^{184}**Hf** β^- **decay** **1973Wa18**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 111,275 (2010)	1-Oct-2009

Parent: ^{184}Hf: E=0.0; J$^\pi$=0$^+$; T$_{1/2}$=4.12 h *5*; Q(β^-)=1340 *30*; %β^- decay=100.0

Source produced by ^{186}W(p,3p), E(p)=92 (97% ^{186}W target), 200 MeV (^{nat}W target); Ge(Li) detector (FWHM=1.2 At 122 keV, 1.9 keV At 1332 keV), NaI detector, plastic scin (FWHM≈16%); chemically-separated source; measured Eγ, Iγ, $\gamma\gamma$ coin, Eβ, $\beta^-\gamma$ coin.

^{184}Ta Levels

E(level)†	J$^\pi$‡
0.0	(5$^-$)
47.9# *2*	(3$^-$)
89.3# *3*	(2$^-$)
228.4# *4*	1$^{(-)}$
272.3 *4*	(0$^-$)
453.3 *5*	1$^{(+)}$
617.2 *5*	1$^{(+)}$

† From Eγ.

‡ From Adopted Levels.

The order of 47.9γ, 41.4γ, and 139.1γ has not been established experimentally so the energies of the 48 and 89 levels May differ from those shown here.

β^- radiations

E(decay)†	E(level)	Iβ^-‡#	Log *ft*	Comments
740 *30*	617.2	36 *4*	6.02 *8*	av Eβ=229 *11*
850 *50*	453.3	15.2 *20*	6.71 *8*	av Eβ=290 *12*
1100 *30*	228.4	47 *12*	6.57 *12*	av Eβ=378 *12*
(1.25×10^3@ *3*)	89.3	≤1.6	≥8.5^{1u}	

† From $\beta\gamma$ coincidence (plastic scintillator).

‡ Assuming Iβ(228+453+617)=100 since negligible β^- feeding to 0, 48, 89 or 272 levels is expected.

Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

γ(^{184}Ta)

Iγ normalization: 1973Wa18 report absolute abundances derived from the growth and decay of the ^{184}Ta daughter. The granddaughter abundances were taken as Iγ(111)=0.247 *35*, Iγ(253)=0.48 *6*, and Iγ(414)=0.85 *9*. These are from 4% − 18% higher than those adopted here for ^{184}Ta decay. The ^{184}Ta half-life (8.55 h) used by 1973Wa18 is about 2% lower than the value adopted in this evaluation. The two discrepancies have opposing effects on the normalization making the correction difficult. Multipolarities can Be deduced for Eγ<150 transitions based on α(exp) (or their limits) deduced using I(γ+ce) balance arguments, measured I(K x ray) and the authors′ Iγ assuming none is M2 or higher. the decay scheme was then renormalized assuming 181γ and 345γ are E1, by requiring total Iβ=100% and constraining the feeding to g.s., 48, 89 and 272 levels to zero (ΔJ=(5) and (3), respectively, to g.s. and 48 level, Iβ^-(89)≤1.6% for log $f^{1u}t$≥8.5, and β^- feeding to the 272 level should Be highly hindered due to cancellation of matrix elements for this proposed 0$^+$ to (0$^-$) transition (1973Wa18)). a less precise normalization factor of 0.87

^{184}Hf β^- decay 1973Wa18 (continued)

γ(^{184}Ta) (continued)

22 can Be obtained from Σ (I(γ+ce) to g.s.)=100%.

Continued on next page (footnotes at end of table)

^{184}Hf β^- decay 1973Wa18 (continued)

γ(^{184}Ta) (continued)

E_γ	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ	α[#]	Comments
41.4 *2*	9.9 *12*	89.3	(2$^-$)	47.9	(3$^-$)	M1		9.71 *20*	α(L)=7.52 *16*; α(M)=1.71 *4*; α(N+..)=0.477 *10* α(N)=0.408 *9*; α(O)=0.0646 *13*; α(P)=0.00446 *9* Mult.: see comment on 48γ.
43.9 *2*	6.1 *8*	272.3	(0$^-$)	228.4	1$^{(-)}$	M1		8.17 *16*	α(L)=6.33 *13*; α(M)=1.44 *3*; α(N+..)=0.402 *8* α(N)=0.344 *7*; α(O)=0.0543 *11*; α(P)=0.00375 *8* Mult.: α(exp)≥7.9 from Ti(44γ)≥(Ti(181γ)+Ti(344γ)) rules out E1 for 44γ; α(exp)≤16.4 from Ti(44γ)≤Ti(139γ) rules out pure E2.
47.9 *2*	1.2 *3*	47.9	(3$^-$)	0.0	(5$^-$)	E2		94.6 *24*	α(L)=71.9 *18*; α(M)=18.0 *5*; α(N+..)=4.74 *12* α(N)=4.19 *11*; α(O)=0.546 *14*; α(P)=0.000429 *9* Mult.: In the absence of β^- feeding to the 48 level, Ti(48γ)=Ti(41γ) and this implies multipolarities of E2 and M1, respectively, for the 48γ and 41γ.
139.1 *2*	48 *4*	228.4	1$^{(-)}$	89.3	(2$^-$)	M1+E2	1.9 *+4−3*	1.20 *5*	α(K)=0.63 *14*; α(L)=0.42 *4*; α(M)=0.104 *10*; α(N+..)=0.0278 *24* α(N)=0.0245 *22*; α(O)=0.00332 *25*; α(P)=5.0×10^{-5} *14* Mult.,δ: from α(K)exp=0.65 *12*, calculated from I(K vacancies)=33 *6* with the assumption that the 181γ and 345γ are E1.
181.0 *2*	14.8 *17*	453.3	1$^{(+)}$	272.3	(0$^-$)	[E1]		0.0785	α(K)=0.0652 *10*; α(L)=0.01036 *15*; α(M)=0.00234 *4*; α(N+..)=0.000642 *10* α(N)=0.000553 *8*; α(O)=8.36×10^{-5} *12*; α(P)=4.70×10^{-6} *7*
344.9 *2*	37 *5*	617.2	1$^{(+)}$	272.3	(0$^-$)	[E1]		0.01585	α(K)=0.01327 *19*; α(L)=0.00200 *3*; α(M)=0.000451 *7*; α(N+..)=0.0001245 *18* α(N)=0.0001069 *15*; α(O)=1.651×10^{-5} *24*; α(P)=1.027×10^{-6} *15*

† From the intensity balance except where noted.

‡ For absolute intensity per 100 decays, multiply by 0.95 *11*.

\# 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.

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