^{177}Lu β^- decay (160.4 d)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 159, 1 (2019)	30-Aug-2019

Parent: ^{177}Lu: E=970.1757 *24*; J^π=23/2$^-$; $T_{1/2}$=160.4 d *3*; Q(β^-)=496.8 *8*; %β^- decay=77.30 *8*

^{177}Lu-E,J^π,$T_{1/2}$: From Adopted Levels of ^{177}Lu.

^{177}Lu-Q(β^-) from 2017Wa10.

^{177}Lu-%β^- decay: From Adopted Levels for ^{177}Lu.

Data taken from: 1964Al04, 1966Bo01, 1967Be34, 1967Ha09, 1969Hu06, 1970Ka39, 1971Gl09, 1972Bo55, 1974Kr12, 1981Hn03, 1972Ch48, 1989Ma56, 1990Bu31, 2012De24, 2012Ko23, 2013La08, 2014La20.

^{177}Hf Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[‡]	Comments
0.0[#]	7/2$^-$	stable	
112.9499[#] *4*	9/2$^-$	0.541 ns *14*	
249.6744[#] *4*	11/2$^-$	107 ps *10*	
321.3162[@] *4*	9/2$^+$	0.665 ns *16*	
409.4085[#] *5*	13/2$^-$		
426.6752[@] *4*	11/2$^+$	40 ps *3*	
555.1779[@] *4*	13/2$^+$		
591.3179[#] *7*	15/2$^-$		
708.4622[@] *5*	15/2$^+$		
794.4394[#] *9*	17/2$^-$		
882.8611[@] *5*	17/2$^+$		
1017.7911[#] *20*	19/2$^-$		
1086.9662[@] *6*	19/2$^+$		
1260.2817[#] *14*	21/2$^-$		
1301.4004[@] *6*	21/2$^+$		
1315.4502[&] *8*	23/2$^+$	1.09 s *5*	$T_{1/2}$: Weighted average of 1.08 s *6* (1971Gl09) and 1.12 s *10* (1966Bo01) measured from $\beta\gamma$(t) in ^{177}Lu β^- decay (160.4 D). Others: 1.1 s (1967Ra36).

[†] From a least-squares fit to Eγ.
[‡] From Adopted Levels.
[#] Band(A): K^π=7/2$^-$, ν7/2[514].
[@] Band(B): K^π=9/2$^+$, ν9/2[624].
[&] K^π=23/2$^+$, ν(7/2[514])$\otimes\pi^2$(7/2[404],9/2[514]).

β^- radiations

E(decay)	E(level)	Iβ^-[†]	Log *ft*	Comments
(151.5 *8*)	1315.4502	77.30 *8*	6.431 *8*	av Eβ=40.39 *23*

[†] Absolute intensity per 100 decays.

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$

Iγ normalization: 100/I(γ+ce)(23/2$^-$ isomer β^- decay)=100/609.8 *17*, weighted average of 610 *11* (Iπ=7/2$^-$), 610 *8* (I=9/2), 610 *5* (I=11/2), 609 *4* (I=13/2), 611.5 *34* (I=15/2), 609.1 *31* (I=17/2), 609 *7* (I=19/2) and 609 *9* (I=21/2).

E_γ [†]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α [‡]	Comments
(14.050 *10*)	1.161 *18*	1315.4502	23/2$^+$	1301.4004	21/2$^+$	[M1+E2]		217	%Iγ=0.1472 *23* α(L)=167.8 *24*; α(M)=38.2 *6* α(N)=9.08 *13*; α(O)=1.389 *20*; α(P)=0.0917 *13* E_γ: From level energy differences. I_γ: Using Iγ+ce(14.050γ)=253.2 *16* from transition intensity balance at the 1301-keV level and α=217.
55.15 *2*	15.42 *17*	1315.4502	23/2$^+$	1260.2817	21/2$^-$	[E1]		0.333	%Iγ=1.955 *22* α(N)=0.01357 *19*; α(O)=0.00183 *3*; α(P)=7.37×10^{-5} *11* I_γ: Using Iγ+ce(55.15γ)=20.55 *22* from transition intensity balance at the 1260-keV level and α=0.333. Others: 13.5 *10* (2014La20), 14.9 *9* (2012De24) and 10.0 *15* (1967Ha09).
69.2 *1*	0.078 *9*	1086.9662	19/2$^+$	1017.7911	19/2$^-$	[E1]		0.919	%Iγ=0.0099 *11* α(K)=0.742 *11*; α(L)=0.1381 *21*; α(M)=0.0313 *5* α(N)=0.00725 *11*; α(O)=0.001000 *15*; α(P)=4.33×10^{-5} *7* I_γ: Weighted average of 0.077 *9* (2012De24) and 0.088 *30* (1967Be34). Other: 0.08 (1967Ha09).
71.6418 *6*	6.91 *20*	321.3162	9/2$^+$	249.6744	11/2$^-$	E1+M2	−0.018 *9*	0.89 *6*	%Iγ=0.876 *26* α(K)=0.71 *4*; α(L)=0.136 *14*; α(M)=0.031 *4* α(N)=0.0072 *9*; α(O)=0.00101 *12*; α(P)=4.5×10^{-5} *7* I_γ: From intensity balance at the 321-keV level, Iγ(208.3662γ)=437 *6* and Iγ(71.6418γ)/Iγ(208.3662γ)=0.0158 *4*, weighted average of 0.0152 *11* (2016Lu16), 0.0163 *2* (2012Ko24), 0.01674 *21* (2001Sc23), 0.0171 *5* (1987Me17), 0.015 *1* (1974Ag01), 0.0146 *6* (1967Ha09) and 0.0140 *10* (1964Al04) (from ^{177}Lu β^- decay (6.6 d) – others: 0.01780 *7* (2011De07), 0.0030 *10* (1961We11) and 0.0091 (1955Ma12)), and 0.0137 *6* (2014La20), 0.0155 *11* (2012De24), 0.0128 *4* (2012Ko23), 0.0158 *6* (1981Hn03), 0.0145 *14* (1972Ch48), 0.0137 *8* (1967Be34), 0.0140 *8* (1967Ha09) and 0.015 *3* (1964Al04) (from ^{177}Lu β^- decay (160.4 d)).
88.4 *1*	0.34 *4*	882.8611	17/2$^+$	794.4394	17/2$^-$	[E1]		0.494	%Iγ=0.043 *5* α(K)=0.403 *6*; α(L)=0.0701 *10*; α(M)=0.01587 *23* α(N)=0.00369 *6*; α(O)=0.000519 *8*; α(P)=2.41×10^{-5} *4* I_γ: Weighted average of 0.30 *7* (2014La20), 0.40 *7* (2012De24) and 0.32 *8* (1967Be34).

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ †	I_γ #	E_i(level)	J_i^π	E_f	J_f^π	Mult. †	δ †	α ‡	Comments
105.3589 *4*	100	426.6752	11/2$^+$	321.3162	9/2$^+$	M1+E2	−0.330 *13*	3.39	%Iγ=12.68 *4* α(K)=2.67 *4*; α(L)=0.555 *11*; α(M)=0.129 *3* α(N)=0.0304 *7*; α(O)=0.00443 *9*; α(P)=0.000226 *4* I_γ: Used for normalization of relative γ-ray emission probabilities.
112.9498 *4*	168.5 *29*	112.9499	9/2$^-$	0.0	7/2$^-$	M1+E2	−4.77 *19*	2.23	%Iγ=21.4 *4* α(K)=0.805 *13*; α(L)=1.085 *16*; α(M)=0.270 *4* α(N)=0.0627 *9*; α(O)=0.00798 *12*; α(P)=5.14×10^{-5} *9* I_γ: From intensity balance at the 113-keV level. Values measured in ^{177}Lu β^- decay (160.4 d) are 173.0 *25* (2014La20), 171.7 *23* (2012De24), 170 *5* (2012Ko23), 179 *4* (1981Hn03), 179 *8* (1972Ch48), 179 *13* (1967Ha09) and 251 *13* (1964Al04), but those can be affected from the ^{177}Lu β^- decay (6.6 d) decay feedings.
117.1442 *12*	1.53 *9*	708.4622	15/2$^+$	591.3179	15/2$^-$	[E1]		0.237	%Iγ=0.194 *11* α(K)=0.196 *3*; α(L)=0.0323 *5*; α(M)=0.00730 *11* α(N)=0.001704 *24*; α(O)=0.000244 *4*; α(P)=1.213×10^{-5} *17* I_γ: Weighted average of 1.5 *2* (2014La20), 1.43 *13* (2012De24), 1.51 *20* (1981Hn03) and 1.8 *2* (1967Ha09). Other: 12 *2* (1964Al04).
128.5027 *4*	126.5 *11*	555.1779	13/2$^+$	426.6752	11/2$^+$	M1+E2	−0.336 *10*	1.90	%Iγ=16.04 *15* α(K)=1.519 *22*; α(L)=0.291 *5*; α(M)=0.0671 *11* α(N)=0.0159 *3*; α(O)=0.00234 *4*; α(P)=0.0001277 *19* I_γ: Weighted average of 126.1 *18* (2014La20), 127.3 *18* (2012De24), 125 *4* (2012Ko23), 126.6 *25* (1981Hn03), 127 *6* (1972Ch48), 127 *8* (1967Ha09) and 125 *6* (1964Al04).
136.7245 *5*	11.45 *9*	249.6744	11/2$^-$	112.9499	9/2$^-$	M1+E2	−3.31 *15*	1.130 *17*	%Iγ=1.452 *12* α(K)=0.540 *10*; α(L)=0.450 *7*; α(M)=0.1113 *17* α(N)=0.0259 *4*; α(O)=0.00334 *5*; α(P)=3.57×10^{-5} *9* I_γ: From intensity balance at the 249-keV level, Iγ(249.6742γ)=49.2 *6* and Iγ(136.7245γ)/Iγ(249.6742γ)=0.2327 *19*, weighted average of 0.243 *6* (2012Ko24), 0.234 *4* (2001Sc23), 0.229 *3* (1987Me17), 0.223 *16* (1964Al04) and 0.24 *8* (1961We11) (from ^{177}Lu β^- decay (6.6 d) − others: 0.184 *11* (2016Lu16), 0.274 *3* (2011De07), 0.274 *26* (1974Ag01), 0.306 *22* (1967Ha09)), and 0.234 *5* (2014La20), 0.236 *9* (2012Ko23), 0.228 *10* (1981Hn03), 0.222 *21* (1972Ch48) and 0.249 *17* (1967Ha09) (from ^{177}Lu β^- decay (160.4 d) − others: 0.315 *11* (2012De24)and 0.27 *5* (1964Al04)). Values measured in ^{177}Lu β^- decay (160.4 d) are 11.47 *23* (2014La20), 14.7 *5* (2012De24), 11.0 *4* (2012Ko23), 11.4 *5* (1981Hn03), 11.4 *11* (1972Ch48), 11.7 *8* (1967Ha09) and 17 *3* (1964Al04).

$^{177}_{72}Hf_{105}$-3

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ [†]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α [‡]	Comments
145.7693 *7*	7.61 *12*	555.1779	13/2$^+$	409.4085	13/2$^-$	[E1]		0.1339	%Iγ=0.965 *16* α(K)=0.1109 *16*; α(L)=0.01781 *25*; α(M)=0.00402 *6* α(N)=0.000940 *14*; α(O)=0.0001361 *19*; α(P)=7.10×10^{-6} *10* I_γ: Weighted average of 7.65 *13* (2014La20), 7.4 *4* (1981Hn03), 7.5 *8* (1972Ch48), 7.7 *5* (1967Be34), 6.6 *9* (1967Ha09). Others: 9.1 *3* (2012De24) and 11 *2* (1964Al04).
153.2842 *4*	130.5 *13*	708.4622	15/2$^+$	555.1779	13/2$^+$	M1+E2	−0.352 *17*	1.135 *17*	%Iγ=16.54 *17* α(K)=0.918 *15*; α(L)=0.168 *3*; α(M)=0.0386 *7* α(N)=0.00913 *15*; α(O)=0.001357 *21*; α(P)=7.70×10^{-5} *13* I_γ: Weighted average of 130.9 *14* (2012De24) and 127 *4* (2012Ko23). Others: 136.2 *20* (2014La20), 136 *3* (1981Hn03), 150 *7* (1972Ch48) 133 *8* (1967Ha09) and 134 *7* (1964Al04).
159.7341 *7*	4.21 *7*	409.4085	13/2$^-$	249.6744	11/2$^-$	M1+E2	−2.4 *10*	0.69 *9*	%Iγ=0.534 *9* α(K)=0.39 *11*; α(L)=0.223 *20*; α(M)=0.055 *6* α(N)=0.0127 *13*; α(O)=0.00167 *13*; α(P)=2.8×10^{-5} *11* I_γ: Weighted average of 4.2 *2* (1981Hn03), 4.21 *9* (2014La20), 4.5 *5* (2012De24), 4.06 *14* (2012Ko23), 5.4 *5* (1967Ha09) and 5.0 *6* (1972Ch48). Other: 5 *1* (1964Al04).
174.3988 *4*	98.4 *8*	882.8611	17/2$^+$	708.4622	15/2$^+$	M1+E2	−0.313 *16*	0.793 *12*	%Iγ=12.47 *11* α(K)=0.649 *10*; α(L)=0.1116 *17*; α(M)=0.0255 *4* α(N)=0.00604 *9*; α(O)=0.000908 *13*; α(P)=5.45×10^{-5} *9* I_γ: Weighted average of 102.5 *20* (1981Hn03), 100.8 *14* (2014La20), 94.7 *14* (2012De24), 93 *3* (2012Ko23), 96 *8* (1967Ha09), 105 *5* (1972Ch48). Other: 110 *6* (1964Al04).
177.0007 *4*	28.6 *3*	426.6752	11/2$^+$	249.6744	11/2$^-$	[E1]		0.0808	%Iγ=3.63 *4* α(K)=0.0672 *10*; α(L)=0.01057 *15*; α(M)=0.00238 *4* α(N)=0.000558 *8*; α(O)=8.15×10^{-5} *12*; α(P)=4.42×10^{-6} *7* I_γ: Weighted average of 28.6 *4* (2014La20), 29.0 *5* (2012De24), 28.0 *9* (1981Hn03), 28.9 *18* (1972Ch48), 27.8 *12* (1967Be34), 26 *3* (1967Ha09). Other: 34 *3* (1964Al04).
181.9093 *13*	0.77 *3*	591.3179	15/2$^-$	409.4085	13/2$^-$	[M1+E2]		0.734	%Iγ=0.098 *4* α(K)=0.612 *9*; α(L)=0.0947 *14*; α(M)=0.0214 *3* α(N)=0.00508 *8*; α(O)=0.000779 *11*; α(P)=5.18×10^{-5} *8* I_γ: From Iγ(181.9γ)/Iγ(341.6423γ)=0.0556 *24* in adopted gammas and Iγ(341.6423γ)=13.88 *22*.
203.0 *1*	0.98 *5*	794.4394	17/2$^-$	591.3179	15/2$^-$	[M1+E2]		0.541	%Iγ=0.124 *6* α(K)=0.451 *7*; α(L)=0.0697 *11*; α(M)=0.01572 *23* α(N)=0.00374 *6*; α(O)=0.000573 *9*; α(P)=3.81×10^{-5} *6* I_γ: From Iγ(203.0γ)/Iγ(385.0304γ)=0.0390 *21* in adopted gammas and Iγ(385.0304γ)=25.0 *3*.

$^{177}_{72}Hf_{105}$-4

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[†]	α[‡]	Comments
204.1050 *4*	106.6 *19*	1086.9662	19/2$^+$	882.8611	17/2$^+$	M1+E2	−0.335 *23*	0.506 *8*	%Iγ=13.51 *24* α(K)=0.415 *7*; α(L)=0.0702 *10*; α(M)=0.01601 *24* α(N)=0.00379 *6*; α(O)=0.000572 *8*; α(P)=3.48×10^{-5} *6* I_γ: Weighted average of 111.7 *25* (1981Hn03), 109.2 *16* (2014La20), 102.5 *14* (2012De24), 105 *3* (2012Ko23), 114 *8* (1967Ha09) and 119 *6* (1972Ch48). Other: 130 *13* (1964Al04).
208.3662 *4*	437 *6*	321.3162	9/2$^+$	112.9499	9/2$^-$	E1+M2	+0.076 *19*	0.068 *9*	%Iγ=55.4 *8* α(K)=0.055 *7*; α(L)=0.0094 *15*; α(M)=0.0022 *4* α(N)=0.00051 *9*; α(O)=7.5×10^{-5} *13*; α(P)=4.3×10^{-6} *8* I_γ: From intensity balance at the 321-keV level, Iγ(71.6418γ)/Iγ(208.3662γ)=0.0158 *4*, weighted average of 0.0152 *11* (2016Lu16), 0.0163 *2* (2012Ko24), 0.01674 *21* (2001Sc23), 0.0171 *5* (1987Me17), 0.015 *1* (1974Ag01), 0.0146 *6* (1967Ha09) and 0.0140 *10* (1964Al04) (from ^{177}Lu β^- decay (6.6 d) − others: 0.01780 *7* (2011De07), 0.0030 *10* (1961We11) and 0.0091 (1955Ma12)), and 0.0137 *6* (2014La20), 0.0155 *11* (2012De24), 0.0128 *4* (2012Ko23), 0.0158 *6* (1981Hn03), 0.0145 *14* (1972Ch48), 0.0137 *8* (1967Be34), 0.0140 *8* (1967Ha09) and 0.015 *3* (1964Al04) (from ^{177}Lu β^- decay (160.4 d)), and Iγ(321.3159γ)/Iγ(208.3662γ)=0.0210 *3*, weighted average of 0.0189 *19* (2012Ko24), 0.02002 *19* (2001Sc23), 0.0217 *2* (1987Me17), 0.0198 *18* (1974Ag01), 0.0220 *12* (1967Ha09), 0.0199 *14* (1964Al04), 0.0228 *10* (1961We11) (from ^{177}Lu β^- decay (6.6 d) − others: 0.0152 *11* (2016Lu16), 0.02470 *7* (2011De07) and 0.0146 (1955Ma12)), and 0.0214 *8* (2014La20), 0.0228 *4* (2012De24), 0.0199 *9* (2012Ko23), 0.0203 *18* (1981Hn03), 0.0227 *18* (1972Ch48), 0.0191 *10* (1967Be34), 0.0186 *21* (1967Ha09) (from ^{177}Lu β^- decay (160.4 d) − other: 0.0197 (1964Al04)).
214.4341 *5*	50.7 *5*	1301.4004	21/2$^+$	1086.9662	19/2$^+$	M1+E2	−0.30 *3*	0.445 *8*	%Iγ=6.43 *7* α(K)=0.367 *7*; α(L)=0.0605 *9*; α(M)=0.01377 *20* α(N)=0.00327 *5*; α(O)=0.000494 *7*; α(P)=3.08×10^{-5} *6* I_γ: Weighted average of 53.7 *15* (1981Hn03), 51.8 *7* (2014La20), 47.6 *9* (2012De24), 55 *3* (1972Ch48), 50.7 *14* (2012Ko23), 48 *4* (1967Ha09). Other: 79 *8* (1964Al04).
223.3 *3*	0.102 *6*	1017.7911	19/2$^-$	794.4394	17/2$^-$	[M1+E2]		0.415	%Iγ=0.0129 *8* α(K)=0.347 *5*; α(L)=0.0534 *8*; α(M)=0.01206 *18* α(N)=0.00287 *5*; α(O)=0.000440 *7*; α(P)=2.93×10^{-5} *5* I_γ: From Iγ(223.3γ)/Iγ(426.4726γ)=0.0270 *17* in adopted gammas and Iγ(385.0304γ)=3.56 *10*.

$^{177}_{72}Hf_{105}$-5

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[‡]	Comments
228.4838 *6*	283 *6*	1315.4502	23/2$^+$	1086.9662	19/2$^+$	E2	0.185	%Iγ=35.9 *8* α(K)=0.1156 *17*; α(L)=0.0533 *8*; α(M)=0.01300 *19* α(N)=0.00303 *5*; α(O)=0.000402 *6*; α(P)=7.81×10^{-6} *11* I_γ: Weighted average of 301 *6* (1981Hn03), 296 *5* (2014La20), 273 *3* (2012De24), 310 *13* (1972Ch48), 271 *8* (2012Ko23) and 287 *26* (1967Ha09) and the external uncertainty. Other: 340 *17* (1964Al04). Note, that Iγ(228.4838)=282 *4* from transition intensity balance at the 1086.9-keV level, which is in excellent agreement with the recommend value.
233.8615 *5*	36.7 *11*	555.1779	13/2$^+$	321.3162	9/2$^+$	E2	0.1719	%Iγ=4.65 *14* α(K)=0.1084 *16*; α(L)=0.0486 *7*; α(M)=0.01183 *17* α(N)=0.00276 *4*; α(O)=0.000367 *6*; α(P)=7.36×10^{-6} *11* I_γ: From 2012Ko23. Others: 44.5 *7* (2014La20), 42.6 *5* (2012De24), 45.3 *15* (1981Hn03), 47.1 *23* (1972Ch48), 45 *4* (1967Ha09) and 43 *4* (1964Al04).
242.1 *3*	0.456 *23*	1260.2817	21/2$^-$	1017.7911	19/2$^-$	[M1+E2]	0.333	%Iγ=0.0578 *29* α(K)=0.278 *4*; α(L)=0.0427 *6*; α(M)=0.00964 *14* α(N)=0.00229 *4*; α(O)=0.000352 *5*; α(P)=2.34×10^{-5} *4* I_γ: Weighted average of 0.458 *24* (2014La20) and 0.43 *9* (2012De24). Other: 0.30 *10* (1981Hn03).
249.6742 *6*	49.2 *6*	249.6744	11/2$^-$	0.0	7/2$^-$	E2	0.1395	%Iγ=6.24 *8* α(K)=0.0905 *13*; α(L)=0.0375 *6*; α(M)=0.00911 *13* α(N)=0.00213 *3*; α(O)=0.000284 *4*; α(P)=6.23×10^{-6} *9* I_γ: From intensity balance at the 249-keV level and Iγ(136.7245γ)/Iγ(249.6742γ)=0.2327 *19*, weighted average of 0.243 *6* (2012Ko24), 0.234 *4* (2001Sc23), 0.229 *3* (1987Me17), 0.223 *16* (1964Al04) and 0.24 *8* (1961We11) (from ^{177}Lu β^- decay (6.6 d) – others: 0.184 *11* (2016Lu16), 0.274 *3* (2011De07), 0.274 *26* (1974Ag01), 0.306 *22* (1967Ha09)), and 0.234 *5* (2014La20), 0.236 *9* (2012Ko23), 0.228 *10* (1981Hn03), 0.222 *21* (1972Ch48) and 0.249 *17* (1967Ha09) (from ^{177}Lu β^- decay (160.4 d) – others: 0.315 *11* (2012De24)and 0.27 *5* (1964Al04)).
281.7868 *5*	110.2 *10*	708.4622	15/2$^+$	426.6752	11/2$^+$	E2	0.0958	%Iγ=13.97 *13* α(K)=0.0650 *10*; α(L)=0.0236 *4*; α(M)=0.00569 *8* α(N)=0.001329 *19*; α(O)=0.000180 *3*; α(P)=4.59×10^{-6} *7* I_γ: Weighted average of 112.6 *23* (2014La20), 108.2 *14* (2012De24), 106 *3* (2012Ko23), 115.2 *25* (1981Hn03), 117 *5* (1972Ch48) and 108 *9* (1967Ha09). Other: 121 *6* (1964Al04).
283.609 *3*	3.25 *19*	1301.4004	21/2$^+$	1017.7911	19/2$^-$	[E1]	0.0245	%Iγ=0.412 *24* α(K)=0.0205 *3*; α(L)=0.00310 *5*; α(M)=0.000697 *10* α(N)=0.0001642 *23*; α(O)=2.44×10^{-5} *4*; α(P)=1.425×10^{-6} *20* I_γ: Weighted average of 2.9 *4* (1981Hn03), 3.23 *26* (2014La20), 4.3 *6* (1972Ch48), 4.7 *12* (1967Ha09), and 2.9 *5* (1967Be34). Other: 5.12 *23* (2012De24).

$^{177}_{72}Hf_{105}$-6

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ [†]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α [‡]	Comments
291.5429 *12*	8.14 *23*	882.8611	17/2$^+$	591.3179	15/2$^-$	E1+M2	+0.08 *8*	0.028 *15*	%Iγ=1.032 *29* α(K)=0.023 *12*; α(L)=0.0037 *25*; α(M)=0.0008 *6* α(N)=0.00020 *14*; α(O)=3.0×10^{-5} *21*; α(P)=1.8×10^{-6} *13* I_γ: Weighted average of 8.2 *6* (1981Hn03), 8.1 *3* (2014La20), 8.3 *6* (2012Ko23), 7.7 *9* (1967Ha09) and 8.4 *8* (1967Be34). Others: 6.3 *3* (2012De24), 14.9 *13* (1972Ch48) and 20 *4* (1964Al04).
292.5266 *14*	6.4 *4*	1086.9662	19/2$^+$	794.4394	17/2$^-$	E1+M2	+0.08 *8*	0.028 *15*	%Iγ=0.81 *5* α(K)=0.023 *12*; α(L)=0.0037 *24*; α(M)=0.0008 *6* α(N)=0.00020 *14*; α(O)=3.0×10^{-5} *21*; α(P)=1.8×10^{-6} *13* I_γ: Weighted average of 6.7 *4* (1981Hn03), 6.75 *10* (2014La20), 6.7 *7* (1967Be34) and 5.4 *3* (2012De24). Others: 7.8 *9* (1967Ha09), 14.9 *13* (1972Ch48) and 20 *4* (1964Al04).
296.4584 *5*	39.5 *10*	409.4085	13/2$^-$	112.9499	9/2$^-$	E2		0.0821	%Iγ=5.01 *13* α(K)=0.0567 *8*; α(L)=0.0195 *3*; α(M)=0.00469 *7* α(N)=0.001097 *16*; α(O)=0.0001490 *21*; α(P)=4.04×10^{-6} *6* I_γ: Weighted average of 40.8 *12* (1981Hn03), 39.8 *8* (2014La20), 35.8 *10* (2012De24), 36.5 *11* (2012Ko23), 38 *4* (1967Ha09), 45 *3* (1972Ch48). Other: 65 *7* (1964Al04).
299.0534 *7*	12.88 *44*	708.4622	15/2$^+$	409.4085	13/2$^-$	E1+M2	+0.11 *5*	0.030 *10*	%Iγ=1.63 *6* α(K)=0.025 *8*; α(L)=0.0041 *16*; α(M)=0.0009 *4* α(N)=0.00022 *9*; α(O)=3.3×10^{-5} *14*; α(P)=2.0×10^{-6} *9* I_γ: Weighted average of 13.11 *29* (2014La20), 11.0 *5* (2012De24), 12.2 *5* (2012Ko23), 14.8 *5* (1981Hn03), 14.3 *10* (1972Ch48), 12.6 *7* (1967Be34), 12 *2* (1967Ha09) and 10 *2* (1964Al04).
305.5033 *5*	14.19 *18*	555.1779	13/2$^+$	249.6744	11/2$^-$	E1+M2	+0.16 *7*	0.038 *18*	%Iγ=1.799 *24* α(K)=0.031 *14*; α(L)=0.005 *3*; α(M)=0.0012 *7* α(N)=0.00029 *16*; α(O)=4.4×10^{-5} *24*; α(P)=2.6×10^{-6} *15* I_γ: Weighted average of 14.11 *29* (2014La20), 14.6 *4* (2012De24), 13.1 *5* (2012Ko23), 14.9 *5* (1981Hn03), 14.5 *12* (1972Ch48), 14.2 *6* (1967Be34), 14 *1* (1967Ha09) and 13 *3* (1964Al04).
313.7250 *5*	10.35 *11*	426.6752	11/2$^+$	112.9499	9/2$^-$	E1+M2	+0.06 *5*	0.021 *6*	%Iγ=1.312 *15* α(K)=0.018 *5*; α(L)=0.0028 *9*; α(M)=0.00063 *20* α(N)=0.00015 *5*; α(O)=2.2×10^{-5} *8*; α(P)=1.3×10^{-6} *5* I_γ: Weighted average of 9.9 *3* (2014La20), 10.42 *14* (2012De24), 10.9 *4* (2012Ko23), 10.0 *4* (1981Hn03), 11.5 *8* (1972Ch48), 10.5 *5* (1967Be34) and 9.4 *7* (1967Ha09). Other: 12 *2* (1964Al04).
321.3159 *6*	9.18 *18*	321.3162	9/2$^+$	0.0	7/2$^-$	E1+M2	+0.175 *10*	0.0354 *21*	%Iγ=1.164 *23*

$^{177}_{72}Hf_{105}$-7

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ [†]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	α [‡]	Comments
								α(K)=0.0289 *16*; α(L)=0.0050 *4*; α(M)=0.00116 *8* α(N)=0.000274 *18*; α(O)=4.1×10^{-5} *3*; α(P)=2.52×10^{-6} *17* I_γ: From intensity balance at the 321-keV level and Iγ(208.3662γ)=437 *6* and Iγ(321.3159γ)/Iγ(208.3662γ)=0.0210 *3*, weighted average of 0.0189 *19* (2012Ko24), 0.02002 *19* (2001Sc23), 0.0217 *2* (1987Me17), 0.0198 *18* (1974Ag01), 0.0220 *12* (1967Ha09), 0.0199 *14* (1964Al04), 0.0228 *10* (1961We11) (from ^{177}Lu β^- decay (6.6 d) − others: 0.0152 *11* (2016Lu16), 0.02470 *7* (2011De07) and 0.0146 (1955Ma12)), and 0.0214 *8* (2014La20), 0.0228 *4* (2012De24), 0.0199 *9* (2012Ko23), 0.0203 *18* (1981Hn03), 0.0227 *18* (1972Ch48), 0.0191 *10* (1967Be34), 0.0186 *21* (1967Ha09) (from ^{177}Lu β^- decay (160.4 d) − other: 0.0197 (1964Al04)).
327.6829 *5*	145.4 *16*	882.8611	17/2$^+$	555.1779	13/2$^+$	E2	0.0610	%Iγ=18.43 *21* α(K)=0.0434 *6*; α(L)=0.01352 *19*; α(M)=0.00324 *5* α(N)=0.000758 *11*; α(O)=0.0001040 *15*; α(P)=3.15×10^{-6} *5* I_γ: Weighted average of 145.8 *28* (2014La20), 148 *4* (2012De24), 137 *4* (2012Ko23), 149 *3* (1981Hn03), 146 *6* (1972Ch48), 136 *8* (1967Ha09) and 149 *15* (1964Al04).
341.6432 *10*	13.88 *22*	591.3179	15/2$^-$	249.6744	11/2$^-$	E2	0.0540	%Iγ=1.760 *28* α(K)=0.0389 *6*; α(L)=0.01165 *17*; α(M)=0.00279 *4* α(N)=0.000652 *10*; α(O)=8.98×10^{-5} *13*; α(P)=2.84×10^{-6} *4* I_γ: Weighted average of 13.8 *4* (2014La20), 14.4 *4* (2012De24), 13.4 *5* (2012Ko23), 13.7 *6* (1981Hn03), 14.9 *13* (1972Ch48), 13 *1* (1967Ha09) and 14 *4* (1964Al04).
378.5036 *5*	231.9 *22*	1086.9662	19/2$^+$	708.4622	15/2$^+$	E2	0.0404	%Iγ=29.40 *29* α(K)=0.0298 *5*; α(L)=0.00817 *12*; α(M)=0.00194 *3* α(N)=0.000455 *7*; α(O)=6.34×10^{-5} *9*; α(P)=2.21×10^{-6} *3* I_γ: Weighted average of 246 *6* (1981Hn03), 241 *5* (2014La20), 227 *3* (2012De24) and 232 *11* (1972Ch48), 224 *7* (2012Ko23), 222 *17* (1967Ha09) and 223 *22* (1964Al04).
385.0304 *9*	25.0 *3*	794.4394	17/2$^-$	409.4085	13/2$^-$	E2	0.0386	%Iγ=3.17 *4* α(K)=0.0285 *4*; α(L)=0.00771 *11*; α(M)=0.00183 *3* α(N)=0.000429 *6*; α(O)=5.98×10^{-5} *9*; α(P)=2.12×10^{-6} *3* I_γ: Weighted average of 25.4 *4* (2014La20), 24.9 *10* (2012De24), 23.1 *7* (2012Ko23), 26.0 *8* (1981Hn03), 24.5 *16* (1972Ch48), and 24 *2* (1967Ha09). Other: 37 *7* (1964Al04).
418.5388 *5*	171.3 *13*	1301.4004	21/2$^+$	882.8611	17/2$^+$	E2	0.0307	%Iγ=21.72 *18* α(K)=0.0231 *4*; α(L)=0.00584 *9*; α(M)=0.001382 *20* α(N)=0.000324 *5*; α(O)=4.56×10^{-5} *7*; α(P)=1.738×10^{-6} *25* I_γ: Weighted average of 176 *4* (1981Hn03), 171.7 *23* (2014La20), 172.1 *18* (2012De24), 167 *8* (1972Ch48), 160 *5* (2012Ko23), 161 *12* (1967Ha09) and 185 *19* (1964Al04).
426.4726 *24*	3.76 *28*	1017.7911	19/2$^-$	591.3179	15/2$^-$	E2	0.0292	%Iγ=0.48 *4* α(K)=0.0221 *3*; α(L)=0.00550 *8*; α(M)=0.001299 *19* α(N)=0.000305 *5*; α(O)=4.29×10^{-5} *6*; α(P)=1.662×10^{-6} *24*

$^{177}_{72}Hf_{105}$-8

^{177}Lu β^- decay (160.4 d) (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ [†]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	α [‡]	Comments
								I_γ: Weighted average (external uncertainty) of 3.52 *20* (1981Hn03), 3.64 *16* (2014La20), 5.7 *3* (2012De24), 3.56 *18* (2012Ko23), 3.4 *4* (1967Ha09) and 3.4 *4* (1972Ch48).
465.8416 *10*	19.49 *21*	1260.2817	21/2$^-$	794.4394	17/2$^-$	E2	0.0232	%Iγ=2.471 *28* α(K)=0.01778 *25*; α(L)=0.00415 *6*; α(M)=0.000977 *14* α(N)=0.000230 *4*; α(O)=3.26×10^{-5} *5*; α(P)=1.351×10^{-6} *19* I_γ: Weighted average of 19.2 *15* (1981Hn03), 19.8 *3* (2014La20), 19.2 *3* (2012De24), 19.4 *13* (1972Ch48) and 19 *2* (1967Ha09). Others: 17.4 *5* (2012Ko23) and 23 *7* (1964Al04).

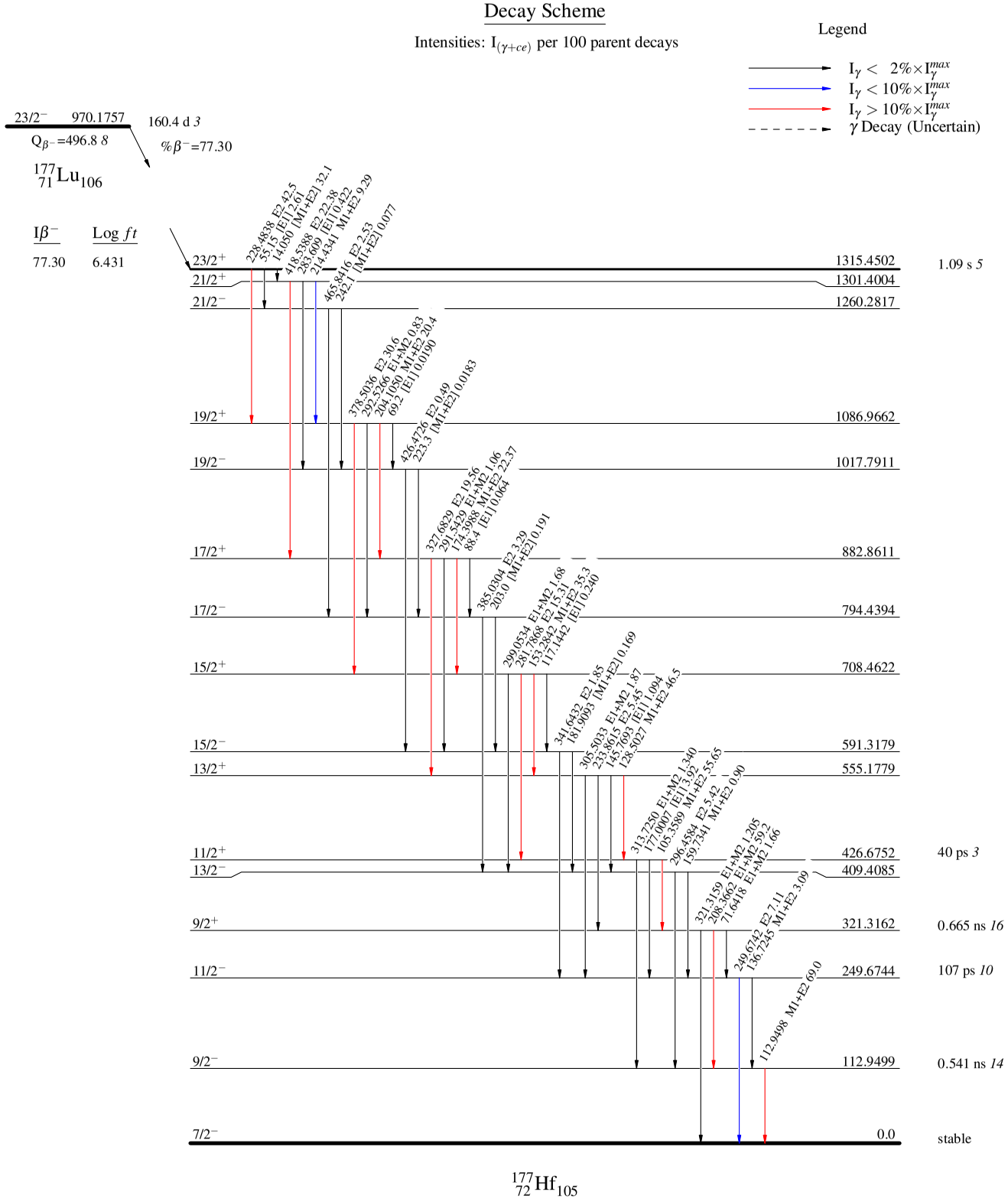
[†] From adopted gammas.
[‡] Additional information 1.
[#] For absolute intensity per 100 decays, multiply by 0.1268 *4*.

$^{177}_{72}Hf_{105}$-9

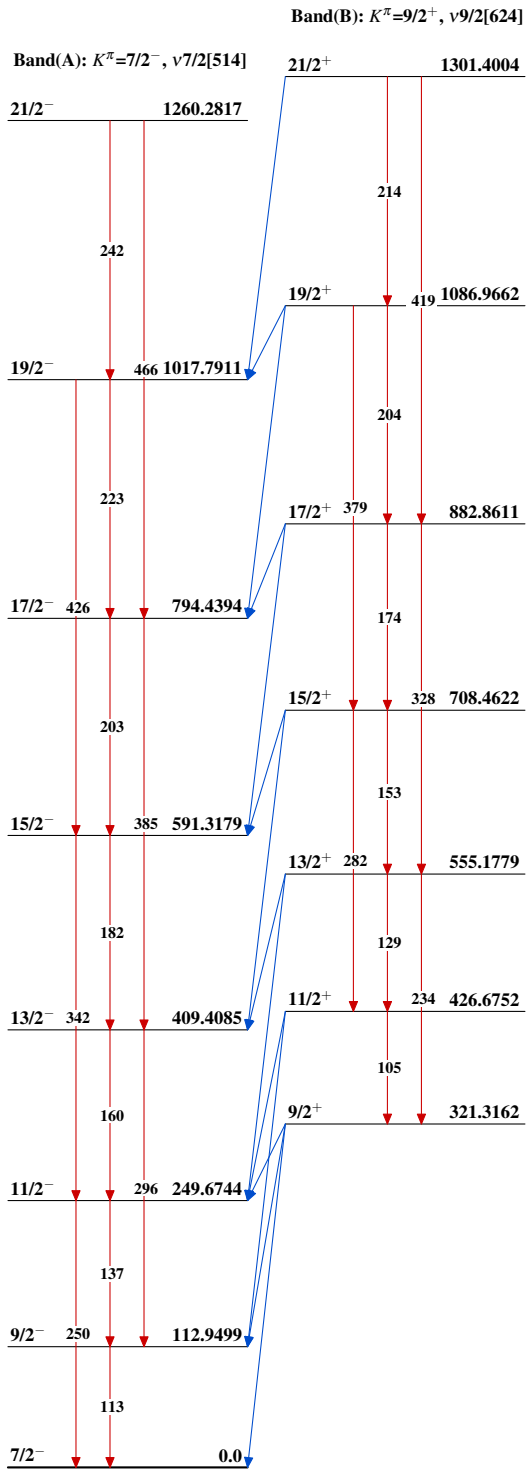
^{177}Lu β^- decay (160.4 d)

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



^{177}Lu β^- decay (160.4 d)



$^{177}_{72}Hf_{105}$