^{172}Ta ε decay (36.8 min) 1973Ca10

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 75,199 (1995)	31-May-1995

Parent: ^{172}Ta: E=0.0; J$^\pi$=(3$^+$); T$_{1/2}$=36.8 min *3*; Q(ε)=4.92×10^3 *18*; %ε+%β^+ decay=100.0

^{172}Ta produced by ^{175}Lu(^{3}He,6n) E=63 MeV. Measured T$_{1/2}$, γ, ce, $\gamma\gamma$, β+γ, Xγ(t). See also an erratum to 1973Ca10 (as a priv comm from one of the authors of 1973Ca10) for revised γ-ray energies of 427γ and 749γ and assignment of 409.2γ and 636.26γ to impurities.

Earlier work:

Source production: ^{181}Ta(p,X) (1972Ch45); Gd(^{20}Ne,X) (1971Na28); Hf(p,X) (1964Ab08).

γ: 1971Na28 (four γ rays reported), 1969Ar22, 1964Ab08.

$\gamma\gamma$(t): 1967Ab06, 1964Ab08.

T$_{1/2}$(^{172}Ta isotope): 1972Ch45, 1971Na28, 1969Ar22, 1964Ab08, 1961Bu13.

The level scheme of ^{172}Hf from ^{172}Ta ε decay is not considered as well established for the following reasons:

1. Many γ rays (about 38) are as yet unassigned in the level scheme. Total unassigned intensity is≈13%.
2. Additional levels are likely to be populated between the energy gap 1791 and 2450.
3. γ-ray intensity balances are inconsistent with expected feedings (from ΔJ$^\pi$) for several levels.

^{172}Hf Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	Comments
0.0[#]	0$^+$		
95.25[#] *5*	2$^+$	1.55 ns *10*	T$_{1/2}$: (95γ)(214γ)(t) (1967Ab06).
309.28[#] *7*	4$^+$		
628.10[#] *19*	6$^+$		
871.33[@] *12*	0$^+$		
952.45[@] *8*	2$^+$		
1031.09 *20*	(4$^+$,5,6$^+$)		
1075.30[&] *8*	(2)$^+$		
1129.57[@] *11*	4$^+$		
1180.91[&] *9*	(3$^+$)		
1295.6 *4*	0$^+$		
1304.71[&] *10*	(4$^+$)		
1335.68[a] *11*	0$^+$		
1359.38 *15*	(2$^+$,3,4$^+$)		
1372.87? *7*			
1397.51[a] *7*	2$^+$		
1418.61 *8*	(4$^-$)	<3 ns	T$_{1/2}$: (K x ray)(1109γ)(t) (1973Ca10).
1463.08[&] *22*	(5$^+$)		
1471.76 *9*	(4$^+$,5)		
1482.29 *7*	(2$^+$,3,4$^+$)		
1495.82 *8*	(2 to 5)		
1503.56 *8*	(5$^-$)		
1534.4?[a] *4*	4$^+$		
1574.91 *23*	(2$^+$,3,4$^+$)		
1600.68 *9*	4$^+$		
1639.73 *8*	(3$^-$)		
1684.50 *8*	(2 to 5)		
1791.07 *19*	(2$^+$,3,4$^+$)		
2450.84 *22*	(2$^+$,3,4$^+$)		

† From least-squares fit to Eγ′s.

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^{172}Ta ε decay (36.8 min) 1973Ca10 (continued)

^{172}Hf Levels (continued)

‡ From Adopted Levels.
# Band(A): (π=+,α=0) g.s. band.
@ Band(B): $K^{\pi}=0^+$ β^-band.
& Band(C): $K^{\pi}=2^+$ γ-band.
a Band(D): $K^{\pi}=0^+$ band.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε†‡	Log ft†	I(ε+β^+)‡	Comments
(2.47×10^3 18)	2450.84	0.10 5	1.8 5	7.1 2	1.9 5	av Eβ=659 80; εK=0.770 23; εL=0.125 4; εM+=0.0382 13
(3.13×10^3 18)	1791.07	0.3 1	1.3 2	7.4 1	1.6 2	av Eβ=953 81; εK=0.67 4; εL=0.108 6; εM+=0.0329 18
(3.24×10^3 18)	1684.50	1.0 3	3.8 6	7.0 1	4.8 7	av Eβ=1000 81; εK=0.65 4; εL=0.104 6; εM+=0.0318 18
(3.28×10^3 18)	1639.73	4 1	14 2	6.5 1	18 2	av Eβ=1021 81; εK=0.64 4; εL=0.103 6; εM+=0.0314 19
(3.32×10^3 18)	1600.68	0.1	0.5 1	7.9 1	0.6 1	av Eβ=1038 81; εK=0.63 4; εL=0.102 6; εM+=0.0310 19
(3.35×10^3 18)	1574.91	1.2 3	3.8 4	7.0 1	5.0 5	av Eβ=1050 82; εK=0.63 4; εL=0.101 6; εM+=0.0307 19
(3.39×10^3 18)	1534.4?	0.2	0.6 1	7.8 1	0.8 1	av Eβ=1068 82; εK=0.62 4; εL=0.099 6; εM+=0.0303 19
(3.42×10^3 18)	1503.56	0.7 1	2.1 2	7.3 1	2.8 2	av Eβ=1082 82; εK=0.61 4; εL=0.098 6; εM+=0.0300 19 log ft=7.6 is inconsistent with $\Delta J^{\pi}=(^{2,}$No. There are probably additional γ transitions populating the 1504 level.
(3.42×10^3 18)	1495.82	0.8 2	2.4 3	7.3 1	3.2 3	av Eβ=1085 82; εK=0.61 4; εL=0.098 6; εM+=0.0299 19
(3.44×10^3 18)	1482.29	0.9 2	2.4 3	7.2 1	3.3 4	av Eβ=1091 82; εK=0.61 4; εL=0.098 6; εM+=0.0298 19
(3.45×10^3 18)	1471.76	0.6 1	1.5 2	7.4 1	2.1 2	av Eβ=1096 82; εK=0.61 4; εL=0.097 6; εM+=0.0297 19
(3.46×10^3 18)	1463.08	0.4 2	1.2 4	7.6 2	1.6 6	av Eβ=1100 82; εK=0.61 4; εL=0.097 6; εM+=0.0296 19
3.50×10^3 18	1418.61	5 1	12 2	6.6 1	17 2	av Eβ=1120 82; εK=0.60 4; εL=0.096 6; εM+=0.0292 19 E(decay): from Eβ+=2480 180 from β^+(1109γ).
(3.52×10^3 18)	1397.51	1.0 2	2.6 3	7.2 1	3.6 4	av Eβ=1130 82; εK=0.59 4; εL=0.095 6; εM+=0.0289 19
(3.55×10^3 18)	1372.87?	0.8 2	2.0 3	7.4 1	2.8 3	av Eβ=1141 82; εK=0.59 4; εL=0.094 6; εM+=0.0287 19
(3.56×10^3 18)	1359.38	1.2 2	3.0 4	7.2 1	4.2 5	av Eβ=1147 82; εK=0.58 4; εL=0.094 6; εM+=0.0286 19
(3.58×10^3# 18)	1335.68					The intensity balance gives≈3% feeding for the 1336 level but ΔJ=3 rules out direct feeding. There must be additional γ transitions populating the 1336 level.
(3.62×10^3 18)	1304.71	0.5 3	1.2 6	7.6 2	1.7 8	av Eβ=1172 82; εK=0.57 4; εL=0.092 6; εM+=0.0280 19
(3.62×10^3# 18)	1295.6					The intensity balance gives≈0.6% feeding for the 1296 level but ΔJ=3 rules out direct feeding. There must be additional γ transitions populating the 1296 level.
(3.74×10^3 18)	1180.91	1.9 4	3.6 6	7.1 1	5.5 8	av Eβ=1228 82; εK=0.55 4; εL=0.088 6; εM+=0.0267 19
(3.79×10^3 18)	1129.57	1.4 3	2.7 4	7.3 1	4.1 5	av Eβ=1251 82; εK=0.54 4; εL=0.086 6; εM+=0.0262 19
(3.84×10^3 18)	1075.30	2.4 4	4.2 5	7.1 1	6.6 7	av Eβ=1276 82; εK=0.53 4; εL=0.084 6; εM+=0.0257 19

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^{172}Ta ε decay (36.8 min) 1973Ca10 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ ‡	Iε †‡	Log *ft* †	I($\varepsilon+\beta^+$) ‡	Comments
(3.89×10^3 # *18*)	1031.09	<0.2	<0.4	>8.2	<0.6	av Eβ=1296 *82*; εK=0.52 *4*; εL=0.083 *6*; εM+=0.0252 *19*
(3.97×10^3 *18*)	952.45	2.9 *5*	4.5 *6*	7.1 *1*	7.4 *8*	av Eβ=1331 *82*; εK=0.50 *4*; εL=0.080 *6*; εM+=0.0244 *18*
(4.05×10^3 # *18*)	871.33					The intensity balance gives≈2% feeding for the 871 level but ΔJ=3 rules out direct feeding. There must be additional γ transitions populating the 871 level.
(4.29×10^3 # *18*)	628.10					The intensity balance gives≈2% feeding for the 628 level but ΔJ=3 and $\gamma(\gamma^{\pm})$ coincidences (1973Ca10) suggest no direct feeding. There must be additional γ transitions populating the 628 level.
(4.61×10^3 # *18*)	309.28					The intensity balance gives≈13% feeding for the 309 level but $\gamma(\gamma^{\pm})$ coincidences (1973Ca10) suggest no direct feeding. There must be additional γ transitions populating the 309 level.

† Values are considered as approximate since a γ-ray intensity of≈13% associated with unplaced γ rays has not been accounted for and many levels have feedings which are inconsistent with ΔJ$^{\pi}$'s.

‡ Absolute intensity per 100 decays.

Existence of this branch is questionable.

γ(^{172}Hf)

Iγ normalization: Σ((I(γ+ce) of γ's to g.s.)=100, with the following assumptions: 1. No direct ε,β^+ feeding is assumed for 95, 309, 628, 871, 1295, and 1336 levels. The coincidence data ($\gamma(\gamma^\pm)$) (1973Ca10) are consistent with no feeding of the first two levels, whereas, ΔJ^π=3 rules out feeding of the last four levels. The in-out intensity balance does suggest feeding of the last five levels, but the apparent feedings can be accounted for by the unplaced γ intensity of≈24 units, which might populate these levels 2. To account for a large in-out intensity imbalance (≈−20%), Iγ(95γ) is assumed as 38.7 *15* instead of Iγ=32.3 (1973Ca10).

409.2 (E0) and 636.26γ reported by 1973Ca10 are omitted since according to erratum to 1973Ca10, these belong to ^{194}Tl decay. ^{194}Tl was formed from the gold foil surrounding the target. However, there is no 409.2 E0 transition known in ^{194}Tl decay. This line must be some other impurity in the electron spectrum of 1973Ca10.

I$\gamma(\gamma^\pm)$=56 *14* (1973Ca10) relative to 100 for 214γ refers, most likely, to the positron intensity, as suggested by the γ-ray spectrum given by 1973Ca10. The deduced positron intensity from the present level scheme is consistent with this value.

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ	α[&]	Comments
95.26 *5*	38.7 *15*	95.25	2$^+$	0.0	0$^+$	E2		4.34	α(K)= 1.064; α(L)= 2.482; α(M)= 0.617; α(N+..)= 0.1764 I_γ: deduced (evaluator) from in-out intensity balance at 95 level. 1973Ca10 give Iγ=32.3 *25* which leads to≈20% (negative) imbalance. Additional information 4. Mult.: α(L)exp=2.6 *5*.
113.9[a] *7*	0.4 *4*	1418.61	(4$^-$)	1304.71	(4$^+$)	[E1]		0.257	α(K)= 0.2117; α(L)= 0.0352; α(M)=0.00789; α(N+..)=0.00227
214.07 *6*	100	309.28	4$^+$	95.25	2$^+$	E2		0.232	α(K)= 0.1397; α(L)= 0.0701; α(M)=0.01706; α(N+..)=0.00484 Additional information 5. α(K)=0.140 (for E2) used for normalization of ce data for other transitions.
221.13 *15*	2.43 *10*	1639.73	(3$^-$)	1418.61	(4$^-$)	M1+E2	0.6 *3*	0.38 *4*	α(K)= 0.366; α(L)= 0.0564; α(M)=0.01270; α(N+..)=0.00373 Additional information 32. Mult.: α(K)exp=0.31 *4*.
[x]225.0 *10*	0.3 *3*								
237.63 *11*	3.63 *7*	1418.61	(4$^-$)	1180.91	(3$^+$)	E1		0.038	α(K)= 0.0320; α(L)=0.00489; α(M)=0.00110; α(N+..)=0.00031 Additional information 22. Mult.: α(L)exp≤0.018 gives E1(+M2), δ<0.2.
260.6[a] *10*	0.25 *25*	1335.68	0$^+$	1075.30	(2)$^+$	[E2]		0.123	Placement based on energy difference (evaluator).
280.0[a] *6*	0.3 *3*	1639.73	(3$^-$)	1359.38	(2$^+$,3,4$^+$)				
289.29 *15*	3.07 *8*	1418.61	(4$^-$)	1129.57	4$^+$	[E1]		0.023	α(K)=0.01967; α(L)=0.00296; α(M)=0.00066; α(N+..)=0.00019 Additional information 23. Mult.: α(K)exp≤0.28.
318.81 *24*	9.54 *18*	628.10	6$^+$	309.28	4$^+$	E2		0.0666	α(K)= 0.0469; α(L)=0.01506; α(M)=0.00361; α(N+..)=0.00102 Additional information 6. Mult.: α(K)exp=0.038 *1*, α(L)exp=0.011 *2*; K/L=3.6 *7*. α(K)exp is≈20% lower than that for E2 but K/L agrees with E2.
335.2 *4*	1.26 *10*	1639.73	(3$^-$)	1304.71	(4$^+$)	[E1]		0.016	
366.1 *4*	0.59 *4*	1495.82	(2 to 5)	1129.57	4$^+$	[D,E2]		0.06 *5*	

γ(^{172}Hf) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[&]	$I_{(\gamma+ce)}$[@]	Comments
379.79 *20*	1.62 *12*	1684.50	(2 to 5)	1304.71	(4^+)				
382.6 *4*	0.74 *8*	1335.68	0^+	952.45	2^+	[E2]	0.040		
402.0 *8*	0.63 *9*	1031.09	(4^+,5,6^+)	628.10	6^+	[M1,E2]	0.06 *3*		
^{x}406.1 *4*	0.60 *5*								α(K)exp<0.27. Tentative placement from a 1034, 8^+ level (1973Ca10) is omitted here.
419.7[a] *9*	≤0.24	1495.82	(2 to 5)	1075.30	$(2)^+$				
424.7 *5*		1295.6	0^+	871.33	0^+	E0		0.12[‡] *2*	Mult.: ce(K) observed (Ice(K)=0.10 *2*), no γ ray reported.
^{x}426.71 *25*	1.9 *4*								E_γ,I_γ: revised values from erratum to 1973Ca10. Previous placement of a 427.56 *12* transition from a 1503.6 level (1973Ca10) is omitted here. Additional information 1. Mult.: α(K)exp<0.08, α(L)exp=0.007 *7* give D,E2.
^{x}429.4 *6*	0.6 *6*								This transition could be from ^{194}Tl decay, similar to the 636.3 transition from this decay present in the spectrum.
445.0 *4*	1.07 *16*	1397.51	2^+	952.45	2^+	E0+M1+E2	0.20[†] *3*		Additional information 20. Mult.: α(K)exp=0.16 *4*.
458.7 *3*	1.02 *8*	1639.73	(3^-)	1180.91	(3^+)				Additional information 33. α(K)exp≤0.06.
464.1 *5*		1335.68	0^+	871.33	0^+	E0		0.275[‡] *11*	Mult.: ce(K) observed (ce(K)=0.224 *9*), no γ ray reported.
500.7 *10*	1.41 *22*	1129.57	4^+	628.10	6^+	[E2]	0.019		
503.0 *5*	2.43 *21*	1684.50	(2 to 5)	1180.91	(3^+)				
^{x}547.9 *3*	1.50 *4*					E1,E2			Additional information 2. Mult.: α(K)exp≤0.02.
564.19 *24*	1.14 *7*	1639.73	(3^-)	1075.30	$(2)^+$				Additional information 34. α(K)exp≤0.03.
^{x}576.1 *7*	0.15 *15*								
^{x}595.6 *7*	0.81 *10*								
^{x}598.1 *4*	0.45 *10*								
^{x}620.94 *24*	0.67 *9*								
643.26 *13*	4.15 *16*	952.45	2^+	309.28	4^+	[E2]	0.0106		α(K)=0.00847; α(L)=0.00164 Additional information 8. Mult.: α(K)exp≤0.02 gives D,E2.
653.6[a] *6*	0.9 *9*	1684.50	(2 to 5)	1031.09	(4^+,5,6^+)				
721.90 *20*	1.00 *12*	1031.09	(4^+,5,6^+)	309.28	4^+				
^{x}726.4 *6*	0.5 *5*								
^{x}728.9 *5*	0.9 *9*								
^{x}735.3 *4*	0.41 *10*								
^{x}742.5 *5*	1.0 *10*								
^{x}748.7 *10*	≤0.25								E_γ,I_γ: revised values from erratum to 1973Ca10.

From ENSDF

$^{172}_{72}$Hf$_{100}$-5

γ(^{172}Hf) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[&]	$I_{(\gamma+ce)}$[@]	Comments
									Additional information 3. α(K)exp≤0.12.
776.08 *11*	4.59 *9*	871.33	0$^+$	95.25	2$^+$	(E2)			Additional information 7. Mult.: α(K)exp=0.008 *3* gives E2(+M1), δ>0.8.
790.8[a] *6*	0.16 *16*	1418.61	(4$^-$)	628.10	6$^+$				Placement from energy difference (evaluator).
^{x}804.8 *4*	0.97 *12*								
820.44 *13*	5.80 *24*	1129.57	4$^+$	309.28	4$^+$	E0+M1+E2	0.062[†] *3*		Additional information 13. Mult.: α(K)exp=0.050 *2*. Authors′ uncertainty of 0.001 is increased to 0.002. K/L/M=100 *2*/22.4 *7*/11 *4*. X(E0/E2)=0.154 *32* (1973Ca10).
^{x}824.9 *6*	0.6 *6*								
^{x}827.1 *6*	0.24 *24*								
835.0[a] *10*	0.9 *9*	1463.08	(5$^+$)	628.10	6$^+$				
839.0 *3*	0.77 *12*	1791.07	(2$^+$,3,4$^+$)	952.45	2$^+$				
843.8 *3*	1.73 *13*	1471.76	(4$^+$,5)	628.10	6$^+$				Additional information 25. α(K)exp≤0.02.
857.21 *10*	8.0 *3*	952.45	2$^+$	95.25	2$^+$	E0+M1+E2	0.058[†] *3*		Additional information 9. Mult.: α(K)exp=0.047 *2*, α(L)exp=0.013 *3*, α(M)exp=0.007 *1*. Authors′ uncertainty of 0.001 for α(K)exp increased to 0.002. X(E0/E2)=0.156 *21* (1973Ca10).
871.5 *10*		871.33	0$^+$	0.0	0$^+$	E0		0.13[‡] *2*	Mult.: ce(K) observed (Ice(K)=0.106 *14*), no γ ray reported. X(E0/E2)=0.121 *18* (1973Ca10).
872.1 *7*	2.6 *10*	1180.91	(3$^+$)	309.28	4$^+$				
(875.5 *3*)	2.3 *4*	1503.56	(5$^-$)	628.10	6$^+$				E_γ,I_γ: from adopted gammas. 1973Ca10 interpret broadening of the peak due to 872.1γ as mixed with an impurity, but it is possible that part of this line is due, instead, to 875γ. It is assumed that the same level is populated in ^{172}Ta ε decay and (HI,xnγ) reactions.
^{x}946.5 *7*	0.51 *9*								
952.25 *17*	3.55 *15*	952.45	2$^+$	0.0	0$^+$				α(K)=0.00374; α(L)=0.00062 Additional information 10. Mult.: α(K)exp≤0.006 gives E1, E2.
980.01 *10*	7.07 *10*	1075.30	(2)$^+$	95.25	2$^+$				α(K)=0.00353; α(L)=0.00058 Additional information 11. Mult.: α(K)exp≤0.004 gives D,E2.
988.9 *10*	0.45 *10*	2450.84	(2$^+$,3,4$^+$)	1463.08	(5$^+$)				
995.52 *16*	3.97 *23*	1304.71	(4$^+$)	309.28	4$^+$				α(K)=0.00342; α(L)=0.00056 Additional information 16. α(K)exp≤0.005.
^{x}997.4 *5*	<0.84								
1034.39 *21*	3.70 *18*	1129.57	4$^+$	95.25	2$^+$				Additional information 14. α(K)exp≤0.01.

$^{172}_{72}Hf_{100}$-6

$\gamma(^{172}Hf)$ (continued)

E_γ	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	$I_{(\gamma+ce)}$[@]	Comments
[x]1042.7 *5*	0.17 *17*								
1050.06 *14*	4.23 *14*	1359.38	(2+,3,4+)	309.28	4+				Additional information 18. α(K)exp≤0.008.
1075.30 *12*	6.66 *16*	1075.30	(2)+	0.0	0+	(E2)			α(K)=0.00294; α(L)=0.00047 Additional information 12. Mult.: α(K)exp=0.004 *1* gives M1,E2; but placement requires E2.
1085.58 *9*	14.7 *5*	1180.91	(3+)	95.25	2+	(E2)			α(K)=0.00289; α(L)=0.00046 Additional information 15. Mult.: α(K)exp=0.0026 *7*.
1109.30 *7*	27.0 *11*	1418.61	(4−)	309.28	4+	(E1)			Additional information 24. Mult.: α(K)exp=0.0035 *9* gives E1+M2 with δ=0.5 *1* or E2(+M1) with δ>0.9. But placement requires Δπ=yes.
1147.2 *5*	0.39 *10*	2450.84	(2+,3,4+)	1304.71	(4+)				
1153.85 *21*	2.40 *17*	1463.08	(5+)	309.28	4+				
1162.47 *6*	2.07 *23*	1471.76	(4+,5)	309.28	4+				Additional information 26. α(K)exp≤0.015.
1172.8 *4*	1.05 *12*	1482.29	(2+,3,4+)	309.28	4+				
1186.54 *5*	4.89 *17*	1495.82	(2 to 5)	309.28	4+				Additional information 28. α(K)exp<0.014.
1194.27 *5*	2.74 *18*	1503.56	(5−)	309.28	4+				Additional information 29. α(K)exp≤0.018.
1199.8 *5*	0.54 *8*	1295.6	0+	95.25	2+				
1209.9 *5*	2.9 *12*	1304.71	(4+)	95.25	2+				
1225.1[a] *4*	<1.4	1534.4?	4+	309.28	4+	(M1+E2+E0)	[†]		Additional information 30. Mult.: ce(K)=0.094 *13* (α(K)exp≥0.06) suggests E0 admixture.
[x]1227.6 *4*	<2.3								
1240.49 *10*	3.84 *18*	1335.68	0+	95.25	2+				Additional information 17. α(K)exp≤0.006.
1264.2 *4*	3.76 *24*	1359.38	(2+,3,4+)	95.25	2+				
1266.0 *5*	4.7 *3*	1574.91	(2+,3,4+)	309.28	4+				
1277.62[a] *5*	5.18 *11*	1372.87?		95.25	2+				Additional information 19. α(K)exp≤0.006.
1291.39 *6*	1.00 *11*	1600.68	4+	309.28	4+	E0+M1+E2	0.049[†] *18*		Additional information 31. Mult.: α(K)exp=0.040 *16*.
1296.2 *10*		1295.6	0+	0.0	0+	E0		0.40[‡] *4*	Mult.: ce observed (ce(K)=0.33 *4*, ce(L)=0.044 *13*), no γ ray reported. X(E0/E2)=19 *4* (1973Ca10).
1302.25 *5*	4.62 *11*	1397.51	2+	95.25	2+	E0+M1+E2	0.098[†] *3*		Additional information 21. Mult.: α(K)exp=0.080 *2*, α(L)exp=0.0093 *24*, α(M)exp=0.0041 *19*. Authors′ uncertainty of 0.001 for α(K)exp increased to 0.002.

$^{172}_{72}Hf_{100}$-7

^{172}Ta ε decay (36.8 min) 1973Ca10 (continued)

γ(^{172}Hf) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	$I_{(\gamma+ce)}$[@]	Comments
1330.41 *6*	14.7 *5*	1639.73	(3⁻)	309.28	4⁺			Additional information 35. α(K)exp≤0.004.
1334.5 *12*		1335.68	0⁺	0.0	0⁺	E0	0.80[‡] *5*	Mult.: ce observed (ce(K)=0.65 *5*,ce(L)=0.115 *17*,ce(M)=0.013 *8*), no γ ray reported. X(E0/E2)=6.0 *7* (1973Ca10).
[x]1370.7 *10*	0.12 *12*							
1375.22 *5*	3.78 *21*	1684.50	(2 to 5)	309.28	4⁺			Additional information 37. α(K)exp≤0.006.
1387.04 *5*	4.9 *3*	1482.29	(2⁺,3,4⁺)	95.25	2⁺			Additional information 27. α(K)exp≤0.014.
1398.0[a] *5*	0.15 *15*	1397.51	2⁺	0.0	0⁺			
[x]1406.89 *20*	1.36 *14*							
1408.9 *10*	0.11 *11*	1503.56	(5⁻)	95.25	2⁺			
1419.8 *4*	1.0 *8*	2450.84	(2⁺,3,4⁺)	1031.09	(4⁺,5,6⁺)			
1479.57 *25*	4.33 *25*	1574.91	(2⁺,3,4⁺)	95.25	2⁺			
1481.6 *8*	0.64 *10*	1791.07	(2⁺,3,4⁺)	309.28	4⁺			
[x]1523.0 *5*	0.61 *10*							
1544.60 *10*	11.9 *5*	1639.73	(3⁻)	95.25	2⁺			Additional information 36. α(K)exp≤0.003.
[x]1637.8 *3*	1.11 *20*							
[x]1646.2 *6*	1.01 *25*							
1695.58 *24*	1.58 *21*	1791.07	(2⁺,3,4⁺)	95.25	2⁺			
[x]1714.7 *8*	0.4 *4*							
[x]1877.9 *5*	0.47 *11*							
[x]2008.7 *6*	0.57 *15*							
[x]2026.6 *24*	0.32 *14*							
[x]2031.6 *10*	0.3 *3*							
[x]2126.7 *15*	0.43 *18*							
2141.2 *8*	0.52 *17*	2450.84	(2⁺,3,4⁺)	309.28	4⁺			
[x]2154.7 *10*	0.36 *13*							
[x]2194.4 *7*	0.60 *18*							
2355.1 *3*	1.07 *15*	2450.84	(2⁺,3,4⁺)	95.25	2⁺			
[x]2725.2 *11*	0.3 *3*							
[x]3046.9 *7*	0.40 *10*							
[x]3195.2 *9*	0.18 *18*							
[x]3512.4 *20*	0.14 *14*							
[x]3815.2 *9*	0.17 *17*							

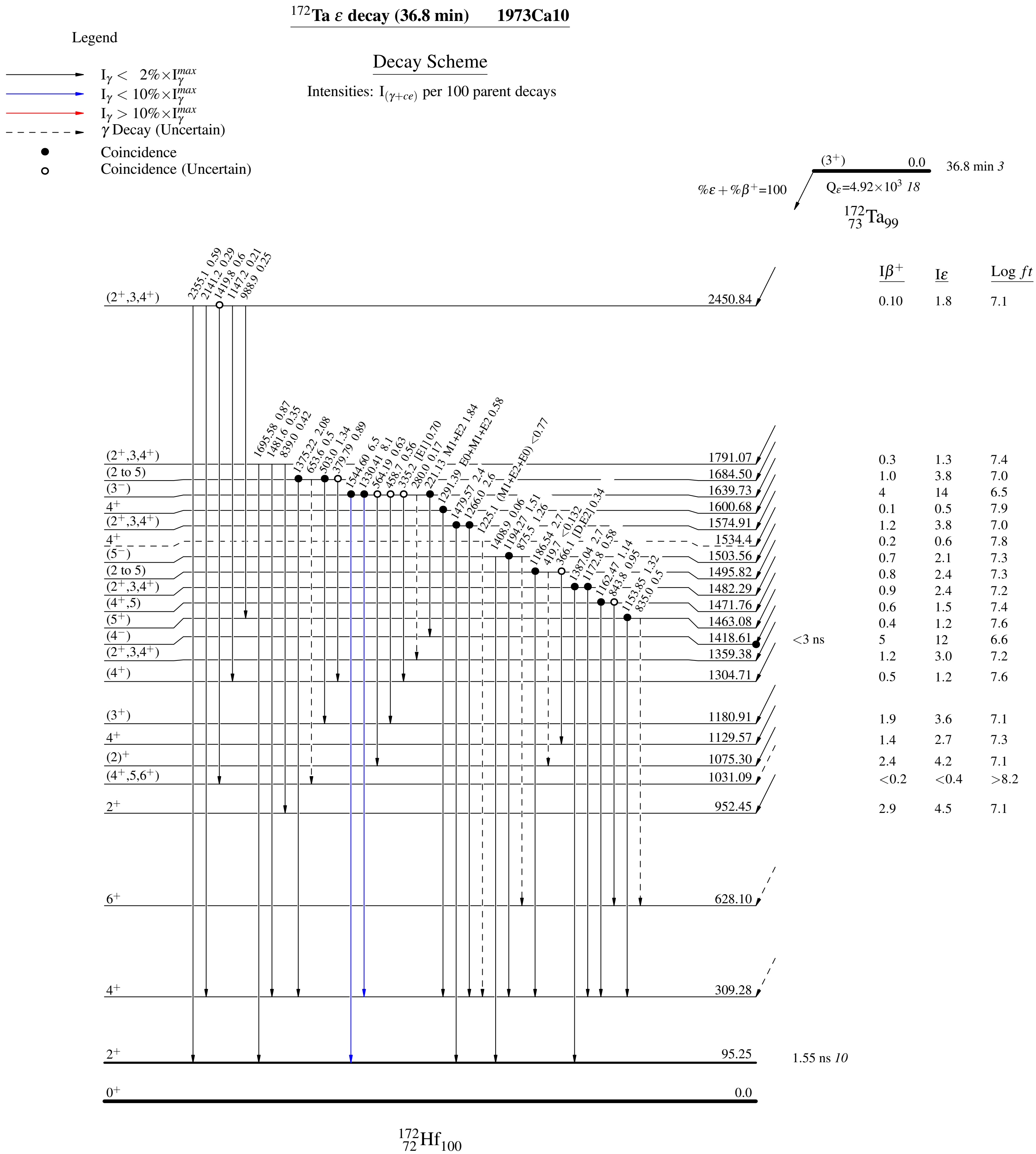
† Total α(exp) deduced from α(K)exp. α(K)exp value multiplied by 1.23 to include contribution from higher shells. The Ice(K) for these lines is expected to be contributed mainly by the E0 component.

‡ Relative transition intensity deduced from Ice(K). Ice(K) multiplied by 1.23 to include contribution from higher shells.

$^{172}_{72}Hf_{100}$-8

γ(^{172}Hf) (continued)

[#] ce data are normalized to α(K)=0.140 for 214γ; mult=E2 from $\gamma(\theta)$ in (HI,xnγ) and RUL (for quadrupole transitions).
[@] For absolute intensity per 100 decays, multiply by 0.55 *5*.
[&] 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.
[a] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

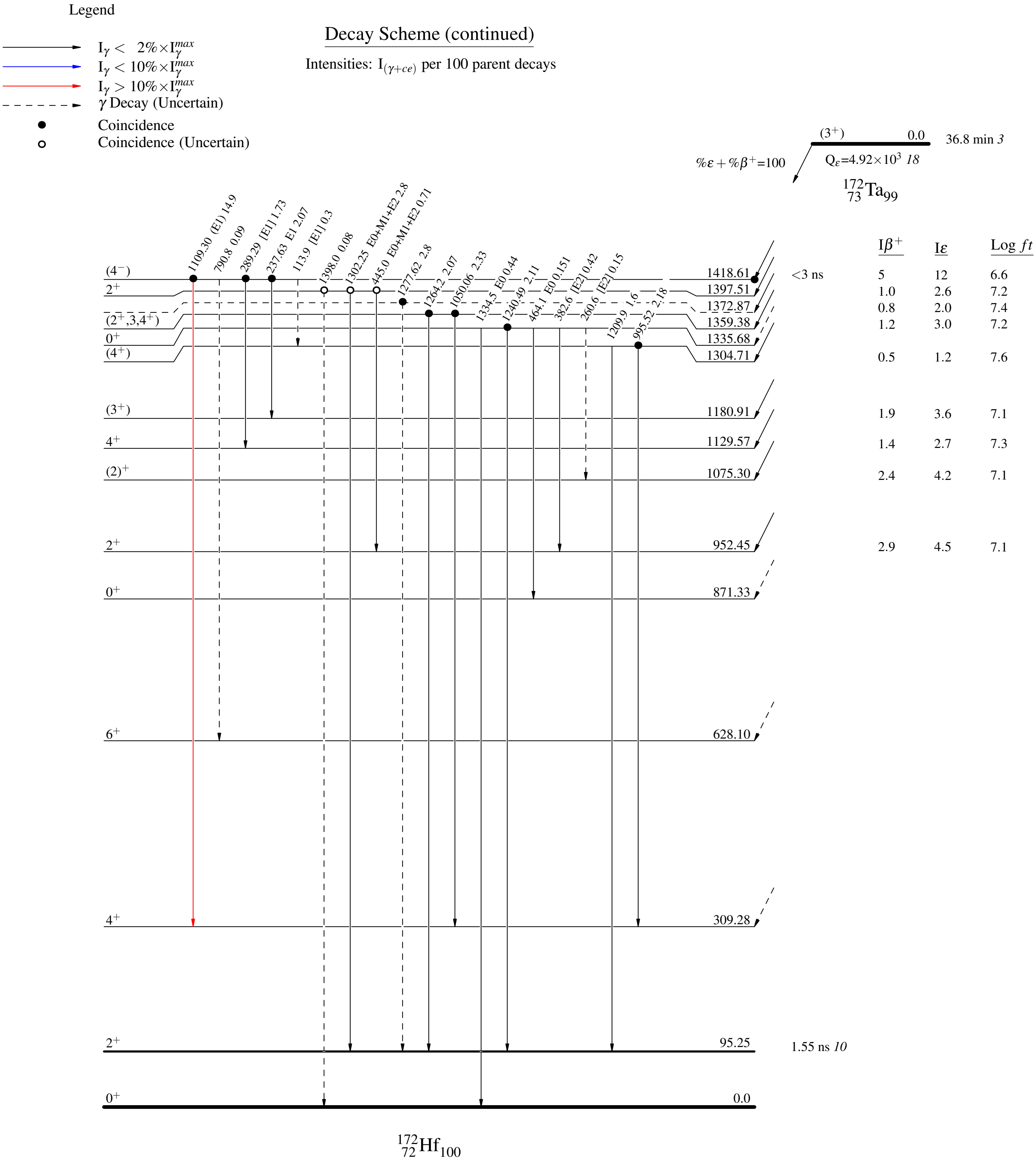


^{172}Ta ε decay (36.8 min) 1973Ca10
Legend
Decay Scheme
Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
Coincidence
Coincidence (Uncertain)
(3+) 0.0 36.8 min 3
Qε=4.92×10³ 18
%ε+%β+=100
$^{172}_{73}Ta_{99}$
Iβ+ Iε Log ft
(2+,3,4+) 2450.84 0.10 1.8 7.1
(2+,3,4+) 1791.07 0.3 1.3 7.4
(2 to 5) 1684.50 1.0 3.8 7.0
(3−) 1639.73 4 14 6.5
4+ 1600.68 0.1 0.5 7.9
(2+,3,4+) 1574.91 1.2 3.8 7.0
4+ 1534.4 0.2 0.6 7.8
(5−) 1503.56 0.7 2.1 7.3
(2 to 5) 1495.82 0.8 2.4 7.3
(2+,3,4+) 1482.29 0.9 2.4 7.2
(4+,5) 1471.76 0.6 1.5 7.4
(5+) 1463.08 0.4 1.2 7.6
(4−) 1418.61 <3 ns 5 12 6.6
(2+,3,4+) 1359.38 1.2 3.0 7.2
(4+) 1304.71 0.5 1.2 7.6
(3+) 1180.91 1.9 3.6 7.1
4+ 1129.57 1.4 2.7 7.3
(2)+ 1075.30 2.4 4.2 7.1
(4+,5,6+) 1031.09 <0.2 <0.4 >8.2
2+ 952.45 2.9 4.5 7.1
6+ 628.10
4+ 309.28
2+ 95.25 1.55 ns 10
0+ 0.0
$^{172}_{72}Hf_{100}$

^{172}Ta ε decay (36.8 min) 1973Ca10

Decay Scheme (continued)

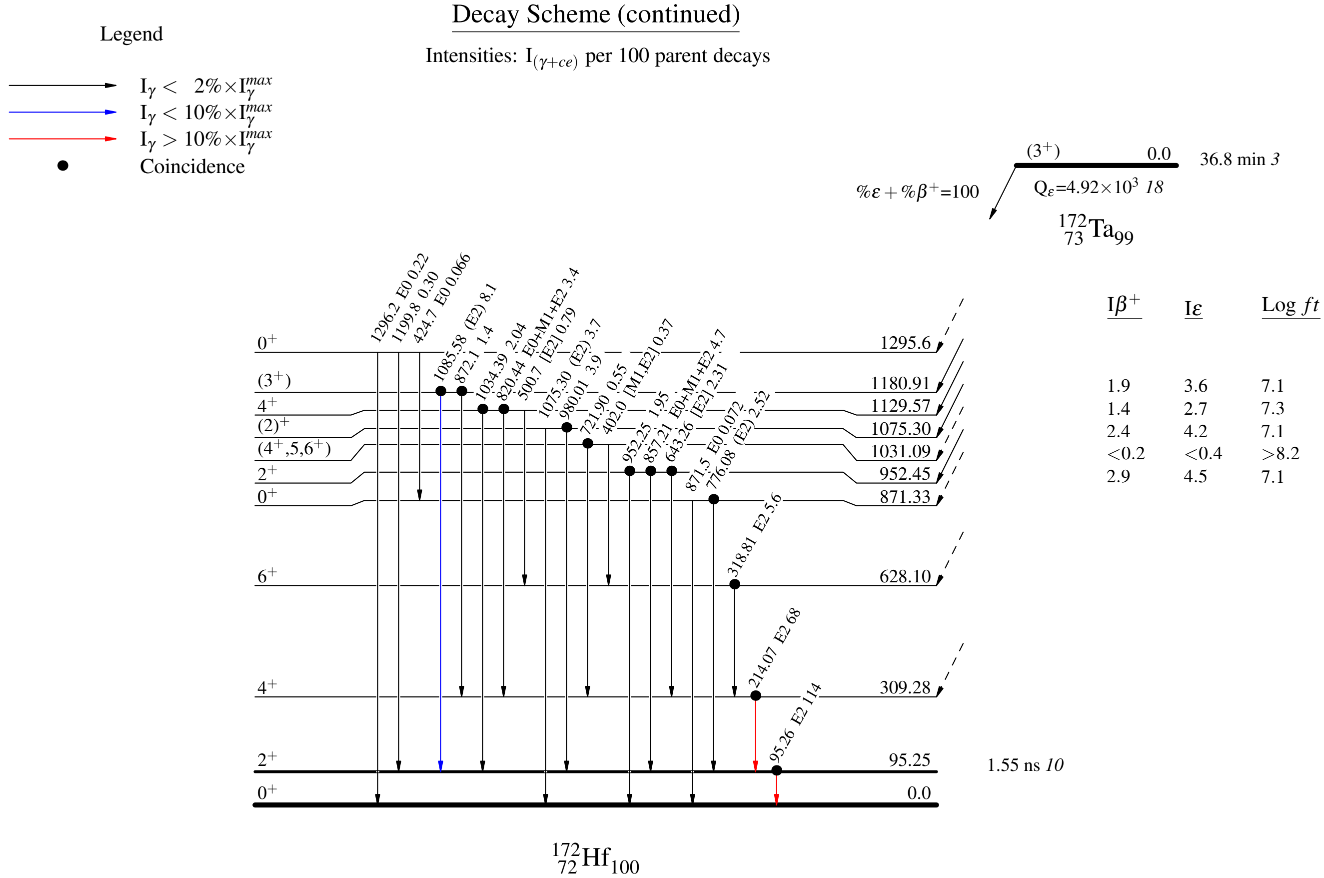
Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



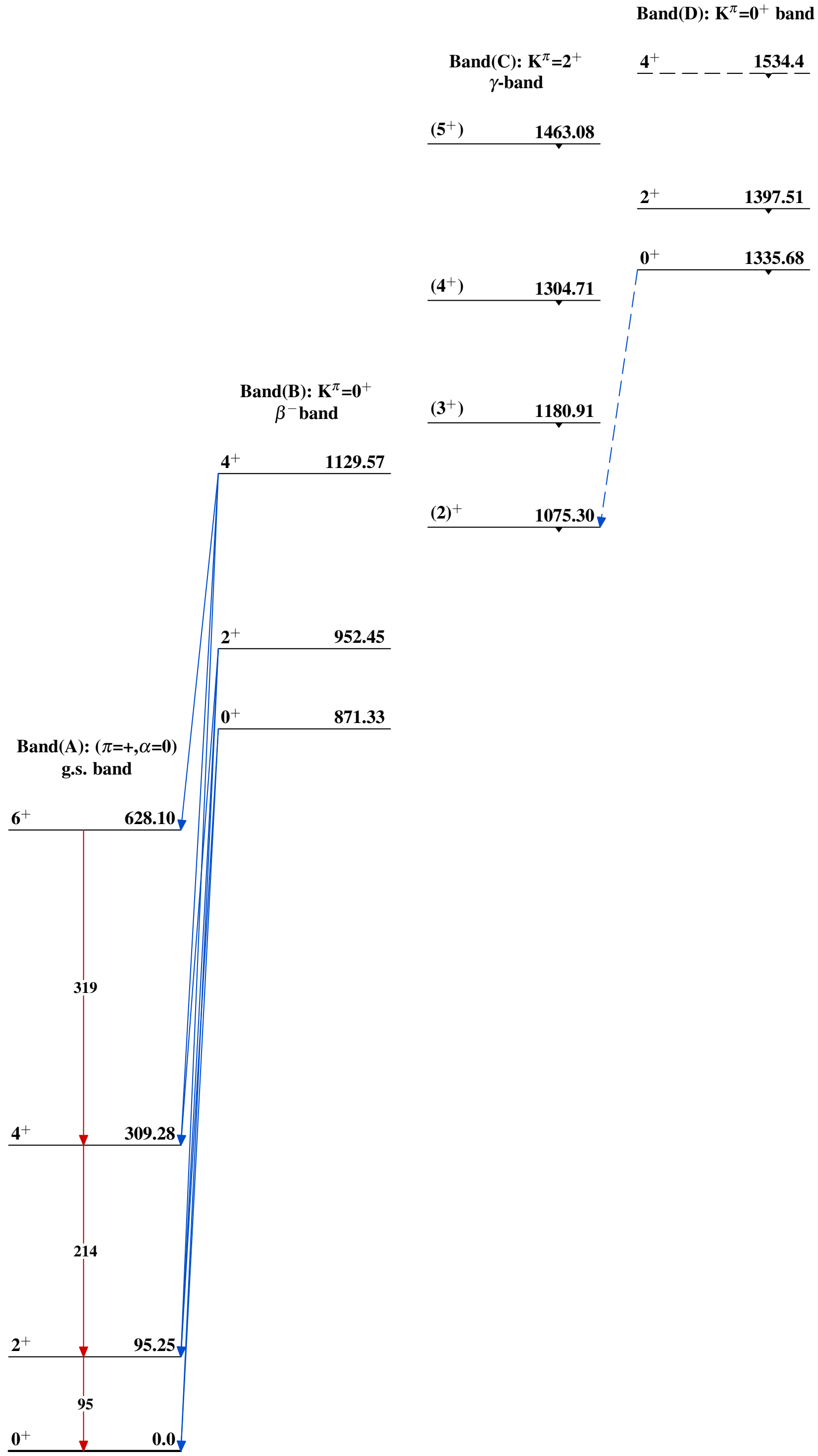
^{172}Ta ε decay (36.8 min) 1973Ca10

Decay Scheme (continued)

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



^{172}Ta ε decay (36.8 min) 1973Ca10



$^{172}_{72}Hf_{100}$