^{99}Rh β^+ decay (16.1 d) 1974An23,2000Mi05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 145,25 (2017)	1-Jul-2017

Parent: ^{99}Rh: E=0.0; $J^\pi=1/2^-$; $T_{1/2}$=16.1 d *2*; Q(β^+)=2103 *10*; %β^+ decay=100

^{99}Rh-Q(β^+): Experimental value (1952Sc11). Q(g.s.)=2044 *6* (2017Wa10) is in conflict with feeding of 2059.58 level.

Measured: γ, $\gamma\gamma$, ce, β^+ (1974An23), γ, $\gamma\gamma(\theta)$ (1967Mo20), γ, $\gamma\gamma$(t) (1972Gu01), $\gamma\gamma(\theta)$ (1976ShYU), $\gamma\gamma$(t), $\beta\gamma$(t) (1973Be72), $\gamma\gamma(\theta$,H,t) (1981Fo08,1973Ha61), K x ray-γ coin (1987BeYR,1986BeZJ).

Measured relative K-electron capture probabilities using the x-γ ray internal sum-coincidence technique (2000Mi05).

^{99}Ru Levels

E(level)	J^π	$T_{1/2}$	Comments
0.0	$5/2^+$		
89.76 *5*	$3/2^+$	20.5 ns *1*	g=−0.189 *4* g: From differential perturbed angular correlations (1965Ma27). $T_{1/2}$: from $\gamma\gamma$(t) (1972Gu01). Others: 21.0 ns *6* (1973Be72), 20.7 ns *3* (1965Ma27), 20 ns *1* (1965Ki01), 19.7 ns *4* (1964Bo28).
322.43 *7*	$3/2^+$		
442.78 *6*	$(3/2^+)$	<0.15 ns	$T_{1/2}$: from $\gamma\gamma$(t) (1973Be72).
576.27 *16*	$5/2^+$		
618.09 *6*	$(1/2)^+$	1.04 ns *8*	$T_{1/2}$: from $\beta\gamma$(t) (1973Be72).
734.10 *20*	$5/2^+$		
896.98 *9*	$(1/2^+,3/2,5/2^+)$	<0.15 ns	$T_{1/2}$: from $\gamma\gamma$(t) (1973Be72).
998.71 *15*	$(1/2^+,3/2,5/2^+)$		
1383.23 *11*	$(1/2^+,3/2)$		
1414.25 *19*	$(1/2,3/2,5/2^+)$		
1531.71 *11*	$(1/2^+,3/2)$		
1662.14 *15*	$(1/2^+,3/2)$		
1749.9 *3*	$(1/2^+,3/2)$		
2059.58 *13*	$(3/2^-)$		

ε,β^+ radiations

E(decay)	E(level)	Iβ^+[†]	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(43 *10*)	2059.58		0.58 *6*	5.4 *5*	0.58 *6*	εK=0.65 *18*; εL=0.28 *14*; εM+=0.07 *4*
(353 *10*)	1749.9		0.068 *20*	8.58 *13*	0.068 *20*	εK=0.8563 *5*; εL=0.1160 *4*; εM+=0.02766 *10*
(441 *10*)	1662.14		0.33 *4*	8.10 *6*	0.33 *4*	εK=0.8592 *3*; εL=0.11381 *21*; εM+=0.02704 *6*
(571 *10*)	1531.71		1.11 *9*	7.81 *4*	1.11 *9*	εK=0.8617 *2*; εL=0.11181 *12*; εM+=0.02650 *4* Relative probability of ε pk=0.871 *32* (1987BeYR).
(689 *10*)	1414.25		0.34 *6*	8.49 *8*	0.34 *6*	εK=0.8631 *1*; εL=0.11069 *8*; εM+=0.02619 *3*
(720 *10*)	1383.23		1.90 *16*	7.78 *4*	1.90 *16*	εK=0.8634 *1*; εL=0.11046 *8*; εM+=0.02613 *2* εK(exp)=0.85 *7* compares to εK(Theory)=0.877 (20000Mi05).
(1104 *10*)	998.71		0.82 *9*	8.53 *5*	0.82 *9*	εK=0.8657; εL=0.10868 *3*; εM+=0.025640 *9*
(1206 *10*)	896.98		1.93 *17*	8.23 *4*	1.93 *17*	εK=0.8657; εL=0.10837 *4*; εM+=0.025555 *9* εK(exp)=0.83 *6* compares to εK(Theory)=0.870 (20000Mi05).
(1369 *10*)	734.10		0.30 *8*	10.00[1u] *12*	0.30 *8*	εK=0.8618; εL=0.11124 *6*; εM+=0.02635 *2*
(1485 *10*)	618.09	0.70 *7*	45.0 *23*	7.048 *24*	45.7 *23*	av Eβ=209.6 *43*; εK=0.8534 *11*; εL=0.10619 *16*; εM+=0.02502 *4* εK(exp)=0.87 *1* compares to εK(Theory)=0.870 (20000Mi05). Relative εK(exp) probability=0.876 *26* from K x ray-γ (1986BeZJ).
(1527 *10*)	576.27	0.0013 *2*	0.37 *6*	10.10[1u] *8*	0.37 *6*	av Eβ=246.8 *46*; εK=0.8602 *3*; εL=0.11026 *8*;

Continued on next page (footnotes at end of table)

^{99}Rh β^+ decay (16.1 d) 1974An23,2000Mi05 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+†	Iε†	Log *ft*	I($\varepsilon+\beta^+$)†	Comments
						εM+=0.02609 *2*
(1660 *10*)	442.78	1.61 *13*	31.3 *18*	7.30 *3*	32.9 *19*	av Eβ=285.2 *44*; εK=0.8247 *23*; εL=0.1023 *3*; εM+=0.02410 *8* εK(exp)=0.88 *4* compares to εK(Theory)=0.871 (20000Mi05).
(1781 *10*)	322.43	0.43 *5*	4.6 *5*	8.20 *5*	5.0 *5*	av Eβ=337.3 *44*; εK=0.792 *4*; εL=0.0981 *5*; εM+=0.02310 *10* εK(exp)=0.86 *6* compares to εK(Theory)=0.869 (20000Mi05).
(2013 *10*)	89.76	1 *1*	6 *3*	8.22 *25*	7 *4*	av Eβ=439.1 *44*; εK=0.700 *5*; εL=0.0865 *6*; εM+=0.02036 *14*
(2103 *10*)	0.0	<0.29	<3.6	>9.7[1u]	<3.9	av Eβ=503.1 *45*; εK=0.8007 *22*; εL=0.1010 *3*; εM+=0.02384 *7* Iε: from Iβ^+<0.3% follows I($\varepsilon+\beta^+$)<3.9%.

† Absolute intensity per 100 decays.

^{99}Rh β^+ decay (16.1 d) 1974An23,2000Mi05 (continued)

$\gamma(^{99}Ru)$

Iγ normalization: Assuming I(ε+β+)(g.s)<3.9%.
Additional information 1.

E_γ	I_γ[a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†‡]	δ[&]	α[@]	Comments
89.76 *6*	88 *4*	89.76	3/2+	0.0	5/2+	E2+M1	−1.56 *2*	1.481 *23*	α(K)exp=1.0 *5*; K/(L+M+N)+O=4.1 *4* α(K)=1.163 *18*; α(L)=0.262 *4*; α(M)=0.0491 *8* α(N)=0.00736 *12*; α(O)=0.000171 *3* Mult.,δ: from adopted gammas.
[x]119.4 *4*	<0.2								
175.43 *10*	5.3 *3*	618.09	(1/2)+	442.78	(3/2+)	E2		0.1731	α(K)exp=0.16 *3* α(K)=0.1454 *21*; α(L)=0.0228 *4*; α(M)=0.00423 *6* α(N)=0.000653 *10*; α(O)=2.30×10^{-5} *4*
232.70 *15*	1.30 *15*	322.43	3/2+	89.76	3/2+	(M1+E2)		0.048[#] *17*	α(K)exp=0.070 *25* α(K)=0.041 *14*; α(L)=0.0055 *23*; α(M)=1.02×10^{-3} *42* α(N)=1.61×10^{-4} *64*; α(O)=7.0×10^{-6} *20*
295.70 *10*	3.5 *3*	618.09	(1/2)+	322.43	3/2+	(E2)		0.0282	α(K)exp=0.035 α(K)=0.0242 *4*; α(L)=0.00325 *5*; α(M)=0.000600 *9* α(N)=9.46×10^{-5} *14*; α(O)=4.06×10^{-6} *6*
322.45 *10*	16.4 *8*	322.43	3/2+	0.0	5/2+	M1+(E2)	−0.01 *2*	0.01365	α(K)exp=0.008 *6* α(K)=0.01195 *17*; α(L)=0.001398 *20*; α(M)=0.000257 *4* α(N)=4.15×10^{-5} *6*; α(O)=2.19×10^{-6} *3* Mult.: from adopted gammas.
353.05 *6*	91.0 *25*	442.78	(3/2+)	89.76	3/2+	M1+E2	+0.16 *+4−6*	0.01100 *17*	α(K)exp=0.011 *2* α(K)=0.00963 *15*; α(L)=0.001127 *19*; α(M)=0.000207 *4* α(N)=3.35×10^{-5} *6*; α(O)=1.76×10^{-6} *3* δ: from 1974BeZI. Other: +0.6 *4* (1976ShYU).
442.8 *2*	5.9 *10*	442.78	(3/2+)	0.0	5/2+				
486.4 *2*	1.0 *1*	576.27	5/2+	89.76	3/2+				
528.24 *7*	100	618.09	(1/2)+	89.76	3/2+	M1+E2	+0.52 *+3−2*	0.00418	α(K)exp=(0.0038) α(K)=0.00366 *6*; α(L)=0.000428 *7*; α(M)=7.85×10^{-5} *12* α(N)=1.268×10^{-5} *19*; α(O)=6.61×10^{-7} *10* α(K)exp: Reference value for calibration of α(K)exp. δ: from 1974Be11. RUL rules out E1+M2. δ=+0.21 *+14−20* or +1.1 *+1−2* from γγ(θ) (1976ShYU); other: 0.1<δ<1.4 from γγ(θ) (1967Mo20).
576.3 *5*	0.38 *8*	576.27	5/2+	0.0	5/2+				
618.13 *10*	11.0 *14*	618.09	(1/2)+	0.0	5/2+				
734.1 *2*	0.8 *2*	734.10	5/2+	0.0	5/2+				

$^{99}_{44}Ru_{55}$-3

^{99}Rh β^+ decay (16.1 d) 1974An23,2000Mi05 (continued)

$\gamma(^{99}Ru)$ (continued)

E_γ	I_γ[a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
796.0 *5*	0.2 *1*	1414.25	(1/2,3/2,5/2$^+$)	618.09	(1/2)$^+$	
807.25 *10*	3.0 *2*	896.98	(1/2$^+$,3/2,5/2$^+$)	89.76	3/2$^+$	
896.90 *15*	2.1 *3*	896.98	(1/2$^+$,3/2,5/2$^+$)	0.0	5/2$^+$	
910.8	<0.14	998.71	(1/2$^+$,3/2,5/2$^+$)	89.76	3/2$^+$	I_γ: 0.13 in 1972Gu01.
940.4 *2*	3.4 *3*	1383.23	(1/2$^+$,3/2)	442.78	(3/2$^+$)	
998.70 *15*	2.1 *2*	998.71	(1/2$^+$,3/2,5/2$^+$)	0.0	5/2$^+$	
1060.75 *15*	0.6 *1*	1383.23	(1/2$^+$,3/2)	322.43	3/2$^+$	
1088.8 *2*	0.9 *1*	1531.71	(1/2$^+$,3/2)	442.78	(3/2$^+$)	
1209.32 *15*	0.50 *7*	1531.71	(1/2$^+$,3/2)	322.43	3/2$^+$	
1293.50 *15*	0.8 *1*	1383.23	(1/2$^+$,3/2)	89.76	3/2$^+$	
1324.5 *2*	0.7 *1*	1414.25	(1/2,3/2,5/2$^+$)	89.76	3/2$^+$	
1383.5 *5*	0.2 *1*	1383.23	(1/2$^+$,3/2)	0.0	5/2$^+$	
1441.8[b] *3*	0.14[b] *5*	1531.71	(1/2$^+$,3/2)	89.76	3/2$^+$	
1441.8[b] *3*	0.14[b] *5*	2059.58	(3/2$^-$)	618.09	(1/2)$^+$	
1483.2 *2*	0.40 *7*	2059.58	(3/2$^-$)	576.27	5/2$^+$	
1531.8 *2*	1.4 *1*	1531.71	(1/2$^+$,3/2)	0.0	5/2$^+$	
1572.5 *2*	0.64 *7*	1662.14	(1/2$^+$,3/2)	89.76	3/2$^+$	
1616.8 *2*	0.54 *6*	2059.58	(3/2$^-$)	442.78	(3/2$^+$)	
1662.0 *2*	0.23 *5*	1662.14	(1/2$^+$,3/2)	0.0	5/2$^+$	
1749.9 *3*	0.18 *5*	1749.9	(1/2$^+$,3/2)	0.0	5/2$^+$	
1970.0 *3*	0.40 *5*	2059.58	(3/2$^-$)	89.76	3/2$^+$	
2059.2 *3*	0.06 *2*	2059.58	(3/2$^-$)	0.0	5/2$^+$	

† Normalized to α(K)(528γ)=0.0038 (average of α(K)(M1)=0.0036 and α(K)(E2)=0.0040).
‡ From α(K)exp if not noted otherwise.
# Average of pure M1 and E2.
@ Additional information 2.
& If no value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.
[a] For absolute intensity per 100 decays, multiply by 0.379 *18*.
[b] Multiply placed with undivided intensity.
[x] γ ray not placed in level scheme.

$^{99}_{44}Ru_{55}$-4

^{99}Rh β^+ decay (16.1 d) 1974An23,2000Mi05

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given