^{87}Nb β^+ decay (2.6 min) 1986CoZQ,1974Vo03,1977Ko05

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}Nb: E=3.84 *14*; $J^\pi=(9/2^+)$; $T_{1/2}$=2.6 min *1*; Q(β^+)=5473 *8*; %β^+ decay=100.0

Although there are five studies of this decay, of the 35 γ's reported here, only 11 are reported by more than one author. Therefore, this activity needs additional study.

1986CoZQ: ^{58}Ni(^{32}S,3p), E(^{32}S)=110 MeV measured γ spectra and $\gamma\gamma$ coincidences. Data taken from authors' decay scheme drawing.

1974Vo03: spallation by 660-MeV protons on silver with chemical separation; measured γ spectra and decay for each γ, $\gamma\gamma$ coincidences.

1977Ko05: ^{58}Ni(^{32}S,n2p)^{87}Mo and ^{58}Ni(^{32}S,3p)^{87}Nb, E(^{32}S)=111 MeV; measured γ spectra and $\gamma\gamma$ coincidences.

1971Do01: ^{58}Ni(^{32}S,3p), E(^{32}S)=90-100 MeV; measured γ spectra.

1972Tu03: ^{90}Zr(p,4n); measured γ spectra and $\gamma\gamma$ coincidences.

^{87}Zr Levels

E(level)†	J^π‡	Comments
0.0	$9/2^+$	
201.01 *19*	$7/2^+$	
470.58 *16*	$(7/2^+)$	
523.8?# *23*		
589.3# *17*		
801.1 *4*	(7/2)	
817.54 *25*		
1087.9 *12*	(9/2)	
1284.0# *24*		
1287.5# *24*		
1505.6# *23*		
1669# *4*		
1749# *4*		
1884.4 *3*	$(7/2^+,9/2^+,11/2^+)$	J^π: From logft.
1911?# *4*		
1919.7# *23*		
1949?# *3*		
2059.3# *23*		
2069.4# *23*		
2245.4# *23*		
2354.4 *8*		
2598.3# *23*		
3053.4# *23*		
3447.1# *23*		

† From least-squares fit to γ-ray energies.

‡ From ^{87}Zr Adopted Levels.

Observed only by 1986CoZQ, not uniquely assigned to this decay.

^{87}Nb β^+ decay (2.6 min) 1986CoZQ,1974Vo03,1977Ko05 (continued)

ε,β^+ radiations

IB,IE,TI The total branching intensities are from γ-ray intensity balances and are based on a 37% branch to the ground state, as reported by 1982De43. Branches less than 5% are not reported here since this scheme is very approximate. The β+ and ε intensities are theoretical values from the LOGFT code.

E(decay)	E(level)	Iβ^+[†]	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(3592 *8*)	1884.4	27	3.6	4.8	31.	av Eβ=1154.6 *38*; εK=0.1013 *9*; εL=0.01205 *11*; εM+=0.002701 *23*
(5006 *8*)	470.58	21	0.75	5.8	22.	av Eβ=1824.1 *39*; εK=0.02968 *18*; εL=0.003520 *21*; εM+=0.000789 *5*
(5276 *8*)	201.01	5	0.1	6.6	5.	av Eβ=1953.3 *39*; εK=0.02458 *14*; εL=0.002915 *16*; εM+=0.000653 *4*
(5477 *8*)	0.0	36	0.91	5.8	37.	av Eβ=2049.9 *39*; εK=0.02151 *12*; εL=0.002550 *14*; εM+=0.000572 *3*

[†] Absolute intensity per 100 decays.

^{87}Nb β^+ decay (2.6 min) 1986CoZQ,1974Vo03,1977Ko05 (continued)

$\gamma(^{87}Zr)$

Iγ normalization, I(γ+ce) normalization: from 1982De43 and considered to be approximate.
coin: from 1986CoZQ.

E_γ [†‡]	I_γ [#c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ	α [b]	Comments
201.0[@] *2*	100 *4*	201.01	7/2$^+$	0.0	9/2$^+$	M1+E2	−0.35	0.0370	α(K)=0.0324 *5*; α(L)=0.00387 *6*; α(M)=0.000673 *10* α(N)=9.43×10^{-5} *14*; α(O)=6.19×10^{-6} *9* Iγ: weighted average of 100 6 (1974Vo03) and 100.0 44 (1972Tu03). Mult.,δ: from Adopted γ's.
242.4[&] *23*	2[&]	1911?		1669					
[x]269.0[a] *10*	≈6[a]								
322.8[&] *23*	2[&]	523.8?		201.01	7/2$^+$				
381.3[&] *23*	[&]	1669		1287.5					
388.7[&] *23*	[&]	589.3		201.01	7/2$^+$				
461.7[&] *23*	2[&]	1749		1287.5					
466.5[&] *23*	2[&]	1284.0		817.54					
470.0[&] *23*	7[&]	1287.5		817.54					
470.6[@] *2*	69 *4*	470.58	(7/2$^+$)	0.0	9/2$^+$				Iγ: Weighted average of 74.0 *44* (1974Vo03), 71.7 *40* (1972Tu03), and 60 *5* (1982DeZQ), and 67 (1986CoZQ), normalized to this value in 1977K05; other: 72 *4* (1972Tu03).
600.0 *5*	9.5 *15*	801.1	(7/2)	201.01	7/2$^+$				
616.6 *2*	31 *3*	817.54		201.01	7/2$^+$				Eγ: this placement is from 1977Ko05, 1974Vo03 place this transition from the 1087 level.
797.0[&] *23*	5[&]	1884.4	(7/2$^+$,9/2$^+$,11/2$^+$)	1087.9	(9/2)				
801.0 *6*	4.0 *12*	801.1	(7/2)	0.0	9/2$^+$				Iγ: from 1974Vo03; others: 8.4 *21* (1977Ko05), 4 *1* (1982De43), and 7 (1986CoZQ).
887.0 *15*	7.2 *22*	1087.9	(9/2)	201.01	7/2$^+$				
[x]983.0[a] *15*	4.8[a] *14*								
1066.8 *5*	37 *4*	1884.4	(7/2$^+$,9/2$^+$,11/2$^+$)	817.54					Eγ: this placement is from 1986CoZQ, 1974Vo03 place this transition from the 2153 level.
1083.0 *7*	7 *2*	1884.4	(7/2$^+$,9/2$^+$,11/2$^+$)	801.1	(7/2)				
[x]1168.0[a] *15*	3.6[a] *11*								
[x]1285.0[a] *14*	4.0[a] *12*								
1295.4[&] *23*	2[&]	1884.4	(7/2$^+$,9/2$^+$,11/2$^+$)	589.3					
1304.6[&] *23*	5[&]	1505.6		201.01	7/2$^+$				
1360.1[&] *23*	2[&]	1949?		589.3					
[x]1559.0[a] *15*	3.0[a] *9*								
1683.2 *3*	2.4 *10*	1884.4	(7/2$^+$,9/2$^+$,11/2$^+$)	201.01	7/2$^+$				Eγ: Adopted 1683.2 *3* (1974Vo03); others: 1686.0 *7*

$^{87}_{40}Zr_{47}$-3

^{87}Nb β^+ decay (2.6 min) 1986CoZQ,1974Vo03,1977Ko05 (continued)

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

E_γ †‡	I_γ #c	E_i(level)	J_i^π	E_f	J_f^π	Comments
						(1977Ko05) and is discrepant, 1682.7 (1982De43), and 1684.1 *23* (1986CoZQ). I_γ: Weighted average of 4.2 *21* (1977Ko05) and 2 *1* (1982De43); others 15.2 *5* (1974Vo03) and 2 (1986CoZQ), but with no uncertainties given. The evaluators have opted for a lower intensity values since at least 3 values have consistently low values, whereas the larger value may be due to impurities. Note that the Iγ(1683)/(Iγ(1067γ + 1884γ)) branching is 0.26 *6* from 1982De43, 0.21 *3* from 1974Vo03, 0.09 *5* from 1977Ko05, and 0.06 from 1986CoZQ.
1718.7& *23*	2&	1919.7		201.01	7/2$^+$	
1858.3& *23*	2&	2059.3		201.01	7/2$^+$	
1868.4& *23*	2&	2069.4		201.01	7/2$^+$	
1884.2 *3*	33 *3*	1884.4	(7/2$^+$,9/2$^+$,11/2$^+$)	0.0	9/2$^+$	
2044.4& *23*	2&	2245.4		201.01	7/2$^+$	
2153.3 *7*	3.8 *11*	2354.4		201.01	7/2$^+$	I_γ: from 1974Vo03; other: 12 (1986CoZQ).
2397.3& *23*	2&	2598.3		201.01	7/2$^+$	
2852.3& *23*	2&	3053.4		201.01	7/2$^+$	
3246.0& *23*	2&	3447.1		201.01	7/2$^+$	

† Average of values from 1974Vo03 and 1977Ko05, unless indicated otherwise.
‡ 914.2 γ was reported by 1974Vo03, but this transition has been reassigned by 1977Ka05 to ^{86}Nb decay.
# Average of data from 1974Vo03, 1977Ko05, and 1982De43, unless indicated otherwise. The values of 1974Vo03 and 1982De43 were normalized to $I_\gamma(201)=100$. The data of 1977Ko05 were normalized to $I_\gamma(470.8\gamma)=69$, based on a weighted average from 1974Vo03, 1986CoZQ, and 1972Tu03. When they were used, the values of 1986CoZQ were normalized to $I_\gamma(616)=31$, since they also included the 3.75-minute activity; no uncertainties are given by 1986CoZQ.
@ Average of values from 1974Vo03, 1977Ko05, 1972Tu03, and 1971Do01.
& Only from 1986CoZQ.
a Only from 1974Vo03.
b Additional information 1.
c For absolute intensity per 100 decays, multiply by 0.3.
x γ ray not placed in level scheme.

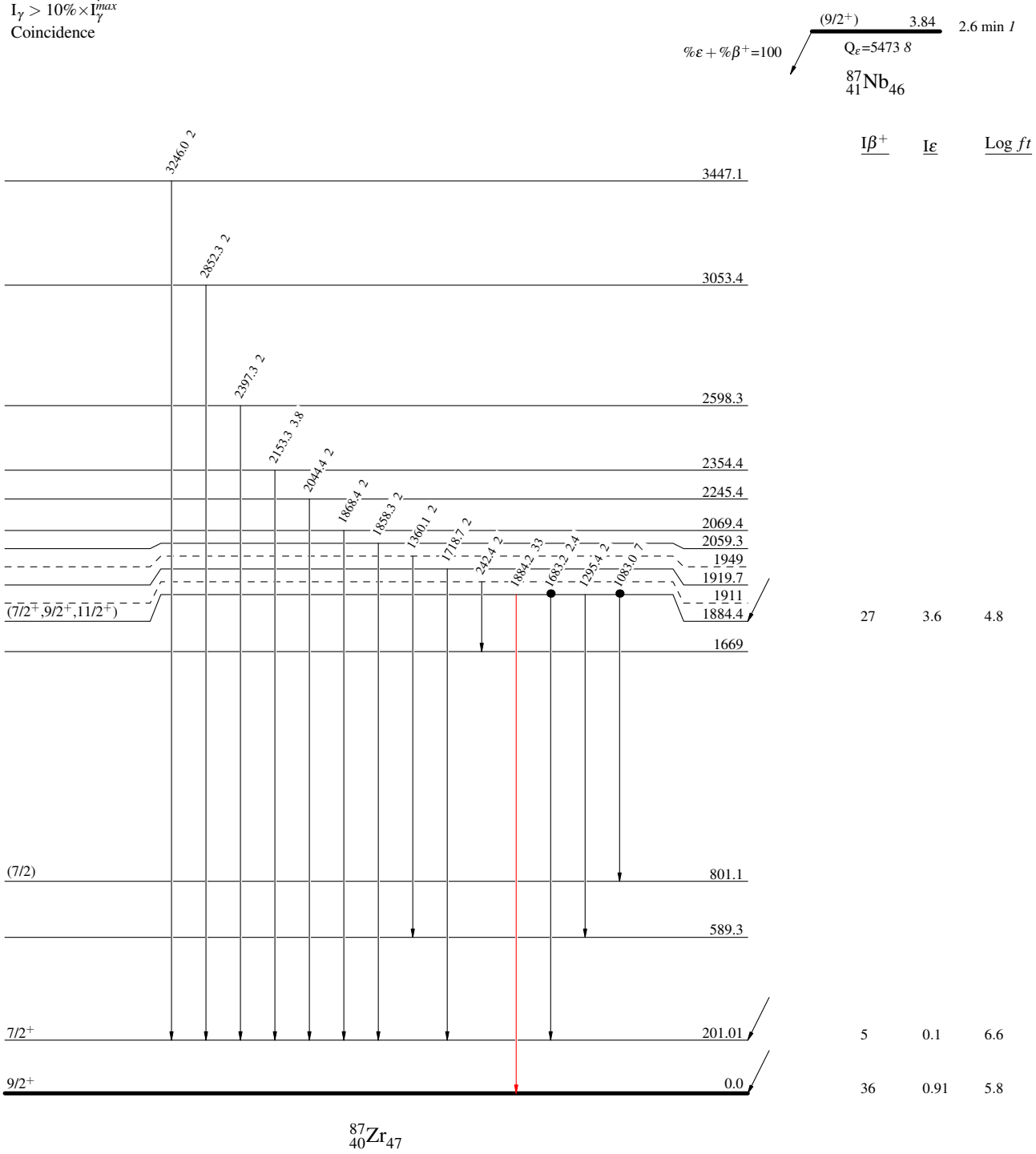
$^{87}_{40}Zr_{47}$-4

^{87}Nb β^+ decay (2.6 min) 1986CoZQ,1974Vo03,1977Ko05

Decay Scheme

Intensities: Relative I_γ

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- Coincidence



^{87}Nb β^+ decay (2.6 min) 1986CoZQ,1974Vo03,1977Ko05

Decay Scheme (continued)

Intensities: Relative I_γ