^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, Balraj Singh	NDS 164, 1 (2020)	15-Feb-2020

Parent: ^{98}Rb: E≈270; J$^\pi$=(3$^+$); $T_{1/2}$=96 ms *3*; Q(β^-)=12054 *16*; %β^- decay=100.0

^{98}Rb-E,J$^\pi$,$T_{1/2}$: From ^{98}Rb Adopted Levels.

^{98}Rb-Q(β^-): From 2017Wa10.

The sources of ^{98}Rb studied contained both 114-ms and 96-ms isomers. Combined γ-ray data were given by 2002Lh01, 1984Be50, 1980Sc13 and 1980JuZY.

2002Lh01: source of ^{98}Rb was produced from the fission of ^{238}U by 600-MeV protons at the ISOLDE facility, followed by on-line mass separation. γ rays were detected with a planar and a large coaxial Ge detectors; β particles were detected with a BaF_2 scintillator. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma$(t), $\beta\gamma$(t). Deduced levels, J, π, $T_{1/2}$, β-decay branching ratios, log*ft*. Comparisons with theoretical calculations.

1984Be50: source of ^{98}Rb was produced by thermal fission of ^{235}U followed by on-line separation by the OSTIS separator at ILL in Grenoble. γ rays were detected with two Ge(Li) detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$. Deduced levels, J, π, γ-ray mixing ratios. Systematics of neighboring isotones.

2002PfZX: re-analyzed data in 1984Be50 and re-assigned J=3 to 1838 level instead of previous assignment of J=2, leading to a revision by 2002Lh01 of the earlier level scheme in 1984Be50. This report shares the same authors as 2002Lh01 and the first author is also the co-author of 1984Be50.

1980Sc13, 1980JuZY (also 1982Ka03): ^{98}Rb was produced from thermal ionization and separated by the on-line mass separator OSTIS. γ rays were detected with Ge(Li) detectors and decay and conversion electrons were detected with Si(Li) detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma$(t), E(ce), I(ce), (ce)γ-coin, β-ce(t). Deduced levels, J, π, $T_{1/2}$, transition strengths. Comparisons with theoretical calculations. Complete details and level scheme are given by 1980JuZY.

2016Pa03: isobaric separated radioactive ion beam of ^{98}Rb was produced in U(p,F),E=500 MeV reaction at TRIUMF-ISAC facility. Measured Eγ, Iγ, I(ce), $\beta\gamma$-, β-ce-, $\gamma\gamma$-, γ(ce)- and ce(ce)-coincidences using 8π array of 20 Compton-suppressed HPGe detectors for γ rays, ten plastic scintillators for β detection, and a set of five Si(Li) detectors (PACES) for conversion electrons. Data collection cycle was: 3 s of background count, 15 s of ^{98}Rb beam implantation on a tape, 15 s of off-beam counting time, and 1 s to roll the implanted tape out of the vacuum chamber to avoid counting of long-lived activities. Deduced absolute intensities of the 71.2- and 144.2-keV transitions, E0 strength of 215-keV transition. Comparison with two-state mixing model for interpretation of ρ^2(E0) value and deduction of mixing of the two low-lying 0$^+$ and 2$^+$ states and deformation parameters.

1979Az01: measured β-ce(t). Deduced half-lives of the first 2$^+$ and 4$^+$ states.

Others:

$T_{1/2}$ (^{98}Rb isotope): 2015Pr03, 2011Ni01, 2003Be05, 1993Ru01, 1987PfZX, 1986ReZU, 1986Wa17, 1983Re10, 1981En05, 1980Sc13, 1981Re05, 1979Pe17, 1979Ri09, 1979Pe01, 1979En02, 1978Wo09, 1976AmZW, 1976Ru01, 1974Ro15, 1971Tr02, 1970KlZZ, 1967Kl06.

γ, $\gamma\gamma$: 1987Ma58, 1979Bo26, 1979Pe17, 1977Wo07.

$\beta\gamma$ and Q(β^-): 1992Pr03, 1988GrZX (and 1982Pa24), 1987Ma58, 1985IaZZ (also 1984IaZZ), 1984BlZN, 1982Br23, 1979Pe17.

$\gamma\gamma(\theta$,H): 1989Wo05.

$\gamma\gamma$(t): 1987Oh05.

$\beta\gamma\gamma$(t): 1989Ma47 (also 1989Ma38).

This decay scheme is from division of the decay scheme for combined source in 2002Lh01 (see Table 3 of 2002Lh01). The decay scheme is considered as incomplete due to a large gap between neutron threshold (S(n)=5913 *5*) and the excitation energy of highest observed level (Pandemonium effect).

^{98}Sr Levels

The following levels are omitted here due to lack of confirmation in more recent work: 799.9, 1888.6, 2519.0 (proposed by 1977Wo07), 2606.1 (from 1979Pe17), 2131.3, 2144.6 (1984Be50).

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^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50 (continued)

^{98}Sr Levels (continued)

E(level)†	J^π‡	$T_{1/2}$‡	Comments
0.0	0^+	0.653 s *2*	
144.5 *1*	2^+	2.78 ns *8*	$T_{1/2}$: 2.80 ns *8* ($\beta\gamma\gamma$(t),1989Ma47,1989Ma38), 2.74 ns *12* ($\gamma\gamma$(t),1987Oh05), 4 ns *1* (β-ce(t),1980Sc13), 3.6 ns *4* (1979Az01, β-ce(t)).
215.5 *1*	0^+	22.9 ns *17*	$T_{1/2}$: 21.2 ns *17* ($\gamma\gamma$(t),2002Lh01), 25 ns *2* (β-ce(t),1980Sc13), 23 ns *3* (1979Az01,β-ce(t)). β_2=−0.23 *2* from two-level mixing analysis (2016Pa03). Mixing of the first two 0^+ states is 8.6% (2016Pa03).
433.8 *1*	4^+	82 ps *6*	J^π: $\gamma\gamma(\theta)$ from 1984Be50 is consistent with J=4. $T_{1/2}$: 80 ps *6* from $\beta\gamma\gamma$(t) (1989Ma47).
867.0 *3*	6^+	7.86 ps *24*	J^π: $\gamma\gamma(\theta)$ from 1984Be50 is consistent with J=6.
871.26 *14*	(2^+)	8.6 ps *14*	
1539.26 *17*	(2^+)		
1600.52 *15*	(2^+)		J^π: $\gamma\gamma(\theta)$ from 1984Be50 is consistent with J=2.
1681.7 *5*	(4^+)		J^π: 2002Lh01 suggest (4^+), assuming a 2-phonon level.
1745.1? *4*			
1837.77# *17*	(3^+)	7.5 ns *15*	J^π: from re-analysis by 2002PfZX of $\gamma\gamma(\theta)$ data in 1984Be50 with configuration=ν9/2[404]$\otimes\nu$3/2[411], $K^\pi=3^+$; also proposed by 2002Lh01 based on arguments of hindrances of γ transitions, β feedings and band head of a possible K=3 band. Note that 1984Be50 give J=2 based on their $\gamma\gamma(\theta)$ data and a 1837γ to 0^+ ground state. But the 1837γ was not observed by 2002Lh01. It is also pointed out by 2002Lh01 that J=3 cannot be rejected by $\gamma\gamma(\theta)$ of the 1693-144 cascade in 1984Be50. $T_{1/2}$: 7.1 ns *8* from $\gamma\gamma$(t) (2002Lh01).
1922.2? *4*			
1964.05 *21*	$(1,2^+)$		
1978.37# *20*	(4^+)		J^π: 2002Lh01 suggest (4^+) based on band assignment; 1984Be50 suggest 1 or 2 based on their placement of 1979γ to 0^+ ground state, which is now placed from 2124 level to 144 level by 2002Lh01.
2124.07 *14*	$(1^+,2,3,4^+)$		J^π: 2002Lh01 suggest (2^-) from model calculations with configuration=ν9/2[404]$\otimes\nu$5/2[532].
2153.5# *3*	(5^+)		J^π: 2002Lh01 suggest (5^+) based on band assignment.
2205.88 *21*	(3)		J^π: $\gamma\gamma(\theta)$ from 1984Be50 is consistent with J=3 or 5.
2231.22 *15*	$(2,3,4^+)$		J^π: 2002Lh01 suggest (2,3); 1984Be50 give J=1 based on $\gamma\gamma(\theta)$ but in evaluator's opinion it is difficult to get a unique value since δ(1456γ) has a wide range of values.
2237.4? *4*			
2289.0? *4*			
2316.00 *22*	(2^+)		J^π: $\gamma\gamma(\theta)$ in 1984Be50 consistent with J=2 and 2002Lh01 suggest (1,2). Note that (2^+) is inconsistent with the possible strong β^- feeding feeding from $0^{(-)}$ parent as also given in 2002Lh01, which could imply that this level could be β^- fed mostly by the decay of (3^+) isomer in this dataset rather than by the decays of both parent states equally as assumed by 2002Lh01, if the (2^+) assignment can be confirmed.
2358.92 *25*	$(2^+,3,4^+)$		
2804.3 *3*	$(1,2^+)$		
2932.0 *5*	$(2^+$ to 4)		J^π: configuration=ν3/2[411]$\otimes\nu$5/2[532], $K^\pi=4^-$ proposed by 2002PfZX as an analogy with the 1619, 4^- level in ^{100}Sr based on decay pattern and the hindrance of the 2498γ.
3290.4 *4*	$(1,2^+)$		
3442.4 *5*	(3)		J^π: 1984Be50 give J=3 based on $\gamma\gamma(\theta)$.
3462.4 *5*	$(2^+$ to 4)		
3622.6 *5*	$(1,2^+)$		
5913+x			E(level): x<6141 *17* from Q(β^-) (for ^{98}Rb decay)-S(n)(^{98}Sr), where Q(β^-)=12054 *16* and S(n)=5913 *5* from 2017Wa10.

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^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50 (continued)

^{98}Sr Levels (continued)

† From least-squares fit to γ-ray energies.
‡ From Adopted Levels. Values from this dataset are given in comments.
# Band(A): K^π=(3+), ν9/2[404]⊗ν3/2[411]. Band assignment from 2002Lh01.

β^- radiations

β feedings and associated log *ft* values are considered as approximate (by evaluators) since several arbitrary assumptions have been made by 2002Lh01 in dividing and separating transitions amongst the two isomers. 2002Lh01 also state that there are unplaced transitions, although, these are not listed in the paper. There could be also a significant amount of unobserved transitions due to Pandemonium effect.

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(3×10^3@ *3*)	5913+x	14.3 *9*		Iβ^-: %β^-n=14.3 *9* for the decay of the ^{98}Rb g.s. and/or isomer in Adopted Levels of ^{98}Rb.
(8701 *16*)	3622.6	1.3	6.1	av Eβ=4010.5 *77*
(8862 *16*)	3462.4	2.1	5.9	av Eβ=4087.6 *77*
(8882 *16*)	3442.4	5.0	5.5	av Eβ=4097.3 *77*
(9034 *16*)	3290.4	2.7	5.8	av Eβ=4170.4 *77*
(9392 *16*)	2932.0	1.2	6.3	av Eβ=4342.7 *77*
(9520 *16*)	2804.3	1.6	6.2	av Eβ=4404.0 *77*
(9965 *16*)	2358.92	2.4	6.1	av Eβ=4618.0 *77*
(10008 *16*)	2316.00	10	5.5	av Eβ=4638.6 *77* E(decay): 10050 *240* from $\beta\gamma$ (1982Pa24). Others: 8600 *110* (1979Pe17), 10203 *60* (1984BlZN), 10026 *150* (1982Br23), 9950 *30* (1985IaZZ,1984IaZZ).
(10035# *16*)	2289.0?	1.4	6.3	av Eβ=4651.6 *77*
(10087# *16*)	2237.4?	0.5	6.8	av Eβ=4676.3 *77*
(10093 *16*)	2231.22	6.5	5.7	av Eβ=4679.3 *77* E(decay): 10450 *160* from $\beta\gamma$ (1982Pa24).
(10118 *16*)	2205.88	3.3	6.0	av Eβ=4691.4 *77*
(10171 *16*)	2153.5	0.3	7.0	av Eβ=4716.6 *77*
(10200# *16*)	2124.07	<0.5	>6.8	av Eβ=4730.7 *77*
(10346 *16*)	1978.37	2.5	6.2	av Eβ=4800.6 *77*
(10360 *16*)	1964.05	3.6	6.0	av Eβ=4807.4 *77*
(10402# *16*)	1922.2?	0.7	6.7	av Eβ=4827.6 *77*
(10486 *16*)	1837.77	8.3	5.7	av Eβ=4868.0 *77*
(10579# *16*)	1745.1?	0.7	6.8	av Eβ=4912.5 *77*
(10642 *16*)	1681.7	0.2	7.3	av Eβ=4942.8 *77*
(10723 *16*)	1600.52	3.1	6.1	av Eβ=4981.7 *77*
(10785 *16*)	1539.26	3.7	6.1	av Eβ=5011.1 *77*
(11453 *16*)	871.26	3.8	6.2	av Eβ=5330.8 *77*
(11457# *16*)	867.0	1.1	6.7	av Eβ=5332.9 *77* Log *ft*: too low for ΔJ=3; β^- feeding may be suspect.
(11890 *16*)	433.8	3.8	6.3	av Eβ=5540.0 *77* E(decay): 12150 *200* from $\beta\gamma$ (1982Pa24).
(12180 *16*)	144.5	17	5.6	av Eβ=5678.2 *77* E(decay): 12340 *130* from $\beta\gamma$. Other: 12330 *200* (1982Pa24).

† From I(γ+ce) balance at each level (deduced by evaluators). Values are approximate.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.
@ Estimated for a range of levels.

γ(^{98}Sr)

Iγ normalization: From I(γ+ce to g.s.)=85.7, using %β^-n=14.3 *9* in Adopted Levels of ^{98}Rb, with uncertain transitions also included. The normalization is considered as approximate (by evaluators) due to unplaced transitions (although not listed by 2002Lh01), uncertain transitions, and arbitrary assumption for division of γ-ray transitions among two isomers by 2002Lh01, e.g., feeding of 2^+ states is considered as negligible in the low-spin isomer, and also unobserved transitions due to Pandemonium effect.

The following γ rays with Eγ(Iγ) reported by 1984Be50 have been omitted due to lack of confirmation by 2002Lh01: 166.1 (1.0), 173.8 (0.5), 253.0 (0.8), 437.2 (0.5), 1259.3 (0.5), 1335.4 (0.7), 1530.2 (0.8), 1837.5 (7.4), 1986.8 (0.9), 2000.1 (0.7).

The following γ rays with Eγ(Iγ) described as uncertain by 1980JuZY (or 1980Sc13) have been omitted due to lack of confirmation by 1984Be50 and 2002Lh01: 301.4 (0.2); 692.2 (1.2), 713.8 (1.1), 776.6 (0.3), 882.8 (0.3), 1119.7 (0.5), 1149.7 (0.6), 1386.2 (3.3), 1611.1 (0.5), 1865.8 (1.1), 2008.2 (0.5), 2035.1 (0.5), 2101.5 (0.5), 2487.5 (1.5), 3680.5 (3.1).

A possible 2526γ to ground state and a 129γ in coin with 2498γ are mentioned 2002PfZX.

$\gamma\gamma(\theta)$ coefficients (A_2 and A_4) are from 1984Be50.

Note that intensity values given under comments from other references are for combined sources of 114-ms and 96-ms isomers, unless otherwise noted.

Note that two γ rays with the same Eγ=167.092 keV *10* are listed in the curved-crystal measurements by 1979Bo26, one assigned to ^{140}Xe decay and the other to ^{98}Rb decay. As there is no γ line observed near 167 keV in the decay of ^{98}Rb, while there is a fairly strong γ ray near this energy in the decay of ^{140}Xe, evaluators believe that there is a print error in 1979Bo26, and that the listed precise gamma energy corresponds to only the decay of ^{140}Xe.

Relative γ intensities for the combined (96 ms+115 ms) activity

Eγ	Iγ 2002Lh01	Iγ* 1984Be50	Eγ	Iγ 2002Lh01	Iγ* 1984Be50
71.0	2.1 *2*	2.5	1359.8	3.0 *5*	3.5
107.2	2.1 *2*	1.9 a	1403.9	0.6 *2*	0.7
140.6	3.9 *3*	3.0	1455.9	6.9 *5*	10.2
144.5	100	126.5	1530.2		0.8
166.1		1.0	1539.2	0.8 *3*	1.2
173.8		0.5	1600.4	1.7 *9*	3.8 b
175.1	0.4 *1*		1600.6	1.6 *4*	
192.1	0.5 *3*		1693.2	15.5 *13*	17.8
215.5	7.8 *9*c	10.0 c	1772.0	3.5 *5*	2.1
234.2	0.8 *4*		1777.7	1.8 *3*	
253.0		0.8	1819.5	4.4 *4*	7.5
286.2	0.5 *1*		1837.5		7.4
289.3	32.6 *17*	31.5	1925.5	1.8 *3*	
433.2	1.5 *2*	2.9	1964.1	2.4 *6*	2.2
437.2		0.5	1979.6	1.2 *3*	0.8
523.4	0.5 *2*		1986.8		0.9
585.0	0.4 *2*		2000.1		0.7
605.4	1.2 *2*	2.0	2086.3	1.0 *3*	1.3 a
630.7	3.0 *3*	3.6	2092.9	1.3 *3*	1.4 a
655.8	8.4 *8*	2.2	2144.5	3.4 *5*	1.8
668.1	1.1 *2*	1.1	2171.5	15.7 *15*	16.7
726.8	1.9 *3*	2.6	2214.7	0.8 *2*	
810.4	0.3 *1*	1.4 a	2315.8	7.5 *21*	10.4
871.4	2.1 *3*	1.9	2498.2	1.7 *3*	
1079.7	2.2 *3*	2.2	2659.8	1.5 *3*	

$^{98}_{38}$Sr$_{60}$-4

1092.8	2.0 *3*	0.9	2804.2	2.1 *5*	2.5 a
1105.5	1.7 *3*	2.9	3008.6	7.0 *7*	9.0
1167.1	0.5 *2*	0.7	3028.6	2.9 *5*	6.8
1253.2	0.7 *2*	0.5 a	3145.9	2.1 *4*	3.6
1259.3		0.5	3290.2	3.6 *14*	4.2
1323.9	2.0 *4*	2.2	3478.1	1.1 *3*	1.6 a
1335.4		0.7	3622.2	1.7 *7*	2.2 a

*: Read from Fig.1 of 1984Be50. Quoted values might be for I(γ+ce) relative to I(144γ)=100 but no explanation is given in 1984Be50.

a: From 1980JuZY (or 1980Sc13)

b: Combined intensity for 1600 doublet

c: Deduced value

E_γ [†]	I_γ [‡@]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ [#]	α [&]	$I_{(\gamma+ce)}$ [@]	Comments
71.0 *1*	1.18 *16*	215.5	0^+	144.5	2^+	E2		3.55		α(K)=2.86; α(L)=0.579; α(M)=0.0979; α(N)=0.01098; α(O)=0.000348 E_γ: others: 70.8 (1979Pe17), 70.9 (1984Be50), 70.9 (1980Sc13). I_γ: from γ+ce intensity balance with ce(K)(216)/ce(K)(71γ)=1.14 *3* (1980Sc13), K/L(216, theory)=9.1, α(K)(71γ)=2.86 *5* and α(total)(71γ)=3.55 *6* (from BrIcc). Others: 3.3 (1979Pe17), 11 (1980Sc13). Mult.: ce(K)/ce(L)+=5.3 *8* (1980Sc13).
107.2 *1*	2.1 *2*	2231.22	$(2,3,4^+)$	2124.07	$(1^+,2,3,4^+)$					
140.6 *1*	3.9 *3*	1978.37	(4^+)	1837.77	(3^+)					E_γ: others: 140.7 (1979Pe17), 140.3 (1984Be50).
144.5 *1*	≈80	144.5	2^+	0.0	0^+	E2		0.264		α(K)=0.226; α(L)= 0.0315; α(M)=0.00507; α(N)=0.000627; α(O)=3.01×10^{-5} E_γ: others: 144.4 *2* (1977Wo07), 144.2 (1987Ma58), 144.5 (1984Be50), 144.7 (1979Pe17), 144.6 (1980Sc13), 144.224 *6* (1979Bo26, curved-crystal data). Value from 1979Bo26 is the most precise, but seems discrepant, in view of several other values which point to a higher energy by about 0.4-0.5 keV, as for example 144.70 *5* in 2019Ur01 from prompt γ rays in ^{248}Cm SF decay. Mult.: ce(K)/ce(L)+=6.0 *4* (1980Sc13). I_γ: from total Iγ=100 for combined source (2002Lh01) and Iγ≈20 for ^{98}Rb β^- decay (115 ms) deduced by evaluators. Others: 100 in 1977Wo07, 1979Pe17, 1980Sc13 for combined source. Iγ(per 100 decays of ^{98}Rb)=34 *3* (1987Ma58). Other: 51 *2* (1982Kr11,1980JuZY). K- and L-conversion lines detected in coin with 656γ (2016Pa03).
175.1 *2*	0.4 *1*	2153.5	(5^+)	1978.37	(4^+)					E_γ: others: 174.9 (1979Pe17). I_γ: others: <1.5 (1979Pe17).

γ(^{98}Sr) (continued)

E_γ[†]	I_γ[‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	$I_{(\gamma+ce)}$[@]	Comments
192.1[a] *4*	<0.8	2316.00	(2$^+$)	2124.07	(1$^+$,2,3,4$^+$)				
215.5		215.5	0$^+$	0.0	0$^+$	E0		4.3 *6*	E_γ: from level energy difference. Mult.: α(K)exp>100, ce(K)/ce(L)=8.7 *6* (K/L(theory)=9.1) (1980Sc13), ce(L)/ce(K)=0.14 *1* (2016Pa03). $I_{(\gamma+ce)}$: see comments for I(71γ). K- and L-conversion lines detected in coin with 656γ (2016Pa03). Measured I(215,E0)/[I(γ+ce)(71,E2)]=0.72 *6* (2016Pa03). Deduced ρ^2(E0)=0.053 *5* (2016Pa03). Using an alternative method, 2016Pa03 deduce ρ^2(E0)=0.049 *7*.
234.2[a] *4*	0.8 *4*	2358.92	(2$^+$,3,4$^+$)	2124.07	(1$^+$,2,3,4$^+$)				
286.2 *2*	0.5 *1*	2124.07	(1$^+$,2,3,4$^+$)	1837.77	(3$^+$)				
289.3 *1*	26 *3*	433.8	4$^+$	144.5	2$^+$	E2	0.0218		α(K)=0.0191; α(L)=0.00230; α(M)=0.000385; α(N)=4.71$\times10^{-5}$; α(O)=2.70$\times10^{-6}$ E_γ: others: 289.2 *2* (1977Wo07), 289.4 (1987Ma58), 289.5 (1984Be50), 289.5 (1979Pe17), 289.4 (1980Sc13). I_γ: others: 34 *3* (1977Wo07), 28.0 (1979Pe17), 29 (1980Sc13). Mult.: α(K)exp=0.021 *3* (1980Sc13). (289γ)(144γ)(θ): A_2=+0.102 *2*, A_4=+0.01 *5* (1984Be50). Iγ(per 100 ^{98}Rb decays)=13 *1* (1987Ma58). Additional information 1.
433.2 *2*	1.5 *2*	867.0	6$^+$	433.8	4$^+$	[E2]	0.0057		E_γ: others: 433.3 (1984Be50), 433.6 (1980Sc13). I_γ: other: 6 (1980Sc13). (433γ)(289γ)(θ): A_2=+0.35 *22*, A_4=0.0 *4*; (433γ)(144γ)(θ): A_2=+0.11 *16*, A_4=−0.0 *3* (1984Be50).
523.4 *3*	0.5 *2*	2124.07	(1$^+$,2,3,4$^+$)	1600.52	(2$^+$)				
585.0 *3*	0.4 *2*	2124.07	(1$^+$,2,3,4$^+$)	1539.26	(2$^+$)				
605.4 *2*	1.2 *2*	2205.88	(3)	1600.52	(2$^+$)				E_γ: others: 605.5 (1979Pe17), 605.6 (1984Be50). I_γ: others: <1.5 (1979Pe17). (606γ)(144γ)(θ): A_2=−0.38 *15*, A_4=−0.09 *34* (1984Be50). 1984Be50 give δ>+2.49, but in evaluator′s estimate, it is difficult to get a unique value since δ(1456γ) has a wide range of values. Coincidence with 1325γ (1984Be50) unexplained.
630.7 *2*	3.0 *3*	2231.22	(2,3,4$^+$)	1600.52	(2$^+$)				E_γ: others: 630.4 *3* (1977Wo07), 630.7 (1979Pe17), 631.0 (1984Be50). I_γ: others: 3 *1* (1977Wo07), 4.9 (1979Pe17). (631γ)(144γ)(θ): A_2=−0.33 *14*, A_4=+0.14 *29* (1984Be50). 1984Be50 give δ=+0.86 to +2.29 for J(2231)=1, but in evaluator′s opinion it is difficult to get a unique value since δ(1456γ) has a wide range of values.
655.8 *2*	7.6 *12*	871.26	(2$^+$)	215.5	0$^+$	[E2]			E_γ: others: 655.6 *2* (1977Wo07), 655.9 (1984Be50), 655.8

$\gamma(^{98}$Sr) (continued)

E_γ[†]	I_γ[‡@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	Comments
								(1979Pe17), 655.3 (1980Sc13). I_γ: from Iγ=8.4 *8* in 2002Lh01 for combined intensity and Iγ<1.7 (deduced by evaluators) in ^{98}Rb β^- decay (115 ms). Others: 3.3 (1977Wo07), 10 (1980Sc13).
668.1 *3*	1.1 *2*	1539.26	(2$^+$)	871.26	(2$^+$)			E_γ: other: 668.4 (1984Be50).
726.8 *4*	1.9 *3*	871.26	(2$^+$)	144.5	2$^+$	[M1+E2]	0.7 *10*	E_γ: others: 727.4 (1984Be50), 726.6 (1979Pe17), 726.6 (1980Sc13). I_γ: others: 1.6 (1979Pe17), 0.4 (1980Sc13).
810.4 *4*	0.3 *1*	1681.7	(4$^+$)	871.26	(2$^+$)			
871.4 *3*	2.1 *3*	871.26	(2$^+$)	0.0	0$^+$	[E2]		E_γ: others: 871.5 (1984Be50), 871.3 (1979Pe17), 870.7 (1980Sc13). I_γ: others: 1.6 (1979Pe17), 2.00 (1980Sc13).
1092.8 *3*	<2.3	1964.05	(1,2$^+$)	871.26	(2$^+$)			E_γ: other: 1093.1 (1984Be50).
1105.5 *3*	1.7 *3*	1539.26	(2$^+$)	433.8	4$^+$			E_γ: other: 1105.2 (1984Be50).
1167.1 *4*	0.5 *2*	1600.52	(2$^+$)	433.8	4$^+$			E_γ: other: 1167.0 (1984Be50).
1253.2 *4*	0.7 *2*	2124.07	(1$^+$,2,3,4$^+$)	871.26	(2$^+$)			
1323.9 *3*	2.0 *4*	1539.26	(2$^+$)	215.5	0$^+$			E_γ: other: 1324.7 (1984Be50).
1359.8 *3*	3.0 *5*	2231.22	(2,3,4$^+$)	871.26	(2$^+$)			E_γ: others: 1359.7 (1979Pe17), 1359.5 (1984Be50). I_γ: others: 1.6 (1979Pe17).
1403.9 *4*	0.6 *2*	1837.77	(3$^+$)	433.8	4$^+$			E_γ: other: 1403.6 (1984Be50).
1455.9 *3*	6.9 *5*	1600.52	(2$^+$)	144.5	2$^+$	Q(+D)	>+1.5	E_γ: others: 1455.1 *4* (1977Wo07), 1455.6 (1979Pe17), 1455.7 (1984Be50). I_γ: others: 7 *1* (1977Wo07), 5.7 (1979Pe17). δ: from (1456γ)(144γ)(θ): A_2=−0.26 *19*, A_4=+0.60 *38* (1984Be50). 1984Be50 quote δ>+3.11.
1539.2 *4*	0.8 *3*	1539.26	(2$^+$)	0.0	0$^+$			E_γ: other: 1539.2 (1984Be50).
1600.4[a] *3*	1.7 *9*	1600.52	(2$^+$)	0.0	0$^+$			E_γ: others: 1600.3 (1979Pe17), 1600.3 (1984Be50). I_γ: others: 3.3 (1979Pe17).
1600.6[a] *4*	<2.0	1745.1?		144.5	2$^+$			
1693.2 *2*	15.5 *13*	1837.77	(3$^+$)	144.5	2$^+$			E_γ: others: 1692.9 *4* (1977Wo07), 1693.1 (1979Pe17), 1693.3 (1984Be50). I_γ: others: 13 *2* (1977Wo07), 8.1 (1979Pe17). δ(Q/D)>+1.5 for J(1837.5)=2 from (1693γ)(144γ)(θ): A_2=−0.25 *16*, A_4=+0.49 *28* (1984Be50). 1984Be50 quote δ=+3.32 to +36.73.
1772.0 *3*	3.5 *5*	2205.88	(3)	433.8	4$^+$	D+Q		E_γ: others: 1771.6 (1979Pe17). I_γ: others: 2.4 (1979Pe17). δ: +0.05 to +4.5 from (1772γ)(289γ)(θ): A_2=−0.44 *27*, A_4=−0.27 *50*. 1984Be50 give δ>6.98.
1777.7[a] *4*	<2.1	1922.2?		144.5	2$^+$			
1819.5 *3*	<4.8	1964.05	(1,2$^+$)	144.5	2$^+$			E_γ: other: 1819.8 (1984Be50).
1925.5 *4*	1.8 *3*	2358.92	(2$^+$,3,4$^+$)	433.8	4$^+$			
1964.1[a] *4*	<3.0	1964.05	(1,2$^+$)	0.0	0$^+$			E_γ: other: 1964.5 (1984Be50).
1979.6 *3*	1.2 *3*	2124.07	(1$^+$,2,3,4$^+$)	144.5	2$^+$			E_γ: other: 1979.1 (1984Be50, placed from 1978 level).
2086.3 *4*	1.0 *3*	2231.22	(2,3,4$^+$)	144.5	2$^+$			
2092.9[a] *4*	0.65 *20*	2237.4?		144.5	2$^+$			
2144.5[a] *3*	<3.9	2289.0?		144.5	2$^+$			E_γ: other: 2144.7 (1984Be50, placed from a 2144 level).
2171.5 *3*	<17.2	2316.00	(2$^+$)	144.5	2$^+$	D+Q		E_γ: others: 2171.8 *6* (1977Wo07), 2171.9 (1979Pe17, placed from a 2606

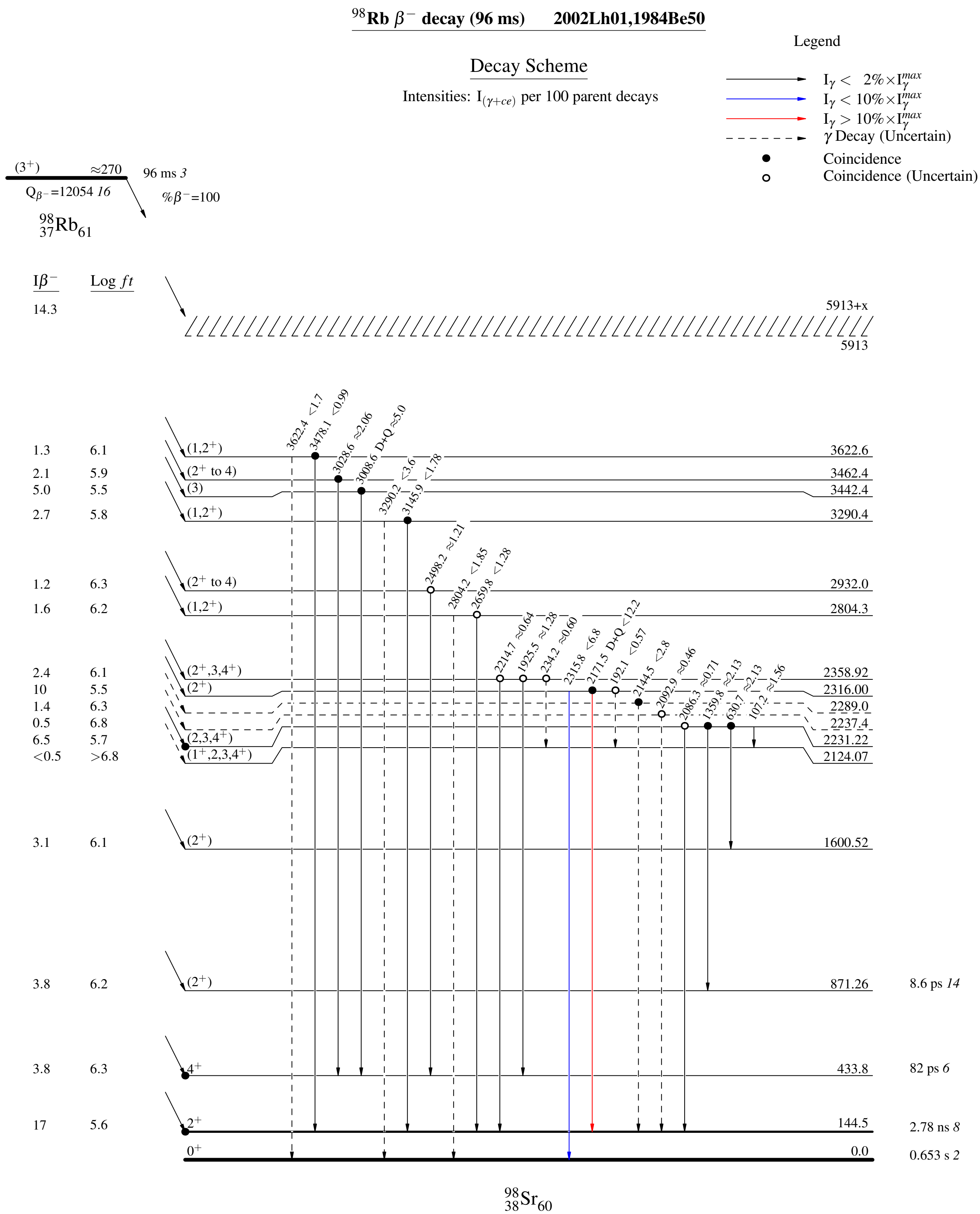
$^{98}_{38}$Sr$_{60}$-7

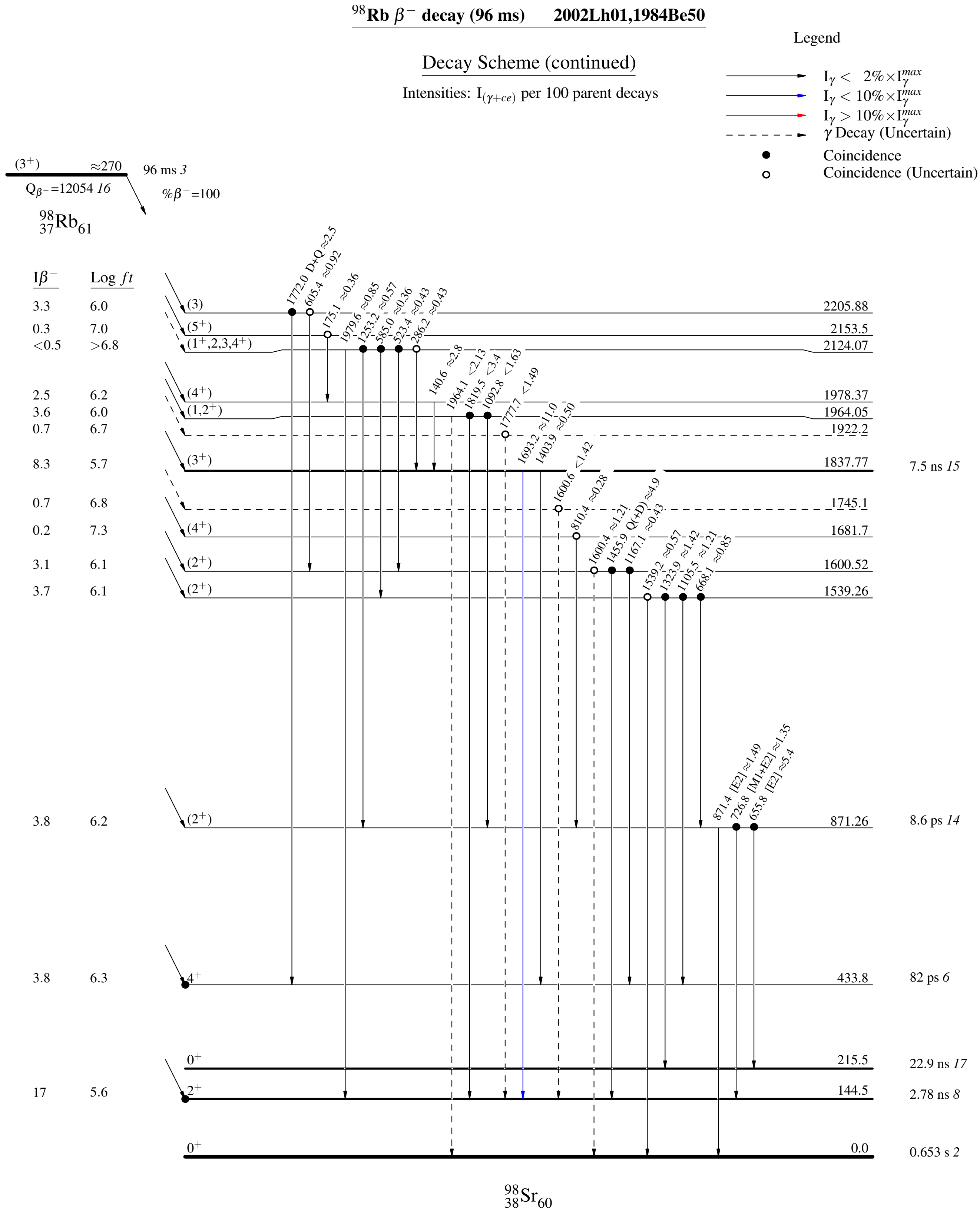
γ(^{98}Sr) (continued)

E_γ[†]	I_γ[‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	Comments
								level), 2171.7 (1984Be50). I_γ: others: 18 *3* (1977Wo07), 18.7 (1979Pe17). δ: +0.5 to +20.0 from (2172γ)(144γ)(θ): A_2=−0.27 *16*, A_4=+0.37 *29*. 1984Be50 give δ=+2.6 to +14.6. Additional information 2.
2214.7 *4*	0.8 *2*	2358.92	(2^+,3,4^+)	144.5	2^+			
2315.8 *4*	<9.6	2316.00	(2^+)	0.0	0^+			E_γ: other: 2316.0 (1984Be50).
2498.2 *4*	1.7 *3*	2932.0	(2^+ to 4)	433.8	4^+			
2659.8 *4*	<1.8	2804.3	(1,2^+)	144.5	2^+			
2804.2[a] *4*	<2.6	2804.3	(1,2^+)	0.0	0^+			
3008.6 *4*	7.0 *7*	3442.4	(3)	433.8	4^+	D+Q	−1.8 *12*	E_γ: others: 3008.4 *10* (1977Wo07), 3009.0 (1979Pe17), 3010.5 (1984Be50). I_γ: others: 3 *1* (1977Wo07), 4.9 (1979Pe17). δ: from (3009γ)(289γ)(θ): A_2=+0.47 *19*, A_4=−0.15 *36*. 1984Be50 give δ=−3.1 to +11.1.
3028.6 *4*	2.9 *5*	3462.4	(2^+ to 4)	433.8	4^+			E_γ: other: 3030.5 (1984Be50).
3145.9 *5*	<2.5	3290.4	(1,2^+)	144.5	2^+			E_γ: other: 3146.6 (1984Be50).
3290.2[a] *6*	<5.0	3290.4	(1,2^+)	0.0	0^+			E_γ: other: 3290.5 (1984Be50).
3478.1 *6*	<1.4	3622.6	(1,2^+)	144.5	2^+			
3622.4[a] *7*	<2.4	3622.6	(1,2^+)	0.0	0^+			

[†] From 2002Lh01, unless otherwise stated.
[‡] From combined γ-ray intensity data of 2002Lh01. For transitions that are in both activities (96 ms and 115 ms), intensities have been divided (with upper limits given) by evaluators based on intensity balances. For obtaining branching ratios used in Adopted Gammas, original values of combined sources in 2002Lh01 are used. Values for combined sources are also available but less complete and precise in 1987Ma58, 1980Sc13, 1979Pe17, 1977Wo07, and are given under comments as relative to I(145γ)=100. Comparable amount of data are also available in 1984Be50 but without uncertainty and listed along with values from 2002Lh01 in the intensity table above.
[#] From Adopted Levels. Assignments of multipolarities are supported by ce data (1980Sc13) and $\gamma\gamma(\theta)$ (1984Be50), given in comments. Values of mixing ratios deduced by 1984Be50 are given in comments and found to be inconsistent with quoted A_2 and A_4 coefficients in some cases, for which the adopted δ values given here are from evaluators′ estimate based on A_2 and A_4 values of 1984Be50.
[@] For absolute intensity per 100 decays, multiply by ≈0.71.
[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[a] Placement of transition in the level scheme is uncertain.

$^{98}_{38}$Sr$_{60}$-8

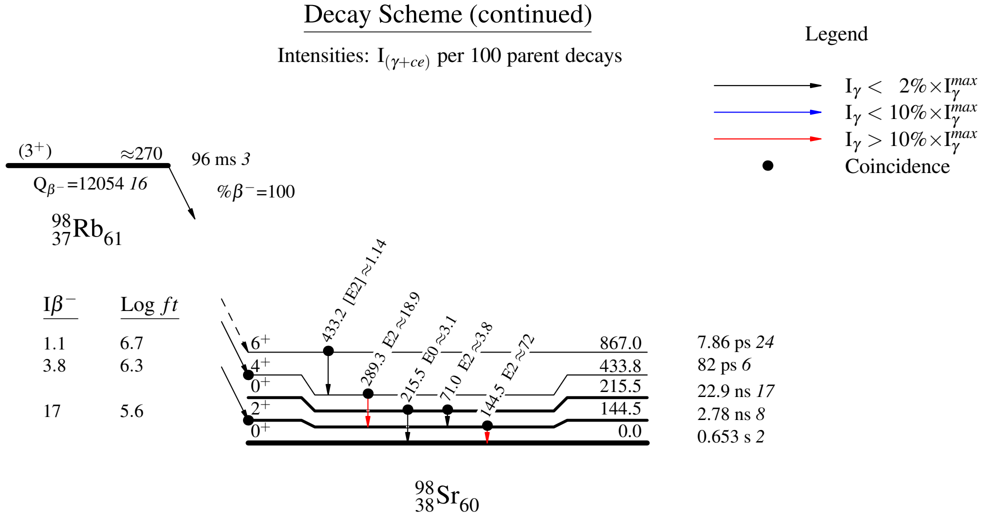

^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50
Decay Scheme
Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
Coincidence
Coincidence (Uncertain)
(3+) ≈270 96 ms 3
Q_{β^-}=12054 16
%β^-=100
$^{98}_{37}Rb_{61}$
$I\beta^-$ Log ft
14.3 5913+x
5913
1.3 6.1 (1,2+) 3622.6
2.1 5.9 (2+ to 4) 3462.4
5.0 5.5 (3) 3442.4
2.7 5.8 (1,2+) 3290.4
1.2 6.3 (2+ to 4) 2932.0
1.6 6.2 (1,2+) 2804.3
2.4 6.1 (2+,3,4+) 2358.92
10 5.5 (2+) 2316.00
1.4 6.3 2289.0
0.5 6.8 2237.4
6.5 5.7 (2,3,4+) 2231.22
<0.5 >6.8 (1+,2,3,4+) 2124.07
3.1 6.1 (2+) 1600.52
3.8 6.2 (2+) 871.26 8.6 ps 14
3.8 6.3 4+ 433.8 82 ps 6
17 5.6 2+ 144.5 2.78 ns 8
0+ 0.0 0.653 s 2
3622.4 <1.7
3478.1 <0.99
3028.6 ≈2.06
3008.6 D+Q ≈5.0
3290.2 <3.6
3145.9 <1.78
2498.2 ≈1.21
2804.2 <1.85
2659.8 <1.28
2214.7 ≈0.64
1925.5 ≈1.28
234.2 ≈0.60
2315.8 <6.8
2171.5 D+Q <12.2
192.1 <0.57
2144.5 <2.8
2092.9 ≈0.46
2086.3 ≈0.71
1359.8 ≈2.13
630.7 ≈2.13
107.2 ≈1.56
$^{98}_{38}Sr_{60}$


^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50
Decay Scheme (continued)
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
Coincidence (Uncertain)
(3+) ≈270
96 ms 3
Q_{β^-}=12054 16
$\%\beta^-$=100
$^{98}_{37}Rb_{61}$
Iβ− Log ft
3.3 6.0 (3) 2205.88
0.3 7.0 (5+) 2153.5
<0.5 >6.8 (1+,2,3,4+) 2124.07
2.5 6.2 (4+) 1978.37
3.6 6.0 (1,2+) 1964.05
0.7 6.7 1922.2
8.3 5.7 (3+) 1837.77 7.5 ns 15
0.7 6.8 1745.1
0.2 7.3 (4+) 1681.7
3.1 6.1 (2+) 1600.52
3.7 6.1 (2+) 1539.26
3.8 6.2 (2+) 871.26 8.6 ps 14
3.8 6.3 4+ 433.8 82 ps 6
0+ 215.5 22.9 ns 17
17 5.6 2+ 144.5 2.78 ns 8
0+ 0.0 0.653 s 2
1772.0 D+Q ≈2.5
605.4 ≈0.92
175.1 ≈0.36
1979.6 ≈0.85
1253.2 ≈0.57
585.0 ≈0.36
523.4 ≈0.43
286.2 ≈0.43
140.6 ≈2.8
1964.1 <2.13
1819.5 <3.4
1092.8 <1.63
1777.7 <1.49
1693.2 ≈11.0
1403.9 ≈0.50
1600.6 <1.42
810.4 ≈0.28
1600.4 ≈1.21
1455.9 Q(+D) ≈4.9
1167.1 ≈0.43
1539.2 ≈0.57
1323.9 ≈1.42
1105.5 ≈1.21
668.1 ≈0.85
871.4 [E2] ≈1.49
726.8 [M1+E2] ≈1.35
655.8 [E2] ≈5.4
$^{98}_{38}Sr_{60}$

^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50

Decay Scheme (continued)

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



^{98}Rb β^- decay (96 ms) 2002Lh01,1984Be50