^{180}Lu β^- decay 1986KeZW,1973KaYQ,1971Gu02

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 126, 151 (2015)	1-Feb-2015

Parent: ^{180}Lu: E=0.0; $J^\pi=5^+$; $T_{1/2}$=5.7 min *1*; Q(β^-)=3100 *70*; %β^- decay=100.0

1986KeZW: ^{180}Lu activity from ^{180}Hf(n,p), E(n)=fast. Measured Eγ, Iγ using Ge(Li) detector (FWHM=1.5 keV at 500 keV).

1973KaYQ: ^{180}Lu activity from ^{180}Hf(n,p), E(n)=14 MeV. Measured Eγ, Iγ, Eβ, Iβ, γ(t), $\gamma\gamma$, and $\beta\gamma$ coincidences with Ge(Li) detectors and scintillation spectrometers.

1971Gu02: ^{180}Lu activity from ^{180}Hf(n,p), E(n)=14.8 MeV. Measured Eγ, Iγ, Eβ, Iβ, γ(t), $\gamma\gamma$, and $\beta\gamma$ coincidences with a Ge(Li) and NaI(Tl) detector and a plastic scintillator.

Other: 1971Sw01.

No β^- population (0.005% *18*) from ^{180}Lu to ^{180m}Hf(5.5 h) (1986Ke19). Other value: 0.46% *15* (1984Es02). The discrepancy with the value given by 1986Ke19 could be explained by assuming the existence of a ^{180}Lu isomer. However, 1986Le19 found no evidence of a ^{180}Lu isomer in the 10-300 s half-life range. % branching given by 1984Es02 may be affected by an imprecise correction of the contribution from ^{180}Hf (5.5 h) directly produced in the reaction. Its uncertainty may have also been underestimated by using a linear approximation with partial derivatives for the propagation of large uncertainties.

Additional information 1.

α: Additional information 2.

^{180}Hf Levels

See 1992So09 and 1990SoZZ for configuration assignments of ^{180}Hf levels populated in the β^- decay of ^{180}Lu, based on β^- transition rates, on calculated two-quasiparticle excitation energies, and on level de-excitation patterns.

E(level)†	Jπ‡	$T_{1/2}$‡	E(level)†	Jπ‡	$T_{1/2}$‡	E(level)†	Jπ‡
0.0#	0^+	stable	1291.46@ *6*	3^+		1742.87 *12*	$(5)^+$
93.306# *15*	2^+	1.519 ns *10*	1374.9 *3*	(4^-)	0.57 μs *2*	2183.1 *3*	
308.541# *21*	4^+	71 ps *10*	1409.56@ *12*	(4^+)		2197.04 *22*	
1183.47 *13*	2^+		1607.97 *5*	$(4)^+$			
1200.04@ *5*	2^+	0.51 ps *5*	1609.8 *4*	(3^-)			

† From a least-squares fit to Eγ, by evaluator.
‡ From the Adopted Levels.
# $K^\pi=0^+$ ground state rotational band.
@ $K^\pi=2^+$ γ-vibrational band.

β^- radiations

E(decay)	E(level)	Iβ−†	Log *ft*	Comments
(1.36×10³ *7*)	1742.87	9 *1*	5.95 *10*	av Eβ=478 *29*
(1.49×10³ *7*)	1609.8	1.5 *2*	6.88 *10*	av Eβ=533 *30*
(1.49×10³ *7*)	1607.97	78 *2*	5.17 *8*	av Eβ=534 *30* Iβ⁻: 90% to 1607.7, 1609.7, and 1742.7 levels (1971Gu02). E(decay): 1540 *100* (1971Gu02).
(1.73×10³ *7*)	1374.9	0.7 *4*	7.5 *3*	av Eβ=633 *30* Iβ⁻: 8% (1971Gu02). E(decay): 2000 *200* (1971Gu02).
(1.81×10³‡ *7*)	1291.46	2 *1*	7.07 *23*	av Eβ=668 *30*
(1.90×10³‡ *7*)	1200.04	3 *2*	7.0 *3*	av Eβ=707 *31*
(2.79×10³ *7*)	308.541	5 *2*	7.42 *18*	av Eβ=1099 *32*

Continued on next page (footnotes at end of table)

^{180}Lu β^- decay 1986KeZW,1973KaYQ,1971Gu02 (continued)

β^- radiations (continued)

E(decay)	E(level)	Comments
		E(decay): 2740 *200* (1971Gu02). Iβ^-: 2% (1971Gu02).

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.

^{180}Lu β^- decay 1986KeZW,1973KaYQ,1971Gu02 (continued)

$\gamma(^{180}Hf)$

Iγ normalization: From decay scheme assuming no β^- feeding to g.s. and 93.3 level and setting Σ(I(γ+ce) to g.s. (except 93.3γ) and 93.3 level)=100%.

E_γ †	I_γ †@	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	δ‡	α	Comments
x69.00# *20*	3.5 *15*								
93.308 *15*	27.3 *15*	93.306	2+	0.0	0+	E2		4.64	α(K)=1.082 *16*; α(L)=2.70 *4*; α(M)=0.675 *10*; α(N)=0.1564 *22*; α(O)=0.0197 *3* α(P)=6.96×10^{-5} *10*
x108.3 *3*	0.129 *53*								
135.0 *2*	4.3 *6*	1742.87	(5)+	1607.97	(4)+	M1		1.700	α(K)=1.416 *21*; α(L)=0.220 *4*; α(M)=0.0497 *8*; α(N)=0.01182 *18*; α(O)=0.00181 *3* α(P)=0.0001202 *18*
198.3 *2*	2.57 *13*	1607.97	(4)+	1409.56	(4+)	[E2]		0.296	α(K)=0.1712 *25*; α(L)=0.0950 *14*; α(M)=0.0233 *4*; α(N)=0.00543 *8*; α(O)=0.000712 *11* α(P)=1.120×10^{-5} *16*
215.241 *15*	51.3 *25*	308.541	4+	93.306	2+	E2		0.225	α(K)=0.1364 *20*; α(L)=0.0678 *10*; α(M)=0.01659 *24*; α(N)=0.00386 *6*; α(O)=0.000510 *8* α(P)=9.09×10^{-6} *13*
234.9 *2*	2.6 *3*	1609.8	(3−)	1374.9	(4−)	M1+E2	0.4 *3*	0.33 *4*	α(K)=0.27 *4*; α(L)=0.0466 *7*; α(M)=0.0106 *3*; α(N)=0.00252 *6*; α(O)=0.000379 *7* α(P)=2.3×10^{-5} *4*
316.50 *3*	30.0 *9*	1607.97	(4)+	1291.46	3+	E2		0.0675	α(K)=0.0476 *7*; α(L)=0.01532 *22*; α(M)=0.00368 *6*; α(N)=0.000860 *12*; α(O)=0.0001176 *17* α(P)=3.43×10^{-6} *5*
333.0 *5*	2.9 *3*	1742.87	(5)+	1409.56	(4+)				
407.96 *3*	100 *2*	1607.97	(4)+	1200.04	2+	E2		0.0329	α(K)=0.0247 *4*; α(L)=0.00636 *9*; α(M)=0.001505 *21*; α(N)=0.000353 *5*; α(O)=4.95×10^{-5} *7* α(P)=1.85×10^{-6} *3*
424.4 *2*	2.8 *4*	1607.97	(4)+	1183.47	2+	E2		0.0296	α(K)=0.0223 *4*; α(L)=0.00559 *8*; α(M)=0.001320 *19*; α(N)=0.000310 *5*; α(O)=4.36×10^{-5} *7* α(P)=1.681×10^{-6} *24*
451.6 *2*	2.2 *1*	1742.87	(5)+	1291.46	3+				
875.3 *3*	0.5 *1*	1183.47	2+	308.541	4+				
891.60 *5*	1.66 *13*	1200.04	2+	308.541	4+	[E2]		0.00517	α(K)=0.00425 *6*; α(L)=0.000716 *10*; α(M)=0.0001633 *23*; α(N)=3.86×10^{-5} *6*; α(O)=5.76×10^{-6} *8* α(P)=3.32×10^{-7} *5*
982.7 *2*	6.0 *7*	1291.46	3+	308.541	4+	M1+E2	−5.0 *+20−15*	0.0044 *3*	α(K)=0.00364 *24*; α(L)=0.00059 *4*; α(M)=0.000134 *8*; α(N)=3.18×10^{-5} *17*; α(O)=4.8×10^{-6} *3* α(P)=2.86×10^{-7} *21*
997.1 *3*	0.37 *11*	2197.04		1200.04	2+				
1066.4 *3*	4.1 *6*	1374.9	(4−)	308.541	4+				

$^{180}_{72}Hf_{108}$-3

^{180}Lu β^- decay 1986KeZW,1973KaYQ,1971Gu02 (continued)

$\gamma(^{180}Hf)$ (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	α	Comments
1089.9 *2*	2.7 *2*	1183.47	2^+	93.306	2^+	M1+E2		0.0051 *17*	α(K)=0.0043 *14*; α(L)=0.00064 *19*; α(M)=0.00014 *5*; α(N)=3.4×10^{-5} *10*; α(O)=5.2×10^{-6} *16*; α(P)=3.4×10^{-7} *12*
1100.9 *2*	3.8 *2*	1409.56	(4^+)	308.541	4^+				
1106.6 *2*	52.7 *19*	1200.04	2^+	93.306	2^+	M1+E2	9.6 *+22−58*	0.00337 *18*	α(K)=0.00280 *15*; α(L)=0.000443 *21*; α(M)=0.000100 *5*; α(N)=2.37×10^{-5} *11*; α(O)=3.58×10^{-6} *17*; α(P)=2.19×10^{-7} *13*
1198.0 *2*	32.2 *18*	1291.46	3^+	93.306	2^+				
1199.7 *2*	54 *4*	1200.04	2^+	0.0	0^+	(E2)		0.00285	α(K)=0.00237 *4*; α(L)=0.000369 *6*; α(M)=8.34×10^{-5} *12*; α(N)=1.97×10^{-5} *3*; α(O)=2.99×10^{-6} *5*; α(P)=1.86×10^{-7} *3*
[x]1219.2[#] *5*	1.0 *5*								
[x]1230.8[#] *5*	1.0 *5*								
[x]1282.5[#] *5*	1.0 *5*								
1299.3 *2*	31.3 *13*	1607.97	$(4)^+$	308.541	4^+	(E2)		0.00246	α(K)=0.00204 *3*; α(L)=0.000312 *5*; α(M)=7.03×10^{-5} *10*; α(N)=1.666×10^{-5} *24*; α(O)=2.53×10^{-6} *4*; α(P)=1.593×10^{-7} *23*
1316.2 *2*	2.3 *2*	1409.56	(4^+)	93.306	2^+	(E2)		0.00240	α(K)=0.00199 *3*; α(L)=0.000304 *5*; α(M)=6.84×10^{-5} *10*; α(N)=1.621×10^{-5} *23*; α(O)=2.46×10^{-6} *4*; α(P)=1.555×10^{-7} *22*
1434.1 *2*	4.8 *5*	1742.87	$(5)^+$	308.541	4^+				I_γ: weighted average of 1973KaYQ and 1986KeZW. Other: 12 *2* (1971Gu02).
[x]1446.1[#] *5*	1.5 *5*								
1514.4 *2*	20 *2*	1607.97	$(4)^+$	93.306	2^+	[E2]		0.00190	α(K)=0.001532 *22*; α(L)=0.000228 *4*; α(M)=5.13×10^{-5} *8*; α(N)=1.215×10^{-5} *17*; α(O)=1.85×10^{-6} *3*; α(P)=1.195×10^{-7} *17*
[x]1613.6 *3*	0.319 *48*								
1874.5 *3*	1.4 *3*	2183.1		308.541	4^+				
1888.4 *3*	2.4 *4*	2197.04		308.541	4^+				

[†] Weighted average of data from 1986KeZW, 1973KaYQ, and 1971Gu02, except where noted.
[‡] From the Adopted Gammas.
[#] Reported by 1971Gu02 have not been confirmed by 1973KaYQ, 1986KeZW.
[@] For absolute intensity per 100 decays, multiply by 0.43 *1*.
[x] γ ray not placed in level scheme.

$^{180}_{72}Hf_{108}$-4

^{180}Lu β^- decay 1986KeZW,1973KaYQ,1971Gu02

Decay Scheme

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