bo41		2(1)*	2(1)*			4(2)*
2374.2(9)			27*		02Bo41						
2396.0(3)	1,3	0.48(5)			02Bo41		16(6)*	14(6)*			
2399.3(6)	$\langle 3^- \rangle$		18	0.01	02Bo41			18(6)*	4(3)*		
2404.0(3)	1,3				02Bo41		4(2)*	6(3)*			1(1)*
2408.8(8)	$\langle 3^- \rangle$	0.47(5)	14	$\langle 0.01 \rangle$	02Bo41		3(2)*	4(2)*			4(3)*
2434.9(2)	1,3	0.10(3)			02Bo41		7(2)*	3(2)*			
2440.6(6)	1,3	0.23(5)	12**		02Bo41						
2448.5(4)	1 $^-$,3	0.33(7)	11		02Bo41		8(4)*		4(3)*		
2455.2(6)	1 $^-$,3	0.29(9)			02Bo41		11(4)*	8(4)*	9(4)*		
2458.9(3)			18**		02Bo41						
2499.1(5)			11		02Bo41						
2508.4(7)	1,3	≈ 0.06	9		02Bo41			6(3)*			
2515.5(3)	3 $^-$		65	0.025	02Bo41						

(continued)

 $^{181}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	I_γ %	σ (d,p) $\mu\text{b/sr}$	$S_{\ell j}$ (d,p)	Ref.	Branching ratios in percentage					
						E_f^* : $2J_f^\pi$:	0.0 1 ⁻	45.8 3 ⁻	98.6 5 ⁻	204 7 ⁻	252 3 ⁻
2533.9(5)			7		02Bo41						
2559.1(6)			8		02Bo41						
2566.7(7)	1 ⁻ ,3	0.20(6)			02Bo41		9(4)*	4(3)*	7(3)*		
2575.1(3)	3 ⁻	0.23(5)	21		02Bo41		11(6)*	6(3)*			
2588.2(5)	$\langle 3^+ \rangle$		18		02Bo41						
2597.2(5)	5 ⁻		31		02Bo41						
2597.7(5)	1,3	0.20(5)			02Bo41		9(5)*	2(2)*			2(1)*
2602.2(2)	1 ⁻ ,3	0.13(4)			02Bo41		4(2)*	5(3)*	2(1)*		
2609.3(8)	1,3	0.39(4)			02Bo41						
2613.5(4)	1,3				02Bo41		27(10)*	12(10)*			
2616.8(4)			27		02Bo41						
2626.6(1)	$\langle 1 \rangle, 3^-$	0.49(5)	21		02Bo41		16(4)*	8(2)*			8(2)*
2642.0(3)	$\langle 1 \rangle, 3^-$	0.51(15)	42		02Bo41		7(2)*	12(5)*			
2659.8(4)			37		02Bo41						
2672.8(5)	$\langle 1^-, 3^- \rangle$	0.23(6)	12		02Bo41						
2677.8(7)		≈ 0.08			02Bo41						
2684.9(4)	$\langle 3^- \rangle$		45		02Bo41						
2692.8(3)	$\langle 3^+ \rangle$	0.2(1)	18		02Bo41		10(6)*	24(6)*			
2739.7(6)	$\langle 1^-, 3^+ \rangle$		32		02Bo41						
2751.6(6)			24		02Bo41						
2758.6(5)	1,3	0.42(8)			02Bo41						
2764.8(1)	1 ⁻ ,3	0.59(12)	15		02Bo41		21(4)*	16(4)*			4(3)*
2772.2(1)	1 ⁻ ,3 ⁻	1.45(15)			02Bo41		17(4)*				
2795.8(6)	3	≤ 0.4	19		02Bo41						
2815.9(6)	$\langle 9^+ \rangle$		44	$\langle 0.02 \rangle$	02Bo41						
2832.8(2)	3	0.28(5)			02Bo41				28(8)*		
2846.9(6)			23		02Bo41						
2850.7(2)	1 ⁻ ,3	0.29(10)			02Bo41		5(3)*	14(3)*			15(5)*
2866.5(5)	1,3	≤ 0.4	37		02Bo41						
2896.6(5)	1,3	≈ 0.2			02Bo41						
2901.2(6)	$\langle 7^- \rangle$		29		02Bo41						
2916.2(7)	$\langle 1^-, 3^- \rangle$		28		02Bo41						
2932.8(7)	$\langle 3^+ \rangle$		22		02Bo41						
2935.8(8)	1,3	0.38(8)			02Bo41						
2950.2(11)	$\langle 1^-, 3^+ \rangle$	0.33(9)	15		02Bo41						
2983.6(2)	1,3	≈ 0.3			02Bo41		19(6)*	15(8)*			
2985.9(6)	$\langle 1^-, 3^+ \rangle$	≈ 0.3	49		02Bo41						
3001.6(2)	$\langle 3^- \rangle$	0.25(8)	26		02Bo41		15(8)*	5(4)*			
3007.8(4)	1,3	≈ 0.2			02Bo41						

(continued)

 $^{181}_{72}\text{Hf}$

E^*	$2J^\pi$	I_γ	σ (d,p)	$S_{\ell j}$	Ref.	Branching ratios in percentage					
[keV]		%	$\mu\text{b/sr}$	(d,p)		E_f^* : $2J_f^\pi$:	0.0 1 ⁻	45.8 3 ⁻	98.6 5 ⁻	204 7 ⁻	252 3 ⁻
3052.3(8)	$\langle 3^- \rangle$	≈ 0.2	28		02Bo41						
3097.0(1)	$\langle 1^- \rangle$	0.64(18)	24		02Bo41		19(4)*	22(7)*	8(9)*		13(3)*

Additional data on this isotope can be found in [02Pr08, 02Gu13, 02Bo41, 01Sh36, 01Ch89, 01Ch10, 00PrZZ, 99BeZX, 95Bo20, 93Bo27, 91Bo56].

* Intensity of γ -rays in units of quanta per 10000 neutron capture events.

** Measured at the angle of 40°, data on σ (d,p) can be found also in [05Wu06].

*** measured at the angle of 14°, many data for this angle are given additionally in [02Bo41].

a,b,c – members of rotational bands built on 1/2⁻ [510], 3/2⁻ [512], 7/2⁻ [503] orbital [02Gu13].

12 bands are assigned to excited states of this nucleus in [05Wu06], see branchings therein.

The ground state has $T_{1/2}=42.39(06)$ days [91Fi01].

Values I_γ in the first column [02Bo41] correspond to the neutron capture state decay.

For levels with E^* less then 1210 keV values Br are from [91Fi01], for levels with the larger energies

– intensities I_γ from [02Bo41] are given instead of Br.

Uncertainties in E^* abd branching ratios are given in Supplement.

Energy levels and branching ratios [02Bo41, 91Fi01]. Part 2

 $^{181}_{72}\text{Hf}$

E^*	$2J^\pi$	Branching ratios in percentage									
[keV]		E_f^* : $2J_f^\pi$:	329 5 ⁻	441 7 ⁻	595 9 ⁺	664 7 ⁻	1045 1 ⁻	1055 5 ⁻	1086 3 ⁻	1117 3 ⁻	1153 1 ⁻
663.8(5) ^c	7 ⁻		100								
904.33(6)	7 ⁻		23(2)	7(2)		7(2)					
1210.5(1)	5 ⁺				88(9)*			3*			
1328.9(1)	1–5 ⁻									41(12)*	
1347.8(1)	1–5									11(4)*	
1363.0(1)	1–5 ⁻									11(4)*	
1635.8(2)	$\langle 5 \rangle$					7.5(23)*		8.2(25)*			
1712.65(6)	1 ⁻ , $\langle 3^- \rangle$		5(3)*								4(2)*
1737.0(1)	3 ⁻		2(1)*								
1805.38(8)	1,3									8(2)*	
1842.55(6)	1 ⁻ , $\langle 3^- \rangle$										3.4
1895.7(1)	1 ⁻ , 3 ⁻		5(2)*								
1998.0(1)	1,3		22(6)*								3(2)*
2194.9(1)	3 ⁻						4(2)*				
2203.0(2)	$\langle 1 \rangle$, 3 ⁻		11(3)*	2.3(4)*							
2257.9(2)	1 ⁻ , 3 ⁻						10(5)*		29(6)*		
2271.3(1)	3 ⁻		33(6)*					12(6)*			
2324.2(4)	$\langle 3^- \rangle$					9(3)*					
2365.7(1)	$\langle 3^- \rangle$		3(2)*							6(3)*	10(4)*
2369.7(5)	1,3		1(1)*								
2404.0(3)	1,3		$\approx 4^*$								
2408.8(8)	$\langle 3^- \rangle$		$\approx 4^*$								

(continued)

 $^{181}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage									
		$E_f^*:$ $2J_f^\pi:$	329 5 ⁻	441 7 ⁻	595 9 ⁺	664 7 ⁻	1045 1 ⁻	1055 5 ⁻	1086 3 ⁻	1117 3 ⁻	1153 1 ⁻
2448.5(4)	1 ⁻ ,3		8(4)*								
2602.2(2)	1 ⁻ ,3		3(1)*								
2609.3(8)	1,3		3(1)*								
2626.6(1)	⟨1⟩,3 ⁻		9(3)*								
2764.8(1)	1 ⁻ ,3		19(9)*								
2832.8(2)	3		16(5)*								
2850.7(2)	1 ⁻ ,3		5(3)*								
3097.0(1)	⟨1 ⁻ ⟩								5(2)*	10(5)*	

Energy levels and branching ratios [02Bo41, 91Fi01]. Part 3

 $^{181}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage									
		$E_f^*:$ $2J_f^\pi:$	1178 5 ⁻	1210 5 ⁺	1230 3 ⁻	1261 5 ⁻	1323 1 ⁻ ,3 ⁻	1329 1-5	1348 1-5	1357 3 ⁻	1363 1,3
1712.65(6)	1 ⁻ ,⟨3 ⁻ ⟩				5(2)						
1805.38(8)	1,3						86				
1847.6(2)	3 ⁻		7(2)*								
2271.3(1)	3 ⁻			37(8)*							
2365.7(1)	⟨3 ⁻ ⟩			4.1*	8(4)*	12(6)*					
2575.1(3)	3 ⁻			6(4)*							
2772.2(1)	1 ⁻ ,3 ⁻							18(5)	9(2)*	3(1)*	4(1)*
3097.0(1)	⟨1 ⁻ ⟩									8(2)*	

Energy levels and branching ratios [02Bo41, 91Fi01]. Part 4

 $^{181}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	Branching ratios in percentage				
		$E_f^*:$ $2J_f^\pi:$	1454 1 ⁺	1618 ⟨1,3⟩	1896 1 ⁻ ,3 ⁻	2195 3 ⁻
1842.55(6)	1 ⁻ ,⟨3 ⁻ ⟩		7			
1941.3(1)	1,3			67		
1998.0(1)	1,3		5(3)*			
2642.0(3)	⟨1⟩,3 ⁻				5(3)*	
2772.2(1)	1 ⁻ ,3 ⁻		3(1)*			
3097.0(1)	⟨1 ⁻ ⟩					3(1)*

Energy levels and branching ratios [95Si04].

¹⁸²Hf
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E^*	J^π	L	$d\sigma/d\Omega$	$T_{1/2}$ or	Ref.	Branching ratios in percentage					
[keV]		(t,p)	$\mu\text{b/sr}$	Γ_{cm}		E_{f}^* : J_{f}^π :	0.0 0 ⁺	97.8 2 ⁺	322 4 ⁺	666. 6 ⁺	1122 8 ⁺
0.0	0 ⁺		287	8.90(9) yr	83Bu03						
97.79(9)	2 ⁺		31		83Bu03		100				
322.18(13)	4 ⁺		23		83Bu03			100			
666.28(17)	6 ⁺		5		83Bu03				100		
818.4(4)	1,2 ⁺		19		83Bu03		50(12)	50(5)			
905.9(5)								100			
1022			11		83Bu03						
1034	0 ⁺	0	15		83Bu03						
1122.08(18)	8 ⁺									100	
1172.88(18)	8 ⁻			61.5(15) m						64(5)	36(4)
1265	0 ⁺	0	8		83Bu03						
1465			13		83Bu03						
1497			51		83Bu03						
≈1590			6		83Bu03						
1724			7		83Bu03						
1829			14		83Bu03						
1885			10		83Bu03						
1915			38		83Bu03						
2214			22		83Bu03						
2280			32		83Bu03						
			83Bu03		Ref.						

Additional data on this isotope can be found in [01Ch89, 01Ch10].

Energy levels and branching ratios [92Fi02].

¹⁸³Hf
72

E^*	$2J^\pi$	$T_{1/2}$ or
[keV]		Γ_{cm}
0	$\langle 3^- \rangle$	1.067(17) h
68.57(18)	$\langle 5^- \rangle$	
168.1(3)	$\langle 7^- \rangle$	
205.7(4)	$\langle 5^- \rangle$	
316.9(4)	$\langle 7^- \rangle$	
1125.3(3)	$\langle 5^+ \rangle$	
1255.8(6)	$\langle 7^+ \rangle$	
1604.8(7)		

Energy levels and branching ratios [92Fi02]. Part 2

 $^{183}_{72}\text{Hf}$

E^* [keV]	$2J^\pi$	$E_f^*:$ $2J_f^\pi:$	Branching ratios in percentage		
			0 $\langle 3^- \rangle$	68.57 $\langle 5^- \rangle$	168.1 $\langle 7^- \rangle$
68.57(18)	$\langle 5^- \rangle$		100		
168.1(3)	$\langle 7^- \rangle$		75(8)	25(5)	
205.7(4)	$\langle 5^- \rangle$		71(21)	29(7)	
316.9(4)	$\langle 7^- \rangle$		19(6)	65(6)	16(3)
1125.3(3)	$\langle 5^+ \rangle$		56(6)	37(4)	7(2)
1255.8(6)	$\langle 7^+ \rangle$			33(17)	67(17)
1604.8(7)				56(28)	44(3)