^{91}Ru ε decay 2004De40,1983Ko43

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 114, 1293 (2013)	1-Sep-2013

Parent: ^{91}Ru: E=0.0; J$^\pi$=(9/2$^+$); T$_{1/2}$=8.0 s *4*; Q(ε)=7747 *3*; %ε+%β^+ decay=100.0

^{91}Ru-T$_{1/2}$: Weighted average of 7.95 s *40* (2004De40) from a fit to the time behavior of the 394γ (the most intense transition in this decay) and 9 s *1* (1983Ko43). The half-life was accurately measured by 2004De40 using a macrocycle of a beam-on period followed by a beam-off one, with on/off times tailored to suit the expected half-life of ^{91}Ru. A time-to-digital converter was started at the beginning of each macrocycle to provide the time of each triggered event relative to the start.

2004De40: ^{91}Ru source from ^{58}Ni(^{36}Ar^{10+},2pn), E(^{36}Ar)158 MeV beam degraded to 130 MeV mid-target using a set of tantalum degraders of varying thicknesses placed in the beam line (to capitalize on a 28 mb maximum cross-section, as calculated using HIVAP code). Nuclei recoiling out of the target were stopped and neutralized by 500 mbar of purified Ar gas inside a cell. Reaction products were ionized selectively, according to Z, using two dye lasers tuned to the resonant atomic transitions of Rh and Ru, thereby enhancing strongly the ionization and, thus, extraction of these nuclei. The laser-ionized nuclei were then guided towards the LISOL mass separator by a sextupole ion guide. Measured Eγ (<4 MeV), Iγ, $\gamma\gamma$ coin, Iβ, $\beta\gamma$ coin, isotope T$_{1/2}$ with two HPGe detectors arranged in a compact configuration around β-sensitive plastic ΔE-E detectors that enclosed the tape station.

1983Ko43: Source from ^{54}Fe(^{40}Ca,2pn). Ge(Li) detector.

^{91}Tc Levels

E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	E(level)[†]
0.0	(9/2)$^+$	892.33 *25*	(13/2$^+$)	1248.41 *10*	1766.44 *16*
394.61 *8*	(7/2)$^+$	905.3 *3*		1339.32 *13*	1996.96 *23*
698.91 *8*		1096.76 *10*	(11/2$^+$)	1465.33 *12*	

† From least-squares fit to Eγ.
‡ From Adopted Levels.

ε,β^+ radiations

I(γ+ce),log *ft* β-feeding to ground and excited states in ^{91}Tc was calculated by 2004De40 based on I(511γ) from annihilation. Since all I(511γ) that could not be associated with γ events visible in the γ-ray spectra was attributed to the g.s. β branch, branches to weakly populated states and to states deexcited by Eγ>4 MeV transitions may have been overlooked, and the deexcitation of those levels may perturb the intensity balance at the levels below them. thus, log *ft* values shown here May be underestimated. I(γ+ce) imbalance At excited states is given In comments and is consistent with (but less precise) than branching deduced by 2004De40.

E(decay)	E(level)	Iβ^+ [†]	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(5750 *3*)	1996.96	0.9 *2*	0.03 *1*	6.20 *10*	0.9 *2*	av Eβ=2180.5 *15*; εK=0.02447 *5*; εL=0.002965 *6*; εM+=0.0006895 *1* I($\varepsilon+\beta^+$): 1.2 *5* from I(γ+ce) imbalance.
(5981 *3*)	1766.44	0.8 *2*	0.02	6.35 *11*	0.8 *2*	av Eβ=2291.5 *15*; εK=0.02134 *4*; εL=0.002585 *5*; εM+=0.0006011 *1* I($\varepsilon+\beta^+$): 1.0 *5* from I(γ+ce) imbalance.
(6282 *3*)	1465.33	1.6 *2*	0.033 *4*	6.16 *6*	1.6 *2*	av Eβ=2437.0 *15*; εK=0.01801 *3*; εL=0.002181 *4*; εM+=0.0005070 *9* I($\varepsilon+\beta^+$): 2.0 *8* from I(γ+ce) imbalance.
(6408[‡] *3*)	1339.32	0.3 *2*	0.006 *4*	6.9 *3*	0.3 *2*	av Eβ=2497.9 *15*; εK=0.01682 *3*; εL=0.002036 *4*; εM+=0.0004734 *8* I($\varepsilon+\beta^+$): ≤0.2 from I(γ+ce) imbalance.

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^{91}Ru ε decay 2004De40,1983Ko43 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ †	Iε†	Log *ft*	I($\varepsilon+\beta^+$)†	Comments
(6499 *3*)	1248.41	0.9 *2*	0.02	6.49 *10*	0.9 *2*	av Eβ=2541.9 *15*; εK=0.01602 *3*; εL=0.001940 *3*; εM+=0.0004510 *8* I($\varepsilon+\beta^+$): 1.2 *5* from I(γ+ce) imbalance.
(6650 *3*)	1096.76	2.2 *3*	0.037 *5*	6.16 *7*	2.2 *3*	av Eβ=2615.4 *15*; εK=0.014805 *23*; εL=0.001792 *3*; εM+=0.0004167 *7* I($\varepsilon+\beta^+$): 2.2 *9* from I(γ+ce) imbalance.
(6842 *3*)	905.3	1.7 *2*	0.026 *3*	6.34 *6*	1.7 *2*	av Eβ=2708.3 *15*; εK=0.013438 *21*; εL=0.0016266 *2*; εM+=0.0003782 *6* I($\varepsilon+\beta^+$): 2.2 *9* from I(γ+ce) imbalance.
(6855 *3*)	892.33	1.2 *3*	0.018 *5*	6.49 *11*	1.2 *3*	av Eβ=2714.6 *15*; εK=0.013352 *20*; εL=0.0016161 *2*; εM+=0.0003757 *6* Log *ft*: value is unrealistically low for a ΔJ=2, $\Delta\pi$=No branch. I($\varepsilon+\beta^+$): 1.2 *6* from I(γ+ce) imbalance.
(7048 *3*)	698.91	1.8 *3*	0.025 *4*	6.38 *8*	1.8 *3*	av Eβ=2808.6 *15*; εK=0.012147 *18*; εL=0.0014701 *2*; εM+=0.0003418 *5* I($\varepsilon+\beta^+$): 2.2 *9* from I(γ+ce) imbalance.
(7352 *3*)	394.61	5.3 *5*	0.065 *6*	6.00 *5*	5.4 *5*	av Eβ=2956.7 *15*; εK=0.010529 *15*; εL=0.0012740 *1*; εM+=0.0002962 *4* I($\varepsilon+\beta^+$): 4.0 *15* from I(γ+ce) imbalance.
(7747 *3*)	0.0	82 *6*	0.84 *6*	4.94 *4*	83 *6*	av Eβ=3149.1 *15*; εK=0.008832 *12*; εL=0.0010684 *1*; εM+=0.0002484 *4*

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

γ(^{91}Tc)

Iγ normalization: if branching to excited states is 17% 6 (based on Iβ(g.s.)=83 *6* deduced by 2004De40).

E$_\gamma$	I$_\gamma$#	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.‡	δ	α†	Comments
204.7 *3*	3.9 *23*	1096.76	(11/2$^+$)	892.33	(13/2$^+$)				
304.1 *1*	11 *2*	698.91		394.61	(7/2)$^+$				
394.4 *1*	100	394.61	(7/2)$^+$	0.0	(9/2)$^+$	M1+E2	−0.7 *+4−13*	0.0085 *14*	α=0.0085 *14*; α(K)=0.0074 *12*; α(L)=0.00088 *18*; α(M)=0.00016 *4*; α(N+..)=2.7×10^{-5} *5* α(N)=2.5×10^{-5} *5*; α(O)=1.62×10^{-6} *20*
657.6 *2*	7.2 *23*	1996.96		1339.32					
669.6 *2*	8.5 *26*	1766.44		1096.76	(11/2$^+$)				
699.1 *1*	21 *5*	698.91		0.0	(9/2)$^+$				
892.8 *4*	21 *6*	892.33	(13/2$^+$)	0.0	(9/2)$^+$				
905.3 *3*	32 *4*	905.3		0.0	(9/2)$^+$				
944.7 *1*	6 *3*	1339.32		394.61	(7/2)$^+$				
1070.7 *1*	19 *3*	1465.33		394.61	(7/2)$^+$				
1096.7 *1*	37 *5*	1096.76	(11/2$^+$)	0.0	(9/2)$^+$	(M1(+E2))	+0.04 *7*	0.000718 *10*	α=0.000718 *10*; α(K)=0.000632 *9*; α(L)=7.09×10^{-5} *10*; α(M)=1.282×10^{-5} *18*; α(N+..)=2.19×10^{-6} *3*

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^{91}Ru ε decay 2004De40,1983Ko43 (continued)

$\gamma(^{91}Tc)$ (continued)

E_γ	I_γ[#]	E_i(level)	E_f	J^π_f	Comments
					α(N)=2.05×10^{-6} *3*; α(O)=1.398×10^{-7} *20*
1248.4 *1*	17 *3*	1248.41	0.0	$(9/2)^+$	
1371.9 *2*	6.1 *22*	1766.44	394.61	$(7/2)^+$	
1465.5 *3*	10 *3*	1465.33	0.0	$(9/2)^+$	
1997.6 *9*	9.5 *22*	1996.96	0.0	$(9/2)^+$	

† Additional information 1.
‡ From Adopted Gammas.
# For absolute intensity per 100 decays, multiply by 0.069 *24*.

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Decay Scheme

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