

^{202}Tl IT decay (215 μs) [2020Wa24](#)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 196,342 (2024)	1-Sep-2023

Parent: ^{202}Tl : E=4148.8 keV ; $J^\pi=(20^+)$; $T_{1/2}=215 \mu\text{s}$ 10 ; %IT decay=100

[2020Wa24](#): $^{198}\text{Pt}(^7\text{Li},3n\gamma)$, E=31-36 MeV at the IUAC-Pelletron facility. Target: $\approx 92\%$ enriched in ^{198}Pt , $\approx 10 \text{ mg/cm}^2$ thick.

Measured: $E\gamma$, $I\gamma$, two- and higher-fold $\gamma\gamma$ -coin, $\gamma\gamma(\theta)(\text{DCO})$, $\gamma\gamma(\text{linear polarization})$ events using the INGA array comprising of 14 Compton-suppressed HPGe detectors. $^{197}\text{Au}(^{209}\text{Bi},X\gamma)$, E=1450 MeV at the ATLAS-ANL facility. Target: 50 mg/cm^2

^{197}Au . Measured: $E\gamma$, $I\gamma$, two- and higher-fold $\gamma\gamma(t)$ -coin using Gammasphere array comprising of 100 Compton-suppressed HPGe detectors. Pulsed beam (200 μs on/800 μs off) with the delayed data used in the analysis.

 ^{202}Tl Levels

E(level) [†]	J^π [‡]	$T_{1/2}$ [@]	Comments
0.0	2^- [#]	12.4706 d 55	
490.47 7	4^- [#]		
950.19 10	7^+ [#]	591 μs 3	%IT=100
1099.3 4	6^+		
1339.9 4	8^+		
1551.9 4	9^+		
1968.0 5	$10^{(+)}$		
2044.8 6	11^+		
2179.0 8	12^-		
2873.5 9	$13^{(-)}$		
3040.4 9	$14^{(-)}$		
3057.1 10	$15^{(-)}$		
3111.2 11	$(15^-, 16^-)$ [#]		
3233.2 10	(16^-) [#]		
3486.2 10	(16^-) [#]		
3862.7 10	(17^-)		
4148.5 12	(20^+)	215 μs 10	%IT=100 configuration: $\pi(h_{11/2}^{-1})\otimes\nu(f_{5/2}^{-1}, i_{13/2}^{-2})$. $T_{1/2}$: From $134\gamma(t)$ and $493\gamma(t)$ in 2020Wa24 .

[†] From least-square fit to $E\gamma$.

[‡] From [2020Wa24](#) based on γ -ray transition multipolarities determined in the present work, unless otherwise stated.

[#] From Adopted Levels.

[@] From Adopted Levels, unless otherwise stated.

γ(²⁰²Tl)

I_γ normalization: From Σ I(γ+ce)(to 7⁺ isomer)=100%. Other: 0.57 5 from I(γ+ce)(285.8γ)=100%.

E _γ [†]	I _γ ^{†&}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [‡]	δ	α [@]	Comments
(16.7)		3057.1	15 ⁽⁻⁾	3040.4	14 ⁽⁻⁾	[M1,E2]		1.7×10 ⁴ 16	α(L)=1.2×10 ⁴ 12; α(M)=3.2×10 ³ 32 α(N)=8×10 ² 8; α(O)=1.4×10 ² 13; α(P)=3.5 32 E _γ : From level-energy difference.
(54.1)		3111.2	(15 ⁻ ,16 ⁻)	3057.1	15 ⁽⁻⁾	[M1,E2]		6.×10 ¹ 5	α(L)=41 34; α(M)=11 9 α(N)=2.7 22; α(O)=0.5 4; α(P)=0.016 8 E _γ : From level-energy difference.
77.0 5		2044.8	11 ⁺	1968.0	10 ⁽⁺⁾	[M1,E2]		11 8	α(L)=8 6; α(M)=2.1 15 α(N)=0.5 4; α(O)=0.09 6; α(P)=0.0037 9
134.2 5	153 11	2179.0	12 ⁻	2044.8	11 ⁺	E1		0.2059 35	DCO=1.15 6 %I _γ =76 6 α(K)=0.1658 28; α(L)=0.0307 5; α(M)=0.00720 12 α(N)=0.001791 31; α(O)=0.000330 6; α(P)=2.38×10 ⁻⁵ 4 I _γ : From intensity balance. I _γ (134.2γ)=139 6 in 2020Wa24 .
149.2 5	5 1	1099.3	6 ⁺	950.19	7 ⁺	M1(+E2) [#]	≤0.3	2.68 8	α(K)=2.17 9; α(L)=0.394 13; α(M)=0.093 4 α(N)=0.0234 9; α(O)=0.00451 14; α(P)=0.000409 9 %I _γ =2.5 5
166.7 5	8 1	3040.4	14 ⁽⁻⁾	2873.5	13 ⁽⁻⁾	M1		2.006 33	α(K)=1.641 27; α(L)=0.280 5; α(M)=0.0654 11 α(N)=0.01651 27; α(O)=0.00321 5; α(P)=0.000303 5 %I _γ =4.0 5
175.6 5	34 4	3233.2	(16 ⁻)	3057.1	15 ⁽⁻⁾	M1		1.733 28	α(K)=1.418 23; α(L)=0.242 4; α(M)=0.0564 9 α(N)=0.01425 23; α(O)=0.00277 4; α(P)=0.000261 4 %I _γ =16.8 21
183.6 5	38 4	3057.1	15 ⁽⁻⁾	2873.5	13 ⁽⁻⁾	E2		0.552 9	α(K)=0.2064 32; α(L)=0.258 5; α(M)=0.0672 12 α(N)=0.01683 31; α(O)=0.00293 5; α(P)=0.0001167 20 %I _γ =18.8 21
211.6 5	50 3	1551.9	9 ⁺	1339.9	8 ⁺	M1		1.028 16	DCO=0.95 5 α(K)=0.841 13; α(L)=0.1429 22; α(M)=0.0334 5 α(N)=0.00843 13; α(O)=0.001637 25; α(P)=0.0001547 24 %I _γ =24.7 18
240.6 5	15 2	1339.9	8 ⁺	1099.3	6 ⁺	E2 [#]		0.2201 34	DCO=1.76 16 α(K)=0.1087 16; α(L)=0.0835 14; α(M)=0.02153 35 α(N)=0.00540 9; α(O)=0.000951 16; α(P)=4.35×10 ⁻⁵ 7 %I _γ =7.4 10
253.0 5	64 4	3486.2	(16 ⁻)	3233.2	(16 ⁻)	E2		0.1873 29	α(K)=0.0963 14; α(L)=0.0682 11; α(M)=0.01756 28 α(N)=0.00440 7; α(O)=0.000777 12; α(P)=3.66×10 ⁻⁵ 6 %I _γ =31.6 24
285.8 5	102 9	4148.5	(20 ⁺)	3862.7	(17 ⁻)	E3		0.727 12	α(K)=0.1946 28; α(L)=0.395 6; α(M)=0.1058 17

²⁰²Tl IT decay (215 μ s) **2020Wa24** (continued)

$\gamma(^{202}\text{Tl})$ (continued)									Comments
E_γ †	I_γ †&	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	δ	α @	
375.0 5	13 3	3486.2	(16 ⁻)	3111.2	(15 ⁻ , 16 ⁻)	M1		0.2142 31	$\alpha(\text{N})=0.0267$ 4; $\alpha(\text{O})=0.00468$ 8; $\alpha(\text{P})=0.0002131$ 34 %I γ =50 5 $\alpha(\text{K})=0.1757$ 25; $\alpha(\text{L})=0.0295$ 4; $\alpha(\text{M})=0.00688$ 10 $\alpha(\text{N})=0.001737$ 25; $\alpha(\text{O})=0.000337$ 5; $\alpha(\text{P})=3.19\times 10^{-5}$ 5 %I γ =6.4 15
376.5 5	97 7	3862.7	(17 ⁻)	3486.2	(16 ⁻)	M1		0.2119 31	$\alpha(\text{K})=0.1739$ 25; $\alpha(\text{L})=0.0292$ 4; $\alpha(\text{M})=0.00680$ 10 $\alpha(\text{N})=0.001718$ 25; $\alpha(\text{O})=0.000334$ 5; $\alpha(\text{P})=3.16\times 10^{-5}$ 5 %I γ =48 4
389.5 5	114 5	1339.9	8 ⁺	950.19	7 ⁺	M1(+E2) #	≤ 0.4	0.184 10	pol=-0.062 4 (2020Wa24) $\alpha(\text{K})=0.150$ 9; $\alpha(\text{L})=0.0257$ 10; $\alpha(\text{M})=0.00601$ 21 $\alpha(\text{N})=0.00152$ 5; $\alpha(\text{O})=0.000294$ 11; $\alpha(\text{P})=2.75\times 10^{-5}$ 14 %I γ =56.4 18
416.0 5	9 1	1968.0	10 ⁽⁺⁾	1551.9	9 ⁺	[M1]		0.1622 23	$\alpha(\text{K})=0.1331$ 19; $\alpha(\text{L})=0.02228$ 32; $\alpha(\text{M})=0.00519$ 7 $\alpha(\text{N})=0.001311$ 19; $\alpha(\text{O})=0.000255$ 4; $\alpha(\text{P})=2.413\times 10^{-5}$ 35 %I γ =4.5 5
429.0 5	12 3	3486.2	(16 ⁻)	3057.1	15 ⁽⁻⁾	[M1]		0.1494 21	$\alpha(\text{K})=0.1226$ 18; $\alpha(\text{L})=0.02051$ 29; $\alpha(\text{M})=0.00478$ 7 $\alpha(\text{N})=0.001207$ 17; $\alpha(\text{O})=0.0002345$ 34; $\alpha(\text{P})=2.222\times 10^{-5}$ 32 %I γ =5.9 15
459.72 # 7		950.19	7 ⁺	490.47	4 ⁻	E3 #		0.1212 17	$\alpha(\text{K})=0.0614$ 9; $\alpha(\text{L})=0.0447$ 6; $\alpha(\text{M})=0.01165$ 16 $\alpha(\text{N})=0.00294$ 4; $\alpha(\text{O})=0.000527$ 7; $\alpha(\text{P})=2.99\times 10^{-5}$ 4
490.47 # 7		490.47	4 ⁻	0.0	2 ⁻	E2 #		0.0295 4	$\alpha(\text{K})=0.02096$ 29; $\alpha(\text{L})=0.00643$ 9; $\alpha(\text{M})=0.001591$ 22 $\alpha(\text{N})=0.000400$ 6; $\alpha(\text{O})=7.33\times 10^{-5}$ 10; $\alpha(\text{P})=4.91\times 10^{-6}$ 7 DCO=1.66 6; pol=+0.045 6
492.7 5	134 6	2044.8	11 ⁺	1551.9	9 ⁺	E2		0.0291 4	$\alpha(\text{K})=0.02076$ 29; $\alpha(\text{L})=0.00634$ 9; $\alpha(\text{M})=0.001568$ 23 $\alpha(\text{N})=0.000394$ 6; $\alpha(\text{O})=7.23\times 10^{-5}$ 10; $\alpha(\text{P})=4.85\times 10^{-6}$ 7 %I γ =66 4
601.8 5	48 4	1551.9	9 ⁺	950.19	7 ⁺	E2 #		0.01826 26	DCO=1.87 13 $\alpha(\text{K})=0.01365$ 19; $\alpha(\text{L})=0.00350$ 5; $\alpha(\text{M})=0.000855$ 12 $\alpha(\text{N})=0.0002150$ 31; $\alpha(\text{O})=3.99\times 10^{-5}$ 6; $\alpha(\text{P})=2.92\times 10^{-6}$ 4 %I γ =23.7 17
628.4 5	49 4	1968.0	10 ⁽⁺⁾	1339.9	8 ⁺	(E2)		0.01658 23	DCO=1.65 10 $\alpha(\text{K})=0.01250$ 18; $\alpha(\text{L})=0.00310$ 4; $\alpha(\text{M})=0.000755$ 11 $\alpha(\text{N})=0.0001899$ 27; $\alpha(\text{O})=3.53\times 10^{-5}$ 5; $\alpha(\text{P})=2.63\times 10^{-6}$ 4 %I γ =24.2 22
629.0 5	17 3	3862.7	(17 ⁻)	3233.2	(16 ⁻)	[M1]		0.0545 8	$\alpha(\text{K})=0.0448$ 6; $\alpha(\text{L})=0.00741$ 10; $\alpha(\text{M})=0.001724$ 24 $\alpha(\text{N})=0.000435$ 6; $\alpha(\text{O})=8.46\times 10^{-5}$ 12; $\alpha(\text{P})=8.03\times 10^{-6}$ 11 %I γ =8.4 15
694.3 5	80 8	2873.5	13 ⁽⁻⁾	2179.0	12 ⁻	(M1)		0.0421 6	DCO=1.20 7 $\alpha(\text{K})=0.0347$ 5; $\alpha(\text{L})=0.00571$ 8; $\alpha(\text{M})=0.001329$ 19

202Tl IT decay (215 μs) 2020Wa24 (continued)

γ(202Tl) (continued)

E_γ [†]	I_γ ^{†&}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	α [@]	Comments
								$\alpha(\text{N})=0.000336$ 5; $\alpha(\text{O})=6.52\times 10^{-5}$ 9; $\alpha(\text{P})=6.20\times 10^{-6}$ 9 %I γ =40 4
806.2 5	54 7	3862.7	(17 ⁻)	3057.1	15 ⁽⁻⁾	[E2]	0.00976 14	$\alpha(\text{K})=0.00764$ 11; $\alpha(\text{L})=0.001615$ 23; $\alpha(\text{M})=0.000387$ 5 $\alpha(\text{N})=9.74\times 10^{-5}$ 14; $\alpha(\text{O})=1.835\times 10^{-5}$ 26; $\alpha(\text{P})=1.479\times 10^{-6}$ 21 %I γ =27 4
861.7 5	100 9	3040.4	14 ⁽⁻⁾	2179.0	12 ⁻	E2	0.00852 12	DCO=1.73 11 $\alpha(\text{K})=0.00672$ 9; $\alpha(\text{L})=0.001372$ 19; $\alpha(\text{M})=0.000328$ 5 $\alpha(\text{N})=8.24\times 10^{-5}$ 12; $\alpha(\text{O})=1.559\times 10^{-5}$ 22; $\alpha(\text{P})=1.279\times 10^{-6}$ 18 %I γ =49 5

[†] From 2020Wa24, unless otherwise stated. Values determined from the ATLAS-ANL data collected in the 800 μs beam-off period.
[‡] From intensity-balance considerations, DCO ratios and POL (2020Wa24), unless otherwise stated. Expected values for the DCO ratios are ≈1.0 for stretched dipole and ≈2.0 for stretched quadrupole transitions, when gated on stretched dipole transitions.
[#] From adopted gammas.
[@] Additional information 1.
[&] For absolute intensity per 100 decays, multiply by 0.495 20.

^{202}Tl IT decay (215 μs) 2020Wa24**Decay Scheme**

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

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)

