^{76}Sr $\varepsilon+\beta^+$ decay (7.89 s) 2004De24

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jun Chen and Ameenah R. Farhan	NDS 194,3 (2024)	8-Jan-2024

Parent: ^{76}Sr: E=0.0; $J^\pi=0^+$; $T_{1/2}$=7.89 s *7*; Q($\varepsilon+\beta^+$)=6230 *30*; %$\varepsilon+\beta^+$ decay=100

^{76}Sr-$T_{1/2}$: From ^{76}Sr Adopted Levels.

^{76}Sr-Q($\varepsilon+\beta^+$): From 2021Wa16.

^{76}Sr-%$\varepsilon+\beta^+$ decay: Measured %εp=0.0034 *8* (2004De24).

2004De24: measured Eγ, Iγ, $\gamma\gamma$-coin, β, $\beta\gamma$-coin, delayed protons, half-life. Source of ^{76}Sr produced as mass-separated beam using fragmentation reaction Nb(p,X),E=1 GeV at ISOLDE-CERN.

2004Na16, 2013Pe13 (also 2003Ma69,2004Na17,2005Ru07): measurement of total absorption gamma-ray spectrum, deduced B(GT) functions. The spectrometer was a NaI(Tl) detector system "Lucrecia".

1993Ad12: measured Eγ, Iγ, $\gamma\gamma$-coin.

1992Gr09: measured Eγ, Iγ.

Due to a large gap of about 3.3 MeV between the highest observed level at E=2881 keV and Q-value=6230 keV *30* (2021Wa16), the decay scheme is considered incomplete.

^{76}Rb Levels

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
0.0	1^-	708.4 *3*		1533.0 *6*	(1^+)	2140.1 *3*	(1^+)
101.35 *13*	$2^{(-)}$	968.9 *4*		1640.1 *4*	(1^+)	2172.7 *3*	(1^+)
246.56 *17*	$3^{(-)}$	982.88 *15*	(1^+)	1948.1 *4*	(1^+)	2281.9 *6*	(1^+)
476.83 *14*	(1^+)	1289.1 *4*	(1^+)	2061.8 *4*	(1^+)	2881.8 *6*	(1^+)
515.92 *15*	(1^+)	1412.3 *4*		2090.7 *4*	(1^+)		

† From a least squares fit to Eγ data.

‡ From Adopted Levels.

ε,β^+ radiations

av Eβ: Additional information 1.

Intensity balance gives %ε+%β^+=−0.5 *5* for 708 level, −0.17 *18* for 969 level, −0.11 *14* for 1412 level.

E(decay)	E(level)	Iβ+ #	Iε#	Log *ft*‡	I($\varepsilon+\beta^+$)†‡#	Comments
(3348 *30*)	2881.8	≈0.32	≈0.04	≈5.3	≈0.36	av Eβ=1035 *14*; εK=0.094 *11*; εL=0.0114 *13*; εM+=0.00251 *25*
(3948 *30*)	2281.9	≈1.20	≈0.07	≈5.2	≈1.27	av Eβ=1314 *14*; εK=0.050 *6*; εL=0.0060 *7*; εM+=0.00133 *13*
(4057 *30*)	2172.7	≈0.91	≈0.05	≈5.3	≈0.96	av Eβ=1365 *14*; εK=0.045 *5*; εL=0.0055 *6*; εM+=0.00119 *11*
(4090 *30*)	2140.1	≈3.28	≈0.17	≈4.8	≈3.45	av Eβ=1381 *14*; εK=0.044 *5*; εL=0.0053 *6*; εM+=0.00116 *11*
(4139 *30*)	2090.7	≈0.84	≈0.04	≈5.4	≈0.88	av Eβ=1404 *14*; εK=0.042 *5*; εL=0.0051 *6*; εM+=0.00111 *11*
(4168 *30*)	2061.8	≈1.83	≈0.09	≈5.1	≈1.92	av Eβ=1418 *14*; εK=0.041 *4*; εL=0.0049 *5*; εM+=0.00108 *10*
(4282 *30*)	1948.1	≈0.86	≈0.04	≈5.5	≈0.90	av Eβ=1471 *14*; εK=0.037 *4*; εL=0.0045 *5*; εM+=9.8×10^{-4} *9*
(4590 *30*)	1640.1	≈0.77	≈0.03	≈5.7	≈0.80	av Eβ=1617 *14*; εK=0.0283 *31*; εL=0.0034 *4*; εM+=7.6×10^{-4} *7*
(4697 *30*)	1533.0	≈2.2	≈0.07	≈5.3	≈2.27	av Eβ=1667 *14*; εK=0.0260 *28*; εL=0.00316 *34*; εM+=6.9×10^{-4} *6*
(4941 *30*)	1289.1	≈4.2	≈0.1	≈5.2	≈4.3	av Eβ=1783 *14*; εK=0.0216 *23*; εL=0.00263 *28*; εM+=5.7×10^{-4} *5*
(5247 *30*)	982.88	≈20	≈0.4	≈4.7	≈20.4	av Eβ=1929 *14*; εK=0.0174 *19*; εL=0.00212 *23*; εM+=4.7×10^{-4} *4*
(5714 *30*)	515.92	≈47.3	≈0.7	≈4.5	≈48	av Eβ=2152 *14*; εK=0.0129 *13*; εL=0.00157 *16*;

Continued on next page (footnotes at end of table)

^{76}Sr $\varepsilon+\beta^+$ decay (7.89 s) 2004De24 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ #	Iε #	Log ft ‡	I($\varepsilon+\beta^+$) †‡#	Comments
						εM+=3.43×10^{-4} *31*
(5753 *30*)	476.83	≈11.8	≈0.2	≈5.1	≈12	av Eβ=2171 *14*; εK=0.0126 *13*; εL=0.00153 *16*; εM+=3.35×10^{-4} *30*
(5983@ *30*)	246.56	<1.62	<0.08	>9.7	<1.7	av Eβ=2292 *14*; εK=0.043 *4*; εL=0.0052 *5*; εM+=0.00114 *10* I($\varepsilon+\beta^+$): 0.8 *9*.
(6129@ *30*)	101.35	<6.8	<0.2	>7.3^{1u}	<7	av Eβ=2348 *14*; εK=0.0221 *23*; εL=0.00269 *28*; εM+=5.9×10^{-4} *5* I($\varepsilon+\beta^+$): 1 *6*.
(6230@ *30*)	0.0	<3.0	<0.033	>5.9	<3	av Eβ=2400 *14*; εK=0.0096 *10*; εL=0.00116 *12*; εM+=2.54×10^{-4} *23* I($\varepsilon+\beta^+$): from assumed log ft>5.9 for the first-forbidden transition.

† From γ+ce intensity balance at each level.
‡ As pointed out by 2004Na16 the "pandemonium effect" may be significant here in view of large gap of about 3.3 MeV between Q value and the highest level reported here. Thus all the $\varepsilon+\beta^+$ feedings are considered as approximate.
# Absolute intensity per 100 decays.
@ Existence of this branch is questionable.

^{76}Sr $\varepsilon+\beta^+$ decay (7.89 s) 2004De24 (continued)

$\gamma(^{76}Rb)$

Iγ normalization: From ΣI(γ+ce to g.s.)=98.5 *15*, assuming %ε+%β^+<3.0 to g.s. from assumed log *ft*>5.9 for the first forbidden transition. 2004De24 quote nearly the same value of 0.495. Due to incomplete decay scheme and unplaced γ transitions, the normalization is considered as approximate.

Following tentative γ rays with Eγ(Iγ) reported in 1993Ad12 are omitted here since these are not confirmed in later work by 2004De24: 159.8 *4*(1.2 *5*); 317.0 *3*(1.3 *4*); 665.7 *4*(0.6 *3*); 735.8 *4*(1.1 *4*). Also a tentative 1174γ with Iγ=22 *6* from 1992Gr09 is omitted.

E_γ[‡]	I_γ[@a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[†]	$I_{(\gamma+ce)}$[@a]	Comments
39.0 *5*	29 *5*	515.92	(1$^+$)	476.83	(1$^+$)	[M1]	2.11 *9*	91 *17*	ce(K)/(γ+ce)=0.597 *13*; ce(L)/(γ+ce)=0.0687 *32*; ce(M)/(γ+ce)=0.0114 *6* ce(N)/(γ+ce)=0.00128 *6*; ce(O)/(γ+ce)=5.34×10^{-5} *26* α(K)=1.86 *8*; α(L)=0.214 *9*; α(M)=0.0353 *14* α(N)=0.00397 *16*; α(O)=0.000166 *7* %Iγ≈14
101.4[#] *2*	59 *10*	101.35	2$^{(-)}$	0.0	1$^-$	(M1)	0.1393 *21*	67 *11*	ce(K)/(γ+ce)=0.1078 *14*; ce(L)/(γ+ce)=0.01220 *18*; ce(M)/(γ+ce)=0.002017 *31* ce(N)/(γ+ce)=0.0002276 *34*; ce(O)/(γ+ce)=9.64×10^{-6} *15* α(K)=0.1228 *18*; α(L)=0.01390 *21*; α(M)=0.002298 *35* α(N)=0.000259 *4*; α(O)=1.098×10^{-5} *16* %Iγ≈29 Mult.: intensity balance at 101 level gives α<0.6 which implies δ(E2/M1)<1. However, γ(θ) and intensity balance in in-beam γ-ray studies are consistent with ΔJ=1, dipole.
145.2[#] *2*	6.7 *10*	246.56	3$^{(-)}$	101.35	2$^{(-)}$	(M1)	0.0526 *8*	7.1 *11*	ce(K)/(γ+ce)=0.0441 *6*; ce(L)/(γ+ce)=0.00494 *7*; ce(M)/(γ+ce)=0.000817 *12* ce(N)/(γ+ce)=9.23×10^{-5} *13*; ce(O)/(γ+ce)=3.93×10^{-6} *6* α(K)=0.0464 *7*; α(L)=0.00520 *8*; α(M)=0.000860 *12* α(N)=9.71×10^{-5} *14*; α(O)=4.14×10^{-6} *6* %Iγ≈3.3
192.4 *5*	2.7 *5*	708.4		515.92	(1$^+$)				%Iγ≈1.3
230.3[#] *3*	7.1 *13*	476.83	(1$^+$)	246.56	3$^{(-)}$	[M2]	0.0841 *12*	7.7 *14*	ce(K)/(γ+ce)=0.0677 *9*; ce(L)/(γ+ce)=0.00831 *12*; ce(M)/(γ+ce)=0.001384 *20* ce(N)/(γ+ce)=0.0001552 *23*; ce(O)/(γ+ce)=6.41×10^{-6} *9* α(K)=0.0734 *11*; α(L)=0.00901 *13*; α(M)=0.001501 *22* α(N)=0.0001683 *25*; α(O)=6.94×10^{-6} *10* %Iγ≈3.5 I_γ: 4.7 *12* in 1993Ad12 is in disagreement.
246.6[#] *3*	2.2 *3*	246.56	3$^{(-)}$	0.0	1$^-$	(E2)	0.0360 *5*	2.3 *3*	ce(K)/(γ+ce)=0.0304 *4*; ce(L)/(γ+ce)=0.00367 *5*; ce(M)/(γ+ce)=0.000604 *9*

^{76}Sr $\varepsilon+\beta^+$ decay (7.89 s) 2004De24 (continued)

$\gamma(^{76}Rb)$ (continued)

E_γ‡	I_γ@a	E_i(level)	J_i^π	E_f	J_f^π	Mult.&	α†	$I_{(\gamma+ce)}$@a	Comments
									ce(N)/(γ+ce)=6.61×10^{-5} *10*; ce(O)/(γ+ce)=2.49×10^{-6} *4* α(K)=0.0315 *5*; α(L)=0.00380 *6*; α(M)=0.000626 *9* α(N)=6.85×10^{-5} *10*; α(O)=2.58×10^{-6} *4* %Iγ≈1.1
375.4# *2*	30 *4*	476.83	(1$^+$)	101.35	2$^{(-)}$	[E1]	2.17×10^{-3} *3*	30 *4*	ce(K)/(γ+ce)=0.001920 *27*; ce(L)/(γ+ce)=0.0002062 *29*; ce(M)/(γ+ce)=3.39×10^{-5} *5* ce(N)/(γ+ce)=3.83×10^{-6} *5*; ce(O)/(γ+ce)=1.633×10^{-7} *23* α(K)=0.001924 *27*; α(L)=0.0002066 *29*; α(M)=3.40×10^{-5} *5* α(N)=3.84×10^{-6} *5*; α(O)=1.637×10^{-7} *23* %Iγ≈15
414.6# *2*	15.0 *15*	515.92	(1$^+$)	101.35	2$^{(-)}$				%Iγ≈7.4
453.0 *5*	2.35 *23*	968.9		515.92	(1$^+$)				%Iγ≈1.2
466.9# *2*	2.7 *3*	982.88	(1$^+$)	515.92	(1$^+$)				%Iγ≈1.3
476.8# *2*	100	476.83	(1$^+$)	0.0	1$^-$	[E1]	1.18×10^{-3} *2*		α(K)=0.001044 *15*; α(L)=0.0001118 *16*; α(M)=1.841×10^{-5} *26* α(N)=2.082×10^{-6} *29*; α(O)=8.93×10^{-8} *13* %Iγ≈49
x494.0 *5*	5.8 *11*								%Iγ≈2.9
506.1 *5*	11.7 *14*	982.88	(1$^+$)	476.83	(1$^+$)				%Iγ≈5.8
515.8 *5*	6.8 *8*	515.92	(1$^+$)	0.0	1$^-$				%Iγ≈3.4
550.1 *5*	4.6 *5*	1533.0	(1$^+$)	982.88	(1$^+$)				%Iγ≈2.3
x563.7 *5*	1.3 *2*								%Iγ≈0.64
580.8 *5*	6.5 *8*	1289.1	(1$^+$)	708.4					%Iγ≈3.2
608.0 *5*	0.81 *12*	708.4		101.35	2$^{(-)}$				%Iγ≈0.4
657.3 *5*	0.67 *11*	1640.1	(1$^+$)	982.88	(1$^+$)				%Iγ≈0.33
679.7 *5*	1.01 *16*	2090.7	(1$^+$)	1412.3					%Iγ≈0.5
707.8 *5*	1.9 *4*	708.4		0.0	1$^-$				%Iγ≈0.94
726.8 *5*	0.98 *15*	2140.1	(1$^+$)	1412.3					%Iγ≈0.48
812.8 *5*	2.51 *25*	1289.1	(1$^+$)	476.83	(1$^+$)				%Iγ≈1.2
881.6# *3*	10.8 *12*	982.88	(1$^+$)	101.35	2$^{(-)}$				%Iγ≈5.3
935.9 *5*	1.76 *20*	1412.3		476.83	(1$^+$)				%Iγ≈0.87
982.9# *2*	21.5 *25*	982.88	(1$^+$)	0.0	1$^-$				%Iγ≈11
1124.0 *5*	0.95 *11*	1640.1	(1$^+$)	515.92	(1$^+$)				%Iγ≈0.47
1171.2 *5*	2.69 *26*	2140.1	(1$^+$)	968.9					%Iγ≈1.3
1187.0 *5*	0.53 *7*	1289.1	(1$^+$)	101.35	2$^{(-)}$				%Iγ≈0.26
1432.1 *5*	1.19 *14*	1948.1	(1$^+$)	515.92	(1$^+$)				%Iγ≈0.59
1471.3 *5*	0.64 *8*	1948.1	(1$^+$)	476.83	(1$^+$)				%Iγ≈0.32
1546.0 *5*	2.7 *3*	2061.8	(1$^+$)	515.92	(1$^+$)				%Iγ≈1.3
x1568.3 *5*	0.56 *12*								%Iγ≈0.28
1584.9 *5*	1.19 *12*	2061.8	(1$^+$)	476.83	(1$^+$)				%Iγ≈0.59

$^{76}_{37}Rb_{39}$-4

^{76}Sr $\varepsilon+\beta^+$ decay (7.89 s) 2004De24 (continued)

$\gamma(^{76}Rb)$ (continued)

E_γ ‡	I_γ @ *a*	E_i(level)	J_i^π	E_f	J_f^π	Comments
1592.7 *5*	0.73 *7*	2881.8	(1^+)	1289.1	(1^+)	%Iγ≈0.36
1612.5 *5*	0.77 *9*	2090.7	(1^+)	476.83	(1^+)	%Iγ≈0.38
1624.4 *5*	2.32 *22*	2140.1	(1^+)	515.92	(1^+)	%Iγ≈1.1
1657.0 *5*	0.56 *7*	2172.7	(1^+)	515.92	(1^+)	%Iγ≈0.28
1695.7 *5*	0.97 *10*	2172.7	(1^+)	476.83	(1^+)	%Iγ≈0.48
1805.0 *5*	2.57 *25*	2281.9	(1^+)	476.83	(1^+)	%Iγ≈1.3
2039.0 *5*	0.66 *8*	2140.1	(1^+)	101.35	$2^{(-)}$	%Iγ≈0.33
2140.5 *5*	0.34 *5*	2140.1	(1^+)	0.0	1^-	%Iγ≈0.17
2172.5 *5*	0.41 *6*	2172.7	(1^+)	0.0	1^-	%Iγ≈0.2
x2248.9 *5*	0.72 *16*					%Iγ≈0.36
x2499.9 *5*	0.27 *7*					%Iγ≈0.13
x2684.5 *5*	0.21 *5*					%Iγ≈0.1
x2719.1 *5*	0.74 *17*					%Iγ≈0.37
x2934.6 *5*	0.77 *18*					%Iγ≈0.38

† Additional information 2.
‡ From 2004De24, unless otherwise stated. About 18 γ rays were reported by 1993Ad12, some with an uncertainty of 0.2 keV.
# Weighted averages of values from 1993Ad12 and 2004De24.
@ From 2004De24. For γ energies above 400 keV, evaluators list values as photon intensities since conversion coefficients are negligible. 2004De24 also list branching ratios of Iγ+ce values obtained from corresponding relative transition intensities.
& From the Adopted Gammas, unless otherwise stated. The assignments in square brackets are assumed based on ΔJ^π.
a For absolute intensity per 100 decays, multiply by ≈0.493.
x γ ray not placed in level scheme.

$^{76}_{37}Rb_{39}$-5

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Decay Scheme

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