^{81}Rb $\varepsilon+\beta^+$ decay (30.5 min)   1977Li14

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 199,271 (2025)	1-Sep-2024

Parent: ^{81}Rb: E=86.31 6; J$^\pi$=9/2$^+$; T$_{1/2}$=30.5 min 3; Q(ε)=2239 5; %ε+%β^+ decay=2.1 5

^{81}Rb-E,J$^\pi$,T$_{1/2}$: from ^{81}Rb Adopted Levels.

^{81}Rb-Q(ε): from 2021Wa16.

^{81}Rb-%ε+%β^+ decay: Using data in 1977Li14, based on ^{81}Rb IT branching + ε decay branching=100, using the data of IT Iγ(1+α)=(4630 200) × (1+17.66 31)=86400 4000 and Iγ(1+α) to g.s.=1840 400 in ε decay.

Others: 1956Do52, 1969Ha03, 1981FrZY.

Only 1977Li14 and 1981FrZY report the decay of the 30.5-min isomer of ^{81}Rb; others report the 4.571-h decay alone. The assignment to one or other isomer was made by 1977Li14 on the basis of half-lives of the γ's and coincidence measurements. However, while 1977Li14 found numerous γ's belonging to the 30.5-min decay, 1981FrZY found only the 49.6γ following the 30.5-min half-life. Consequently, this decay scheme probably should be accepted with caution.

1977Li14: Eγ, Iγ, $\gamma\gamma$-coin, and internal conversion measurement; Ge(Li) (FWHM=2.5 keV at 1.33 MeV), β spectrometer.

1981FrZY: singles and coin spectra, measured with Ge(Li) (FWHM=2.5-3.5 keV at 1.33 MeV) and Si(Li), timing FWHM≈12 ns.

^{81}Kr Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[‡]	Comments
0	7/2$^+$	2.13×10^5 y +16−26	
49.50 8	9/2$^+$	4.0 ns 4	
190.44 7	1/2$^-$	13.10 s 2	T$_{1/2}$: from Adopted Levels.
456.88 10	5/2$^-$		
548.92 9	5/2$^+$		
636.74 12	3/2$^-$		
731.86 11	(5/2)$^+$		
873.8 3	11/2$^+$		
934.50 22	11/2$^+$	0.19 ps 6	
981.74 13	(9/2$^+$)		
1014.42 24			
1100.01 11	5/2$^+$		
1206.44 20	7/2		
1682.7 4	7/2,9/2,11/2$^{(+)}$		
1687.9 3	7/2,9/2,11/2$^{(+)}$		
1743.61 11	(7/2)$^+$		
1781.8 5	7/2,9/2,11/2$^{(+)}$		
1902.6 6	7/2,9/2,11/2$^{(+)}$		

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

ε,β^+ radiations

εK, εL, εM, εN: Additional information 1.
av Eβ: Additional information 2.
εK, εL, εM, εN: Additional information 3.
av Eβ: Additional information 4.

E(decay)	E(level)	Iε[†]	Log ft	I($\varepsilon+\beta^+$)[†]	Comments
(423 5)	1902.6	0.0057 20	6.65 22	0.0057 20	εK=0.87232 40; εL=0.10447 20; εM+=0.02321 16
(544 5)	1781.8	≈0.0065	≈6.8	≈0.0065	εK=0.87383 36; εL=0.10327 17; εM+=0.02290 15

^{81}Rb $\varepsilon+\beta^+$ decay (30.5 min)   1977Li14 (continued)

ε,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ †	I$\varepsilon^\dagger$	Log ft	I($\varepsilon+\beta^+$)†	Comments
(582 5)	1743.61		0.34 12	5.15 21	0.34 12	εK=0.87417 35; εL=0.10300 17; εM+=0.02283 15
(637 5)	1687.9		0.023 8	6.41 22	0.023 8	εK=0.87459 34; εL=0.10266 16; εM+=0.02274 15
(643 5)	1682.7		0.022 8	6.44 21	0.022 8	εK=0.87463 34; εL=0.10263 16; εM+=0.02274 15
(1119 5)	1206.44	1.2×10^{-6} 6	0.020 8	6.95 17	0.020 7	av Eβ=47.3 22; εK=0.87641 32; εL=0.10116 14; εM+=0.02236 14
(1344 5)	981.74	5.6×10^{-4} 23	0.055 23	6.67 18	0.056 19	av Eβ=144.0 21; εK=0.8681 7; εL=0.09984 15; εM+=0.02207 14
(1391 5)	934.50	6.2×10^{-4} 27	0.036 16	6.88 19	0.037 13	av Eβ=163.8 21; εK=0.8622 9; εL=0.09910 17; εM+=0.02189 14
(1452 5)	873.8	6.8×10^{-4} 30	0.022 10	7.13 19	0.023 8	av Eβ=189.6 21; εK=0.8511 13; εL=0.09775 20; εM+=0.02160 14
(1594 5)	731.86	8.2×10^{-4} 34	0.055 23	7.80 18	0.056 19	av Eβ=271.6 22; εK=0.8623 6; εL=0.10076 15; εM+=0.02229 14
(2276 5)	49.50	0.8 7	0.66 35	6.06 23	1.5 7	av Eβ=547.0 22; εK=0.3889 41; εL=0.04440 47; εM+=0.00980 11
						E(decay): 2420 *200* from 1956Do52; were there a g.s. branch, the authors could not have resolved it from this one.
(2325‡ 5)	0					I($\varepsilon+\beta^+$): 0.3 +4−3 from measured I($\gamma^\pm$), β^+/ε(theory) and decay scheme.

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.

^{81}Rb $\varepsilon+\beta^+$ decay (30.5 min)   **1977Li14 (continued)**

$\gamma({}^{81}$Kr)

Iγ normalization: from ΣI$\gamma(1+\alpha)$ to g.s.=100 and decay mode branching.
α(K)exp from β spectra of 1977Li14, normalized so α(K)exp(446.15 transition)=0.00273 *20* (adopted from (p,nγ)).

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ	α[#]	Comments
49.5 *1*	660 *35*	49.50	$9/2^+$	0	$7/2^+$	M1(+E2)	0.19 +*12*−*19*	1.3 *6*	%Iγ=0.75 *22* α(K)=1.1 *5*; α(L)=0.17 *12*; α(M)=0.028 *19* α(N)=0.0025 *15* Also present in ^{81}Rb (4.571 h) ε decay.
190.44 *7*	12.1 *12*	190.44	$1/2^-$	0	$7/2^+$	E3		0.479 *7*	%Iγ=0.014 *4* α(exp)=0.54 *7* α(K)=0.399 *6*; α(L)=0.0681 *10*; α(M)=0.01110 *17* α(N)=0.000985 *15* E_γ: from Adopted Gammas. α(exp): from 1956Do52. α(K)exp/(α(L+...)expα(M)exp)=5.16 *30* (1956Do52), α(K)exp/α(LM)exp=3.6 *5* (1969Ha03).
266.2[‡] *5*	≈0.1	456.88	$5/2^-$	190.44	$1/2^-$	[E2]		0.0258 *4*	%Iγ≈1.1×10^{-4} α(K)=0.02270 *35*; α(L)=0.00266 *4*; α(M)=0.000429 *7* α(N)=4.17×10^{-5} *6*
368.3 *3*	9.2 *5*	1100.01	$5/2^+$	731.86	$(5/2)^+$	[M1,E2]		0.0064 *20*	%Iγ=0.0105 *31* α(K)=0.0057 *18*; α(L)=6.3×10^{-4} *21*; α(M)=1.03×10^{-4} *34* α(N)=1.02×10^{-5} *33*
446.3[‡] *1*	18.0 *20*	636.74	$3/2^-$	190.44	$1/2^-$	E2+M1	0.44 +*20*−*26*	0.00308 *23*	%Iγ=0.021 *6* α(K)=0.00273 *20*; α(L)=0.000296 *24*; α(M)=4.8×10^{-5} *4* α(N)=4.8×10^{-6} *4*
456.9[‡] *1*	7.4 *14*	456.88	$5/2^-$	0	$7/2^+$	E1		1.22×10^{-3} *2*	%Iγ=0.0085 *29* α(K)=0.001080 *15*; α(L)=0.0001146 *16*; α(M)=1.852×10^{-5} *26* α(N)=1.863×10^{-6} *26*
463.3 *3*	18.0 *20*	1100.01	$5/2^+$	636.74	$3/2^-$	[E1]		1.17×10^{-3} *2*	%Iγ=0.021 *6* α(K)=0.001043 *15*; α(L)=0.0001107 *16*; α(M)=1.788×10^{-5} *25* α(N)=1.799×10^{-6} *25*
465.5 *3*	18.0 *20*	1014.42		548.92	$5/2^+$				%Iγ=0.021 *6*
499.4 *2*	25.0 *15*	548.92	$5/2^+$	49.50	$9/2^+$	[E2]		0.00321 *5*	%Iγ=0.029 *8* α(K)=0.00284 *4*; α(L)=0.000314 *4*; α(M)=5.07×10^{-5} *7* α(N)=5.04×10^{-6} *7* Also present in ^{81}Rb (4.571 h) ε decay.

^{81}Rb $\varepsilon+\beta^+$ decay (30.5 min)   1977Li14 (continued)

$\gamma(^{81}$Kr) (continued)

$E_\gamma^\dagger$	$I_\gamma^{\dagger @}$	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ	$\alpha^\#$	Comments
548.9 *1*	90 *6*	548.92	5/2$^+$	0	7/2$^+$	E2(+M1)	≥0.8	0.00220 *21*	%Iγ=0.103 *31* α(K)=0.00195 *19*; α(L)=0.000213 *22*; α(M)=3.45×10^{-5} *35* α(N)=3.45×10^{-6} *34* Also present in ^{81}Rb (4.571 h) ε decay.
551.5 *15*	5 *2*	1100.01	5/2$^+$	548.92	5/2$^+$	[M1,E2]		0.00204 *34*	%Iγ=0.0057 *28* α(K)=0.00181 *30*; α(L)=0.000197 *35*; α(M)=3.2×10^{-5} *6* α(N)=3.2×10^{-6} *5* E_γ,I_γ: from $\gamma\gamma$ coin.
643.6$^{\&}$ *15*	1.6$^{\&}$ *8*	1100.01	5/2$^+$	456.88	5/2$^-$	[E1]		5.36×10^{-4} *8*	%Iγ=0.0018 *11* α(K)=0.000477 *7*; α(L)=5.04×10^{-5} *8*; α(M)=8.14×10^{-6} *12* α(N)=8.21×10^{-7} *12* E_γ,I_γ: from $\gamma\gamma$ coin.
643.6$^{\&}$ *1*	98$^{\&}$ *4*	1743.61	(7/2)$^+$	1100.01	5/2$^+$				%Iγ=0.112 *33*
657.5 *2*	11.7 *5*	1206.44	7/2	548.92	5/2$^+$	D+Q			%Iγ=0.013 *4*
682.3 *1*	42.0 *18*	731.86	(5/2)$^+$	49.50	9/2$^+$	(E2)		1.30×10^{-3} *2*	%Iγ=0.048 *14* α(K)=0.001153 *16*; α(L)=0.0001253 *18*; α(M)=2.028×10^{-5} *28* α(N)=2.031×10^{-6} *28*
729.2 *8*	28 *2*	1743.61	(7/2)$^+$	1014.42					%Iγ=0.032 *10* E from $\gamma\gamma$ coin; γ also present in ^{81}Rb (4.571 h) ε decay.
732.1 *2*	18 *1*	731.86	(5/2)$^+$	0	7/2$^+$	[M1,E2]		0.00099 *9*	%Iγ=0.021 *6* α(K)=0.00088 *8*; α(L)=9.4×10^{-5} *9*; α(M)=1.53×10^{-5} *15* α(N)=1.54×10^{-6} *14*
761.9 *2*	8.0 *6*	1743.61	(7/2)$^+$	981.74	(9/2$^+$)				%Iγ=0.0091 *27*
824.2 *5*	13 *1*	873.8	11/2$^+$	49.50	9/2$^+$	(M1+E2)	−0.8 +*4*−*6*	7.35×10^{-4} *27*	%Iγ=0.015 *4* α(K)=0.000653 *24*; α(L)=6.97×10^{-5} *29*; α(M)=1.13×10^{-5} *5* α(N)=1.14×10^{-6} *4*
873.8 *3*	7.7 *6*	873.8	11/2$^+$	0	7/2$^+$	E2		6.85×10^{-4} *10*	%Iγ=0.0088 *26* α(K)=0.000608 *9*; α(L)=6.53×10^{-5} *9*; α(M)=1.057×10^{-5} *15* α(N)=1.063×10^{-6} *15*
885.0 *2*	32.7 *14*	934.50	11/2$^+$	49.50	9/2$^+$	M1+E2	−0.4 *1*	6.09×10^{-4} *9*	%Iγ=0.037 *11* α(K)=0.000541 *8*; α(L)=5.74×10^{-5} *9*; α(M)=9.30×10^{-6} *15* α(N)=9.41×10^{-7} *15*

^{81}Rb $\varepsilon+\beta^+$ **decay (30.5 min)**   **1977Li14 (continued)**

$\gamma(^{81}$Kr) (continued)

E$_\gamma$[†]	I$_\gamma$[†@]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
932.4 2	32.7 14	981.74	(9/2$^+$)	49.50	9/2$^+$	%Iγ=0.037 11
981.6 2	24.9 14	981.74	(9/2$^+$)	0	7/2$^+$	%Iγ=0.028 8
1011 1	<3	1743.61	(7/2)$^+$	731.86	(5/2)$^+$	%Iγ<0.00343
1014.4 4	10.3 7	1014.42		0	7/2$^+$	%Iγ=0.0118 35
[x]1087 1	10.2 15					
1099.9 2	64.2 27	1100.01	5/2$^+$	0	7/2$^+$	%Iγ=0.073 22
						E$_\gamma$: 1981FrZY report E$_\gamma$=1100.3 5, tentatively assigned to ^{81}Kr, but associated with "long" T$_{1/2}$ isomer.
[x]1136 1	3.6 7					
1157.0 4	6.0 6	1206.44	7/2	49.50	9/2$^+$	%Iγ=0.0069 21
1194.6 2	95 4	1743.61	(7/2)$^+$	548.92	5/2$^+$	%Iγ=0.109 32
1206.0[a] 15	<1	1206.44	7/2	0	7/2$^+$	
1286.9 4	5.9 4	1743.61	(7/2)$^+$	456.88	5/2$^-$	%Iγ=0.0067 20
[x]1297.0 4	6.3 4					
1633.2 5	6.0 4	1682.7	7/2,9/2,11/2$^{(+)}$	49.50	9/2$^+$	%Iγ=0.0069 20
1638.4 4	10.8 7	1687.9	7/2,9/2,11/2$^{(+)}$	49.50	9/2$^+$	%Iγ=0.012 4
1682.7 4	13.1 8	1682.7	7/2,9/2,11/2$^{(+)}$	0	7/2$^+$	%Iγ=0.015 4
1687.9 4	9.1 7	1687.9	7/2,9/2,11/2$^{(+)}$	0	7/2$^+$	%Iγ=0.0104 31
1694.4 4	15.6 8	1743.61	(7/2)$^+$	49.50	9/2$^+$	%Iγ=0.018 5
1732 1	≈1	1781.8	7/2,9/2,11/2$^{(+)}$	49.50	9/2$^+$	%Iγ≈0.0011
						E$_\gamma$: 1981FrZY report E$_\gamma$=1732.4 5 for a γ ray with no isotopic assignment.
1743.5 3	48.4 21	1743.61	(7/2)$^+$	0	7/2$^+$	%Iγ=0.055 16
1781.8 5	4.7 4	1781.8	7/2,9/2,11/2$^{(+)}$	0	7/2$^+$	%Iγ=0.0054 16
1853 1	0.9 2	1902.6	7/2,9/2,11/2$^{(+)}$	49.50	9/2$^+$	%Iγ=0.0010 4
1902.6 7	4.1 4	1902.6	7/2,9/2,11/2$^{(+)}$	0	7/2$^+$	%Iγ=0.0047 14

[†] From 1977Li14. On the intensity scale, I($\gamma^\pm$)=1810 100 and I(86.6γ, ^{81}Rb)=4630 200 (1977Li14).
[‡] From ^{81}Rb ε decay (4.571 h) data of 1977Li14.
[#] Additional information 5.
[@] For absolute intensity per 100 decays, multiply by 0.0011 4.
[&] Multiply placed with intensity suitably divided.
[a] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{81}Rb ε decay (30.5 min)　　1977Li14

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided

Legend

I$_\gamma <$ 2%×I$_\gamma^{max}$
I$_\gamma <$ 10%×I$_\gamma^{max}$
I$_\gamma >$ 10%×I$_\gamma^{max}$
γ Decay (Uncertain)
● Coincidence

9/2$^+$　86.31　30.5 min 3

%ε + %β^+=2.1　　Q$_\varepsilon$=2239 5

$^{81}_{37}$Rb$_{44}$

	Iβ^+	Iε	Log ft
7/2,9/2,11/2$^{(+)}$　1902.6		0.0057	6.65
7/2,9/2,11/2$^{(+)}$　1781.8		≈0.0065	≈6.8
(7/2)$^+$　1743.61		0.34	5.15
7/2,9/2,11/2$^{(+)}$　1687.9		0.023	6.41
7/2,9/2,11/2$^{(+)}$　1682.7		0.022	6.44
7/2　1206.44	1.2 × 10^{-6}	0.020	6.95
5/2$^+$　1100.01			
1014.42			
(9/2$^+$)　981.74	0.00056	0.055	6.67
11/2$^+$　934.50　0.19 ps 6	0.00062	0.036	6.88
11/2$^+$　873.8	0.00068	0.022	7.13
(5/2)$^+$　731.86	0.00082	0.055	7.80
3/2$^-$　636.74			
5/2$^+$　548.92			
5/2$^-$　456.88			
1/2$^-$　190.44　13.10 s 2			
9/2$^+$　49.50　4.0 ns 4	0.8	0.66	6.06
7/2$^+$　0　2.13×10^5 y +16−26			

$^{81}_{36}$Kr$_{45}$