^{97}Ru ε decay 1974Hu05,1971Ph02,1970Co02

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 111, 525 (2010)	19-Nov-2009

Parent: ^{97}Ru: E=0.0; J^π=5/2$^+$; $T_{1/2}$=2.83 d *23*; Q(ε)=1108 *9*; %ε+%β^+ decay=100.0

^{97}Tc Levels

Level scheme is that proposed by 1969Gr04 with levels added by subsequent researchers.

E(level)	J^{π}†	$T_{1/2}$	Comments
0.0	9/2$^+$	4.21×10^6† y *16*	
96.5	1/2$^-$	91.0† d *6*	
216	7/2$^+$	69 ps *19*	$T_{1/2}$: weighted average of: 90 ps *11* (1976Be34, measured (570γ)(215γ)(t)) and 51 ps *10* (1974Be24, measured (KLM Auger ce)(216 ce(K) & ce(L))(t)). Other: $T_{1/2}$≤0.15 ns (1973Ch26).
324	5/2$^+$	0.45 ns *8*	$T_{1/2}$: mean value (with uncertainty covering both values) of: 0.52 ns *6* (measured (KLM Auger ce)(108 ce(K))(t) (1974Be24)), 0.37 ns *2* (measured X(325γ)(t) (1973Ch26)).
580	3/2$^-$		
657	5/2$^-$		
785	5/2$^+$		
855	7/2$^+$		
946?	3/2$^-$		
970	7/2$^+$		
995	(3/2$^+$)		

† From Adopted Levels.

ε,β^+ radiations

1958Ka95 measured the relative intensities of 91-d ^{97}Tc K x ray and 2.8-d ^{97}Ru K x ray and deduced the following branching in ^{97}Ru decay: 0.0171 % 2 to 91-d ^{97}Tc isomeric state and 99.9829 % 2 to ^{97}Tc g.s..

E(decay)	E(level)	Iε†	Log *ft*	Comments
(113 *9*)	995	0.0088 *4*	7.58 *10*	εK=0.824 *6*; εL=0.142 *5*; εM+=0.0345 *12*
(138 *9*)	970	0.144 *5*	6.57 *8*	εK=0.834 *4*; εL=0.1337 *25*; εM+=0.0322 *7*
(162‡ *9*)	946?	0.0014 *11*	8.7 *4*	εK=0.8405 *22*; εL=0.1287 *17*; εM+=0.0308 *5*
(253 *9*)	855	0.0522 *12*	7.60 *5*	εK=0.8525 *8*; εL=0.1192 *6*; εM+=0.02825 *16*
(323 *9*)	785	1.065 *18*	6.51 *5*	εK=0.8568 *5*; εL=0.1158 *4*; εM+=0.02733 *10*
(451 *9*)	657	0.033 *3*	8.33 *6*	εK=0.8610 *3*; εL=0.11254 *17*; εM+=0.02644 *5*
(528 *9*)	580	0.0020 *3*	9.69 *8*	εK=0.8625 *2*; εL=0.11136 *12*; εM+=0.02612 *4*
(784 *9*)	324	11.01 *18*	6.30 *4*	εK=0.8653; εL=0.10916 *6*; εM+=0.02552 *2* εK(exp): 0.884 *46* (1999Ka69).
(892 *9*)	216	87.69 *9*	5.51 *4*	εK=0.8660; εL=0.10863 *4*; εM+=0.02538 *1* εK(exp): 0.886 *18* (1999Ka69).

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

γ(^{97}Tc)

Iγ normalization: Σ (Iγ(g.s.) + Iγ(96.5 level)=100. It is assumed that there is no comparable direct ε decay to ^{97}Tc g.s. (second forbidden nonunique transition) or to the 96.5-keV level (first forbidden, unique transition).

1974Hu05: measured: Eγ, Iγ, $\gamma\gamma$;Ge(Li) detector.

1971Ph02: measured Eγ, Iγ, Ice, α, $\gamma\gamma$. For γ:Ge(Li)-Na(Tl) anticompton spec, for ce: Si(Li) detector.

1970Co02: measured Eγ, Iγ, $\gamma\gamma$;Ge(Li) detector.

1977Be33: measured $\gamma\gamma(\theta)$; Na(Tl) andGe(Li) detectors.

1977Kr03: measured $\gamma\gamma(\theta)$; Na(Tl) andGe(Li) detectors.

1976Ba39: measured γ(θ,H,T) from oriented nuclei.

1976Be34: measured (570γ)(215γ)(t).

1974Be24: measured Ice, (ce)(ce)T$_{1/2}$.

1973Ch26: measured Xγ(t).

1970Ho01: measured Eγ, Iγ, $\gamma\gamma$; prod: ^{96}Ru(th n,γ), chem; detectorGe(Li) with FWHM=3.3 keV at 1332 keV.

1969Gr04: measured Eγ, Iγ, α, $\gamma\gamma$; prod: from ^{97}Ag, ^{97}Pd decay; detector:Ge(Li) for γ Si(Li) for ce. α calibration ^{137}Ba α(K)(89.4γ)=0.0894.

E$_\gamma$ †	I$_\gamma$ †@	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.‡	δ‡	α&	Comments
108.79 *3*	0.140 *15*	324	5/2$^+$	216	7/2$^+$	M1+E2	+1.6 *5*	0.73 *13*	α(K)=0.59 *10*; α(L)=0.111 *21*; α(M)=0.020 *4*; α(N+..)=0.0031 *6* α(N)=0.0030 *6*; α(O)=0.000111 *16* Mult.,δ: from 1977Be33 includes results of 1971Ph02 and 1974Be24; K:L1:L2:L3=910 *170*: 100: 44 *7*: 50 *8* (1974Be24). Theory (δ=1.6) K:L1:L2:L3=1068: 100: 44: 55.
114.4 *2*	0.0020 *4*	970	7/2$^+$	855	7/2$^+$				E$_\gamma$: weighted average of measurements by 1974Hu05, 1971Ph02. I$_\gamma$: from 1974Hu05.
185.00# *1*	0.0054# *25*	970	7/2$^+$	785	5/2$^+$				
215.70 *3*	100	216	7/2$^+$	0.0	9/2$^+$	M1+E2	+0.27 *2*	0.0378 *7*	α(N)=0.0001143 *23*; α(O)=7.30×10^{-6} *12* δ: other: δ=+0.20 *5* (1977Be33, includes data from 1971Ph02 and 1974Be24); δ=+0.27 *2* or +6.2 *5* (1976Ba39) K:L1:L2:L3=910 *10*: 100: 6 *3*: 4 *2* (1974Be24); α(K)exp=0.0350 *12*, K/LM=7.0 (1971Ph02); α(K)exp=0.0340 *30*, K/LM=5.55 (1969Gr04). Theory (δ=0.27): K:L1:L2:L3=918: 100: 6.5: 4.1.
324.49 *4*	12.6 *2*	324	5/2$^+$	0.0	9/2$^+$	E2		0.0196	α(K)=0.01696 *24*; α(L)=0.00219 *3*; α(M)=0.000399 *6*; α(N+..)=6.56×10^{-5} *10* α(N)=6.20×10^{-5} *9*; α(O)=3.51×10^{-6} *5* Mult.: E2 from α(K)exp=0.0178 *8*, K/LM=6.5 (1971Ph02); α(K)exp=0.016 *3*, K/LM=6.5 (1969Gr04).
460.56 *4*	0.141 *4*	785	5/2$^+$	324	5/2$^+$	M1+E2	−0.6 *+4−3*	0.0055 *3*	α(K)=0.0048 *3*; α(L)=0.00056 *4*; α(M)=0.000102 *8*; α(N+..)=1.73×10^{-5} *11* α(N)=1.62×10^{-5} *11*; α(O)=1.06×10^{-6} *5* Mult.,δ: from 1977Kr03. Other: −1.6 *4* or −0.01 *10* (1977Be33); α(K)exp=0.0050 (1971Ph02).

$^{97}_{43}$Tc$_{54}$-2

γ(^{97}Tc) (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	α[&]	Comments
483.76[#] *10*	0.0023[#] *3*	580	3/2−	96.5	1/2−	M1+E2	−0.6 *5*	0.0048 *3*	α(K)=0.00425 *24*; α(L)=0.00050 *4*; α(M)=9.0×10^{-5} *7*; α(N+..)=1.52×10^{-5} *11* α(N)=1.42×10^{-5} *11*; α(O)=9.3×10^{-7} *4*
531.06 *9*	0.0031 *3*	855	7/2+	324	5/2+				
560.34 *4*	0.038 *3*	657	5/2−	96.5	1/2−	[E2]		0.00362	α(K)=0.00316 *5*; α(L)=0.000380 *6*; α(M)=6.88×10^{-5} *10*; α(N+..)=1.152×10^{-5} *17* α(N)=1.084×10^{-5} *16*; α(O)=6.78×10^{-7} *10*
569.29 *4*	1.02 *2*	785	5/2+	216	7/2+	M1+E2	+0.128 *14*	0.00313	α(K)=0.00275 *4*; α(L)=0.000314 *5*; α(M)=5.68×10^{-5} *8*; α(N+..)=9.66×10^{-6} *14* α(N)=9.05×10^{-6} *13*; α(O)=6.12×10^{-7} *9* Mult.,δ: from 1977Kr03. Other: +2.8 *5* or +0.13 *5* (1977Be33), δ=+0.12 *5* or>16 (1976Ba39); M1,E2 from α(K)exp=0.00314 *15* (1971Ph02).
639.72 *2*	0.0098 *7*	855	7/2+	216	7/2+	(M1+E2)	−2.3 *+6−1*	0.00249	α(K)=0.00218 *4*; α(L)=0.000256 *5*; α(M)=4.65×10^{-5} *8*; α(N+..)=7.82×10^{-6} *13* α(N)=7.35×10^{-6} *12*; α(O)=4.72×10^{-7} *7*
645.23 *5*	0.072 *4*	970	7/2+	324	5/2+	M1+E2	−1.2 *+8−9*	0.00240 *7*	α(K)=0.00211 *6*; α(L)=0.000245 *10*; α(M)=4.44×10^{-5} *19*; α(N+..)=7.5×10^{-6} *3* α(N)=7.0×10^{-6} *3*; α(O)=4.60×10^{-7} *7* Mult.: M1,E2 from α(K)exp=0.00125 *20* (1971Ph02).
670.21 *2*	0.0100 *4*	995	(3/2+)	324	5/2+	(M1+E2)		0.00218 *5*	α(K)=0.00191 *4*; α(L)=0.000221 *9*; α(M)=4.00×10^{-5} *15*; α(N+..)=6.77×10^{-6} *22* α(N)=6.35×10^{-6} *22*; α(O)=4.18×10^{-7} *6*
753.99 *3*	0.088 *3*	970	7/2+	216	7/2+	M1+E2	−2.2 *8*	1.63×10^{-3}	α(K)=0.001431 *20*; α(L)=0.0001662 *25*; α(M)=3.01×10^{-5} *5*; α(N+..)=5.08×10^{-6} *8* α(N)=4.77×10^{-6} *7*; α(O)=3.11×10^{-7} *5* Mult.,δ: other: δ=−3.9 *7* or +0.53 *6* (1977Be33); M1,E2 from α(K)exp=0.00151 *12* (1971Ph02).
785.05 *4*	0.084 *3*	785	5/2+	0.0	9/2+	(E2)		1.47×10^{-3}	α(K)=0.001291 *18*; α(L)=0.0001503 *21*; α(M)=2.72×10^{-5} *4*; α(N+..)=4.59×10^{-6} *7* α(N)=4.31×10^{-6} *6*; α(O)=2.80×10^{-7} *4* Mult.: M1,E2 from α(K)exp=0.00141 *14* (1971Ph02).
850.1[a] *4*	0.0016 *13*	946?	3/2−	96.5	1/2−				E_γ,I_γ: from 1971Ph02.
855.44 *6*	0.050 *1*	855	7/2+	0.0	9/2+	M1+E2	+0.3 *2*	1.23×10^{-3}	α(K)=0.001082 *16*; α(L)=0.0001223 *18*; α(M)=2.21×10^{-5} *4*; α(N+..)=3.77×10^{-6} *6* α(N)=3.53×10^{-6} *5*; α(O)=2.40×10^{-7} *4* Mult.: M1,E2 from α(K)exp=0.00108 *12* (1971Ph02).
898.08 *19*	0.00021 *6*	995	(3/2+)	96.5	1/2−	(E1)		4.37×10^{-4}	α(K)=0.000385 *6*; α(L)=4.29×10^{-5} *6*; α(M)=7.74×10^{-6} *11*; α(N+..)=1.316×10^{-6} *19* α(N)=1.232×10^{-6} *18*; α(O)=8.31×10^{-8} *12*

$^{97}_{43}Tc_{54}$-3

γ(^{97}Tc) (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J^π_i	E_f	J^π_f	Comments
969.65[#] *18*	0.00093[#] *10*	970	7/2$^+$	0.0	9/2$^+$	E_γ,I_γ: weighted average of measurements by 1974Hu05, 1971Ph02.

[†] Weighted averages of measurements by 1974Hu05, 1971Ph02 and 1970Co02, unless otherwise noted.

[‡] Same As Adopted Gammas.

[#] From 1974Hu05.

[@] For absolute intensity per 100 decays, multiply by 0.8562.

[&] 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.

$^{97}_{43}Tc_{54}$-4

^{97}Ru ε decay 1974Hu05,1971Ph02,1970Co02

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 decays through this branch