^{194}Tl ε decay (33.0 min) 2003Su30,1972Am03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 177, 1 (2021)	3-Sep-2021

Parent: ^{194}Tl: E=0.0; $J^\pi=2^-$; $T_{1/2}$=33.0 min *5*; Q(ε)=5246 *14*; %ε+%$β^+$ decay=100.0

^{194}Tl-J^π,$T_{1/2}$: From Adopted Levels of ^{194}Tl.

^{194}Tl-Q(ε): From 2021Wa16.

2003Su30: ^{194}Tl source was obtained as daughter of ^{194}Pb isotope produced in the reaction of ^{181}Ta(^{19}F,6n) with 110 MeV ^{19}F beam from BARC-TIFR Pelletron accelerator at Mumbai. γ rays were detected with two HPGe detectors. Measured Eγ, Iγ, γγ-coin, γ(t). Deduced levels, parent $T_{1/2}$, absolute γ-ray intensities. Absolute γ-ray intensity measured from ^{194}Pb-^{194}Tl successive decays and using absolute γ-ray intensity information for ^{194}Pb decay.

1972Am03: ^{194}Tl ions were obtained from spallation of lead by bombarding a PbF_2 target with 660 MeV proton beam from the synchrocyclotron of the Nuclear Problems Laboratory of JINR. γ rays were detected with Ge(Li) detectors and conversion electrons were detected with a β spectrometer with a Si(Li) detector (FWHM=3.2 keV at ≈200 keV). Measured Eγ, Iγ, E(ce), I(ce). Deduced levels, J, π, ε-decay branching ratios, log *ft*, conversion coefficients, γ-ray multipolarities.

Others: 1970To14, 1968Pe13, 1960Ju01, 1976WeZM.

Due to a large gap (>3 MeV) between Q-value=5246 *14* and the highest observed level of 2052, the decay scheme is considered incomplete and the branching ratios and Log *ft* values are considered as approximated values.

^{194}Hg Levels

A 1292 level proposed on the basis of energy sums of 219.0γ and 227.98γ (1972Am03) is discarded by the evaluator. The 227.98γ is placed with an 8^- level at 2138 known from (HI,xnγ) and the 219.0γ is considered unplaced due to the absence of any other supporting argument.

Negative result in the search for super-deformation at low-spin states populated by ^{194}Tl ε decay. Expected 3600γ in coincidence with 428γ (from 428 level) was not observed (1989HeYZ, 1990HeYY).

E(level)†	J^π‡
0.0	0^+
427.91 *9*	2^+
1064.25 *14*	4^+
1073.05 *13*	$(2)^+$
1468.44 *14*	$(3)^+$
1957.8 *5*	$(0^+$ to $4^+)$
1979.5 *5*	$(0^+$ to $4^+)$
2051.7 *3*	$(0^+$ to $4^+)$

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

‡ From Adopted Levels.

ε,$β^+$ radiations

E($β^+$)=4.4 MeV *3*, reported by 1976WeZM probably corresponds to a $β^+$ transition to g.s.

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)†‡	Comments
(3194 *14*)	2051.7	0.25 *5*	1.8 *4*	7.5 *1*	2.0 *4*	av Eβ=982.3 *63*; εK=0.7104 *18*; εL=0.1258 *4*; εM+=0.04047 *11* Log *ft*: 9.2 for 1U.
(3267 *14*)	1979.5	0.57 *5*	3.6 *3*	7.23 *5*	4.2 *4*	av Eβ=1014.3 *63*; εK=0.7014 *18*; εL=0.1241 *4*; εM+=0.03991 *11* Log *ft*: 8.9 for 1U.

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^{194}Tl ε decay (33.0 min) 2003Su30,1972Am03 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)†‡	Comments
(3288 *14*)	1957.8	0.28 *4*	1.7 *3*	7.6 *1*	2.0 *3*	av Eβ=1024.0 *63*; εK=0.6987 *18*; εL=0.1236 *4*; εM+=0.03974 *11* Log *ft*: 9.2 for 1U.
(3778 *14*)	1468.44	1.6 *2*	5.6 *5*	7.17 *5*	7.2 *7*	av Eβ=1242.4 *63*; εK=0.6298 *22*; εL=0.1108 *4*; εM+=0.03559 *13*
(4173 *14*)	1073.05	3.9 *3*	9.0 *7*	7.05 *4*	12.9 *10*	av Eβ=1420.3 *64*; εK=0.5685 *22*; εL=0.0997 *4*; εM+=0.03200 *13*
(4182 *14*)	1064.25	1.1 *2*	7.4 *12*	9.0[1u] *1*	8.5 *14*	av Eβ=1393.0 *61*; εK=0.6980 *14*; εL=0.1266 *3*; εM+=0.04089 *9*
(4818 *14*)	427.91	19 *3*	27 *3*	6.7 *1*	46 *6*	av Eβ=1712.9 *64*; εK=0.4684 *21*; εL=0.0817 *4*; εM+=0.02622 *12*
(5246 *14*)	0.0	4.8 *17*	12 *4*	9.1[1u] *2*	17 *6*	av Eβ=1856.0 *62*; εK=0.5805 *17*; εL=0.1038 *4*; εM+=0.03346 *11* I(ε+β+): as stated in 2003Su30, the branching ratio to g.s. appears to be over-estimated, which could be due to errors on the branching intensities of other levels or unobserved transitions to g.s.

† From γ+ce intensity balance at each level.
‡ Absolute intensity per 100 decays.

γ(^{194}Hg)

Iγ normalization: from absolute γ-ray intensity measurement by 2003Su30.
Several unplaced γ rays are given with the decay of the 32.8-min isomer of ^{194}Tl. These belong to either or both the isomers. See γ rays from ^{194}Tl ε decay (32.8 min).

E_γ†	I_γ†@	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	δ#	α&	Comments
395.39 *13*	1.5 *4*	1468.44	$(3)^+$	1073.05	$(2)^+$	M1(+E2)	<1	0.14 *3*	α(K)=0.11 *3*; α(L)=0.021 *3*; α(M)=0.0048 *6* α(N)=0.00121 *16*; α(O)=0.00023 *4*; α(P)=1.6×10^{-5} *4* E_γ: other: 395.5 *5* (1972Am03). Mult.: α(K)exp=0.13 (1972Am03).
404.19 *8*	0.70 *7*	1468.44	$(3)^+$	1064.25	4^+	M1(+E2)	<1	0.13 *3*	α(K)=0.11 *3*; α(L)=0.019 *3*; α(M)=0.0045 *6* α(N)=0.00113 *15*; α(O)=0.00021 *3*; α(P)=1.5×10^{-5} *4* E_γ: other: 403.9 *7* (1972Am03). Mult.: α(K)exp=0.12 (1972Am03).
427.91 *9*	75 *5*	427.91	2^+	0.0	0^+	E2		0.0398	α(K)=0.0275 *4*; α(L)=0.00929 *13*; α(M)=0.00231 *4* α(N)=0.000575 *8*; α(O)=0.0001014 *15*; α(P)=3.62×10^{-6} *5* Mult.: from (L1+L2)/L3=5.1 *10*, K/L=3.0 *6*, L/M=1.3 *5* (1960Ju01). I_γ: deduced from composite Iγ=220 *25* (1972Am03) for 33.0-min and 32.8-min activities on the basis of intensity balance at 428 level in the decay of 32.8-min isomer.

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^{194}Tl ε decay (33.0 min) 2003Su30,1972Am03 (continued)

γ(^{194}Hg) (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	Comments
636.34 *14*	9.1 *13*	1064.25	4^+	427.91	2^+	E2	0.01542	α(K)=0.01173 *17*; α(L)=0.00280 *4*; α(M)=0.000678 *10* α(N)=0.0001693 *24*; α(O)=3.06×10^{-5} *5*; α(P)=1.557×10^{-6} *22* Mult.: from α(K)exp=0.013 (1972Am03), 0.014 *4* (1968Pe13).
645.18 *14*	10.8 *7*	1073.05	$(2)^+$	427.91	2^+	M1+E2	0.031 *16*	α(K)=0.025 *14*; α(L)=0.0045 *19*; α(M)=0.0011 *4* α(N)=0.00027 *11*; α(O)=5.0×10^{-5} *21*; α(P)=3.5×10^{-6} *20* E_γ: other: 645.5 *7* (1968Pe13), 645.2 *3* (1972Am03). Mult.: dominant E2 from α(K)exp=0.015 in 1972Am03, but dominant M1 from α(K)exp=0.029 *9* in 1968Pe13.
978.7[‡] *3*	1.4[‡] *3*	2051.7	$(0^+$ to $4^+)$	1073.05	$(2)^+$			
1040.5 *3*	4.8 *4*	1468.44	$(3)^+$	427.91	2^+			E_γ: other: 1040.7 *10* (1968Pe13), 1040.3 *5* (1972Am03).
1073.0 *3*	4.8 *4*	1073.05	$(2)^+$	0.0	0^+			E_γ: other: 1073.4 *10* (1968Pe13), 1073.3 *5* (1972Am03).
1529.9[‡] *5*	2.0[‡] *3*	1957.8	$(0^+$ to $4^+)$	427.91	2^+			
1551.6[‡] *5*	4.2[‡] *4*	1979.5	$(0^+$ to $4^+)$	427.91	2^+			
1623.5[‡] *6*	0.64[‡] *23*	2051.7	$(0^+$ to $4^+)$	427.91	2^+			

[†] From 2003Su30. Corresponding values from 1972Am03 are in agreement but less precise. The γ-ray intensities are absolute intensities (per 100 decays of 33.0 min ^{194}Tl).

[‡] From 2003Su30 only.

[#] From ce data (1972Am03,1968Pe13) given under comments where available. Uncertainty of 30% in ce data from 1972Am03 is assumed by evaluators when deducing δ value.

[@] Absolute intensity per 100 decays.

[&] 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.

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Decay Scheme

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