

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	S. -c. Wu	NDS 106,367 (2005)	31-Aug-2005

$Q(\beta^-)=1036.4$ 23; $S(n)=5694.80$ 7; $S(p)=8.02\times 10^3$ 7; $Q(\alpha)=1154.6$ 18 [2012Wa38](#)

Note: Current evaluation has used the following Q record 1029.8 21 5694.80 7 8020 70 1152.4 18 [2003Au03](#).

Other Reactions:

$^{181}\text{Ta}(\gamma, \pi^+)$: [1999Sa08](#), [1985To14](#), [1984Mc11](#).

$^{181}\text{Ta}(e, e' \pi^+)$: [1989FI02](#), [1987An15](#).

$^{181}\text{Ta}(e, \gamma)$, $^{181}\text{Ta}(\text{pol } e, \gamma)$: [1988Sa38](#), [1986De06](#).

$^{181}\text{Ta}(n, p)$: [2001Ko35](#), [2000Be62](#), [1998Lo12](#), [1992Ko17](#), [1989Sc20](#), [1988Wo05](#), [1987Ho22](#), [1982Lu06](#), [1981Ch20](#), [1980Ho23](#), [1973De58](#), [1969Br25](#).

$^{184}\text{W}(n, \alpha)$: [1998Ka03](#), [1975Qa01](#).

 ^{181}Hf Levels

Band assignments here indicate the dominant configurations assigned in $^{180}\text{Hf}(n, \gamma)$ E=thermal ([2002Bo41](#)). However, many configurations are expected to be mixed. See Table of results of the Quasiparticle Phonon Model (QPM) and the standard particle-rotor model (PRM) calculations of [2002Bo41](#) for those authors' calculations of likely admixtures.

Cross Reference (XREF) Flags

A	$^{181}\text{Lu } \beta^-$ decay	D	$^{179}\text{Hf}(t, p)$
B	$^{180}\text{Hf}(n, \gamma)$ E=thermal	E	$^{180}\text{Hf}(d, p\gamma)$
C	$^{180}\text{Hf}(\text{pol } d, p)$, $^{180}\text{Hf}(d, p)$	F	$^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$

E(level) [†]	J ^π	T _{1/2}	XREF	Comments
0.0 [‡]	1/2 ⁻	42.39 d 6	ABC EF	$\% \beta^- = 100$ J ^π : L=1 in (pol d,p). T _{1/2} : weighted average of 42.29 d 10 (1966Br20), 42.45 d 8 (1960Li14), and 42.4 d 2 (1968Re04).
45.763 [‡] 24	3/2 ⁻		ABC F	J ^π : L=1 in (pol d,p).
98.603 [‡] 25	5/2 ⁻		ABC EF	J ^π : L=3 in (pol d,p).
203.992 [‡] 25	7/2 ⁻		ABC EF	J ^π : L=3 in (pol d,p).
251.991 [#] 21	3/2 ⁻		ABC EF	J ^π : L=1 in (pol d,p).
303.88 [‡] 4	9/2 ⁻		BC EF	J ^π : L=5 in (pol d,p).
329.309 [#] 22	5/2 ⁻		ABC E	J ^π : L=3 in (pol d,p).
440.68 [#] 3	7/2 ⁻		ABC EF	XREF: C(441.09). J ^π : L=3 in (pol d,p).
465.93 [‡] 4	11/2 ⁻		BC EF	J ^π : 162γ to 9/2 ⁻ , 262γ to 7/2 ⁻ , rotational band member.
573.64 [#] 5	9/2 ⁻		BC E	J ^π : L=5 in (pol d,p).
595.27 ^l 4	9/2 ⁺		BCDEF	J ^π : L=4 in (pol d,p), L=0 in (t,p). Configuration= $\nu 9/2[624]$. T _{1/2} : 1.1 μs +22-4 from $^{180}\text{Hf}(n, \gamma)$; 80 μs 5 from $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$. The two half-lives probably belong to two different states. See comments on 620 level. T _{1/2} <1 μs if no gammas with E<100 keV deexcite this level, from (t,pγ) coincidence data.
617.20 ^m 8	(11/2 ⁺)		DEF	XREF: D(622)E(617.24). E(level): See comments on 619.9 level. J ^π : 22.1γ M1 to 9/2 ⁺ , 313γ to 9/2 ⁻ .
619.9 [‡] 3	(13/2 ⁻)		C E	XREF: E(617.24).

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Adopted Levels, Gammas (continued) ^{181}Hf Levels (continued)

E(level) [†]	J ^π	T _{1/2}	XREF	Comments
Additional information 1.				
E(level): There could be a 3 keV transition yet unobserved, to clarify the existence of the 616.9 keV level as the discrepant T _{1/2} measured for the 595 keV state from $^{180}\text{Hf}(n,\gamma)$ and $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$.				
663.53 [@] 3	7/2 ⁻		ABC E	J ^π : L=3 from (pol d,p).
749.36 [#] 6	11/2 ⁻		C E	XREF: C(750.7). J ^π : L=5 from (pol d,p).
758.63 ^m 21	13/2 ⁺		CD F	XREF: F(755.6). Additional information 2. J ^π : L=6 from (pol d,p).
E(level): Assumption made that the energies for the ν11/2[615] band members in $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$ are too low by 3 keV.				
799.95 [@] 8	9/2 ⁻		BC E	J ^π : L=5(+6) from (pol d,p), band member.
805.57 ^l 11	11/2 ⁺		DE	J ^π : 210γ to 9/2 ⁺ , band structure.
835 [‡] 1	(15/2 ⁻)		C E	XREF: E(830.94). J ^π : 365γ to 11/2 ⁻ , possible band member.
904.24 ^{&} 5	7/2 ⁻		ABC E	XREF: C(905.5). J ^π : L=3 from (pol d,p). Proposed configuration=7/2[514].
928.1 ^m 7	(15/2 ⁺)		F	
930.03 [#] 8	13/2 ⁻		C E	J ^π : 357γ to 9/2 ⁻ , 464γ to 11/2 ⁻ , band member.
964.99 [@] 9	11/2 ⁻		C E	J ^π : 165γ to 9/2 ⁻ , 302γ to 7/2 ⁻ , band member.
1009.07 ^l 15	13/2 ⁺		CDE	XREF: D(1010). J ^π : L=(6) from (pol d,p), 203γ to 11/2 ⁺ , band member.
1031.7 ^{&} 4	9/2 ⁻		C	J ^π : L=5 from (pol d,p).
1043.5 8	(17/2 ⁺)	≈100 μs	F	π9/2[514]π7/2[404]ν1/2[510] state, tentative assignment in $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$ (2001Sh36). T _{1/2} : estimated from the observed intensities of γ rays in the double-gated spectrum from the delayed γ-γ-γ cube.
1045.00 ⁱ 7	1/2 ⁻		B	J ^π : fed by primary γ in (n,γ), 793γ to 3/2 ⁻ , 946γ to 5/2 ⁻ , band structure.
1055.95 ^a 5	5/2 ⁻		B	J ^π : 753γ to 9/2 ⁻ , 1056γ to 1/2 ⁻ , band head of ν5/2[512].
1086.19 ⁱ 5	3/2 ⁻		B	J ^π : fed by primary γ in (n,γ), 882γ to 7/2 ⁻ , 1086γ to 1/2 ⁻ , band structure.
1117.18 ^b 5	3/2 ⁻		B	J ^π : fed by primary γ in (n,γ), 1019γ to 5/2 ⁻ , 1117γ to 1/2 ⁻ , band head of ν1/2[510]-Q ₂₂ .
1122.3 [?] m 12	(17/2 ⁺)		F	
1127	(13/2 ⁻)		C	Proposed configuration: 7/2[503] band member.
1134.67 ⁱ 10	5/2 ⁻		B	J ^π : 831γ to 9/2 ⁻ , 1135γ to 1/2 ⁻ , band structure.
1153.15 ^c 8	1/2 ⁻		B	J ^π : fed by primary γ in (n,γ), 1107γ to 3/2 ⁻ , band head of ν1/2[521].
1157.41 ^a 19	7/2 ⁻		BC	J ^π : L=3 from (pol d,p).
1178.19 ^b 14	5/2 ⁻		B	J ^π : 738γ to 7/2 ⁻ , 1132γ to 3/2 ⁻ , band structure.
1210.50 9	5/2 ⁺		B D	J ^π : 156γ to 5/2 ⁻ , 615γ to 9/2 ⁺ . Configuration=ν9/2[624]-Q ₂₂ .
1229.72 ^c 9	3/2 ⁻		B	J ^π : fed by primary γ in (n,γ), 1026γ to 7/2 ⁻ , 1230γ to 1/2 ⁻ , band structure.
1242.7 11	(19/2 ⁺)		F	
1260.68 ^c 10	5/2 ⁻		B	J ^π : 1056γ to 7/2 ⁻ , band structure.
1282			D	
1287.3 ^a 6	9/2 ⁻		BC	J ^π : 231γ to 5/2 ⁻ , band structure.
1312			D	
1321.87 ^d 3	3/2 ⁻		BC	J ^π : L=1 from (pol d,p).
1328.94 9	1/2,3/2,5/2 ⁻		B	J ^π : 1329γ to 1/2 ⁻ .
1347.2 [?] m 13	(19/2 ⁺)		F	

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Adopted Levels, Gammas (continued)

^{181}Hf Levels (continued)					
E(level) [†]	J ^π	T _{1/2}	XREF	Comments	
1347.75 10	1/2,3/2,5/2		B	J ^π : 1302γ to 3/2 ⁻ .	
1356.98 ⁸ 10	3/2 ⁻		BC	XREF: C(1356.2).	
				J ^π : fed by primary γ in (n,γ), 1259γ to 5/2 ⁻ , 1357γ to 1/2 ⁻ ; member of 1/2 ⁻ [770] band; L=(1) from (pol d,p).	
1362.98 8	1/2,3/2,5/2 ⁻		B	J ^π : 1362γ to 1/2 ⁻ .	
1385.0 11	(19/2 ⁺)		F	π9/2[514]π7/2[404]ν3/2[512] state.	
1396.92 ^d 15	5/2 ⁻		BC	J ^π : L=3 from (pol d,p).	
1400.7 4	(7/2 ⁻)		C	J ^π : L=3(2) from (pol d,p).	
				Possible configuration: 1/2[770] band member.	
1424.44 10	5/2 ⁻		BC	J ^π : L=3 from (pol d,p).	
				Configuration ν5/2[503].	
1435.5 4			C		
1444.2 6			C		
1451.99 ^e 20	5/2 ⁺		BC	J ^π : L=2 from (pol d,p).	
1453.3 ^e 4	1/2 ⁺		B	J ^π : fed by primary γ in (n,γ), 1454γ to 1/2 ⁻ , band structure.	
1492.63 ^d 12	7/2 ⁻		B	J ^π : γ to 7/2 ⁻ , band structure.	
1494.17 ⁸ 10	1/2 ⁻		BC	J ^π : fed by primary γ in (n,γ), 1448γ to 3/2 ⁻ , 1494γ to 1/2 ⁻ ; member of 1/2 ⁻ [770] band; L=(1) from (pol d,p).	
1497.1 5			C		
1505.14 ^f 22	1/2 ⁺		B	J ^π : 1460γ to 3/2 ⁻ , 1505γ to 1/2 ⁻ , band structure.	
1505.2 ^f 2	5/2 ⁺		C	J ^π : L=2 from (pol d,p).	
				Proposed configuration: 1/2[660] band member.	
1520.2 ^e 2	9/2 ⁺		C	J ^π : L=4 from (pol d,p).	
1568.4 5			C		
1574.7 ^f 3	9/2 ⁺		C	J ^π : L=4 from (pol d,p).	
1615.75 ^e 8	3/2 ⁺		BCD	J ^π : L=2 from (pol d,p).	
1629.47 ^h 6	1/2 ⁻		BC	XREF: C(1628.4).	
				J ^π : L=1 from (pol d,p).	
1635.88 15	(5/2)		B	J ^π : 972γ to 7/2 ⁻ , 1385γ to 3/2 ⁻ .	
1641.54 7	1/2 ⁻ ,3/2 ⁺		BC	J ^π : fed by primary γ in (n,γ), L=(1,2,3) from (pol d,p), 1543γ to 5/2 ⁻ .	
1656.53 ^f 12	3/2 ⁺		BC	J ^π : L=2 from (pol d,p).	
1667.5 11	(13/2 ⁺)		C	Possible configuration: 1/2[651] band member.	
1682.90 ^h 14	3/2 ⁻		BCD	XREF: C(1682.3)D(1687).	
				J ^π : L=1 from (pol d,p).	
1696.5 3	9/2 ⁻		CD	XREF: D(1687).	
				J ^π : L=5 from (pol d,p).	
				Proposed configuration: 9/2[505].	
1705.5 4	(1/2 ⁺)		C	J ^π : L=(0) from (pol d,p).	
1712.65 ^j 7	1/2 ⁻ , (3/2 ⁻)		B	J ^π : fed by primary γ in (n,γ), 1614γ to 5/2 ⁻ , 1712γ to 1/2 ⁻ .	
1716.99 ^j 6	3/2 ⁻		B	J ^π : fed by primary γ in (n,γ), 1513γ to 7/2 ⁻ , 1717γ to 1/2 ⁻ .	
1726.5 3	(5/2 ⁻)		C	J ^π : L=(3) from (pol d,p).	
				Possible configuration: 1/2[770] band member.	
1736.95 13	3/2 ⁻		BC	J ^π : fed by primary γ in (n,γ), L=1,(2) from (pol d,p).	
1741.9 13	(25/2 ⁻)	1.5 ms 5	F	%IT=100 π9/2[514]π7/2[404]ν9/2[624] state, tentative assignment (2001Sh36). T _{1/2} : from $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$.	
1746.6 ^h 5	5/2 ⁻		BC	J ^π : L=3 from (pol d,p).	
1766.4 4	(5/2 ⁻)		C	J ^π : L=(2,3) from (pol d,p).	
1770.03 13	1/2,3/2		B	J ^π : fed by primary γ in (n,γ), 1724γ to 3/2 ⁻ , 1771γ to 1/2 ⁻ .	
1774.9 4	5/2 ⁻		C	J ^π : L=3 from (pol d,p).	
1799.8 4	5/2 ⁻		C	J ^π : L=3 from (pol d,p).	
1805.41 8	1/2,3/2		B	J ^π : fed by primary γ in (n,γ), 1761γ to 3/2 ⁻ , 1805γ to 1/2 ⁻ .	
1808.2 4	3/2 ⁺		C	J ^π : L=2 from (pol d,p).	

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Adopted Levels, Gammas (continued) ^{181}Hf Levels (continued)

E(level) [†]	J ^π	XREF	Comments
1813.2 4		C	
1834.3 4	5/2 ⁻	C	J ^π : L=2,3 from (pol d,p). Possible configuration: 1/2[770]+1/2[501] band member.
1842.52 ^j 6	1/2 ⁻ , (3/2 ⁻)	B	J ^π : fed by primary γ in (n,γ), 1744γ to 5/2 ⁻ , 1843γ to 1/2 ⁻ .
1847.53 ^j 14	3/2 ⁻	BC	XREF: C(1846.9). J ^π : L=1 from (pol d,p).
1866.99 15	1/2, 3/2	BC	XREF: C(1865.1). J ^π : fed by primary γ in (n,γ), L=(2) from (pol d,p).
1873.8 3	5/2 ⁻	C	J ^π : L=3 from (pol d,p).
1885.8 5	(7/2 ⁺)	C	J ^π : L=(4) from (pol d,p). Possible configuration: 1/2[660] band member.
1895.67 8	1/2 ⁻ , 3/2 ⁻	BC	XREF: C(1894.0). J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p), 1797γ to 5/2 ⁻ , 1895γ to 1/2 ⁻ .
1908.3 3	(5/2 ⁺)	C	J ^π : L=2 from (pol d,p).
1920.7 3	(3/2 ⁺)	BC	J ^π : fed by primary γ in (n,γ), L=(2) from (pol d,p), 1921γ to 1/2 ⁻ . Configuration=ν3/2[642].
1941.32 12	1/2, 3/2	BC	J ^π : fed by primary γ in (n,γ), 1843γ to 5/2 ⁻ , 1941γ to 1/2 ⁻ .
1951.32 13	(1/2 ⁻)	BC	J ^π : fed by primary γ in (n,γ), 1905γ to 3/2 ⁻ , 1952γ to 1/2 ⁻ .
1955.7 3	(5/2 ⁺)	C	J ^π : L=(1,2) from (pol d,p).
1962.88 16	1/2 ⁻ , 3/2	B	J ^π : fed by primary γ in (n,γ), 1864γ to 5/2 ⁻ , 1964γ to 1/2 ⁻ .
1985.2 3	5/2 ⁺	C	J ^π : L=2 from (pol d,p). Proposed configuration: 3/2[642] band member.
1986.47 20	1/2, 3/2	B	J ^π : fed by primary γ in (n,γ), 1941γ to 3/2 ⁻ , 1986γ to 1/2 ⁻ .
1997.88 13	1/2 ⁻ , 3/2	B	J ^π : fed by primary γ in (n,γ), 844γ to 1/2 ⁻ , 1668γ to 5/2 ⁻ .
2026.0 4		C	
2032.74 ^k 17	1/2 ⁻	BC	XREF: C(2034.3). J ^π : L=1 from (pol d,p).
2053.2 9		C	Possible configuration=11/2[651].
2082.3 3	3/2 ⁻	C	J ^π : L=1 from (pol d,p). Proposed configuration: 1/2[501] band member.
2096.6 5	(7/2 ⁺)	C	J ^π : L=(4) from (pol d,p). Possible configuration: 3/2[642] band member.
2109.7 4		C	
2120.6 4		C	
2128.8 4		C	
2140.43 8	1/2 ⁻ , 3/2	B	J ^π : fed by primary γ in (n,γ), 2042γ to 5/2 ⁻ , 2140γ to 1/2 ⁻ .
2147.8 4	1/2 ⁻ , 3/2 ⁺	BC	J ^π : fed by primary γ in (n,γ), L=1,2 from (pol d,p).
2162.1 5	3/2 ⁺ , (5/2 ⁻)	BC	J ^π : fed by primary γ in (n,γ), L=2,3 from (pol d,p).
2175.5 6	(11/2 ⁻)	C	Proposed configuration: 1/2[501] band member.
2194.91 13	3/2 ⁻	BC	XREF: C(2194.4). J ^π : L=1 from (pol d,p).
2200.6 3	9/2 ⁺	C	J ^π : L=4 from (pol d,p). Proposed configuration: 3/2[642] band member.
2203.09 17	3/2 ⁻	B	J ^π : fed by primary γ in (n,γ), 1763γ to 7/2 ⁻ , 2203γ to 1/2 ⁻ .
2216.2 6	1/2 ⁻	BC	XREF: C(2214.9). J ^π : L=1 from (pol d,p).
2224.0 5	(3/2 ⁻ , 5/2 ⁺)	C	Proposed configuration: 1/2[501] band member. J ^π : L=1,2,(3) from (pol d,p).
2230.2 4		C	J ^π : L=(4) from (pol d,p).
2247.0 3	1/2 ⁻	C	J ^π : L=1 from (pol d,p). Proposed configuration: 1/2[501] band member.
2254.5 3	(3/2 ⁺ , 5/2 ⁻)	C	J ^π : L=(2,3) from (pol d,p).
2257.90 17	1/2 ⁻ , 3/2 ⁻	B	J ^π : fed by primary γ in (n,γ), 2212γ to 3/2 ⁻ , 2258γ to 1/2 ⁻ .
2271.24 11	3/2 ⁻	BC	J ^π : fed by primary γ in (n,γ), 1061γ to 5/2 ⁺ , 1942γ to 5/2 ⁻ , 2271γ to 1/2 ⁻ .
2282.4 4	(3/2 ⁻)	BC	J ^π : L=(1) from (pol d,p).

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Adopted Levels, Gammas (continued) ^{181}Hf Levels (continued)

E(level) [†]	J ^π	XREF	Comments
2285.4 3	1/2,3/2	B	Proposed configuration: 1/2[501] band member.
2294.1 4	11/2 ⁻ ,13/2 ⁺	C	J ^π : 2240γ to 3/2 ⁻ , 2286γ to 1/2 ⁻ .
2310.2 4		C	J ^π : L=5,6 from (pol d,p).
2324.20 23	(3/2 ⁻)	BC	J ^π : L=3,4 from (pol d,p).
2341.7 12	1/2,3/2	BC	J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p), 1660γ to 7/2 ⁻ .
2352.37 3	(3/2 ⁻)	BC	J ^π : fed by primary γ in (n,γ),
			XREF: C(2351.3).
			J ^π : L=(1) from (pol d,p).
2365.41 12	(3/2 ⁻)	BC	XREF: C(2364.5).
			J ^π : L=(1) from (pol d,p) 1155γ to 5/2 ⁺ .
2369.4 4	1/2 ⁻ ,3/2	B	J ^π : 2040γ to 5/2 ⁻ , 2117γ to 3/2 ⁻ , 2371γ to 1/2 ⁻ .
2374.2 9		C	
2396.0 4	1/2,3/2	B	J ^π : 2350γ to 3/2 ⁻ , 2396γ to 1/2 ⁻ .
2399.4 4	(3/2 ⁻)	BC	J ^π : L=(1) from (pol d,p).
2404.61 23	1/2 ⁻ ,3/2	B	J ^π : 2077γ to 5/2 ⁻ , 2404γ to 1/2 ⁻ .
2407.95 24	(3/2 ⁻)	BC	XREF: C(2407.3).
			J ^π : L=(1) from (pol d,p).
2434.95 23	1/2,3/2	B	J ^π : fed by primary γ in (n,γ), 2389γ to 3/2 ⁻ , 2435γ to 1/2 ⁻ .
2440.4 6	1/2,3/2	BC	J ^π : fed by primary γ in (n,γ), 2188γ to 3/2 ⁻ .
2448.5 3	1/2 ⁻ ,3/2	BC	J ^π : fed by primary γ in (n,γ), 2351γ to 5/2 ⁻ , 2448γ to 1/2 ⁻ .
2455.79 18	1/2 ⁻ ,3/2	B	J ^π : fed by primary γ in (n,γ), 2355γ to 5/2 ⁻ , 2456γ to 1/2 ⁻ .
2458.9 3		C	
2499.1 5		C	
2508.4 9	1/2,3/2	BC	J ^π : fed by primary γ in (n,γ), 2463γ to 3/2 ⁻ .
2515.5 3	3/2 ⁻	C	J ^π : L=1 from (pol d,p).
			Proposed configuration: 3/2[501] band member.
2533.9 5		C	
2559.1 6		C	
2566.72 18	1/2 ⁻ ,3/2	B	J ^π : fed by primary γ in (n,γ), 2467γ to 5/2 ⁻ , 2568γ to 1/2 ⁻ .
2574.6 3	3/2 ⁻	BC	XREF: C(2572.7).
			J ^π : L=1 from (pol d,p).
2588.2 5	(3/2 ⁺)	C	J ^π : L=(2) from (pol d,p).
2597.2 5	5/2 ⁻	C	J ^π : L=3 from (pol d,p).
			Proposed configuration: 3/2[501] band member.
2597.7 4	1/2,3/2	B	J ^π : 2550γ to 3/2 ⁻ , 2598γ to 1/2 ⁻ .
2602.24 19	1/2 ⁻ ,3/2	B	J ^π : 2504γ to 5/2 ⁻ , 2602γ to 1/2 ⁻ .
2610.16 24	1/2 ⁻ ,3/2	B	J ^π : fed by primary γ in (n,γ), 2281γ to 5/2 ⁻ .
2613.6 4	1/2,3/2	B	J ^π : 2567γ to 3/2 ⁻ , 2614γ to 1/2 ⁻ .
2616.8 4		C	J ^π : L=(1),2,3 from (pol d,p).
2626.56 12	(1/2 ⁻),3/2 ⁻	BC	J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p).
2642.38 11	(1/2 ⁻),3/2	BC	XREF: C(2639.0).
			J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p).
2659.8 4		C	J ^π : L=(1,2) from (pol d,p).
2671.3 7	(1/2 ⁻ ,3/2 ⁻)	BC	XREF: C(2673.3).
			J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p).
2679.1 6		B	J ^π : fed by primary γ in (n,γ).
2684.9 4	(3/2 ⁻)	C	J ^π : L=(1) from (pol d,p).
2692.8 3	(3/2 ⁺)	BC	XREF: C(2691.6).
			J ^π : fed by primary γ in (n,γ), L=(2) from (pol d,p).
2739.7 6	(1/2 ⁻ ,3/2 ⁺)	C	J ^π : L=(1,2) from (pol d,p).
2751.6 6		C	
2758.6 5	1/2,3/2	B	J ^π : fed by primary γ in (n,γ), 2759γ to 1/2 ⁻ .
2764.75 12	1/2 ⁻ ,3/2	BC	J ^π : fed by primary γ in (n,γ), 2435γ to 5/2 ⁻ , 2765γ to 1/2 ⁻ .
2772.12 12	1/2 ⁻ ,3/2 ⁻	B	J ^π : fed by primary γ in (n,γ), 1319γ to 1/2 ⁺ , 1416γ to 3/2 ⁻ , 2772γ to 1/2 ⁻ .
2795.8 6	3/2	BC	J ^π : L=(1,2) from (pol d,p).
2815.9 6	(9/2 ⁺)	C	J ^π : L=(4,5) from (pol d,p).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{181}Hf Levels (continued)

E(level) [†]	J ^π	XREF	Comments
2832.79 22	3/2	B	J ^π : fed by primary γ in (n,γ), 2734γ to 5/2 ⁻ .
2846.9 6		C	
2850.70 12	1/2 ⁻ , 3/2	B	J ^π : fed by primary γ in (n,γ), 2521γ to 5/2 ⁻ , 2850γ to 1/2 ⁻ .
2866.0 7	1/2, 3/2	BC	J ^π : L=(1,2) from (pol d,p).
2896.5 6	1/2, 3/2	B	J ^π : fed by primary γ in (n,γ), 2566γ to 5/2 ⁻ , 2896γ to 1/2 ⁻ .
2901.2 6	(7/2 ⁻)	C	J ^π : L=(2,3) from (pol d,p).
2916.2 7	(1/2 ⁻ , 3/2 ⁻)	C	J ^π : L=(1) from (pol d,p).
2932.8 7	(3/2 ⁺)	C	J ^π : L=(2) from (pol d,p).
2935.8 6	1/2 ⁻ , 3/2	B	J ^π : 2837γ to 5/2 ⁻ , 2935γ to 1/2 ⁻ .
2950.3 6	(1/2 ⁻ , 3/2 ⁺)	BC	J ^π : fed by primary γ in (n,γ), L=(1,2) from (pol d,p).
2983.63 19	1/2, 3/2	B	J ^π : fed by primary γ in (n,γ), 2938γ to 3/2 ⁻ , 2984γ to 1/2 ⁻ .
2987.0 10	(1/2 ⁻ , 3/2 ⁺)	BC	J ^π : L=(1,2) from (pol d,p).
3001.59 23	(3/2 ⁻)	BC	J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p).
3007.4 5	1/2, 3/2	B	J ^π : fed by primary γ in (n,γ), 3007γ to 1/2 ⁻ .
3051.6 8	(3/2 ⁻)	BC	J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p).
3096.88 10	(1/2 ⁻)	BC	J ^π : fed by primary γ in (n,γ), L=(1) from (pol d,p).

[†] From least-squares fit to Eγ's with 0.3 keV uncertainties for Eγ's only observed in $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U})\gamma$. Because of the possible unobserved 3 keV transition, the level energies at 619.9 and 758.63 were fixed in the fitting process.

[‡] Band(A): ν1/2[510] band. Rotational parameters: A=12.82, B=4.51, a=0.194, fit to levels J=1/2 to 9/2.

Band(B): ν3/2[512] band. Rotational parameters: A=16.22, B=-35, fit to levels J=3/2 to 9/2.

@ Band(C): ν7/2[503] band. Rotational parameters: A=15.3, B=7.7, fit to levels J=7/2, 9/2, 11/2.

& Band(D): ν7/2[514] band. Rotational parameters: A=14.2, fit to levels J=7/2 and 9/2.

^a Band(E): ν5/2[512] band. Rotational parameters: A=14.54, B=-3.9, fit to levels J=5/2, 7/2, 9/2.

^b Band(F): γ-vibrational band based on ν1/2[510].

^c Band(G): ν1/2[521] band. Rotational parameters: A=15.86, B=9.67, a=0.61, fit to levels J=1/2, 3/2, 5/2.

^d Band(H): admixture of the ν3/2[501] and (ν7/2[503]-2).

^e Band(I): ν1/2[651] band. Rotational parameters: A=9.9, a=4.35, fit to levels J=1/2, 3/2, 5/2 and 9/2.

^f Band(J): ν1/2[660] band. Rotational parameters: A=9.55, a=4.2, fit to levels J=1/2, 3/2, 5/2 and 9/2.

^g Band(K): ν1/2[770] band. Rotational parameters: A=14.09, a=-4.25, fit to levels J=1/2, 3/2 and (5/2) at 1726.

^h Band(L): ν1/2[501] band. Rotational parameters: A=15.28, a=0.166, fit to levels J=1/2, 3/2 and 5/2.

ⁱ Band(M): β-vibrational states based on ν1/2[510].

^j Configuration=ν1/2[770]+Q.

^k Configuration=ν1/2[501]+Q.

^l Possible ν9/2[624] band.

^m ν11/2[615] band.

Adopted Levels, Gammas (continued)

$\gamma(^{181}\text{Hf})$									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.#	$\delta^\#$	$\alpha^\&$	Comments
45.763	3/2 ⁻	45.80 14	100	0.0	1/2 ⁻	M1+E2	0.19 4	10.4 16	
98.603	5/2 ⁻	52.76 19	100 20	45.763	3/2 ⁻	M1+E2	0.25 5	7.5 12	
		98.59 5	97 9	0.0	1/2 ⁻	E2		3.749	
203.992	7/2 ⁻	105.46 6	100 12	98.603	5/2 ⁻				
		158.41 9	28 4	45.763	3/2 ⁻				
251.991	3/2 ⁻	153.35 4	18 3	98.603	5/2 ⁻				
		206.22 2	100 7	45.763	3/2 ⁻				
		251.90 4	17 6	0.0	1/2 ⁻				
303.88	9/2 ⁻	99.97 9	9.3 25	203.992	7/2 ⁻				
		205.31 11	100 17	98.603	5/2 ⁻				
329.309	5/2 ⁻	77.37 9	6 3	251.991	3/2 ⁻				
		125.32 2	60 8	203.992	7/2 ⁻				
		230.73 9	6.8 11	98.603	5/2 ⁻				
		283.49 21	10.0 14	45.763	3/2 ⁻				
		329.40 3	100 8	0.0	1/2 ⁻				
440.68	7/2 ⁻	110.97 9	4.9 25	329.309	5/2 ⁻				
		136.73 9	3.9 21	303.88	9/2 ⁻				
		188.97 7	9.6 16	251.991	3/2 ⁻				
		236.75 6	25 4	203.992	7/2 ⁻				
		342.09 4	100 13	98.603	5/2 ⁻				
		394.92 7	14.6 24	45.763	3/2 ⁻				
465.93	11/2 ⁻	162.11 6	75 13	303.88	9/2 ⁻				
		261.92 6	100 17	203.992	7/2 ⁻				
573.64	9/2 ⁻	133.18 8	30 6	440.68	7/2 ⁻				
		244.24 9	100 16	329.309	5/2 ⁻				
		369.7 1	86 17	203.992	7/2 ⁻				
595.27	9/2 ⁺	129.36 4	48 20	465.93	11/2 ⁻				
		154.56 3	28 5	440.68	7/2 ⁻				
		291.39 1	100 12	303.88	9/2 ⁻				
		391.19 12	41 6	203.992	7/2 ⁻				
617.20	(11/2 ⁺)	22.1		595.27	9/2 ⁺	M1 @			
		313.1 1		303.88	9/2 ⁻				
619.9	(13/2 ⁻)	(3)		617.20	(11/2 ⁺)				E _γ : Transition observed in ¹⁸⁰ Hf(d,py).
663.53	7/2 ⁻	222.91 11	24 3	440.68	7/2 ⁻				
		334.40 3	100 15	329.309	5/2 ⁻				
		359.72 9	16 5	303.88	9/2 ⁻				
		411.68 12	33 5	251.991	3/2 ⁻				
		459.59 7	36 6	203.992	7/2 ⁻				
		565.11 21	31 5	98.603	5/2 ⁻				
749.36	11/2 ⁻	175.7 1	24 5	573.64	9/2 ⁻				
		283.5 1	33 7	465.93	11/2 ⁻				

Adopted Levels, Gammas (continued)

							$\gamma(^{181}\text{Hf})$ (continued)		Comments
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. #	$\alpha^\&$		
749.36	11/2 ⁻	308.6 1 445.5 1	37 7 100 20	440.68 303.88	7/2 ⁻ 9/2 ⁻				
758.63	13/2 ⁺	138.4		619.9	(13/2 ⁻)	@		Mult.: M1 from $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$ 2001Sh36 , in disagreement with the 13/2 ⁺ to (13/2 ⁻) transition.	
799.95	9/2 ⁻	136.39 9		663.53	7/2 ⁻				
805.57	11/2 ⁺	210.3 1		595.27	9/2 ⁺				
835	(15/2 ⁻)	365.0 ^a 1		465.93	11/2 ⁻			E _γ : From (d,pγ) only, tentative assignment.	
904.24	7/2 ⁻	240.51 9 463.52 16 575.16 13 652.29 6 700.4 8 806.0 8 858.5 8	24 9 13 8 56 15 100 6 14 6 34 7 31 8	663.53 440.68 329.309 251.991 203.992 98.603 45.763	7/2 ⁻ 7/2 ⁻ 5/2 ⁻ 3/2 ⁻ 7/2 ⁻ 5/2 ⁻ 3/2 ⁻				
928.1	(15/2 ⁺)	169.5 308.1	100 3 52 3	758.63 617.20	13/2 ⁺ (11/2 ⁺)	M1 @ @	0.92	Mult.: E2 from $^{180}\text{Hf}(^{238}\text{U}, ^{237}\text{U}\gamma)$ 2001Sh36 , in disagreement with the (15/2 ⁺) to (13/2 ⁻) transition.	
930.03	13/2 ⁻	312.6 1 356.7 1 464.0 1		617.20 573.64 465.93	(11/2 ⁺) 9/2 ⁻ 11/2 ⁻				
964.99	11/2 ⁻	165.0 1 301.5 1	100 20 45 9	799.95 663.53	9/2 ⁻ 7/2 ⁻				
1009.07	13/2 ⁺	203.5 1		805.57	11/2 ⁺				
1043.5	(17/2 ⁺)	115.3 284.9	100 5 61 3	928.1 758.63	(15/2 ⁺) 13/2 ⁺	M1 @ E2 @	2.74 0.093		
1045.00	1/2 ⁻	792.8 5 946.40 8 999.33 14	4 2 87 9 100 5	251.991 98.603 45.763	3/2 ⁻ 5/2 ⁻ 3/2 ⁻				
1055.95	5/2 ⁻	615.64 24 726.64 19 752.7 4 803.94 4 851.9 3 957.6 5 1010.12 26 1055.7 7	9 2 45 13 13 4 100 19 24 7 13 4 48 13 48 19	440.68 329.309 303.88 251.991 203.992 98.603 45.763 0.0	7/2 ⁻ 5/2 ⁻ 9/2 ⁻ 3/2 ⁻ 7/2 ⁻ 5/2 ⁻ 3/2 ⁻ 1/2 ⁻				
1086.19	3/2 ⁻	882.28 13 987.68 20 1040.41 20 1086.18 5	54 5 44 5 74 7 100 10	203.992 98.603 45.763 0.0	7/2 ⁻ 5/2 ⁻ 3/2 ⁻ 1/2 ⁻				

Adopted Levels, Gammas (continued)

$\gamma(^{181}\text{Hf})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. [#]	$\alpha^\&$
1117.18	$3/2^-$	787.66 25	8 2	329.309	$5/2^-$		
		865.1 4	2.9 14	251.991	$3/2^-$		
		1019.2 4	7 2	98.603	$5/2^-$		
		1071.43 7	36 4	45.763	$3/2^-$		
		1117.13 7	100 4	0.0	$1/2^-$		
1122.3?	$(17/2^+)$	197 ^a		928.1	$(15/2^+)$		
		367 ^a		758.63	$13/2^+$		
1134.67	$5/2^-$	694.1 3	9 3	440.68	$7/2^-$		
		830.78 13	37 7	303.88	$9/2^-$		
		930.6 5	32 6	203.992	$7/2^-$		
		1035.9 3	100 12	98.603	$5/2^-$		
		1134.58 18	96 46	0.0	$1/2^-$		
1153.15	$1/2^-$	1107.26 14	100	45.763	$3/2^-$		
1157.41	$7/2^-$	716.55 23	59 20	440.68	$7/2^-$		
		828.4 3	100 18	329.309	$5/2^-$		
1178.19	$5/2^-$	738.1 4	10 3	440.68	$7/2^-$		
		1079.62 19	100 35	98.603	$5/2^-$		
		1132.28 26	65 23	45.763	$3/2^-$		
		155.5 7	3.4 17	1055.95	$5/2^-$		
1210.50	$5/2^+$	615.12 9	100 10	595.27	$9/2^+$		
		978.1 6	3 2	251.991	$3/2^-$		
		1025.7 6	4 2	203.992	$7/2^-$		
		1130.87 21	33 17	98.603	$5/2^-$		
		1184.11 22	73 14	45.763	$3/2^-$		
1229.72	$3/2^-$	1229.73 13	100 21	0.0	$1/2^-$		
		199.3	100	1043.5	$(17/2^+)$	M1 [@]	0.584
		1056.68 9	100	203.992	$7/2^-$		
		231.3 6	100	1055.95	$5/2^-$		
		658.58 3	55 8	663.53	$7/2^-$		
1321.87	$3/2^-$	992.38 8	55 15	329.309	$5/2^-$		
		1069.65 3	69 21	251.991	$3/2^-$		
		1276.28 10	56 11	45.763	$3/2^-$		
		1321.86 5	100 10	0.0	$1/2^-$		
		211.68 10	63 18	1117.18	$3/2^-$		
1328.94	$1/2, 3/2, 5/2^-$	1282.6 3	10 5	45.763	$3/2^-$		
		1329.27 17	100 31	0.0	$1/2^-$		
		225 ^a		1122.3?	$(17/2^+)$		
1347.2?	$(19/2^+)$	422 ^a		928.1	$(15/2^+)$		
		230.66 12	65 24	1117.18	$3/2^-$		
1347.75	$1/2, 3/2, 5/2$	1301.51 23	100 35	45.763	$3/2^-$		
		1105.1 4	12 4	251.991	$3/2^-$		
1356.98	$3/2^-$						

Adopted Levels, Gammas (continued)

$\gamma(^{181}\text{Hf})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.#	$\alpha^\&$
1356.98	3/2 ⁻	1259.0 7	26 13	98.603	5/2 ⁻		
		1311.4 5	8.7 10	45.763	3/2 ⁻		
		1357.10 12	100 21	0.0	1/2 ⁻		
1362.98	1/2,3/2,5/2 ⁻	245.86 13	92 33	1117.18	3/2 ⁻		
		1111.03 10	100 33	251.991	3/2 ⁻		
		1362.44 24	50 25	0.0	1/2 ⁻		
1385.0	(19/2 ⁺)	142.4	8 2	1242.7	(19/2 ⁺)	M1@	1.50
		341.4	100 13	1043.5	(17/2 ⁺)	M1@	0.135
1396.92	5/2 ⁻	733.4 3	81 24	663.53	7/2 ⁻		
		956.33 22	100 33	440.68	7/2 ⁻		
		1067.47 26	62 31	329.309	5/2 ⁻		
1424.44	5/2 ⁻	1326.23 16	100 19	98.603	5/2 ⁻		
		1378.48 11	76 24	45.763	3/2 ⁻		
1451.99	5/2 ⁺	1248.4 7	31 10	203.992	7/2 ⁻		
		1406.1 3	100 34	45.763	3/2 ⁻		
1453.3	1/2 ⁺	1453.6 6	100	0.0	1/2 ⁻		
1492.63	7/2 ⁻	829.10 11	100	663.53	7/2 ⁻		
1494.17	1/2 ⁻	1448.33 18	78 16	45.763	3/2 ⁻		
		1494.19 11	100 16	0.0	1/2 ⁻		
1505.14	1/2 ⁺	1459.6 3	100 38	45.763	3/2 ⁻		
		1504.9 3	28 8	0.0	1/2 ⁻		
1615.75	3/2 ⁺	1286.1 4	12 4	329.309	5/2 ⁻		
		1363.97 10	59 13	251.991	3/2 ⁻		
		1570.19 26	44 13	45.763	3/2 ⁻		
		1615.22 15	100 28	0.0	1/2 ⁻		
1629.47	1/2 ⁻	308.3 3	20 20	1321.87	3/2 ⁻		
		1299.35 26	20 6	329.309	5/2 ⁻		
		1377.51 7	27 8	251.991	3/2 ⁻		
		1583.73 12	100 20	45.763	3/2 ⁻		
		1629.36 12	78 16	0.0	1/2 ⁻		
1635.88	(5/2)	579.72 22	100 30	1055.95	5/2 ⁻		
		972.27 22	91 28	663.53	7/2 ⁻		
		1384.8 4	59 29	251.991	3/2 ⁻		
1641.54	1/2 ⁻ ,3/2 ⁺	1389.67 7	84 26	251.991	3/2 ⁻		
		1542.51 13	100 21	98.603	5/2 ⁻		
1656.53	3/2 ⁺	1557.90 13	100 22	98.603	5/2 ⁻		
		1656.59 23	18 7	0.0	1/2 ⁻		
1682.90	3/2 ⁻	1353.7 4	67 17	329.309	5/2 ⁻		
		1478.9 5	58 42	203.992	7/2 ⁻		
		1585.0 5	100 50	98.603	5/2 ⁻		
		1637.07 16	29 8	45.763	3/2 ⁻		

Adopted Levels, Gammas (continued)

$\gamma(^{181}\text{Hf})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. #	$\alpha^\&$
1682.90	3/2 ⁻	1682.5 5	63 19	0.0	1/2 ⁻		
1712.65	1/2 ⁻ , (3/2 ⁻)	482.9 3	18 8	1229.72	3/2 ⁻		
		559.43 8	15 7	1153.15	1/2 ⁻		
		1383.8 4	17 10	329.309	5/2 ⁻		
		1460.67 10	50 12	251.991	3/2 ⁻		
		1614.0 3	88 27	98.603	5/2 ⁻		
		1667.09 14	18 7	45.763	3/2 ⁻		
		1712.0 5	100 19	0.0	1/2 ⁻		
1716.99	3/2 ⁻	1465.36 15	14 5	251.991	3/2 ⁻		
		1512.95 20	7 2	203.992	7/2 ⁻		
		1618.40 11	51 10	98.603	5/2 ⁻		
		1671.11 9	100 12	45.763	3/2 ⁻		
		1716.93 11	77 15	0.0	1/2 ⁻		
1736.95	3/2 ⁻	1407.5 6	8 4	329.309	5/2 ⁻		
		1638.48 17	78 22	98.603	5/2 ⁻		
		1690.9 7	100 30	45.763	3/2 ⁻		
		1736.77 21	48 13	0.0	1/2 ⁻		
1741.9	(25/2 ⁻)	357.0	19 2	1385.0	(19/2 ⁺)	E3 @	0.185
		499.2	100 3	1242.7	(19/2 ⁺)	E3 @	0.0591
1746.6	5/2 ⁻	1700.8 5	100	45.763	3/2 ⁻		
1770.03	1/2, 3/2	1723.71 17	100 30	45.763	3/2 ⁻		
		1770.78 20	78 22	0.0	1/2 ⁻		
1805.41	1/2, 3/2	688.09 20	14 3	1117.18	3/2 ⁻		
		1760.6 5	21 7	45.763	3/2 ⁻		
		1805.40 8	100 10	0.0	1/2 ⁻		
1842.52	1/2 ⁻ , (3/2 ⁻)	1744.09 26	6 2	98.603	5/2 ⁻		
		1796.71 8	46 6	45.763	3/2 ⁻		
		1842.52 8	100 10	0.0	1/2 ⁻		
1847.53	3/2 ⁻	669.6 3	57 18	1178.19	5/2 ⁻		
		1802.22 24	100 25	45.763	3/2 ⁻		
		1847.17 18	75 33	0.0	1/2 ⁻		
1866.99	1/2, 3/2	1768.27 23	37 19	98.603	5/2 ⁻		
		1867.06 19	100 19	0.0	1/2 ⁻		
1895.67	1/2 ⁻ , 3/2 ⁻	743.4 5	16 4	1153.15	1/2 ⁻		
		1565.3 5	11 4	329.309	5/2 ⁻		
		1797.20 20	55 10	98.603	5/2 ⁻		
		1849.87 8	100 33	45.763	3/2 ⁻		
		1895.4 5	47 10	0.0	1/2 ⁻		
1920.7	(3/2 ⁺)	1821.4 7	86 43	98.603	5/2 ⁻		
		1875.0 3	100 50	45.763	3/2 ⁻		
		1920.8 7	57 29	0.0	1/2 ⁻		

Adopted Levels, Gammas (continued)

$\gamma(^{181}\text{Hf})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π
1941.32	1/2,3/2	1842.63 20	50 17	98.603	5/2 ⁻	2271.24	3/2 ⁻	1215.3 5	32 16	1055.95	5/2 ⁻
		1895.57 15	100 31	45.763	3/2 ⁻			1942.31 17	89 16	329.309	5/2 ⁻
		1941.4 4	10 5	0.0	1/2 ⁻			2271.4 3	24 11	0.0	1/2 ⁻
1951.32	(1/2 ⁻)	1905.43 16	100 33	45.763	3/2 ⁻	2282.4	(3/2 ⁻)	2237.1 5	100 43	45.763	3/2 ⁻
		1951.50 20	92 25	0.0	1/2 ⁻			2282.0 5	86 43	0.0	1/2 ⁻
1962.88	1/2 ⁻ ,3/2	1710.52 23	100 29	251.991	3/2 ⁻	2285.4	1/2,3/2	2239.5 3	100 50	45.763	3/2 ⁻
		1864.1 6	27 8	98.603	5/2 ⁻			2285.7 5	20 10	0.0	1/2 ⁻
		1917.33 25	71 36	45.763	3/2 ⁻	2324.20	(3/2 ⁻)	1659.5 6	28 8	663.53	7/2 ⁻
		1963.8 5	29 11	0.0	1/2 ⁻			2279.2 3	100 66	45.763	3/2 ⁻
1986.47	1/2,3/2	1940.7 2	71 43	45.763	3/2 ⁻			2323.3 4	72 16	0.0	1/2 ⁻
		1986.3 8	100 57	0.0	1/2 ⁻	2352.37	(3/2 ⁻)	2307.5 4	35 19	45.763	3/2 ⁻
1997.88	1/2 ⁻ ,3/2	545.86 24	25 12	1451.99	5/2 ⁺			2352.35 3	100 31	0.0	1/2 ⁻
		844.4 3	15 8	1153.15	1/2 ⁻	2365.41	(3/2 ⁻)	1104.7 4	71 35	1260.68	5/2 ⁻
		1668.39 25	100 27	329.309	5/2 ⁻			1135.7 5	47 24	1229.72	3/2 ⁻
		1746.6 4	50 14	251.991	3/2 ⁻			1155.0 5	24 12	1210.50	5/2 ⁺
		1952.20 20	59 23	45.763	3/2 ⁻			1212.45 20	59 24	1153.15	1/2 ⁻
2032.74	1/2 ⁻	1780.0 7	48 24	251.991	3/2 ⁻			1230.4 3	100 29	1134.67	5/2 ⁻
		1987.12 18	100 33	45.763	3/2 ⁻			1247.1 4	35 18	1117.18	3/2 ⁻
		2031.6 6	33 19	0.0	1/2 ⁻			2036.6 4	18 12	329.309	5/2 ⁻
2140.43	1/2 ⁻ ,3/2	1889.0 3	31 10	251.991	3/2 ⁻			2113.4 4	18 12	251.991	3/2 ⁻
		2041.80 15	25 8	98.603	5/2 ⁻			2266.6 3	59 24	98.603	5/2 ⁻
		2094.84 23	100 20	45.763	3/2 ⁻			2320.7 8	18 12	45.763	3/2 ⁻
		2140.31 11	71 10	0.0	1/2 ⁻			2366.3 6	24 12	0.0	1/2 ⁻
2147.8	1/2 ⁻ ,3/2 ⁺	1894.5 5	100 50	251.991	3/2 ⁻	2369.4	1/2 ⁻ ,3/2	2040.3 12	25 25	329.309	5/2 ⁻
		2148.6 4	46 23	0.0	1/2 ⁻			2117.1 5	100 50	251.991	3/2 ⁻
2162.1	3/2 ⁺ , (5/2 ⁻)	2063.3 6	43 29	98.603	5/2 ⁻			2323.4 8	50 25	45.763	3/2 ⁻
		2116.6 6	100 86	45.763	3/2 ⁻			2370.7 9	50 25	0.0	1/2 ⁻
2194.91	3/2 ⁻	1150.8 5	26 13	1045.00	1/2 ⁻	2396.0	1/2,3/2	2350.2 4	88 38	45.763	3/2 ⁻
		1942.83 18	52 16	251.991	3/2 ⁻			2396.1 5	100 38	0.0	1/2 ⁻
		2149.1 4	69 19	45.763	3/2 ⁻	2399.4	(3/2 ⁻)	2300.8 4	22 17	98.603	5/2 ⁻
		2194.7 3	100 50	0.0	1/2 ⁻			2353.5 6	100 33	45.763	3/2 ⁻
2203.09	3/2 ⁻	1762.9 3	21 4	440.68	7/2 ⁻	2404.61	1/2 ⁻ ,3/2	2076.8 4	≈67	329.309	5/2 ⁻
		1873.5 3	100 27	329.309	5/2 ⁻			2152.5 5	17 17	251.991	3/2 ⁻
		1951.3 4	33 16	251.991	3/2 ⁻			2358.0 5	100 50	45.763	3/2 ⁻
		2156.8 5	13 6	45.763	3/2 ⁻			2403.7 4	67 33	0.0	1/2 ⁻
		2202.8 4	47 24	0.0	1/2 ⁻	2407.95	(3/2 ⁻)	2076.8 4	≈100	329.309	5/2 ⁻
2216.2	1/2 ⁻	2117.6 6	100	98.603	5/2 ⁻			2157.8 4	100 75	251.991	3/2 ⁻
2257.90	1/2 ⁻ ,3/2 ⁻	1172.0 3	100 21	1086.19	3/2 ⁻			2361.6 5	100 50	45.763	3/2 ⁻
		1213.1 3	34 17	1045.00	1/2 ⁻			2409.6 9	75 50	0.0	1/2 ⁻
		2211.5 3	17 10	45.763	3/2 ⁻	2434.95	1/2,3/2	2389.2 5	43 29	45.763	3/2 ⁻
		2258.4 6	34 17	0.0	1/2 ⁻			2434.92 25	100 29	0.0	1/2 ⁻
2271.24	3/2 ⁻	1060.51 12	100 22	1210.50	5/2 ⁺	2440.4	1/2,3/2	2188.4 6	100	251.991	3/2 ⁻

Adopted Levels, Gammas (continued)

 $\gamma(^{181}\text{Hf})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π
2448.5	1/2 ⁻ ,3/2	2119.5 4	100 50	329.309	5/2 ⁻	2764.75	1/2 ⁻ ,3/2	2764.7 3	100 19	0.0	1/2 ⁻
		2350.6 6	50 38	98.603	5/2 ⁻	2772.12	1/2 ⁻ ,3/2 ⁻	1318.9 4	18 6	1453.3	1/2 ⁺
		2447.6 5	100 50	0.0	1/2 ⁻			1408.8 5	20 8	1362.98	1/2,3/2,5/2 ⁻
2455.79	1/2 ⁻ ,3/2	2355.2 5	82 36	98.603	5/2 ⁻			1415.6 3	18 7	1356.98	3/2 ⁻
		2409.3 5	73 36	45.763	3/2 ⁻			1424.31 13	50 11	1347.75	1/2,3/2,5/2
		2456.2 2	100 36	0.0	1/2 ⁻			1443.0 3	100 28	1328.94	1/2,3/2,5/2 ⁻
2508.4	1/2,3/2	2462.6 9	100	45.763	3/2 ⁻			2772.09 26	94 22	0.0	1/2 ⁻
2566.72	1/2 ⁻ ,3/2	2467.35 23	78 33	98.603	5/2 ⁻	2832.79	3/2	2503.57 25	57 18	329.309	5/2 ⁻
		2520.8 7	44 33	45.763	3/2 ⁻			2733.9 4	100 29	98.603	5/2 ⁻
		2568.0 3	100 44	0.0	1/2 ⁻	2850.70	1/2 ⁻ ,3/2	2521.4 4	33 20	329.309	5/2 ⁻
2574.6	3/2 ⁻	1365.6 6	55 36	1210.50	5/2 ⁺			2598.59 16	100 33	251.991	3/2 ⁻
		2528.3 4	55 27	45.763	3/2 ⁻			2751.0 10	33 20	98.603	5/2 ⁻
		2574.5 5	100 55	0.0	1/2 ⁻			2805.25 21	93 20	45.763	3/2 ⁻
2597.7	1/2,3/2	2346.1 4	24 13	251.991	3/2 ⁻			2849.6 6	33 20	0.0	1/2 ⁻
		2550.4 8	27 18	45.763	3/2 ⁻	2866.0	1/2,3/2	2536		329.309	5/2 ⁻
		2597.7 7	100 56	0.0	1/2 ⁻			2768		98.603	5/2 ⁻
2602.24	1/2 ⁻ ,3/2	2272.70 23	56 29	329.309	5/2 ⁻			2821 ^a		45.763	3/2 ⁻
		2503.9 6	31 15	98.603	5/2 ⁻	2896.5	1/2,3/2	2566		329.309	5/2 ⁻
		2557.3 5	100 50	45.763	3/2 ⁻			2646		251.991	3/2 ⁻
		2602.2 7	83 33	0.0	1/2 ⁻			2896		0.0	1/2 ⁻
2610.16	1/2 ⁻ ,3/2	2280.84 24	100	329.309	5/2 ⁻	2935.8	1/2 ⁻ ,3/2	2837		98.603	5/2 ⁻
2613.6	1/2,3/2	2567.1 8	44 37	45.763	3/2 ⁻			2891		45.763	3/2 ⁻
		2613.7 4	100 37	0.0	1/2 ⁻			2935		0.0	1/2 ⁻
2626.56	(1/2 ⁻),3/2 ⁻	2297.8 3	56 17	329.309	5/2 ⁻	2950.3	(1/2 ⁻ ,3/2 ⁺)	2620		329.309	5/2 ⁻
		2374.48 15	47 14	251.991	3/2 ⁻			2851		98.603	5/2 ⁻
		2581.2 5	48 14	45.763	3/2 ⁻			2952		0.0	1/2 ⁻
		2626.30 23	100 25	0.0	1/2 ⁻	2983.63	1/2,3/2	2938.1 5	79 42	45.763	3/2 ⁻
2642.38	(1/2 ⁻),3/2	746.0 5	42 25	1895.67	1/2 ⁻ ,3/2 ⁻			2983.56 20	100 32	0.0	1/2 ⁻
		2596.68 11	100 42	45.763	3/2 ⁻	2987.0	(1/2 ⁻ ,3/2 ⁺)	2987		0.0	1/2 ⁻
		2642.0 3	58 17	0.0	1/2 ⁻	3001.59	(3/2 ⁻)	2956.1 5	33 27	45.763	3/2 ⁻
2671.3	(1/2 ⁻ ,3/2 ⁻)	2574		98.603	5/2 ⁻			3001.48 26	100 53	0.0	1/2 ⁻
		2670		0.0	1/2 ⁻	3007.4	1/2,3/2	3007.4 5	100	0.0	1/2 ⁻
2679.1		2353		329.309	5/2 ⁻	3096.88	(1/2 ⁻)	901.89 23	15 5	2194.91	3/2 ⁻
		2426		251.991	3/2 ⁻			1740.5 3	34 10	1356.98	3/2 ⁻
		2677		0.0	1/2 ⁻			1979.7 3	45 23	1117.18	3/2 ⁻
2692.8	(3/2 ⁺)	2647.1 3	100 25	45.763	3/2 ⁻			2011.0 6	22 11	1086.19	3/2 ⁻
		2692.4 5	42 25	0.0	1/2 ⁻			2844.70 20	59 14	251.991	3/2 ⁻
2758.6	1/2,3/2	2758.6 5	100	0.0	1/2 ⁻			2998.5 4	36 18	98.603	5/2 ⁻
2764.75	1/2 ⁻ ,3/2	2435.42 15	90 43	329.309	5/2 ⁻			3051.00 20	100 32	45.763	3/2 ⁻
		2512.2 5	19 14	251.991	3/2 ⁻			3096.7 3	86 18	0.0	1/2 ⁻
		2719.09 23	76 19	45.763	3/2 ⁻						

Adopted Levels, Gammas (continued)

$\gamma(^{181}\text{Hf})$ (continued)

[†] From weighted average of the values from ^{181}Lu β^- decay, $^{180}\text{Hf}(n,\gamma)$, E=thermal, $^{180}\text{Hf}(d,p\gamma)$ and $^{180}\text{Hf}(^{238}\text{U},^{237}\text{U}\gamma)$. Unweighted averages are adopted when data do not agree within the quoted errors.

[‡] From weighted average of the values from ^{181}Lu β^- decay, $^{180}\text{Hf}(n,\gamma)$, E=thermal and $^{180}\text{Hf}(d,p\gamma)$. Unweighted averages are adopted when data do not agree within the quoted errors.

[#] From (n,γ) , except as noted.

[@] From $^{180}\text{Hf}(^{238}\text{U},^{237}\text{U}\gamma)$.

[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^a Placement of transition in the level scheme is uncertain.

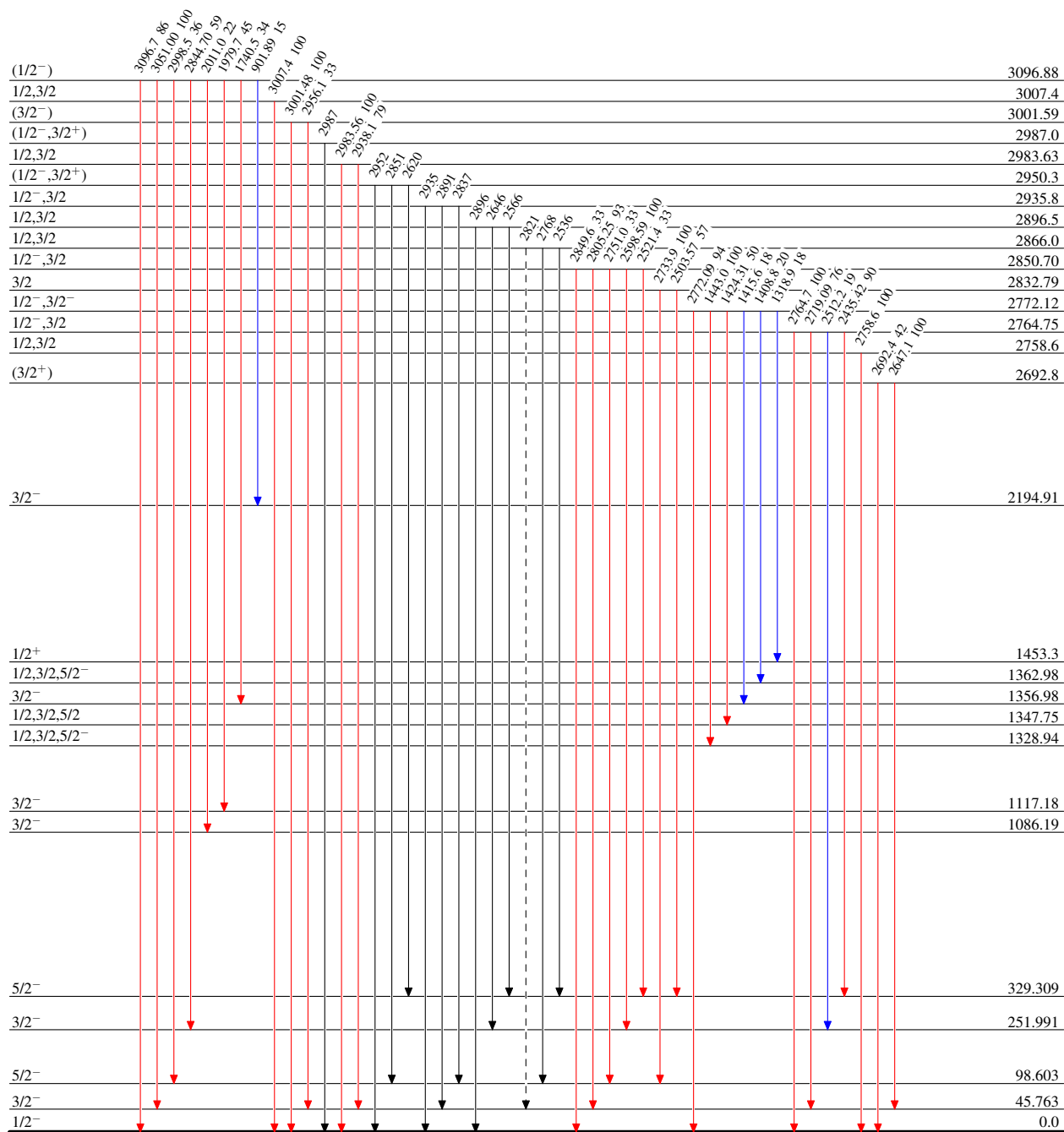
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Type not specified

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

 $^{181}_{72}\text{Hf}_{109}$

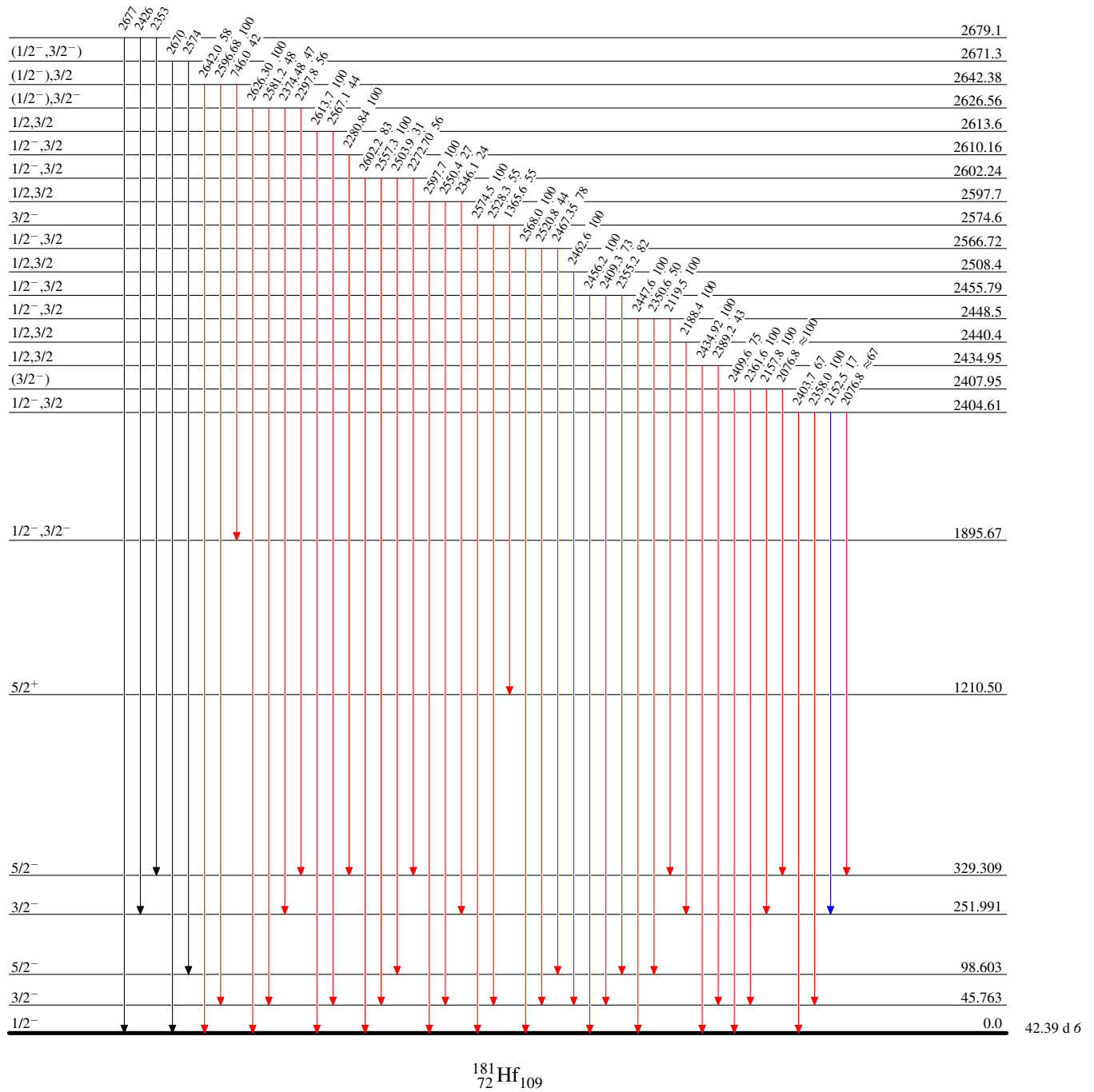
42.39 d 6

Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Type not specified

Legend

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

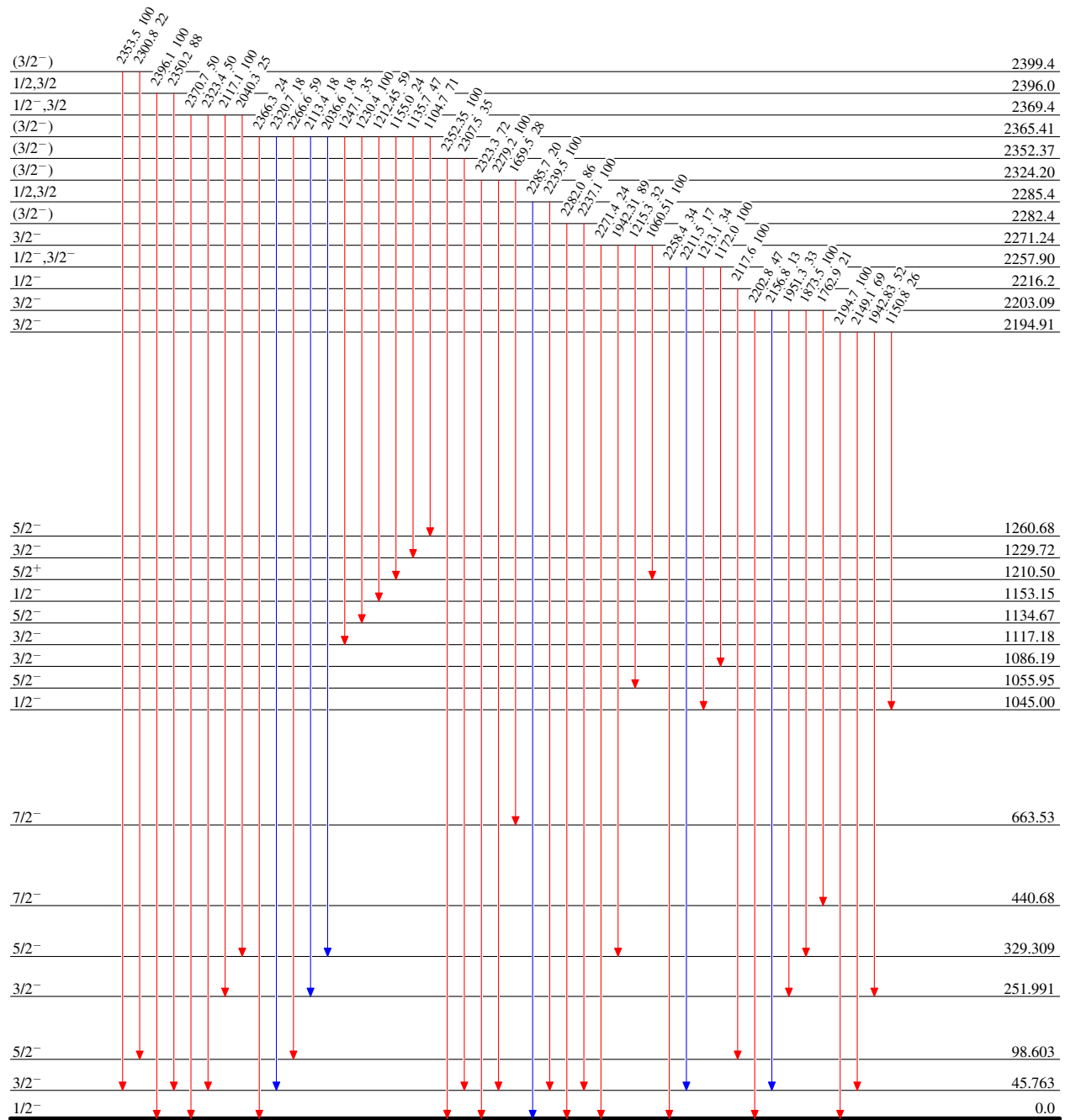


Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Type not specified

Legend

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

 $^{181}_{72}\text{Hf}_{109}$

42.39 d 6

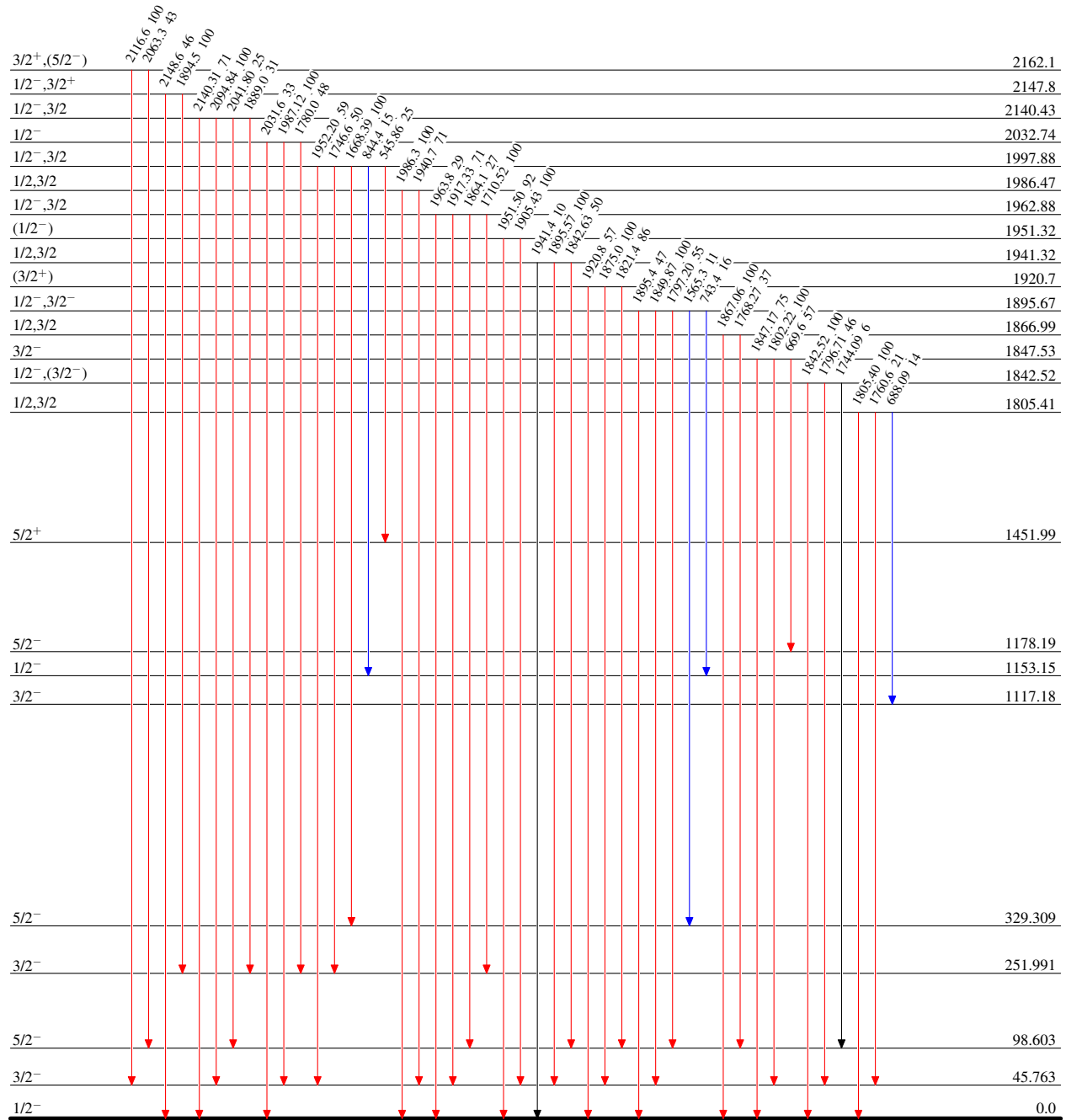
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Type not specified

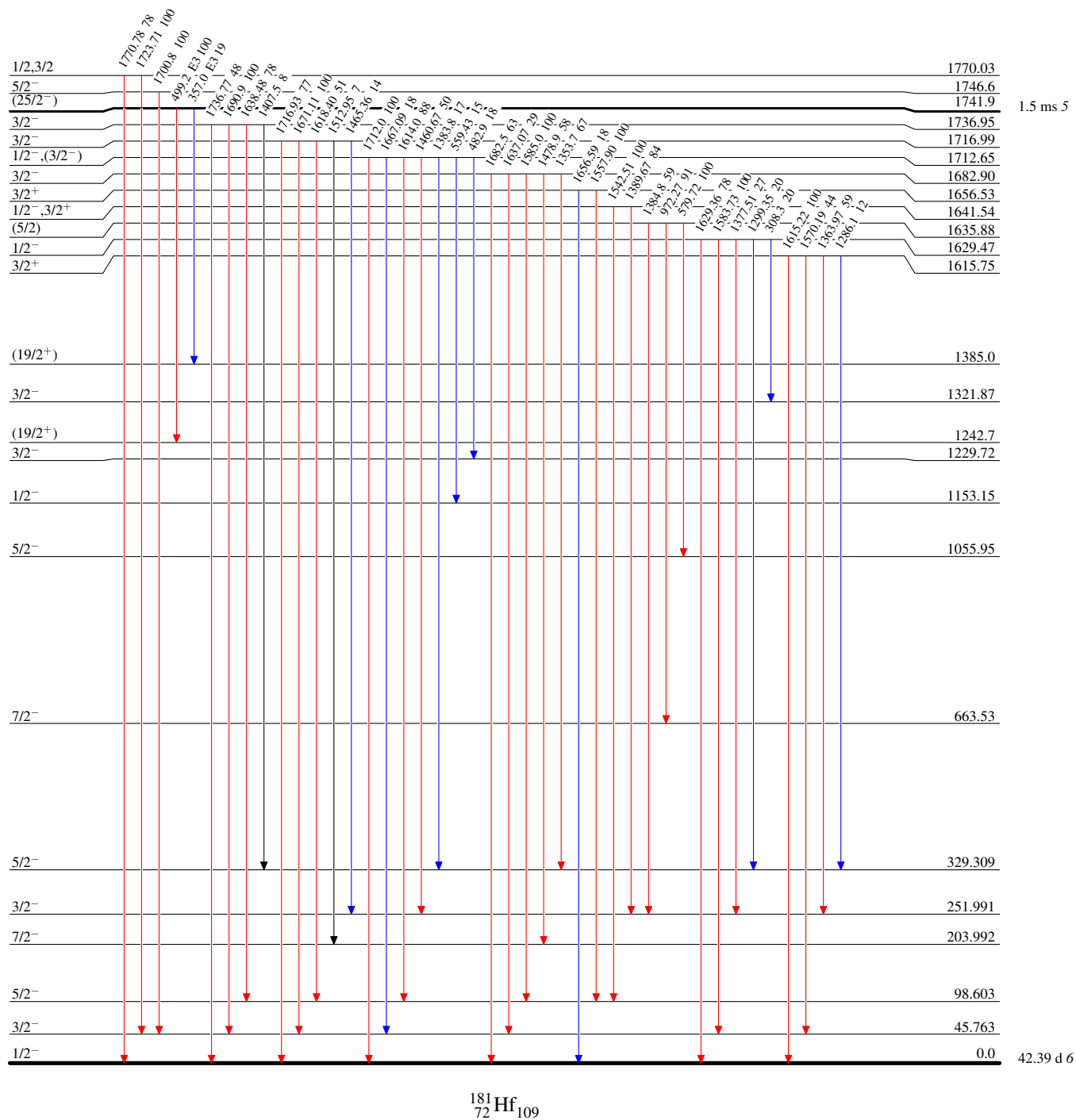
Legend

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

 $^{181}_{72}\text{Hf}_{109}$

42.39 d 6

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

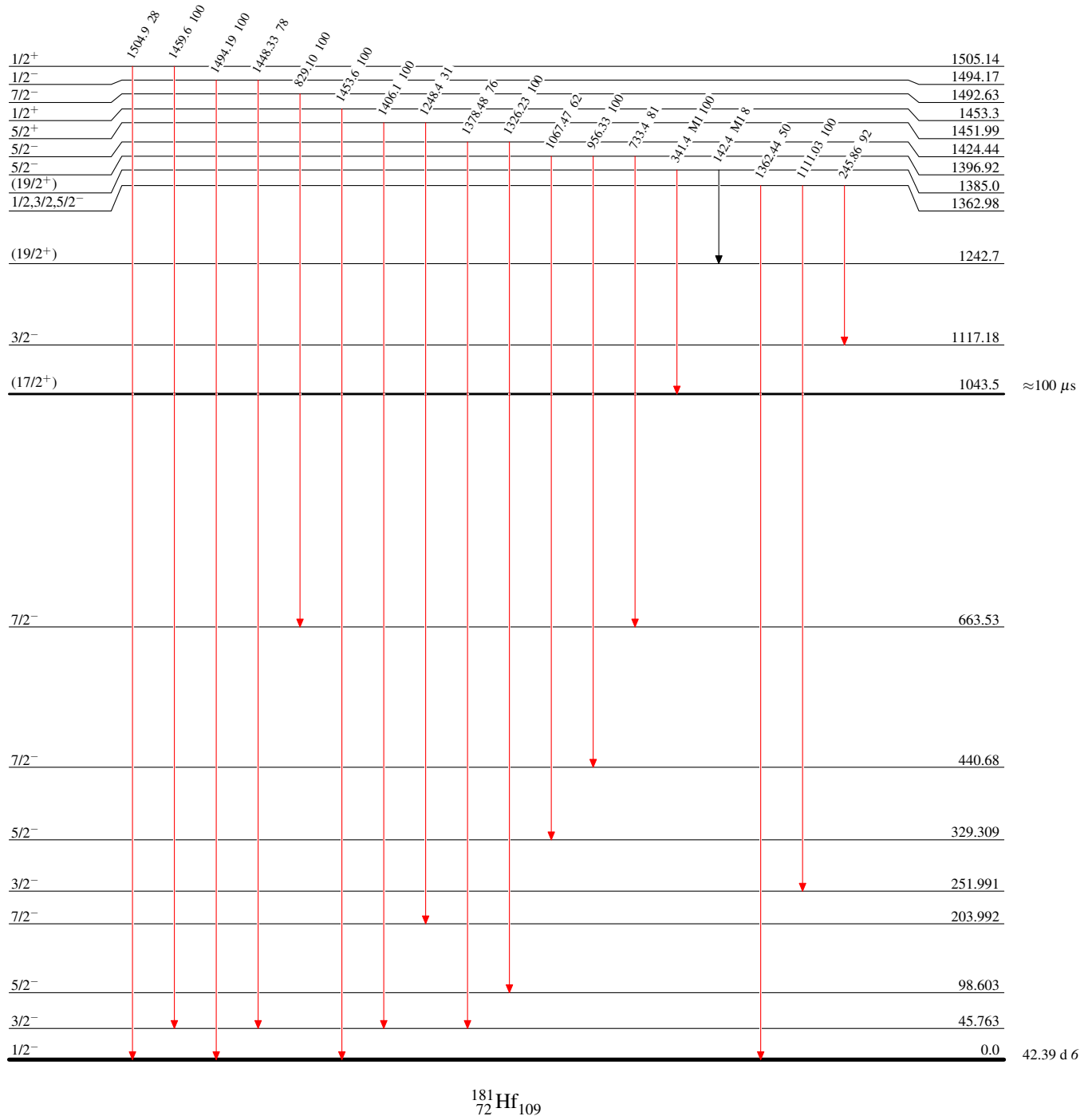


Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Type not specified

Legend

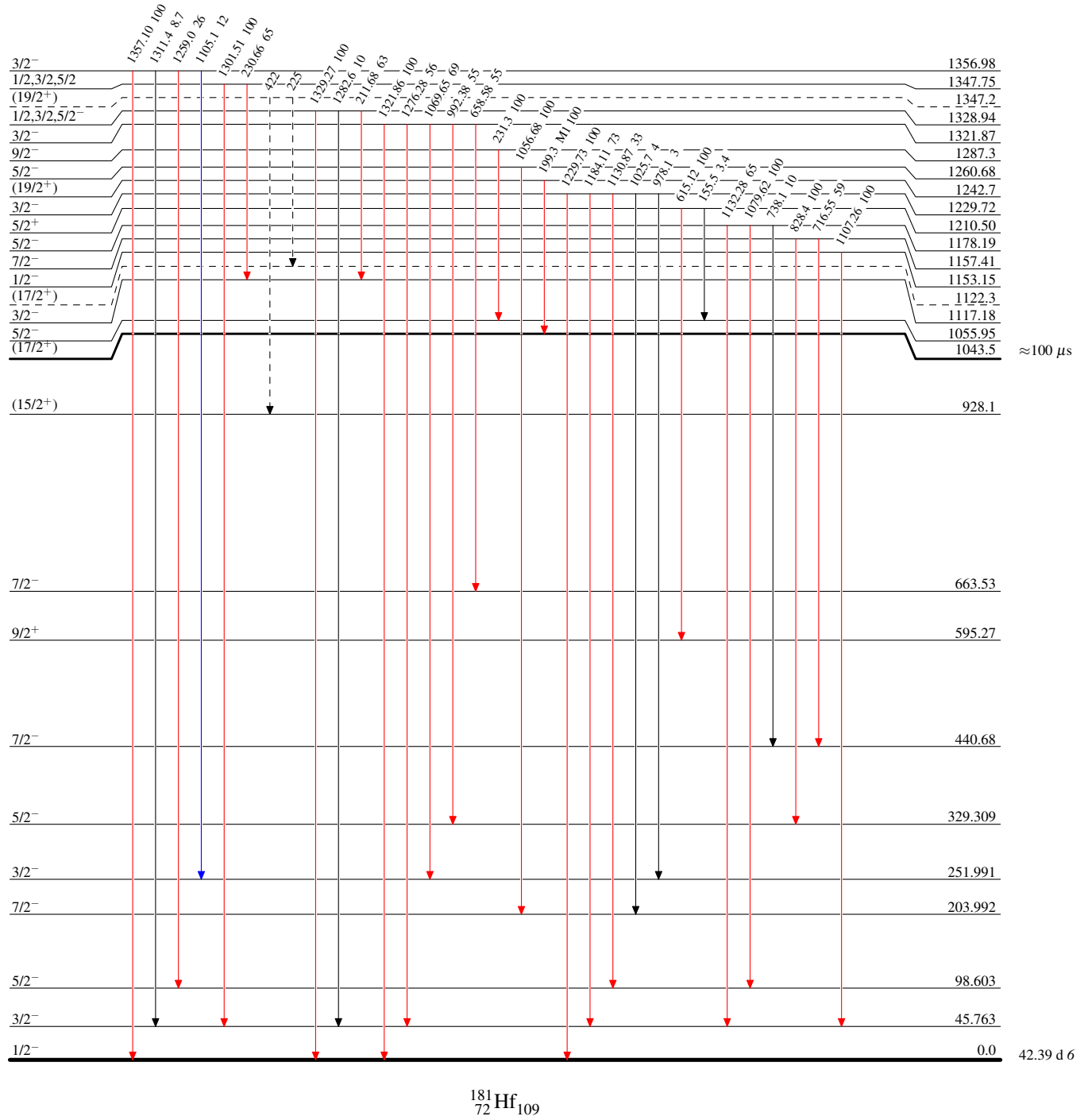
-  $I_\gamma < 2\% \times I_\gamma^{\max}$
 $I_\gamma < 10\% \times I_\gamma^{\max}$
 $I_\gamma > 10\% \times I_\gamma^{\max}$



Adopted Levels, Gammas**Legend****Level Scheme (continued)**

Intensities: Type not specified

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

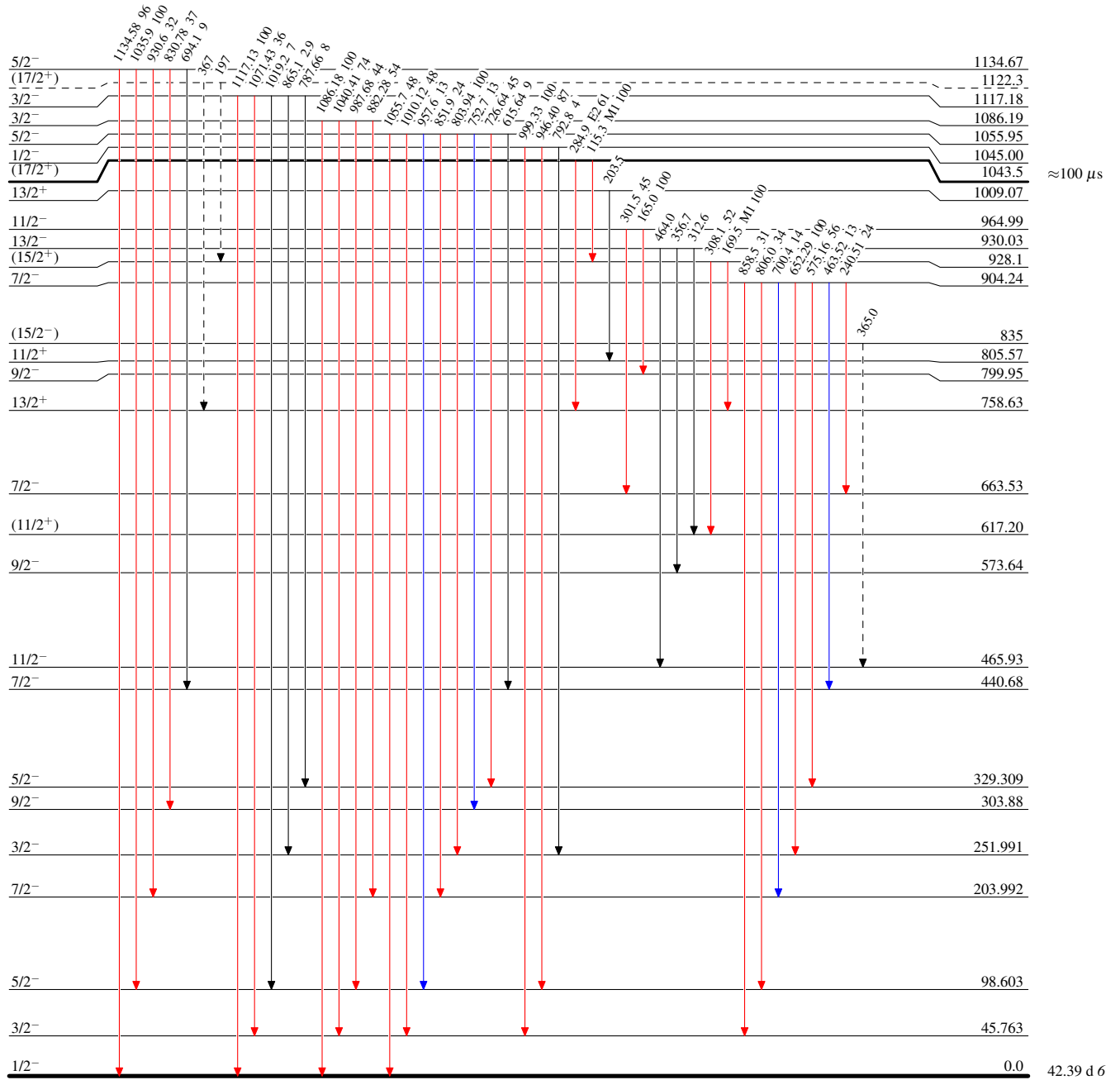
 $^{181}_{72}\text{Hf}_{109}$

Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Type not specified

Legend

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



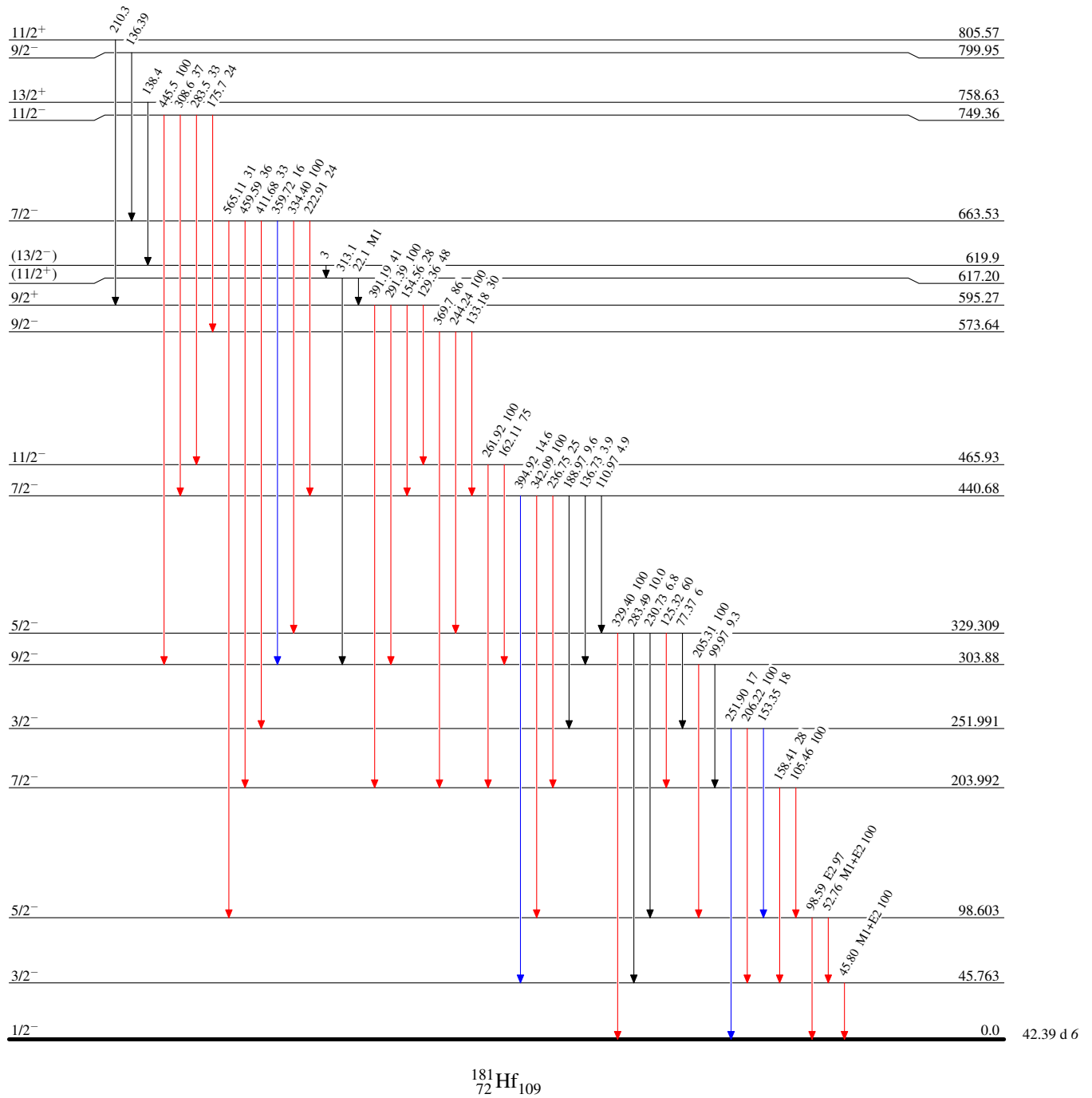
Adopted Levels, Gammas

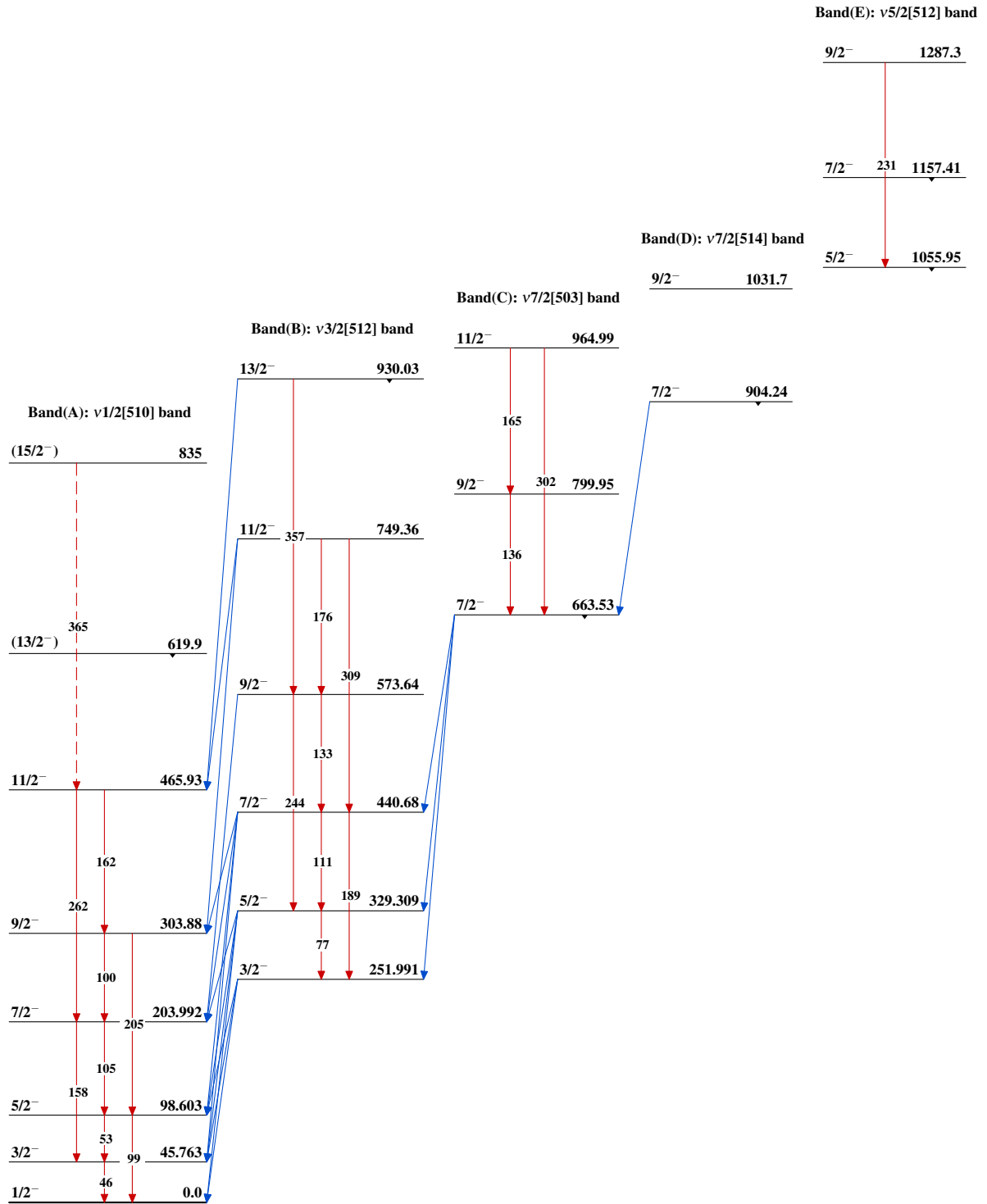
Legend

Level Scheme (continued)

Intensities: Type not specified

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



Adopted Levels, Gammas

Adopted Levels, Gammas (continued)

Band(H): Admixture of
the $\nu 3/2[501]$ and
($\nu 7/2[503]-2$)

7/2⁻ 1492.63

5/2⁻ 1396.92

3/2⁻ 1321.87

Band(G): $\nu 1/2[521]$ band

5/2⁻ 1260.68

3/2⁻ 1229.72

Band(F): γ -vibrational
band based on $\nu 1/2[510]$

5/2⁻ 1178.19

1/2⁻ 1153.15

3/2⁻ 1117.18

¹⁸¹₇₂Hf₁₀₉

Adopted Levels, Gammas (continued)Band(L): $\nu 1/2[501]$ band $5/2^-$ 1746.6
↓Band(J): $\nu 1/2[660]$ band $3/2^+$ 1656.53
↓ $3/2^-$ 1682.90
↓Band(I): $\nu 1/2[651]$ band $3/2^+$ 1615.75
↓ $1/2^-$ 1629.47
↓ $9/2^+$ 1574.7 $9/2^+$ 1520.2 $5/2^+$ 1505.2
 $1/2^+$ 1505.14
↓Band(K): $\nu 1/2[770]$ band $1/2^-$ 1494.17
↓ $1/2^+$ 1453.3
 $5/2^+$ 1451.99
↓ $3/2^-$ 1356.98
↓Band(M): β -vibrational
states based on
 $\nu 1/2[510]$ $5/2^-$ 1134.67
↓ $3/2^-$ 1086.19
↓ $1/2^-$ 1045.00
↓