^{162}Hf $\varepsilon+\beta^+$ decay 1995Hi12,1982Sc15

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 195,1 (2024)	19-Sep-2023

Parent: ^{162}Hf: E=0; $J^\pi=0^+$; $T_{1/2}$=39.4 s *9*; Q(ε)=3660 *80*; %ε+%β^+ decay=99.992 *1*

^{162}Hf-$T_{1/2}$: Additional information 1.

^{162}Hf-Q(ε): Additional information 2.

^{162}Hf-Q(ε): From 2021Wa16.

^{162}Hf-%ε+%β^+ decay: From %α=0.008 *1* (1995Hi12). Other values: 0.0063 *14* (1992Ha10); and 0.0087 *+17−37* (1982Sc15). (Note that 1992Ha10 quote the value from 1982Sc15 (both papers have many of the same authors) as %α=0.0087 *7*.) However, in none of these studies were the absolute Iγ values measured. 1995Hi12 estimated the absolute Iγ values by requiring the sum of the intensities of the γ's feeding the g.s. to be 100% (K. S. Toth, priv. comm. (Oct., 1996)). 1992Ha10 assumed the Iγ value of the strongest γ transition in the spectrum to be 100%. In their paper, 1982Sc15 report Iα/Iγ(174γ)=0.00091 *9* but, in their data tables, they show the value given here for them. Note, also, that all three of these approaches lead to situations in which the Iγ values used may be larger than the actual ones. Consequently, the inferred %α values should perhaps be regarded as upper limits for the correct value. Nonetheless, the listed value agrees well with the result expected on the basis of systematics.

^{162}Hf-%ε+%β^+ decay: note that a simple weighted average of the three %α values listed here gives %α=0.0076 *7*.

Additional information 3.

1995Hi12: source material produced via the ^{135}Ba(^{32}S,5n) reaction, with E(^{32}S) having five different values, ranging from 214 MeV down to 172 MeV. Enriched (92.7% ^{135}Ba) BaF_2 targets. The reaction products were removed from the reaction chamber to a moving tape, for subsequent analysis, using a He-jet system. Measurements were made with two high-resolution Ge detectors in a close 180° geometry and a 450-mm^2 Si surface α detector. Excitation functions were used to assign mass numbers to the radiations. Measured Eγ, Iγ, $\gamma\gamma$, Xγ, $T_{1/2}$, Eα.

1982Sc15: source material produced via the ^{142}Nd(^{24}Mg,4n) reaction on an enriched (96.24% ^{142}Nd) target. γ singles and $\gamma\gamma$ coincidences measured with Ge detectors. α's measured with Si detector.

The data are from 1995Hi12, unless noted otherwise.

^{162}Lu Levels

E(level)	J^π
0	1^-
5.0?† *3*	
79.2?† *3*	
173.89? *5*	
196.34 *5*	
453.34† *5*	
552.8† *3*	
606.47 *11*	

† Level not reported by 1982Sc15.

$\gamma(^{162}Lu)$

Iγ normalization: The decay scheme is clearly incomplete (no levels reported above 0.61 MeV, while Q(ε)≈3.7 MeV). Thus, the evaluator has not attempted to deduce a value for Iγ normalization. If one wishes to provide an estimate for Iγ normalization by requiring that the sum of the I(γ+ce) values of the γ (and $\varepsilon+\beta^+$) transitions feeding the g.s. be 100%, one must somehow estimate the (unknown) direct $\varepsilon+\beta^+$ feeding of the g.s. and the effects of internal conversion on the intensities of several of the γ transitions to the g.s.. Note, however, that while 1995Hi12 report intensities for those $\varepsilon+\beta^+$ transitions which they propose to populate several of the ^{162}Lu levels, the evaluator has not adopted them here.

The data are from 1995Hi12, unless noted otherwise.

Values of α for several multipolarities are given in the ENSDF file.

Continued on next page (footnotes at end of table)

^{162}Hf $\varepsilon+\beta^+$ decay 1995Hi12,1982Sc15 (continued)

$\gamma(^{162}Lu)$ (continued)

E_γ	I_γ[†]	E_i(level)	E_f	J^π_f	Mult.	Comments
(5.0 *3*)		5.0?	0	1^-		E_γ: from level-energy difference. γ is not observed.
22.48[‡#] *10*	3 *1*	196.34	173.89?		(M1)	Mult.: from comparison of γ intensities in singles and coincidence spectra, 1995Hi12 conclude that α(exp)≈30 for this transition. Since α(E1)=3.83, α(E2)=3374, and α(M1)=48.9 for a 22.5γ, mult is most likely M1 (although an admixture of E2 cannot be excluded).
79.2[@] *4*	2 *1*	79.2?	0	1^-		I_γ: value corrected (by 1995Hi12) for the contribution from the 78.2γ from the decay of ^{161}Yb.
117.2[@] *4*	≈1	196.34	79.2?			
173.90[‡#] *5*	100	173.89?	0	1^-		I_γ: value corrected (by 1995Hi12) for the contribution from the 173.8γ from the ^{160}Yb decay. Additional information 4.
191.2 *3*	3 *1*	196.34	5.0?			I_γ: value corrected (by 1995Hi12) for the contribution from the 192.1γ from the ^{158}Tm decay.
196.34[‡] *5*	30 *3*	196.34	0	1^-		Additional information 5.
257.3 *3*	4 *1*	453.34	196.34			
356.5 *3*	2.3 *5*	552.8	196.34			
410.12[‡] *10*	18 *3*	606.47	196.34			Additional information 6.
452.8 *4*	3 *1*	453.34	0	1^-		
[x]532.9 *3*	≈1					
601.7 *5*	1.7 *5*	606.47	5.0?			

[†] Annihilation radiation is observed, but 511 peak includes contribution from ^{163}Hf decay. For the combined 511 peak, Iγ(174)/I(511)=1.13 *21* (1982Sc15).

[‡] From 1982Sc15. This value agrees well with that of 1995Hi12, but is considerably more precise.

[#] The ordering of these two transitions is that given by both 1982Sc15 and 1995Hi12, but it has not been definitely established.

[@] The ordering of these two transitions is not definitely established. The one shown here is that shown by 1995Hi12, based on the larger intensity of the 79γ.

[x] γ ray not placed in level scheme.

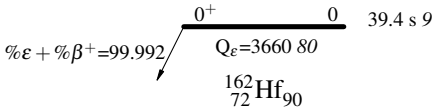
^{162}Hf ε decay 1995Hi12,1982Sc15

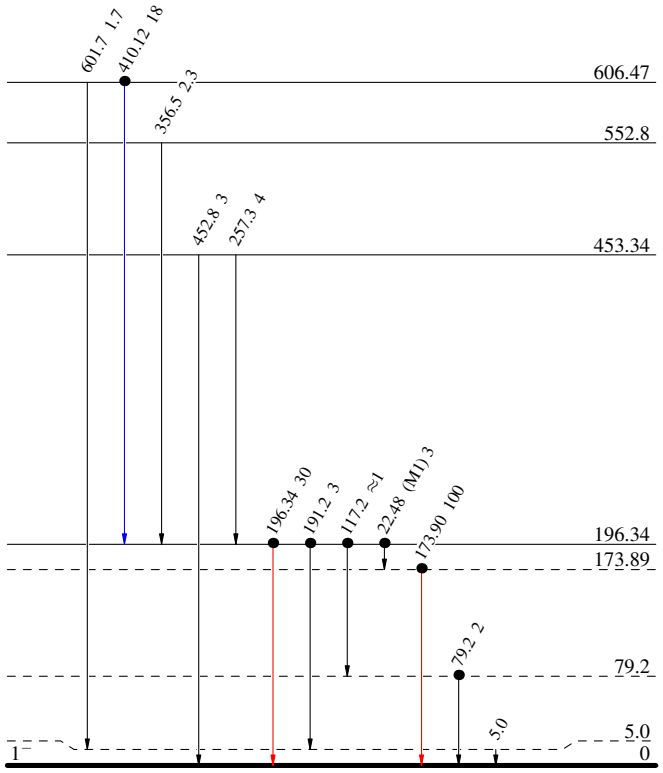
Legend

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

Decay Scheme

Intensities: Relative I_γ





$^{162}_{71}Lu_{91}$