^{87}Zr β^+ decay 1971AwZZ,1989Sh39

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	T. D. Johnson and W. D. Kulp(a)	NDS 129, 1 (2015)	27-Jul-2015

Parent: ^{87}Zr: E=0.0; $J^\pi=(9/2)^+$; $T_{1/2}$=1.68 h *1*; Q(β^+)=3672 *4*; %β^+ decay=100.0

1989Sh39: produced by proton-induced spallation and measured absolute γ intensities.

1971AwZZ: produced by ^{86}Sr(^{3}He,2n) followed by chemical separation. Measured γ singles and $\gamma\gamma$ coincidences; more accurate coincidences were reported by same authors (1973KaZD).

1971Ar18: produced by irradiation of yttrium and niobium with 120 and 660-MeV protons, respectively, followed by chemical separation. Measured γ's. Report 15 γ's.

1965Ba48: produced by (α,n) and measured β+ and γ spectra. They report β+ to ground state and isomeric level and no γ rays.

1964Aw02: produced by (p,3n) and report two γ rays.

1963Bu06: produced by (p,pxn) and report one γ ray.

^{87}Y Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	Comments
0.0	$1/2^-$	79.8 h *3*	
380.79 *7*	$9/2^+$	13.37 h *3*	%IT=98.43 *16*; %ε+%β^+=1.57 *16*
794 *1*	$5/2^-$		
1153 *1*	$5/2^+$		
1405 *1*	$(7/2^+,9/2^+,13/2^+)$		J^π: Previously $(7/2^+,9/2^+)$, however as the logft value is still consistent with $13/2^+$, it is not clear that this level can be unambiguously differentiated from the $13/2^+$ 1405 level in the Adopted Set.
1590 *1*	$11/2^+$		
1608 *1*	$(7/2^+,9/2^+)$		
2073 *1*	$(7/2^+,9/2^+)$		
2202 *1*	$7/2^+,9/2^+$		
2241 *1*	$(7/2,9/2^-)$		
2553 *2*	$(9/2)^+$		
2564 *1*	$9/2,11/2^+$		
2602 *2*	$7/2^+$		
2996 *2*	(7/2,9/2,11/2)		
3263 *2*	$9/2^+,11/2^+$		
3405 *2*	$3/2^+,5/2^+$		

[†] From least-squares fit to γ energies.
[‡] From ^{87}Y Adopted Levels.
[#] From ^{87}Y Adopted Levels.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+[†]	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(267 *5*)	3405		0.14 *3*	5.46 *10*	0.14 *3*	εK=0.8616 *3*; εL=0.11306 *20*; εM+=0.02538 *5* No feeding to this level is expected from $(9/2)^+$. This indicates there may be another level very close to 3405 keV with a different J^π, or there is unobserved β^+ feeding to a higher level which subsequently feeds into this one.
(409 *5*)	3263		0.11 *5*	5.95 *20*	0.11 *5*	εK=0.8665 *1*; εL=0.10917 *8*; εM+=0.02438 *2*
(676 *5*)	2996		0.17 *7*	6.21 *18*	0.17 *7*	εK=0.8699; εL=0.10642 *3*; εM+=0.023674 *7*
(1070 *5*)	2602		0.34 *7*	6.32 *9*	0.34 *7*	εK=0.8718; εL=0.1049; εM+=0.023289 *3*
(1108 *4*)	2564		0.42 *5*	6.26 *6*	0.42 *5*	εK=0.8719; εL=0.1048; εM+=0.023266 *3*
(1119 *5*)	2553		0.17 *4*	6.66 *11*	0.17 *4*	εK=0.8719; εL=0.10481 *1*; εM+=0.023260 *3*
(1431 *4*)	2241	0.0024 *9*	0.14 *5*	6.97 *16*	0.14 *5*	av Eβ=182.8 *19*; εK=0.8578 *6*; εL=0.10252 *8*; εM+=0.02273 *2*

Continued on next page (footnotes at end of table)

^{87}Zr β^+ decay 1971AwZZ,1989Sh39 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+[†]	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(1470 *4*)	2202	0.0074 *19*	0.30 *8*	6.65 *12*	0.31 *8*	av Eβ=199.6 *18*; εK=0.8519 *8*; εL=0.1017 *1*; εM+=0.02256 *2*
(1599 *4*)	2073	0.0016 *8*	0.026 *13*	7.78 *22*	0.028 *14*	av Eβ=254.9 *20*; εK=0.8216 *14*; εL=0.09798 *17*; εM+=0.02172 *4*
(2064 *4*)	1608	0.869 *22*	1.79 *4*	6.173 *11*	2.66 *6*	av Eβ=456.9 *19*; εK=0.588 *3*; εL=0.0698 *4*; εM+=0.01547 *7*
(2082 *4*)	1590	0.24 *2*	0.46 *5*	6.77 *5*	0.70 *7*	av Eβ=464.5 *19*; εK=0.578 *3*; εL=0.0686 *4*; εM+=0.01519 *7*
(2267 *4*)	1405	0.13 *5*	0.15 *5*	7.33 *16*	0.28 *10*	av Eβ=546.9 *19*; εK=0.4666 *25*; εL=0.0553 *3*; εM+=0.01226 *7*
(2519 *4*)	1153	0.04 *3*	0.02 *2*	8.2 *4*	0.06 *5*	av Eβ=659.9 *20*; εK=0.3387 *19*; εL=0.04012 *23*; εM+=0.00889 *5* No feeding is expected from (9/2)$^+$. This indicates there may be another level very close to 1153 keV with a different J$^\pi$, or there is unobserved β^+ feeding to a higher level which subsequently feeds into this one.
(2878 *4*)	794	0.13 *5*	0.041 *17*	9.29^{1u} *18*	0.17 *7*	av Eβ=823.5 *19*; εK=0.2122 *12*; εL=0.02510 *14*; εM+=0.00556 *3*
(3291 *4*)	380.79	80.45 *19*	13.87 *14*	5.692 *5*	94.32 *15*	av Eβ=1013.7 *20*; εK=0.1285 *7*; εL=0.01518 *8*; εM+=0.003361 *17* E(decay): measured E(β+) are 2260 *40* (1965Ba48) and 2280 *50* (1971AwZZ).

[†] Absolute intensity per 100 decays.

$\gamma(^{87}Y)$

Iγ normalization: from 1989Sh39 from relative intensities of parent and daughter γ rays during decay and growth (no details). This value conflicts with I_γ(norm)=0.010 based on $I_\varepsilon+I_{\beta^+}$= 98.0 *6* to the 381 level, by 1984Pr01 from the ratio of I_γ of 381 and 485 from ^{87}Sr, and γ intensity balance.
Coincidence data are from 1971AwZZ.

E_γ †	I_γ †@	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α#	Comments
(380.79 *7*)		380.79	$9/2^+$	0.0	$1/2^-$	M4	0.256 *4*	B(M4)(W.u.)=2.76 *15* ce(K)/(γ+ce)=0.174 *5*; ce(L)/(γ+ce)=0.0264 *8*; ce(M)/(γ+ce)=0.00462 *15* ce(N)/(γ+ce)=0.000605 *19*; ce(O)/(γ+ce)=3.58×10^{-5} *11* α(K)=0.219 *7*; α(L)=0.0333 *11*; α(M)=0.00582 *18* α(N)=0.000762 *24*; α(O)=4.51×10^{-5} *14* E_γ: not measured here, from ^{87}Y Adopted γ's.
611 *1*	4 *1*	2202	$7/2^+,9/2^+$	1590	$11/2^+$			
633 *1*	2 *1*	2241	$(7/2,9/2^-)$	1608	$(7/2^+,9/2^+)$			
772 *1*	8 *1*	1153	$5/2^+$	380.79	$9/2^+$			
794 *1*	10 *2*	794	$5/2^-$	0.0	$1/2^-$			
797 *1*	6 *2*	2202	$7/2^+,9/2^+$	1405	$(7/2^+,9/2^+,13/2^+)$			
836 *1*	2 *1*	2241	$(7/2,9/2^-)$	1405	$(7/2^+,9/2^+,13/2^+)$			
(921)		2073	$(7/2^+,9/2^+)$	1153	$5/2^+$			A weak 921 keV was observed but not placed in 1971AwZZ. From the spectra shown, it seems the 921γ has about half the intensity of the 1692 γ. Comparison with data from the 87Sr(p,nγ) reaction (1980Ta13) indicates that this may be the same transition depopulating the $(7/2^+,9.2^+)$ level at 2073.
973 *1*	4 *1*	2564	$9/2,11/2^+$	1590	$11/2^+$			
1024 *1*	28 *2*	1405	$(7/2^+,9/2^+,13/2^+)$	380.79	$9/2^+$			
1048 *1*	2 *1*	2202	$7/2^+,9/2^+$	1153	$5/2^+$			
1159 *1*	8 *1*	2564	$9/2,11/2^+$	1405	$(7/2^+,9/2^+,13/2^+)$			
1203 *1*	5 *1*	3405	$3/2^+,5/2^+$	2202	$7/2^+,9/2^+$			
1210 *1*	32.9 *10*	1590	$11/2^+$	380.79	$9/2^+$			I_γ: from 1989Sh39.
x1216 *1*	3 *2*							
1227 *1*	100	1608	$(7/2^+,9/2^+)$	380.79	$9/2^+$			
1388.0 *15*	3 *1*	2996	(7/2,9/2,11/2)	1608	$(7/2^+,9/2^+)$			
1400.0 *15*	4 *1*	2553	$(9/2)^+$	1153	$5/2^+$			
1410.0 *15*	1.0 *5*	2202	$7/2^+,9/2^+$	794	$5/2^-$			
x1657 *2*	3 *1*							
1692.0 *15*	1.0 *5*	2073	$(7/2^+,9/2^+)$	380.79	$9/2^+$			
1808.0 *15*	3 *1*	2602	$7/2^+$	794	$5/2^-$			
1821.0 *15*	3 *1*	2202	$7/2^+,9/2^+$	380.79	$9/2^+$			
1857.0 *15*	2 *1*	3263	$9/2^+,11/2^+$	1405	$(7/2^+,9/2^+,13/2^+)$			
1862 *2*	1.0 *5*	2241	$(7/2,9/2^-)$	380.79	$9/2^+$			

$^{87}_{39}Y_{48}$-3

^{87}Zr β^+ decay 1971AwZZ,1989Sh39 (continued)

$\gamma(^{87}Y)$ (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π
2172 *2*	2 *1*	2553	$(9/2)^+$	380.79	$9/2^+$
2183.0 *15*	3 *1*	2564	$9/2,11/2^+$	380.79	$9/2^+$
2222.0 *15*	9 *2*	2602	$7/2^+$	380.79	$9/2^+$
2615.0 *15*	3 *2*	2996	(7/2,9/2,11/2)	380.79	$9/2^+$
2883 *2*	2.0 *15*	3263	$9/2^+,11/2^+$	380.79	$9/2^+$

† From 1971AwZZ, unless otherwise noted; for another less extensive set, see 1971Ar18.
‡ From ^{87}Y Adopted γ's.
# Additional information 1.
@ For absolute intensity per 100 decays, multiply by 0.0280 *4*.
x γ ray not placed in level scheme.

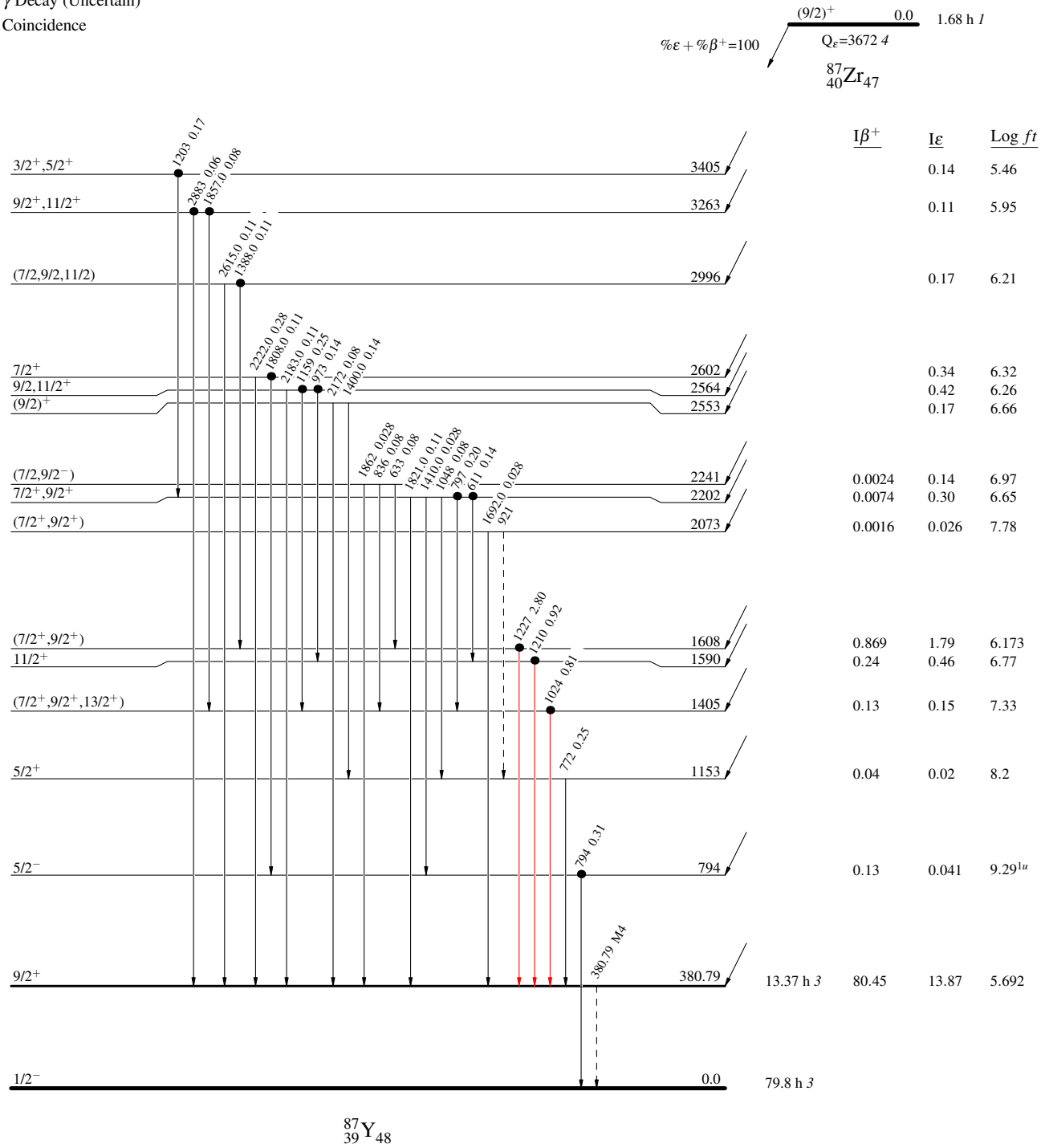
$^{87}_{39}Y_{48}$-4

^{87}Zr β^+ decay 1971AwZZ,1989Sh39

Decay Scheme

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

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



$^{87}_{39}Y_{48}$