^{178}Ta ε decay (2.36 h) 1989Ki24,1975Wa24

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Achterberg, O. A. Capurro, G. V. Marti	NDS 110, 1473 (2009)	31-May-2008

Parent: ^{178}Ta: E=0.0+x; J$^\pi$=(7)$^-$; $T_{1/2}$=2.36 h *8*; Q(ε)=1937 *15*; %ε+%β^+ decay=100.0

^{178}Ta-Q(β^+) from 2003Au03. $T_{1/2}$ weighted average of 2.1 h *1* (1950Wi67), 2.50 h *17* (1958Ca10), 2.2 h *1* (1963Ra14), 2.45 h *5* (1975Wa24).

1958Ca10: Studied the decay of the 2.36 h ^{178}Ta isomer. Scintillation detectors. Identified γ rays at ≈215, 325, 415 keV with a $T_{1/2}$≈150 min. First tentative level scheme for ^{178}Hf.

1960Ha18: Magnetic spectrograph. Measured E(ce), I(ce). Calculated conversion coefficients, assigned multipolarities, deduce Iγ.

1975Mo13: Planar and coax Ge(Li). Precision measurements of some Eγ.

1975Wa24: Measured Eγ, Iγ. Ge(Li) detectors. Calculated log *ft* values.

1979He11: Planar Ge(Li) detector. Measured Eγ, Iγ.

1989Ki24: Measured Eγ, Iγ, Ice. Detectors: HPGe, magnetic spectrometer.

^{178}Hf Levels

E(level)[†]	J$^\pi$	$T_{1/2}$	Comments
0.0[‡]	0$^+$		
93.179[‡] *6*	2$^+$	1.47 ns *6*	$T_{1/2}$: from 1963Fo02.
306.613[‡] *15*	4$^+$		
632.168[‡] *17*	6$^+$		
1058.524[‡] *20*	8$^+$		
1147.381 *21*	8$^-$	4.0 s *2*	$T_{1/2}$: from Adopted Levels.
1364.02 *5*	9$^-$		
1478.989 *21*	8$^-$		

[†] From a least-squares fit to γ-ray energies.

[‡] K^π=0$^+$ g.s. rotational band.

ε,β^+ radiations

E(decay)	E(level)	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(458 *15*)	1478.989	35.8 *3*	4.81 *4*	35.8 *3*	εK=0.7908 *17*; εL=0.1590 *12*; εM+=0.0502 *5* Iε: 36 (1975Wa24), 35.8 *2* (1989Ki24).
(790 *15*)	1147.381	64.2 *3*	5.074 *24*	64.2 *3*	εK=0.8097 *5*; εL=0.1453 *4*; εM+=0.04508 *13* Iε: 64 (1975Wa24), 64.2 *2* (1989Ki24).

[†] Absolute intensity per 100 decays.

γ(^{178}Hf)

Iγ normalization: from decay scheme assuming I(γ+ce)(325γ)=100%, and using theoretical conversion coefficients.

E$_\gamma$[†]	I$_\gamma$[‡@]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[#]	α[&]	Comments
88.857 *7*	71.1 *18*	1147.381	8$^-$	1058.524	8$^+$	E1	0.487	B(E1)(W.u.)=5.1×10^{-14} *3* Mult.: α(K)=0.398 *9*, α(L1)=0.0378 *19*, α(L2)=0.0130 *7*, α(L3)=0.0148 *8*, α(M)=0.480 *9* (1989Ki24). Other:

Continued on next page (footnotes at end of table)

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γ(^{178}Hf) (continued)

E_γ [†]	I_γ [‡@]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	α [&]	Comments
								α(K/L)(exp)≥2.3, α(L1/L2)(exp)=3.1, α(L1/L3)(exp)=2.4 (1960Ha18). Theory: α(K)=0.40, α(L1)=0.041, α(L2)=0.0129, α(L3)=0.0150, α(K/L)=5.8, α(L1/L2)=3.2, α(L1/L3)=2.8.
93.179 *6*	18.4 *5*	93.179	2^+	0.0	0^+	E2	4.66	B(E2)(W.u.)=163 *7* Mult.: α(K/L)≥0.2, α(L1/L2)≈0.1, α(L2/L3)=1.05, α(L/M)=4.0 (1960Ha18); α(tot)=5.0 *3* (1963Fo02). Theory: α(K/L)=0.40, α(L1/L2)=0.082, α(L2/L3)=1.06, α(L/M)=4.0, α(tot)=4.70.
213.434 *13*	85.9 *22*	306.613	4^+	93.179	2^+	E2	0.232	Mult.: α(K/L2)=2.9, α(K/L3)=4.8, α(K/M)=6.8, α(L2/M)=2.4, α(L3/M)=1.4 (1960Ha18). Theory: α(K/L2)=4.4, α(K/L3)=6.2, α(K/M)=8.1, α(L2/M)=1.9, α(L3/M)=1.3.
216.64 *4*	0.26 *9*	1364.02	9^-	1147.381	8^-	M1+E2	0.34 *12*	I_γ: from Iγ(216γ)/Iγ(213γ)=0.003 *1* (1979He11). Other: < 0.3 (1975Wa24). Mult.: from adopted values.
325.555 *8*	100.0 *10*	632.168	6^+	306.613	4^+	E2	0.0622	Mult.: α(K/L2)=5.8, α(K/L3)=13.8, α(K/M)=12, α(L2/M)=2.5, α(L3/M)=0.9 (1960Ha18). Theory: α(K/L2)=8.3, α(K/L3)=14.3, α(K/M)=13.3, α(L2/M)=1.6, α(L3/M)=0.93.
331.608 *4*	33.15 *20*	1478.989	8^-	1147.381	8^-	M1(+E2)	0.10 *5*	Mult.: Experiment: α(K)=0.121 *2*, α(L2/L1)=0.077 *7* (1989Ki24). Other values: α(K/L1)=6.9, α(K/M)=24 (1960Ha18). δ≤0.063 (1989Ki24) Theory: α(K)=0.119, α(L2/L1)=0.083, α(K/L1)=7.1, α(K/M)=29.
426.355 *10*	103.5 *30*	1058.524	8^+	632.168	6^+	E2	0.0292	Mult.: α(K/L1)=3.8, α(K/M)=13, α(L1/M)=3.6 (1960Ha18). Theory: α(K/L1)=7.9, α(K/M)=17, α(L1/M)=2.2.

[†] Weighted averages of values in 1958Ca10, 1960Ha18, 1975Mo13, 1975Wa24, 1979He11, 1989Ki24 and 2007La14.
[‡] Weighted averages of values in 1975Wa24 and 1989Ki24, except when noted otherwise.
[#] From adopted values. Note that the quoted electron conversion data from 1960Ha18 appear rather crude and unreliable, having trouble reproducing even the well known E2 multipolarities of the g.s. band cascade.
[@] For absolute intensity per 100 decays, multiply by 0.941 *12*.
[&] 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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Decay Scheme