$$^{99}\text{Ru}(\alpha,\text{n}\gamma),^{100}\text{Ru}(\alpha,\text{2n}\gamma) \quad \textbf{1973Si09,1986An03}$$

		History	
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	D. De Frenne	NDS 110, 1745 (2009)	31-Dec-2008

1973Si09: ^{99}Ru$(\alpha,\text{n}\gamma)$. E=16-20 MeV; measured: Eγ, Iγ, $\gamma\gamma$-coin, I$\gamma(\theta)$.

Assignment of the γ-rays to ^{102}Pd is based on $\gamma\gamma$-coin and measured γ-ray excitation functions, including also the results of the ^{100}Ru$(\alpha,\text{2n}\gamma)$ reaction study up to 24 MeV. For extensive coincidence data, see 1973Si09.

1986An03: ^{100}Ru$(\alpha,\text{n}\gamma)$. Eα=27 MeV. Measured: Eγ, Iγ, $\alpha\gamma$(t). Deduced: ^{102}Pd levels, T$_{1/2}$, B(E1)(W.u.). Only the decay of the level at 2294.4 keV was studied by the authors.

^{102}Pd Levels

E(level)‡	J$^{\pi\dagger}$	T$_{1/2}$	Comments
0	0$^+$		
556.4 1	2$^+$		
1275.8 2	4$^+$		
1534.8 4	2$^+$		
1715.0?			
1919.0?			
2111.3 3	3$^+$		
2111.4 2	6$^+$		
2138.0 2	4$^+$		
2294.3 2	(4$^-$)	1.1 ns 1	T$_{1/2}$: from $\alpha\gamma$(t) using centroid-shift method (1986An03).
2301.5 2	(4)$^+$		
2342.9 3	(3$^-$)		
2474.2 2	5$^-$		
2553.5 10			
2606.4 6			
2651.3 2	(4$^+$)		
2769.0 4			
2914.2 2	6$^-$		
2976.2 11	4$^{(+)}$,5$^{(+)}$,6$^{(+)}$		
3001.5?	4$^+$,5$^+$,6$^+$		
3013.1 2	8$^+$		
3189.3 4	7$^-$		
3340.4 3	8$^+$		
3670.7 11	8$^-$		
3991.8 6	10$^+$		

† From Adopted Levels.

‡ From a least-squares procedure using observed gammas.

$\gamma(^{102}$Pd$)$

For A$_2$ and A$_4$ see 1973Si09.

E$_{\gamma}^{\dagger}$	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Mult.$^{\#}$	Comments
27$^{\&}$	2138.0	4$^+$	2111.3	3$^+$		Unclear if 27-keV γ decays to 2111.3 or 2111.4 levels or both if it is an unresolved doublet.
156.7	2294.3	(4$^-$)	2138.0	4$^+$	E1	E$_{\gamma}$: only observed by 1986An03.
173$^{\&}$	2474.2	5$^-$	2301.5	(4)$^+$		δ=-6.0 if J(2474 level)=5.
176$^{\&}$	2651.3	(4$^+$)	2474.2	5$^-$		

^{99}**Ru**(α,nγ),^{100}**Ru**(α,2nγ)　　**1973Si09,1986An03** (continued)

γ(^{102}Pd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
179.8 *1*	2.5	2474.2	5$^-$	2294.3	(4$^-$)		
182.9 *1*	1.9	2294.3	(4$^-$)	2111.3	3$^+$	E1	
221[&]		2138.0	4$^+$	1919.0?			
259[&]		1534.8	2$^+$	1275.8	4$^+$		
275.1 *5*	2.1	3189.3	7$^-$	2914.2	6$^-$		
327.3 *1*	1.4	3340.4	8$^+$	3013.1	8$^+$		
336.2 *1*	5.5	2474.2	5$^-$	2138.0	4$^+$		
383[&]		1919.0?		1534.8	2$^+$		
439[&]		1715.0?		1275.8	4$^+$		Only a 440-keV γ-ray was observed, which was placed elsewhere on the basis of $\gamma\gamma$-coin.
440.0 *1*	3.6	2914.2	6$^-$	2474.2	5$^-$		
514[&]		2651.3	(4$^+$)	2138.0	4$^+$		
540.0 *2*	0.8	2651.3	(4$^+$)	2111.4	6$^+$		
556.4 *1*	61.8	556.4	2$^+$	0	0$^+$		
603.6 *5*	1.2	2138.0	4$^+$	1534.8	2$^+$		
620.1 *5*	2.0	2914.2	6$^-$	2294.3	(4$^-$)		δ=$-$5.0 or $-$0.15 but adopted mult is E2 from (HI,xnγ).
715.1 *5*	8.4	3189.3	7$^-$	2474.2	5$^-$		
719.4 *1*	47.4	1275.8	4$^+$	556.4	2$^+$		
719.4[&]		3013.1	8$^+$	2294.3	(4$^-$)		E_γ: perhaps weak component of 719.4-keV γ from the 1275.8 level.
756.5 *10*	1.4	3670.7	8$^-$	2914.2	6$^-$		
835.4 *2*	23.3	2111.4	6$^+$	1275.8	4$^+$		
861[&]		2138.0	4$^+$	1275.8	4$^+$		
864.8 *10*	2.9	2976.2	4$^{(+)}$,5$^{(+)}$,6$^{(+)}$	2111.4	6$^+$		
890[&]		3001.5?	4$^+$,5$^+$,6$^+$	2111.4	6$^+$		
901.7 *1*	9.1	3013.1	8$^+$	2111.4	6$^+$		
978.7[@] *5*	2.6[@]	1534.8	2$^+$	556.4	2$^+$		Unresolved doublet (see also 3991.6-keV level).
978.7[@] *5*	0.9[@]	3991.8	10$^+$	3013.1	8$^+$		Unresolved doublet (see also 1534.5-keV level). I_γ: about 1/4 of the 978-keV intensity was seen to be coincident with the 835-keV transition.
1018.4 *2*	3.3	2294.3	(4$^-$)	1275.8	4$^+$	E1	
1198.4 *2*	2.5	2474.2	5$^-$	1275.8	4$^+$		
1277.7 *10*	1.8	2553.5		1275.8	4$^+$		
1330.6 *5*	1.5	2606.4		1275.8	4$^+$		
1375.4 *1*	2.2	2651.3	(4$^+$)	1275.8	4$^+$		
1493.1 *3*	1.8	2769.0		1275.8	4$^+$		δ=$-$0.6 if J(2769 level)=4.
1534	$\approx$2.6	1534.8	2$^+$	0	0$^+$		I_γ: from I_γ(1534γ)=I_γ(978γ).
1554.9 *5*	2.9	2111.3	3$^+$	556.4	2$^+$		
1581.6 *1*	5.7	2138.0	4$^+$	556.4	2$^+$		
1745.1 *1*	1.9	2301.5	(4)$^+$	556.4	2$^+$		
1786.5 *2*	2.4	2342.9	(3$^-$)	556.4	2$^+$		

[†] Unless noted otherwise, from 1973Si09.
[‡] At Eα=18 MeV (1973Si09).
[#] From $\alpha\gamma(\theta)$ in (α,2nγ) (1986An03).
[@] Multiply placed with intensity suitably divided.
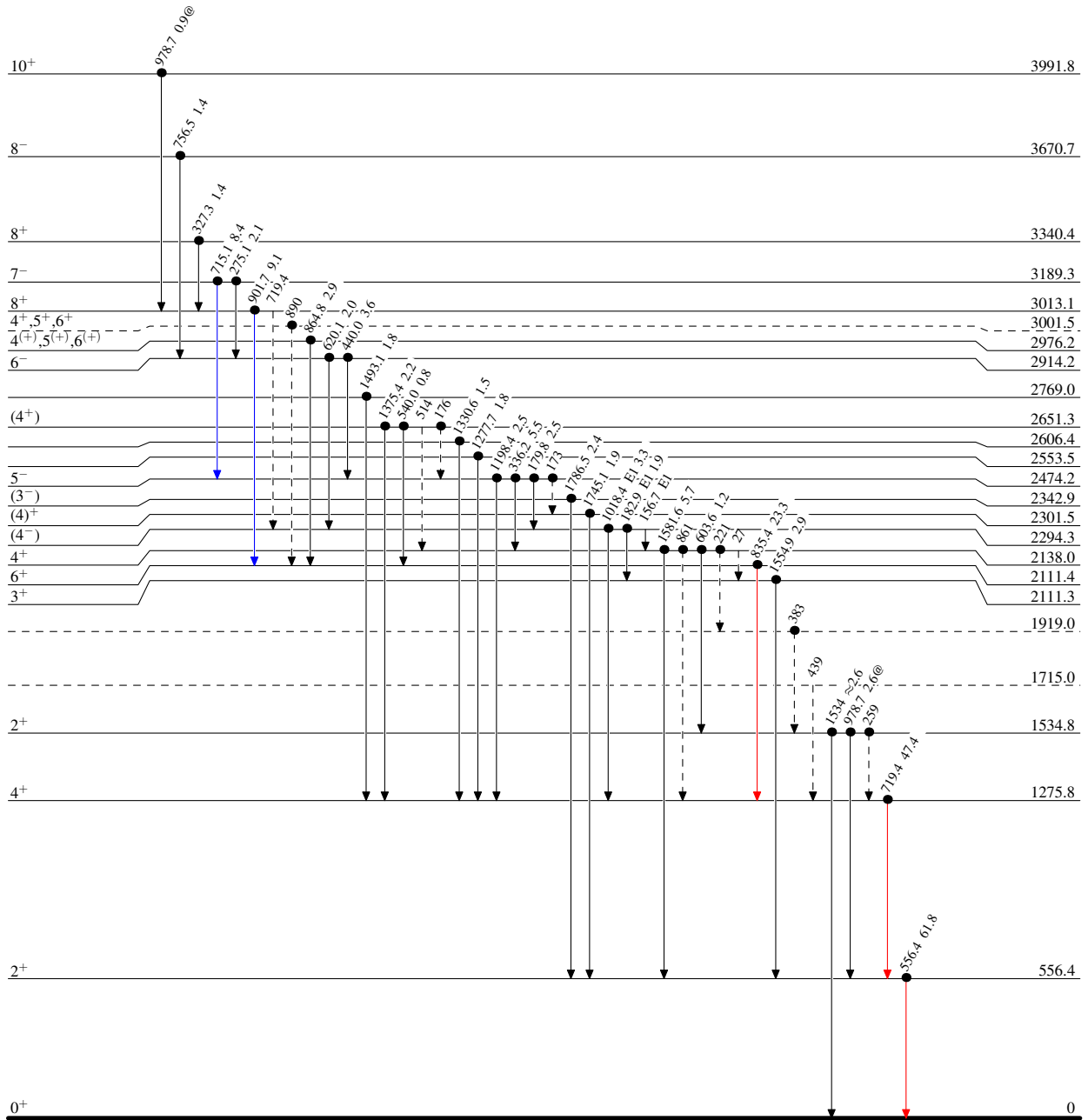[&] Placement of transition in the level scheme is uncertain.

^{99}Ru(α,nγ),^{100}Ru(α,2nγ)   1973Si09,1986An03

Legend

Level Scheme

Intensities: Type not specified
@ Multiply placed: intensity suitably divided

$I_\gamma <\ \ 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
● Coincidence

${}^{102}_{46}Pd_{56}$