^{109}Sb ε decay 2002Re14,1982Jo03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. Kumar(a), J. Chen(b) and F. G. Kondev	NDS 137, 1 (2016)	31-May-2016

Parent: ^{109}Sb: E=0; J^π=(5/2$^+$); $T_{1/2}$=17.2 s *5*; Q(ε)=6380 *9*; %ε+%$β^+$ decay=100.0

2002Re14: ^{109}Sb activity produced using E(^{58}Ni)=230 MeV beam on ^{54}Fe target (470 μg/cm^2). Moving Tape Collector, Fragment Mass Analyzer (FMA), Argonne National Laboratory, USA. Detectors: 3 large volume HPGe (two 80 %, one 120 %), 1 LEPS (70 %). Measured: Eγ, Iγ, γγ, γ(t). Comparisons with shell model calculations.

1982Jo03: ^{109}Sb activity produced in ^{92}Mo + ^{20}Ne and ^{58}Ni + ^{58}Ni reactions. E(^{20}Ne)=195 MeV from the HI linear accelerator, University of Manchester on a 2 mg/cm^2 target of ^{92}Mo; helium-jet system and tape with 40 s intervals. E(^{58}Ni)=290 MeV using GSI accelerator. Mass separated activity was implanted onto a tape with 32 s intervals. Detectors: plastic scintillator telescope and Ge(Li). Measured: $T_{1/2}$, Eγ, Iγ, γγ, γ-X, γβ, Q(ε); 1981JoZx reports same as preliminary results.

1976Ox01: ^{109}Sb activity produced in ^{112}Sn(p,4n), E(p)=25-65 MeV, McGill University cyclotron. Target: isotopically enriched (79.6 %), metallic powder sealed in thin-walled Be tube. Detectors: two Ge(Li) (96 and 50 cm^3). Measured: $T_{1/2}$, Eγ, Iγ, γγ.

The following gammas: 407, 1273, 1488, 1632, 1836, 2195 reported by 1976Ox01 were not observed in 1982Jo03 and 2002Re14, and certainly belong to other nuclide.

^{109}Sn Levels

E(level)†	J^π‡	$T_{1/2}$‡	Comments
0	5/2$^+$	18.2 min *2*	configuration: $\nu d_{5/2}$.
13.97 *7*	(7/2$^+$)		configuration: $\nu g_{7/2}$.
544.80 *13*	(1/2$^+$)		J^π: from 2002Re14 based on the non-observation of γ to the 7/2$^+$ state and shell-model predictions. configuration: $\nu s_{1/2}$ proposed in 2002Re14.
664.42 *12*	(3/2$^+$)		
678.31 *14*	(5/2)$^+$		
925.50 *13*	(3/2)$^+$		configuration: $d_{3/2}$ state.
991.34 *17*	(3/2)$^+$		
1061.80 *15*	(3/2)$^+$		
1078.13 *9*	(7/2)$^+$		
1228.74 *18*	(3/2$^+$,5/2$^+$)		
1343.72 *13*	(7/2)$^+$		
1495.89 *13*	(3/2$^+$)		
1614.23 *19*	(3/2$^+$,5/2$^+$)		
1649.85 *15*	(3/2$^+$,5/2$^+$)		
1914.01 *16*	(3/2$^+$,5/2$^+$)		
2015.95 *17*	(3/2$^+$,5/2$^+$)		
2126.62 *16*	(3/2$^+$,5/2$^+$)		

† From a least-squares fit to Eγ, by assuming ΔEγ=1 keV when uncertainty is not given.
‡ From Adopted Levels.

ε,$β^+$ radiations

E(decay)	E(level)	Iβ$^+$ #	Iε#	Log *ft*	I(ε+β$^+$)†#	Comments
(4253 *9*)	2126.62	1.8 *5*	0.32 *9*	5.44 *13*	2.1 *6*	av Eβ=1467.0 *76*; εK=0.1305 *17*; εL=0.01677 *22*; εM+=0.00430 *6*
(4364 *9*)	2015.95	1.45 *13*	0.234 *21*	5.60 *5*	1.68 *15*	av Eβ=1519.0 *76*; εK=0.1197 *15*; εL=0.01539 *20*; εM+=0.00395 *5*
(4466 *9*)	1914.01	1.31 *18*	0.19 *3*	5.70 *7*	1.50 *21*	av Eβ=1567.0 *76*; εK=0.1108 *14*; εL=0.01423 *18*; εM+=0.00365 *5*
(4730 *9*)	1649.85	2.23 *21*	0.264 *25*	5.61 *5*	2.49 *23*	av Eβ=1691.7 *76*; εK=0.0912 *11*; εL=0.01171 *14*;

Continued on next page (footnotes at end of table)

^{109}Sb ε decay 2002Re14,1982Jo03 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ #	Iε#	Log *ft*	I(ε+β+)†#	Comments
						εM+=0.00300 *4*
(4766 *9*)	1614.23	1.78 *16*	0.204 *19*	5.73 *5*	1.98 *18*	av Eβ=1708.5 *76*; εK=0.0889 *11*; εL=0.01142 *14*; εM+=0.00293 *4*
(4884 *9*)	1495.89	8.5 *7*	0.89 *8*	5.11 *4*	9.4 *8*	av Eβ=1764.6 *76*; εK=0.0818 *10*; εL=0.01050 *12*; εM+=0.00269 *3*
(5036 *9*)	1343.72	0.69 *6*	0.064 *6*	6.28 *5*	0.75 *7*	av Eβ=1836.7 *76*; εK=0.0737 *8*; εL=0.00946 *11*; εM+=0.00243 *3*
(5151 *9*)	1228.74	2.19 *19*	0.189 *17*	5.83 *5*	2.38 *21*	av Eβ=1891.4 *76*; εK=0.0683 *8*; εL=0.00876 *10*; εM+=0.002247 *24*
(5302 *9*)	1078.13	0.81 *9*	0.063 *7*	6.34 *6*	0.87 *10*	av Eβ=1963.0 *77*; εK=0.0619 *7*; εL=0.00794 *9*; εM+=0.002037 *21*
(5318 *9*)	1061.80	19.7 *16*	1.51 *12*	4.96 *4*	21.2 *17*	av Eβ=1970.8 *77*; εK=0.0613 *7*; εL=0.00786 *9*; εM+=0.002016 *21* $E\beta^+_{max}$=4332 keV *24* (1982Jo03).
(5389 *9*)	991.34	0.33 *7*	0.024 *5*	6.77 *10*	0.35 *8*	av Eβ=2004.4 *77*; εK=0.0586 *6*; εL=0.00752 *8*; εM+=0.001928 *20*
(5455 *9*)	925.50	27.9 *22*	1.95 *16*	4.87 *4*	29.9 *24*	av Eβ=2035.8 *77*; εK=0.0563 *6*; εL=0.00721 *8*; εM+=0.001850 *19* I(ε+β+): From log *ft*=4.87 3 for a similar $\pi d_{5/2}$ to $\nu d_{3/2}$ decay in ^{111}Sb ε decay, log *f*=3.110 7 and $T_{1/2}$=17.2 s 5. $E\beta^+_{max}$=4416 keV *21* (1982Jo03).
(5702 *9*)	678.31	9.3 *9*	0.56 *6*	5.45 *5*	9.9 *10*	av Eβ=2153.9 *77*; εK=0.0484 *5*; εL=0.00621 *6*; εM+=0.001591 *16*
(5716 *9*)	664.42	4.8 *8*	0.28 *5*	5.75 *8*	5.1 *9*	av Eβ=2160.6 *77*; εK=0.0480 *5*; εL=0.00615 *6*; εM+=0.001578 *15* $E\beta^+_{max}$=4674 keV *22* (1982Jo03).
(6366 *9*)	13.97	1.9 *13*	0.08 *5*	6.4 *3*	2.0‡ *14*	av Eβ=2472.7 *77*; εK=0.0334 *3*; εL=0.00428 *4*; εM+=0.001096 *10*
(6380 *9*)	0	8 *6*	0.3 *2*	5.8 *4*	8‡ *6*	av Eβ=2479.5 *77*; εK=0.0331 *3*; εL=0.00424 *4*; εM+=0.001088 *10*

† From intensity balances and %Iβ(ε+β+)(925.5-keV level)=29.9 24.
‡ from %Iβ(ε+β+)(gs)/%Iβ(ε+β+)(13.96-keV level)=4, as suggested in 2002Re14, and the decay scheme.
# Absolute intensity per 100 decays.

γ(^{109}Sn)

Iγ normalization: From intensity balance at the 925.5 keV level and %Iβ(ε+β$^+$)(925.5-keV level)= 29.9 24.

E_γ[†]	I_γ[‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	$I_{(\gamma+ce)}$[@]	Comments
13.97 *9*	1.91 *18*	13.97	(7/2$^+$)	0	5/2$^+$	[M1]	24.9 *6*	49.5 *45*	ce(L)/(γ+ce)=0.778 *12*; ce(M)/(γ+ce)=0.153 *5* ce(N)/(γ+ce)=0.0286 *10*; ce(O)/(γ+ce)=0.00245 *9* α(L)=20.2 *5*; α(M)=3.96 *10* α(N)=0.742 *18*; α(O)=0.0635 *16* %Iγ=0.51 *5*, using the calculated normalization. E_γ: from Adopted gammas. $I_{(\gamma+ce)}$: from %Iβ(ε+β$^+$)(gs)/%Iβ(ε+β$^+$)(13.96-keV level)=4, as suggested in 2002Re14 and the decay scheme. I_γ: from I(γ+ce) and α.
246.6 *3*	2.8 *1*	925.50	(3/2)$^+$	678.31	(5/2)$^+$	[M1]	0.0476		α(K)=0.0412 *6*; α(L)=0.00514 *8*; α(M)=0.001007 *15* α(N)=0.000190 *3*; α(O)=1.652×10^{-5} *24* %Iγ=0.75 *7*, using the calculated normalization.
260.8 *3*	6.4 *2*	925.50	(3/2)$^+$	664.42	(3/2$^+$)	[M1]	0.0411		α(K)=0.0356 *6*; α(L)=0.00443 *7*; α(M)=0.000868 *13* α(N)=0.0001634 *24*; α(O)=1.425×10^{-5} *21* %Iγ=1.71 *15*, using the calculated normalization.
381.3 *3*	0.6 *2*	925.50	(3/2)$^+$	544.80	(1/2$^+$)	[M1]	0.01551		α(K)=0.01347 *19*; α(L)=0.001655 *24*; α(M)=0.000324 *5* α(N)=6.10×10^{-5} *9*; α(O)=5.34×10^{-6} *8* %Iγ=0.16 *6*, using the calculated normalization.
397.5 *3*	3.0 *7*	1061.80	(3/2)$^+$	664.42	(3/2$^+$)	[M1]	0.01397		α(K)=0.01213 *18*; α(L)=0.001489 *21*; α(M)=0.000291 *5* α(N)=5.49×10^{-5} *8*; α(O)=4.80×10^{-6} *7* %Iγ=0.80 *20*, using the calculated normalization.
433.6 *3*	0.5 *1*	1495.89	(3/2$^+$)	1061.80	(3/2)$^+$	[M1]	0.01125		α(K)=0.00977 *14*; α(L)=0.001196 *17*; α(M)=0.000234 *4* α(N)=4.41×10^{-5} *7*; α(O)=3.86×10^{-6} *6* %Iγ=0.13 *3*, using the calculated normalization.
446.3 *3*	0.4 *1*	991.34	(3/2)$^+$	544.80	(1/2$^+$)	[M1]	0.01048		α(K)=0.00910 *13*; α(L)=0.001113 *16*; α(M)=0.000218 *3* α(N)=4.10×10^{-5} *6*; α(O)=3.59×10^{-6} *5* %Iγ=0.11 *3*, using the calculated normalization.
516.5 *3*	4 *1*	1061.80	(3/2)$^+$	544.80	(1/2$^+$)	[M1]	0.00732		α(K)=0.00637 *9*; α(L)=0.000775 *11*; α(M)=0.0001514 *22* α(N)=2.85×10^{-5} *4*; α(O)=2.50×10^{-6} *4* %Iγ=1.1 *3*, using the calculated normalization.
544.4 *3*	11.2 *1*	544.80	(1/2$^+$)	0	5/2$^+$	[E2]	0.00581		α(K)=0.00499 *7*; α(L)=0.000665 *10*; α(M)=0.0001307 *19* α(N)=2.43×10^{-5} *4*; α(O)=1.94×10^{-6} *3* %Iγ=2.99 *24*, using the calculated normalization. E_γ: Others: 544.4 3 (2002Re14) and 544.8 *3* (1982Jo03). I_γ: Other: 10.6 *5* (1982Jo03).
550.2 *3*	0.6 *1*	1228.74	(3/2$^+$,5/2$^+$)	678.31	(5/2)$^+$	[M1]	0.00628		α(K)=0.00546 *8*; α(L)=0.000664 *10*; α(M)=0.0001296 *19* α(N)=2.44×10^{-5} *4*; α(O)=2.15×10^{-6} *3* %Iγ=0.16 *3*, using the calculated normalization.
571.3 *3*	0.8 *1*	1649.85	(3/2$^+$,5/2$^+$)	1078.13	(7/2)$^+$	[M1,E2]	0.00574		α(K)=0.00499 *7*; α(L)=0.000605 *9*; α(M)=0.0001183 *17*

$^{109}_{50}$Sn$_{59}$-3

γ(^{109}Sn) (continued)

E_γ †	I_γ ‡@	E_i(level)	J_i^π	E_f	J_f^π	Mult. †	α #	Comments
								α(N)=2.23×10^{-5} *4*; α(O)=1.96×10^{-6} *3* %Iγ=0.21 *4*, using the calculated normalization.
650.1 *3*	1.3 *1*	664.42	(3/2$^+$)	13.97	(7/2$^+$)	[E2]	0.00361	α(K)=0.00312 *5*; α(L)=0.000403 *6*; α(M)=7.91×10^{-5} *12* α(N)=1.476×10^{-5} *21*; α(O)=1.209×10^{-6} *17* %Iγ=0.35 *4*, using the calculated normalization.
664.0 *3*	39 *2*	664.42	(3/2$^+$)	0	5/2$^+$	[M1]	0.00401	α(K)=0.00349 *5*; α(L)=0.000421 *6*; α(M)=8.23×10^{-5} *12* α(N)=1.551×10^{-5} *22*; α(O)=1.365×10^{-6} *20* %Iγ=10.4 *9*, using the calculated normalization.
664.5 *1*	24 *2*	678.31	(5/2)$^+$	13.97	(7/2$^+$)	M1	0.00401	α(K)=0.00349 *5*; α(L)=0.000421 *6*; α(M)=8.22×10^{-5} *12* α(N)=1.550×10^{-5} *22*; α(O)=1.364×10^{-6} *20* %Iγ=6.4 *7*, using the calculated normalization. E_γ: Others: 664.2 3 (2002Re14), 664.5 *3* (1982Jo03), and 664.6 *5* (1976Ox01). I_γ: Others: 63 *4* (1982Jo03), 51 *7* (1976Ox01, may combine 664.0 γ + 664.2γ).
665.8 *3*	0.5 *1*	1343.72	(7/2)$^+$	678.31	(5/2)$^+$	[M1]	0.00399	α(K)=0.00347 *5*; α(L)=0.000419 *6*; α(M)=8.18×10^{-5} *12* α(N)=1.541×10^{-5} *22*; α(O)=1.356×10^{-6} *19* %Iγ=0.13 *3*, using the calculated normalization.
678.6 *1*	20.2 *2*	678.31	(5/2)$^+$	0	5/2$^+$	M1(+E2)	0.00381	α(K)=0.00332 *5*; α(L)=0.000401 *6*; α(M)=7.82×10^{-5} *11* α(N)=1.474×10^{-5} *21*; α(O)=1.298×10^{-6} *19* %Iγ=5.4 *5*, using the calculated normalization. E_γ: Others: 678.6 3 (2002Re14) abd 678.6 *3* (1982Jo03). I_γ: Other: 19 *1* (1982Jo03).
685	≤1.0	1914.01	(3/2$^+$,5/2$^+$)	1228.74	(3/2$^+$,5/2$^+$)	[M1]	0.00373	α(K)=0.00324 *5*; α(L)=0.000391 *6*; α(M)=7.64×10^{-5} *11* α(N)=1.440×10^{-5} *21*; α(O)=1.268×10^{-6} *18* %Iγ=0.13 *14*, using the calculated normalization.
687.3 *3*	0.4 *1*	1614.23	(3/2$^+$,5/2$^+$)	925.50	(3/2)$^+$	[M1]	0.00370	α(K)=0.00322 *5*; α(L)=0.000388 *6*; α(M)=7.58×10^{-5} *11* α(N)=1.429×10^{-5} *20*; α(O)=1.258×10^{-6} *18* %Iγ=0.11 *3*, using the calculated normalization. E_γ: poor fit, level-energy difference=688.74.
831.4 *3*	2.1 *6*	1495.89	(3/2$^+$)	664.42	(3/2$^+$)	[M1]	0.00238	α(K)=0.00207 *3*; α(L)=0.000248 *4*; α(M)=4.84×10^{-5} *7* α(N)=9.13×10^{-6} *13*; α(O)=8.05×10^{-7} *12* %Iγ=0.56 *17*, using the calculated normalization.
835.0 *3*	0.6 *2*	1914.01	(3/2$^+$,5/2$^+$)	1078.13	(7/2)$^+$	[M1,E2]	0.00235	α(K)=0.00205 *3*; α(L)=0.000246 *4*; α(M)=4.79×10^{-5} *7* α(N)=9.04×10^{-6} *13*; α(O)=7.97×10^{-7} *12* %Iγ=0.16 *6*, using the calculated normalization.
910.9 *3*	2.9 *2*	925.50	(3/2)$^+$	13.97	(7/2$^+$)	[E2]	1.59×10^{-3}	α(K)=0.001377 *20*; α(L)=0.0001707 *24*; α(M)=3.34×10^{-5} *5* α(N)=6.26×10^{-6} *9*; α(O)=5.30×10^{-7} *8* %Iγ=0.77 *8*, using the calculated normalization.
925.3 *2*	100	925.50	(3/2)$^+$	0	5/2$^+$	M1(+E2)	0.00186	α(K)=0.001622 *23*; α(L)=0.000194 *3*; α(M)=3.78×10^{-5} *6* α(N)=7.14×10^{-6} *10*; α(O)=6.30×10^{-7} *9* %Iγ=26.7 *21*, using the calculated normalization. E_γ: Others: 925.0 3 (2002Re14), 925.4 *3* (1982Jo03), 925.4 *3*

^{109}Sb ε decay 2002Re14,1982Jo03 (continued)

γ(^{109}Sn) (continued)

E_γ [†]	I_γ [‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	Comments
								(1976Ox01).
								I_γ: Others: 100 (1982Jo03, 1976Ox01).
[x]932.1 *3*	0.5 *2*							%Iγ=0.13 *6*, using the calculated normalization.
								E_γ: placement by 2002Re14 from 2016 is incorrect, as confirmed in an e-mail reply from one of the authors (J. Ressler to B. Singh) on June 10, 2002. It is however seen in coin with 1078γ.
936.2 *3*	3.2 *2*	1614.23	$(3/2^+,5/2^+)$	678.31	$(5/2)^+$	[M1]	0.00181	α(K)=0.001579 *23*; α(L)=0.000189 *3*; α(M)=3.68×10^{-5} *6* α(N)=6.94×10^{-6} *10*; α(O)=6.13×10^{-7} *9* %Iγ=0.85 *9*, using the calculated normalization.
951.1 *3*	2.4 *2*	1495.89	$(3/2^+)$	544.80	$(1/2^+)$	[M1]	1.75×10^{-3}	α(K)=0.001523 *22*; α(L)=0.000182 *3*; α(M)=3.55×10^{-5} *5* α(N)=6.70×10^{-6} *10*; α(O)=5.91×10^{-7} *9* %Iγ=0.64 *8*, using the calculated normalization.
985.5 *3*	1.1 *2*	1649.85	$(3/2^+,5/2^+)$	664.42	$(3/2^+)$	[M1]	1.61×10^{-3}	α(K)=0.001406 *20*; α(L)=0.0001679 *24*; α(M)=3.27×10^{-5} *5* α(N)=6.18×10^{-6} *9*; α(O)=5.45×10^{-7} *8* %Iγ=0.29 *6*, using the calculated normalization.
991.2 *3*	1.8 *1*	991.34	$(3/2)^+$	0	$5/2^+$	M1(+E2)	1.59×10^{-3}	α(K)=0.001388 *20*; α(L)=0.0001657 *24*; α(M)=3.23×10^{-5} *5* α(N)=6.09×10^{-6} *9*; α(O)=5.38×10^{-7} *8* %Iγ=0.48 *5*, using the calculated normalization.
1024.4 *3*	0.5 *1*	2015.95	$(3/2^+,5/2^+)$	991.34	$(3/2)^+$	[M1]	1.48×10^{-3}	α(K)=0.001289 *18*; α(L)=0.0001538 *22*; α(M)=3.00×10^{-5} *5* α(N)=5.66×10^{-6} *8*; α(O)=5.00×10^{-7} *7* %Iγ=0.13 *3*, using the calculated normalization.
1047.7 *3*	4.8 *1*	1061.80	$(3/2)^+$	13.97	$(7/2^+)$	[E2]	1.16×10^{-3}	α(K)=0.001009 *15*; α(L)=0.0001234 *18*; α(M)=2.41×10^{-5} *4* α(N)=4.52×10^{-6} *7*; α(O)=3.87×10^{-7} *6* %Iγ=1.28 *11*, using the calculated normalization.
1061.8 *3*	67.9 *7*	1061.80	$(3/2)^+$	0	$5/2^+$	M1(+E2)	1.37×10^{-3}	α(K)=0.001190 *17*; α(L)=0.0001418 *20*; α(M)=2.77×10^{-5} *4* α(N)=5.22×10^{-6} *8*; α(O)=4.61×10^{-7} *7* %Iγ=18.1 *15*, using the calculated normalization. E_γ: Others: 1061.7 *3* (1982Jo03), 1061.6 *3* (1976Ox01). I_γ: Others: 75 *5* (1982Jo03), 74 *4* (1976Ox01).
1064.0 *3*	0.86 *6*	1078.13	$(7/2)^+$	13.97	$(7/2^+)$	M1(+E2)	1.36×10^{-3}	α(K)=0.001185 *17*; α(L)=0.0001412 *20*; α(M)=2.75×10^{-5} *4* α(N)=5.19×10^{-6} *8*; α(O)=4.59×10^{-7} *7* %Iγ=0.230 *24*, using the calculated normalization. E_γ: From adopted gammas. Other: 1064 keV (2012Re14). I_γ: From adopted gammas. Authors in 2002Re14 adopted a value based on branching ratio from in-beam γ-ray studies of 1999Da05.
1078.0 *1*	3.8 *1*	1078.13	$(7/2)^+$	0	$5/2^+$	M1(+E2)	1.32×10^{-3}	α(K)=0.001151 *17*; α(L)=0.0001371 *20*; α(M)=2.67×10^{-5} *4* α(N)=5.04×10^{-6} *7*; α(O)=4.45×10^{-7} *7* %Iγ=1.01 *9*, using the calculated normalization. E_γ: Others: 1078 keV (2012Re14) and 1078.0 keV *3* (1982Jo03). I_γ: Other: 3.9 *2* (1982Jo03).
1090.8 *3*	0.5 *1*	2015.95	$(3/2^+,5/2^+)$	925.50	$(3/2)^+$	[M1]	1.29×10^{-3}	α(K)=0.001121 *16*; α(L)=0.0001335 *19*; α(M)=2.60×10^{-5} *4*

$^{109}_{50}Sn_{59}$-5

^{109}Sb ε decay 2002Re14,1982Jo03 (continued)

γ(^{109}Sn) (continued)

E_γ [†]	I_γ [‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	α [#]	Comments
								α(N)=4.91×10^{-6} *7*; α(O)=4.34×10^{-7} *6* %Iγ=0.13 *3*, using the calculated normalization.
1104.4 *3*	2.7 *2*	1649.85	(3/2$^+$,5/2$^+$)	544.80	(1/2$^+$)	[M1,E2]	1.25×10^{-3}	α(K)=0.001091 *16*; α(L)=0.0001298 *19*; α(M)=2.53×10^{-5} *4* α(N)=4.77×10^{-6} *7*; α(O)=4.22×10^{-7} *6*; α(IPF)=4.82×10^{-7} *9* %Iγ=0.72 *8*, using the calculated normalization. E_γ: poor fit, level-energy difference=1105.16.
1135.1 *3*	0.4 *2*	2126.62	(3/2$^+$,5/2$^+$)	991.34	(3/2)$^+$	[M1]	1.18×10^{-3}	α(K)=0.001027 *15*; α(L)=0.0001221 *18*; α(M)=2.38×10^{-5} *4* α(N)=4.49×10^{-6} *7*; α(O)=3.97×10^{-7} *6*; α(IPF)=1.312×10^{-6} *22* %Iγ=0.11 *6*, using the calculated normalization.
[x]1175.3 *3*	2.8 *1*							%Iγ=0.75 *7*, using the calculated normalization.
1200.8 *3*	0.3 *1*	2126.62	(3/2$^+$,5/2$^+$)	925.50	(3/2)$^+$	[M1]	1.05×10^{-3}	α(K)=0.000907 *13*; α(L)=0.0001078 *16*; α(M)=2.10×10^{-5} *3* α(N)=3.96×10^{-6} *6*; α(O)=3.50×10^{-7} *5*; α(IPF)=6.15×10^{-6} *10* %Iγ=0.08 *3*, using the calculated normalization.
1214.4 *3*	1.1 *1*	1228.74	(3/2$^+$,5/2$^+$)	13.97	(7/2$^+$)	[M1,E2]	1.02×10^{-3}	α(K)=0.000885 *13*; α(L)=0.0001051 *15*; α(M)=2.05×10^{-5} *3* α(N)=3.87×10^{-6} *6*; α(O)=3.42×10^{-7} *5*; α(IPF)=7.72×10^{-6} *12* %Iγ=0.29 *4*, using the calculated normalization.
1229.3 *3*	7.7 *1*	1228.74	(3/2$^+$,5/2$^+$)	0	5/2$^+$	[M1]	9.98×10^{-4}	α(K)=0.000862 *12*; α(L)=0.0001023 *15*; α(M)=1.99×10^{-5} *3* α(N)=3.76×10^{-6} *6*; α(O)=3.33×10^{-7} *5*; α(IPF)=9.61×10^{-6} *14* %Iγ=2.06 *17*, using the calculated normalization.
1249.4 *3*	1.8 *5*	1914.01	(3/2$^+$,5/2$^+$)	664.42	(3/2$^+$)	[M1]	9.66×10^{-4}	α(K)=0.000832 *12*; α(L)=9.87×10^{-5} *14*; α(M)=1.92×10^{-5} *3* α(N)=3.63×10^{-6} *5*; α(O)=3.21×10^{-7} *5*; α(IPF)=1.241×10^{-5} *18* %Iγ=0.48 *14*, using the calculated normalization.
1343.64 *13*	2.3 *1*	1343.72	(7/2)$^+$	0	5/2$^+$	M1	8.44×10^{-4}	α(K)=0.000711 *10*; α(L)=8.42×10^{-5} *12*; α(M)=1.641×10^{-5} *23* α(N)=3.10×10^{-6} *5*; α(O)=2.74×10^{-7} *4*; α(IPF)=2.96×10^{-5} *5* %Iγ=0.61 *6*, using the calculated normalization. E_γ: From adopted gammas. Others: 1343.7 keV 3 (2012Re14) and 1343.5 *3* (1982Jo03). I_γ: Other: 2.2 *2* (1982Jo03).
1351.1 *3*	0.7 *1*	2015.95	(3/2$^+$,5/2$^+$)	664.42	(3/2$^+$)	[M1]	8.36×10^{-4}	α(K)=0.000702 *10*; α(L)=8.32×10^{-5} *12*; α(M)=1.621×10^{-5} *23* α(N)=3.06×10^{-6} *5*; α(O)=2.71×10^{-7} *4*; α(IPF)=3.13×10^{-5} *5* %Iγ=0.19 *3*, using the calculated normalization.
1369.6 *3*	0.8 *1*	1914.01	(3/2$^+$,5/2$^+$)	544.80	(1/2$^+$)	[M1,E2]	8.18×10^{-4}	α(K)=0.000682 *10*; α(L)=8.08×10^{-5} *12*; α(M)=1.574×10^{-5} *22* α(N)=2.97×10^{-6} *5*; α(O)=2.63×10^{-7} *4*; α(IPF)=3.58×10^{-5} *5* %Iγ=0.21 *4*, using the calculated normalization.
1462.2 *3*	6 *2*	2126.62	(3/2$^+$,5/2$^+$)	664.42	(3/2$^+$)	[M1]	7.42×10^{-4}	α(K)=0.000593 *9*; α(L)=7.01×10^{-5} *10*; α(M)=1.366×10^{-5} *20* α(N)=2.58×10^{-6} *4*; α(O)=2.28×10^{-7} *4*; α(IPF)=6.20×10^{-5} *9* %Iγ=1.6 *6*, using the calculated normalization.
1482.2 *3*	1.7 *1*	1495.89	(3/2$^+$)	13.97	(7/2$^+$)	[E2]	6.41×10^{-4}	α(K)=0.000493 *7*; α(L)=5.89×10^{-5} *9*; α(M)=1.147×10^{-5} *16* α(N)=2.16×10^{-6} *3*; α(O)=1.88×10^{-7} *3*; α(IPF)=7.48×10^{-5} *11* %Iγ=0.45 *5*, using the calculated normalization.
1496.0 *2*	28.3 *2*	1495.89	(3/2$^+$)	0	5/2$^+$	[M1]	7.21×10^{-4}	α(K)=0.000565 *8*; α(L)=6.68×10^{-5} *10*; α(M)=1.301×10^{-5} *19* α(N)=2.45×10^{-6} *4*; α(O)=2.17×10^{-7} *3*; α(IPF)=7.30×10^{-5} *11* %Iγ=7.6 *6*, using the calculated normalization.

$^{109}_{50}Sn_{59}$-6

γ(^{109}Sn) (continued)

E_γ [†]	I_γ [‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	α [#]	Comments
								E_γ: From adopted gammas. Others: 1496.1 keV 3 (2012Re14) and 1495.8 *3* (1982Jo03). I_γ: Other: 30 *2* (1982Jo03).
1581.8 *3*	0.4 *1*	2126.62	(3/2$^+$,5/2$^+$)	544.80	(1/2$^+$)	[M1,E2]	6.80×10^{-4}	α(K)=0.000502 *7*; α(L)=5.93×10^{-5} *9*; α(M)=1.155×10^{-5} *17* α(N)=2.18×10^{-6} *3*; α(O)=1.93×10^{-7} *3*; α(IPF)=0.0001040 *15* %Iγ=0.11 *3*, using the calculated normalization.
1601.4 *3*	3.8 *2*	1614.23	(3/2$^+$,5/2$^+$)	13.97	(7/2$^+$)	[M1]	6.72×10^{-4}	α(K)=0.000490 *7*; α(L)=5.78×10^{-5} *8*; α(M)=1.125×10^{-5} *16* α(N)=2.12×10^{-6} *3*; α(O)=1.88×10^{-7} *3*; α(IPF)=0.0001115 *16* %Iγ=1.01 *10*, using the calculated normalization.
1636.3 *3*	1.6 *2*	1649.85	(3/2$^+$,5/2$^+$)	13.97	(7/2$^+$)	[M1,E2]	6.61×10^{-4}	E_γ: poor fit, level-energy difference=1600.26. α(K)=0.000468 *7*; α(L)=5.52×10^{-5} *8*; α(M)=1.075×10^{-5} *15* α(N)=2.03×10^{-6} *3*; α(O)=1.80×10^{-7} *3*; α(IPF)=0.0001252 *18* %Iγ=0.43 *7*, using the calculated normalization.
1650.4 *3*	3.1 *2*	1649.85	(3/2$^+$,5/2$^+$)	0	5/2$^+$	[M1]	6.57×10^{-4}	α(K)=0.000460 *7*; α(L)=5.42×10^{-5} *8*; α(M)=1.055×10^{-5} *15* α(N)=1.99×10^{-6} *3*; α(O)=1.763×10^{-7} *25*; α(IPF)=0.0001308 *19* %Iγ=0.83 *9*, using the calculated normalization.
[x]1760.4 *3*	2.6 *1*							%Iγ=0.69 *6*, using the calculated normalization.
1914.7 *3*	1.9 *1*	1914.01	(3/2$^+$,5/2$^+$)	0	5/2$^+$	[M1]	6.35×10^{-4}	α(K)=0.000338 *5*; α(L)=3.97×10^{-5} *6*; α(M)=7.74×10^{-6} *11* α(N)=1.459×10^{-6} *21*; α(O)=1.293×10^{-7} *19*; α(IPF)=0.000248 *4* %Iγ=0.51 *5*, using the calculated normalization.
2016.2 *3*	4.6 *2*	2015.95	(3/2$^+$,5/2$^+$)	0	5/2$^+$	[M1]	6.44×10^{-4}	α(K)=0.000304 *5*; α(L)=3.57×10^{-5} *5*; α(M)=6.96×10^{-6} *10* α(N)=1.312×10^{-6} *19*; α(O)=1.163×10^{-7} *17*; α(IPF)=0.000296 *5* %Iγ=1.23 *11*, using the calculated normalization.
2127.1 *3*	0.9 *1*	2126.62	(3/2$^+$,5/2$^+$)	0	5/2$^+$	[M1]	6.63×10^{-4}	α(K)=0.000273 *4*; α(L)=3.20×10^{-5} *5*; α(M)=6.24×10^{-6} *9* α(N)=1.177×10^{-6} *17*; α(O)=1.043×10^{-7} *15*; α(IPF)=0.000350 *5* %Iγ=0.24 *4*, using the calculated normalization.

[†] From Adopted Gammas.
[‡] From 2002Re14.
[#] Additional information 1.
[@] For absolute intensity per 100 decays, multiply by 0.267 *21*.
[x] γ ray not placed in level scheme.

$^{109}_{50}Sn_{59}$-7

^{109}Sb ε decay 2002Re14,1982Jo03

Decay Scheme

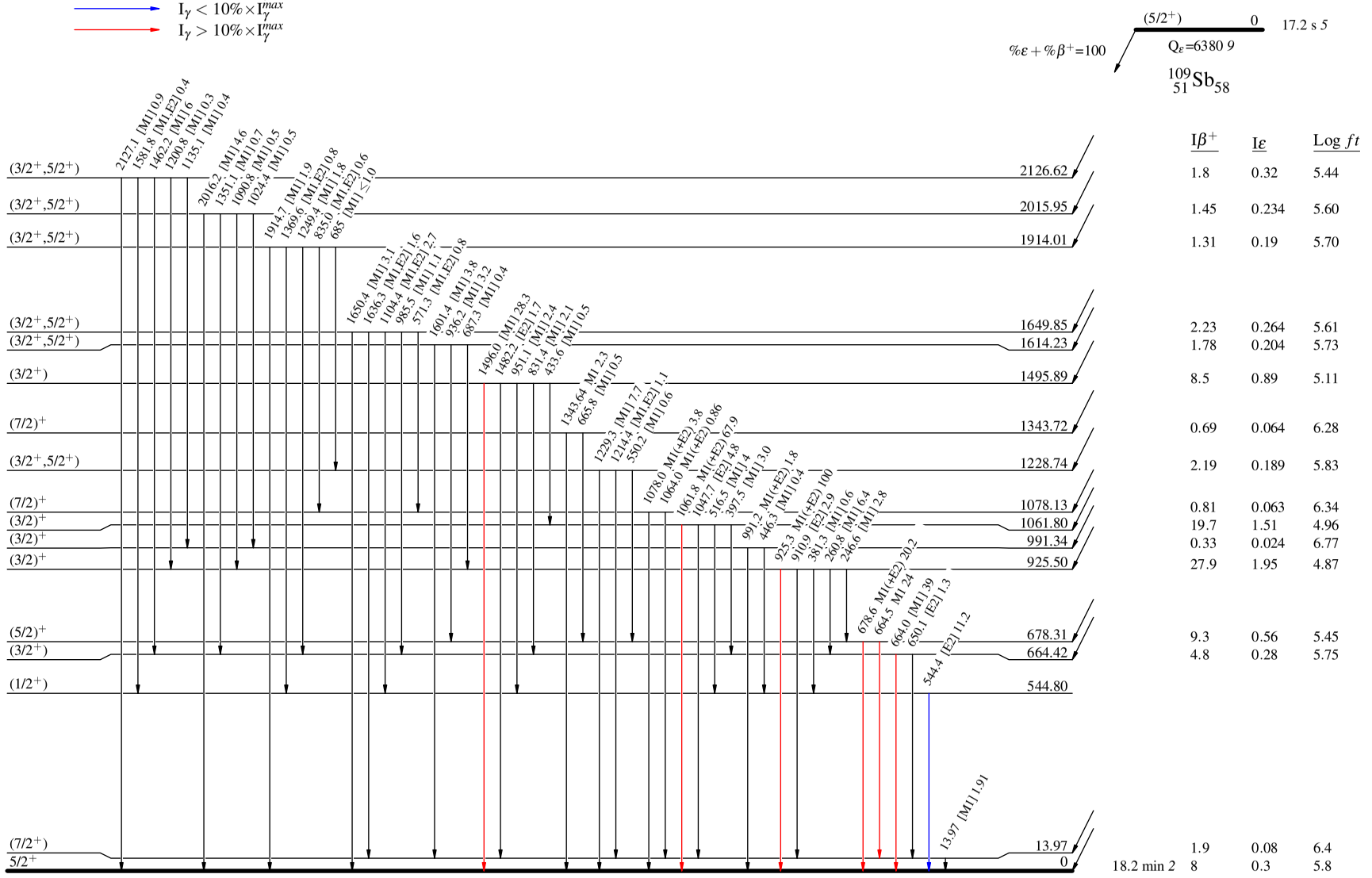
Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$



	Iβ+	Iε	Log *ft*
2126.62	1.8	0.32	5.44
2015.95	1.45	0.234	5.60
1914.01	1.31	0.19	5.70
1649.85	2.23	0.264	5.61
1614.23	1.78	0.204	5.73
1495.89	8.5	0.89	5.11
1343.72	0.69	0.064	6.28
1228.74	2.19	0.189	5.83
1078.13	0.81	0.063	6.34
1061.80	19.7	1.51	4.96
991.34	0.33	0.024	6.77
925.50	27.9	1.95	4.87
678.31	9.3	0.56	5.45
664.42	4.8	0.28	5.75
13.97	1.9	0.08	6.4
0	8	0.3	5.8

$^{109}_{50}Sn_{59}$

$^{109}_{50}Sn_{59}$-8