^{93}Rh ε decay 2004De40

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 112, 1163 (2011)	15-Dec-2010

Parent: ^{93}Rh: E=0.0; J$^{\pi}$=(9/2^{+}); $T_{1/2}$=11.9 s *7*; Q(ε)=8203.0 *6*; %ε+%β^{+} decay=100.0

^{93}Rh-Q(ε): From 2009AuZZ; Q=8090 *410* from systematics (2003Au03).

^{93}Rh-$T_{1/2}$: Calculated from a fit to the sum of the individual time-to-digital spectra gated on each of the 7 transitions attributed to ^{93}Rh decay. Half-life was accurately measured using a macrocycle of a beam-on period followed by a beam-off period. The on/off times were altered to suit the expected $T_{1/2}$ of the isotope of interest. The tdc was started at the beginning of each macrocycle, recording the time of each triggered event relative to the start.

2004De40: ^{93}Rh source from ^{58}Ni(^{40}Ar^{11+},P4N), E=171 MeV At target face (after degradation of 250 MeV beam using Ta foils); 99.93% ^{58}Ni target; recoils were stopped and neutralized in 500 mbar of purified Ar gas before being ionized selectively (according to Z) using two dye lasers tuned to the resonant atomic transitions of Rh to enhance ionization, and thus extraction; laser-ionized nuclei guided towards the LISOL mass separator by a sextupole ion guide, then implanted onto movable tape; β-sensitive plastic ΔE detectors; 2 HPGe detectors; measured Eγ, Iγ, $\gamma\gamma$ coin, $\beta\gamma$ coin, Iβ, isotope $T_{1/2}$.

No evidence (neither the IT nor any β-delayed γ events) was found by 2004De40 for the presence of the known (1976De37) $T_{1/2}$=10.8 s, 1/2^{-} isomer In ^{93}Ru.

^{93}Ru Levels

2004De40 conclude that many of the low-lying ^{93}Ru states populated in ^{93}Rh ε decay can be understood as belonging to $\pi(p_{1/2},g_{9/2})^{-6}\ \nu g_{9/2}^{-1}$ configurations.

E(level)†	J$^{\pi\ddagger}$	Comments
0.0	(9/2)$^{+}$	
1359.42 *10*		Additional information 1.
1393.31 *20*	(13/2)$^{+}$	Additional information 2.
1629.92 *10*		Additional information 3.
1842.1 *3*		Additional information 4.
2273.53 *14*		Additional information 5. J$^{\pi}$: 2004De40 conclude that this level is a likely candidate for the first excited 9/2^{+} state predicted at 2 MeV by shell-model calculations.

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

ε,β^{+} radiations

E(decay)	E(level)	Iβ^{+} #	Iε#	Log *ft*‡	I($\varepsilon+\beta^{+}$)†#	Comments
(5929.5 *6*)	2273.53	5.1 *10*	0.15 *3*	5.68 *9*	5.2 *10*	av Eβ=2266.43 *30*; εK=0.024271 *9*; εL=0.002962 *1*; εM+=0.0006961 *3*
(6360.9 *7*)	1842.1	2.9 *9*	0.066 *20*	6.09 *14*	3.0 *9*	av Eβ=2474.67 *33*; εK=0.019051 *7*; εL=0.0023241 *9*; εM+=0.0005461 *2*
(6573.1 *6*)	1629.92	3.2 *8*	0.065 *16*	6.12 *11*	3.3 *8*	av Eβ=2577.34 *30*; εK=0.017026 *6*; εL=0.0020767 *7*; εM+=0.0004880 *2*
(6809.7 *6*)	1393.31	4.1 *8*	0.073 *14*	6.10 *9*	4.2 *8*	av Eβ=2692.02 *31*; εK=0.015093 *5*; εL=0.0018406 *6*; εM+=0.0004325 *2* Log *ft*: value is unrealistically low compared to that expected for a ΔJ=2, $\Delta\pi$=No ε transition.
(6843.6 *6*)	1359.42	4.5 *9*	0.079 *15*	6.07 *9*	4.6 *9*	av Eβ=2708.46 *30*; εK=0.014841 *5*; εL=0.0018097 *6*; εM+=0.0004252 *2*
(8203.0 *6*)	0.0	79 *16*	0.74 *15*	5.26 *9*	80 *16*	av Eβ=3370.72; εK=0.008075 *2*; εL=0.0009838 *3*; εM+=0.0002311

Continued on next page (footnotes at end of table)

^{93}Rh ε decay 2004De40 (continued)

ε,β^+ radiations (continued)

† Absolute intensity determined by 2004De40 from I($\gamma^{\pm}$) after correction for contribution from decay of the ^{93}Ru isobar. All I($\gamma^{\pm}$) not associated with γ events visible in the γ-ray spectra were attributed to the g.s. branch. Consequently, this branch may be overestimated because it will incorporate branching to states whose deexciting γ-rays are too weak or too energetic (>4 MeV) to have been detected in this experiment. Also, the existence of such transitions may result in an under-estimation of branching to some excited states.

‡ Values should probably be regarded as lower limits because the large Q value suggests the possibility of significant unobserved feeding to highly excited states which subsequently decay to low-lying levels. Weakly populated states and branching to states producing γ-rays outside the 4 MeV γ-energy range may be wrongly attributed to ground-state decay. A further consequence may be that apparently-forbidden β decays may result from γ transitions from higher-lying levels fed by allowed ε transitions.

Absolute intensity per 100 decays.

γ(^{93}Ru)

Iγ normalization: from comparison of Σ(I(γ+ce) to g.s.) with authors′ summed %ε+%β^+ to excited states (=20.3 *20*).

E_γ	I_γ ‡	E_i(level)	J^π_i	E_f	J^π_f	Mult.†	α#	Comments
482.6 *3*	20 *7*	1842.1		1359.42				
643.6 *1*	42 *8*	2273.53		1629.92				
1359.4 *1*	100	1359.42		0.0	(9/2)$^+$			
1393.3 *2*	72 *14*	1393.31	(13/2)$^+$	0.0	(9/2)$^+$	E2	0.000483 *7*	α=0.000483 *7*; α(K)=0.000382 *6*; α(L)=4.33×10^{-5} *6*; α(M)=7.93×10^{-6} *11*; α(N+..)=4.98×10^{-5} *7* α(N)=1.283×10^{-6} *18*; α(O)=6.81×10^{-8} *10*; α(IPF)=4.84×10^{-5} *7*
1629.9 *1*	98 *19*	1629.92		0.0	(9/2)$^+$			
1842.4 *6*	31 *13*	1842.1		0.0	(9/2)$^+$			
2273.8 *9*	48 *13*	2273.53		0.0	(9/2)$^+$			

† From Adopted Gammas.

‡ For absolute intensity per 100 decays, multiply by 0.058.

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