Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 130, 21 (2015)	15-Jul-2015

Q(β^-)=381 *6*; S(n)=6718 *6*; S(p)=8.54×10^3 *16*; Q(α)=1217 *12* 2012Wa38
S(2n)=12413 *6*, S(2p)=16030 *300* (syst) (2012Wa38).
First identifications of ^{182}Hf: 1961Ar07, 1961Hu01, 1961Na03, 1961Wi09.
^{182}Hf produced in ^{180}Hf(2n,γ) (1961Ar07,1961Hu01,1961Na03, 1961Wi09,1971He13).
Additional information 1.
Structure calculations: 2012Ze02, 2011Li26, 2011No15, 2009Ef01, 2009Ro20, 2008Sa21, 2001Oi03, 2000Xu03.
^{186}W could, in principle, undergo α decay to ^{182}Hf. Recent studies by 2004Co26, 2003Bi13, 2003Da05, 2003Ce01 and 1997Ge15 have established upper limit for $T_{1/2}(\alpha)$ for ^{186}W as ≥8.2x10^{21} y (2004Co26) with 90% confidence limit.

^{182}Hf Levels

Cross Reference (XREF) Flags

A	^{182}Lu β^- decay (2.0 min)	D	^{180}Hf(^{136}Xe,^{134}Xeγ)
B	^{182}Hf IT decay (61.5 min)	E	^{180}Hf(^{238}U,^{236}Uγ)
C	^{180}Hf(t,p)		

E(level)†	J$^\pi$	$T_{1/2}$	XREF	Comments
0.0@	0$^+$‡	8.90×10^6 y *9*	ABCDE	%β^-=100 $T_{1/2}$: from 2004Vo16 (also 2005Vo17,specific activity technique using two independent methods). Others: 9×10^6 y *2* (1961Wi09), 8.5×10^6 y (1961Hu01), 8.0×10^6 y *5* (1961Na03), 1961Ar07. Additional information 2. (<r^2>)$^{1/2}$(rms charge radius)=5.3516 fm *36* (2013An02,evaluation). Δ<r^2>(^{182}Hf−^{180}Hf)=0.048 fm^2 *4* (1994An14,1994An09).
97.79@ *9*	2$^+$‡		ABCDE	
322.17@ *14*	(4$^+$)‡		ABCDE	
666.27@ *17*	(6$^+$)‡		BCDE	
818.4 *3*	(1,2$^+$)		A C	J$^\pi$: γ to 0$^+$.
905.9? *5*			A	J$^\pi$: γ to 2$^+$.
1022 *3*			C	
1034 *3*	(0$^+$)		C	J$^\pi$: L(t,p)=(0).
1122.07@ *18*	(8$^+$)‡		B DE	
1172.87& *18*	(8$^-$)#	61.5 min *15*	B DE	%β^-=54 *2*; %IT=46 *2* J$^\pi$: systematics, probable configuration=π7/2[404]⊗π9/2[514]; K^π=8$^-$ (1974Wa14,1999Da09). Theoretical calculations (2000Xu03) predict 8$^-$ isomer in ^{182}Hf. $T_{1/2}$: from 1974Wa14. Others: 65 min *5*, 68 min *4* (1971Wa09). 2006Av01: cross section measurement in ^{186}W(n,n'α) at 14.72-14.88 MeV.
1265 *3*	(0$^+$)		C	J$^\pi$: L(t,p)=(0).
1419.5& *5*	(9$^-$)#		DE	
1465			C	
1497 *3*			C	
≈1590			C	
1680.3@ *6*	(10$^+$)‡		D	
1691.9& *5*	(10$^-$)#		DE	
1724 *5*			C	
1829 *5*			C	
1885 *5*			C	

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Adopted Levels, Gammas (continued)

^{182}Hf Levels (continued)

E(level)[†]	J$^\pi$	T$_{1/2}$	XREF	Comments
1915 *5*			C	
1988.4[&] *5*	(11$^-$)[#]		DE	
2214 *5*			C	
2280 *5*			C	
2307.3[&] *6*	(12$^-$)[#]		DE	
2331.7[@] *8*	(12$^+$)[‡]		D	
2571.3 *12*	(13$^+$)	40 μs *10*	E	%IT≈100 T$_{1/2}$: from γ(t) in ^{180}Hf(^{238}U,^{236}Uγ) (1999Da09). J$^\pi$: Configuration=(ν11/2[615]⊗ν1/2[510])(π^2_{8-}); K^π=(13$^+$). Theoretical calculations (2001Oi03,2000Xu03) predict 13$^+$ isomer in ^{182}Hf.
2649.3[&] *6*	(13$^-$)[#]		D	
3010.0[&] *7*	(14$^-$)[#]		D	
3065.3[@] *9*	(14$^+$)[‡]		D	
3869.2[@] *11*	(16$^+$)[‡]		D	
4733.9[@] *12*	(18$^+$)[‡]		D	

[†] From least-squares fit to Eγ data for levels populated in γ-ray datasets, others are from (t,p).
[‡] g.s. band members.
[#] Possible member of configuration=π7/2[404]⊗π9/2[514], K^π=(8$^-$).
[@] Band(A): The g.s. band.
[&] Band(B): K^π=(8$^-$) band. Configuration=π7/2[404]⊗π9/2[514].

γ(^{182}Hf)

E$_i$(level)	J$_i^\pi$	E$_\gamma$[†]	I$_\gamma$[†]	E$_f$	J$_f^\pi$	Mult.	α[#]	Comments
97.79	2$^+$	97.79 *9*	100	0.0	0$^+$	E2[‡]	3.85	α(K)=0.995 *14*; α(L)=2.17 *4*; α(M)=0.542 *8* α(N)=0.1256 *19*; α(O)=0.01587 *24*; α(P)=6.26×10^{-5} *9* Mult.: from intensity balance arguments in IT decay.
322.17	(4$^+$)	224.38 *10*	100	97.79	2$^+$	(E2)[‡]	0.198 *4*	α(K)=0.1215 *17*; α(L)=0.0573 *8*; α(M)=0.01399 *20* α(N)=0.00326 *5*; α(O)=0.000432 *6*; α(P)=8.18×10^{-6} *12*
666.27	(6$^+$)	344.1 *1*	100	322.17	(4$^+$)	(E2)[‡]	0.0529	α(K)=0.0381 *6*; α(L)=0.01136 *16*; α(M)=0.00272 *4* α(N)=0.000636 *9*; α(O)=8.76×10^{-5} *13*; α(P)=2.79×10^{-6} *4*
818.4	(1,2$^+$)	720.6 *4*	100 *10*	97.79	2$^+$			
		818.4 *4*	100 *25*	0.0	0$^+$			
905.9?		808.1 *5*	100	97.79	2$^+$			
1122.07	(8$^+$)	455.80 *8*	100	666.27	(6$^+$)	(E2)[‡]	0.0245	α(K)=0.0187 *3*; α(L)=0.00445 *7*; α(M)=0.001047 *15* α(N)=0.000246 *4*; α(O)=3.48×10^{-5} *5*; α(P)=1.422×10^{-6} *20*
1172.87	(8$^-$)	50.80 *8*	56 *7*	1122.07	(8$^+$)	(E1)	0.418 *7*	α(L)=0.325 *5*; α(M)=0.0740 *12* α(N)=0.0170 *3*; α(O)=0.00228 *4*; α(P)=8.92×10^{-5} *14* B(E1)(W.u.)=1.26×10^{-16} *19* Mult.: from intensity-balance in IT decay.

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Adopted Levels, Gammas (continued)

γ(^{182}Hf) (continued)

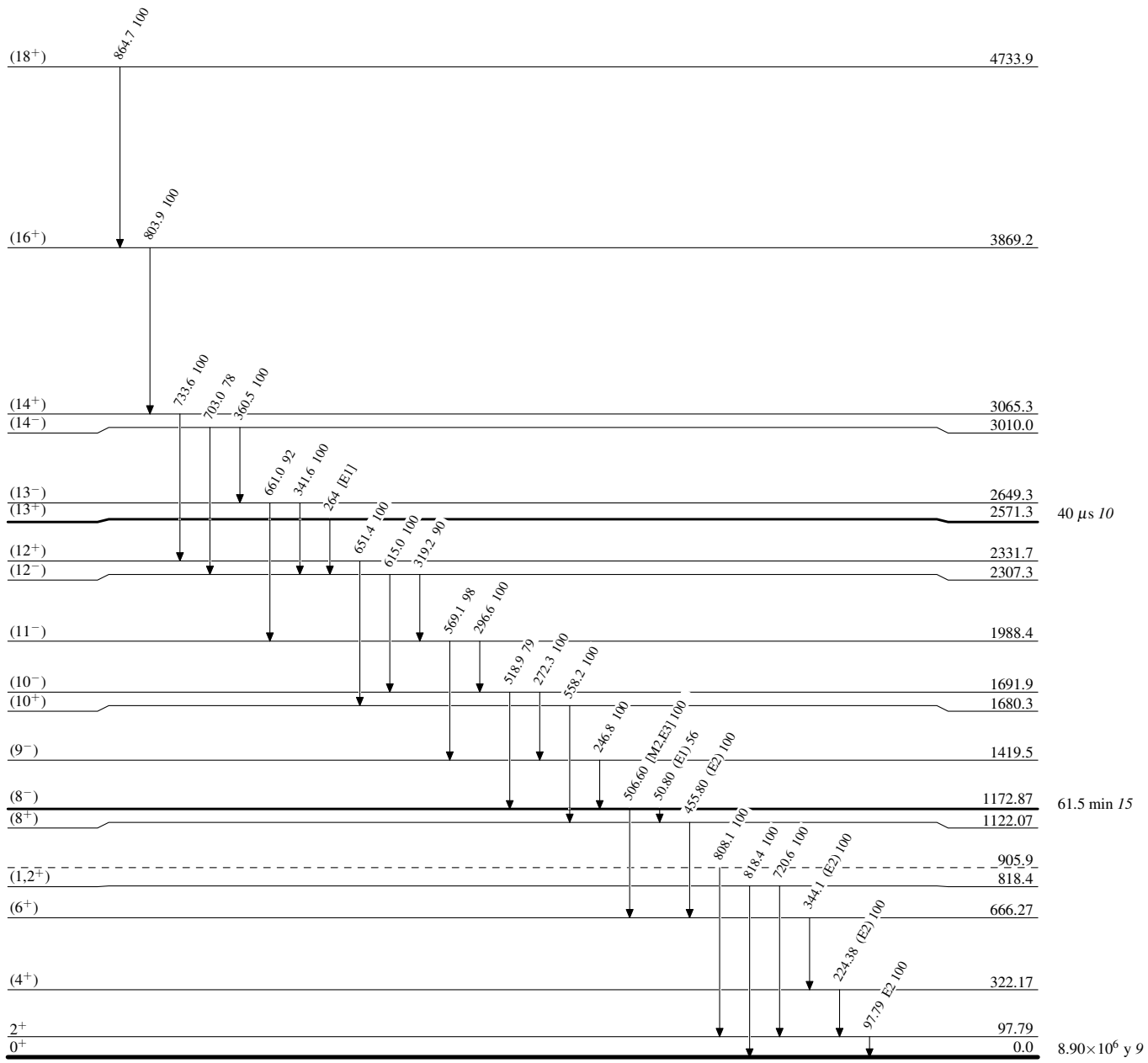
E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	α[#]	Comments
1172.87	(8$^-$)	506.60 *8*	100 *8*	666.27	(6$^+$)	[M2,E3]	0.10 *5*	B(M2)(W.u.)=4.0×10^{-12} *5* α(K)=0.08 *4*; α(L)=0.018 *4*; α(M)=0.0042 *7* α(N)=0.00100 *16*; α(O)=0.00015 *3*; α(P)=7.E−6 *4*
1419.5	(9$^-$)	246.8 *5*	100	1172.87	(8$^-$)			
1680.3	(10$^+$)	558.2 *5*	100	1122.07	(8$^+$)			
1691.9	(10$^-$)	272.3 *5*	100 *8*	1419.5	(9$^-$)			
		518.9 *5*	79 *8*	1172.87	(8$^-$)			
1988.4	(11$^-$)	296.6 *5*	100 *7*	1691.9	(10$^-$)			
		569.1 *5*	98 *7*	1419.5	(9$^-$)			
2307.3	(12$^-$)	319.2 *5*	90 *7*	1988.4	(11$^-$)			
		615.0 *5*	100 *7*	1691.9	(10$^-$)			
2331.7	(12$^+$)	651.4 *5*	100	1680.3	(10$^+$)			
2571.3	(13$^+$)	264		2307.3	(12$^-$)	[E1]		Mult.: Weisskopf estimate supports E1.
2649.3	(13$^-$)	341.6 *5*	100 *8*	2307.3	(12$^-$)			
		661.0 *5*	92 *8*	1988.4	(11$^-$)			
3010.0	(14$^-$)	360.5 *5*	100 *7*	2649.3	(13$^-$)			
		703.0 *5*	78 *6*	2307.3	(12$^-$)			
3065.3	(14$^+$)	733.6 *5*	100	2331.7	(12$^+$)			
3869.2	(16$^+$)	803.9 *5*	100	3065.3	(14$^+$)			
4733.9	(18$^+$)	864.7 *5*	100	3869.2	(16$^+$)			

[†] From weighted averages of values when a level is populated in more than one of the four datasets involving γ-ray studies.
[‡] From intensity balance in IT decay, multipolarities of the transitions in the g.s. band up to 8$^+$ are consistent with E2.
[#] 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.

Adopted Levels, Gammas

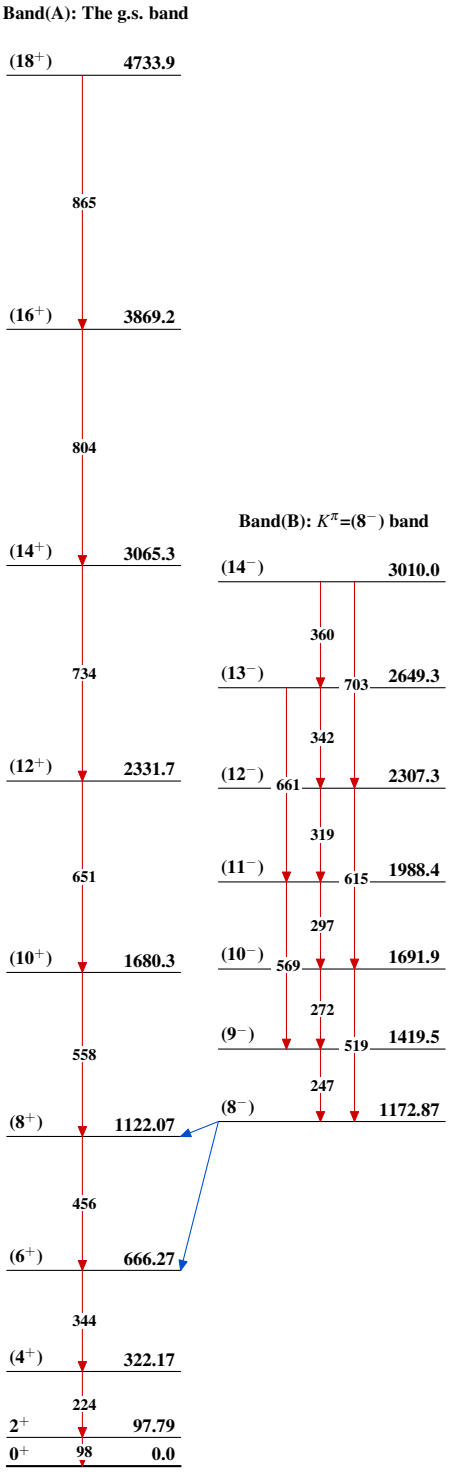
Level Scheme

Intensities: Relative photon branching from each level



$^{182}_{72}Hf_{110}$

Adopted Levels, Gammas



$^{182}_{72}Hf_{110}$