^{197}Au(α,4nγ) 1978Li10

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Huang Xiaolong, Zhou Chunmei	NDS 104, 283 (2005)	1-Jan-2002

Other: 1974Ne16: (α,4nγ) E=42-59 MeV, ^{190}Os(^{11}B,4nγ) E=57 MeV. 1985Ca22 (E=10-55 MeV), 1984ShZP (E=20-120 MeV), 1984Bl06 (E=threshold−80 MeV), and 1982Si11 (E not given) deduce reaction mechanism.
1998CH02:E=34-50 MeV,measured residuals production sigma, deduced excitation functions.
1998IS08: E=15-52 MeV,measured production sigma, deduced excitation functions, isomer production ratios.
1978Li10: E=50,51 MeV; measured γ singles, $\gamma\gamma$ coin, $\gamma(\theta)$, γ(t) pulsed beam.

^{197}Tl Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$[@]	Comments
0.0	1/2+[#]	2.84[#] h *4*	
385.60 *20*	3/2+[#]		
608.1[&] *3*	9/2−[#]	0.54[#] s *1*	
995.7[&] *4*	11/2−		
1303.5[&] *4*	13/2−		Band assignment based on B(E2)(695γ)/B(E2)(308γ)=0.86 *20* exp, 1.1 theory (triaxial rotor). Branching: Iγ(695γ)/Iγ(308γ)=1.4 *3* (1978Li10), 1.1 *2* (1974Ne16); (^{3}He,3nγ) and ^{197}Pb decay results differ from (α,4nγ).
1553.3 *4*	13/2−		
1719.6[&] *4*	15/2−		Branching: Iγ(416γ)/Iγ(724γ)=1.0 *2* (1978Li10), 1.15 *17* (1974Ne16).
2018.5[&] *4*	17/2−		Band assignment based on B(E2)(715γ)/B(E2)(299γ)=2.1 *3* exp, 1.4 theory (triaxial rotor). Branching: Iγ(299γ)/Iγ(715γ)=0.30 *6* (1978Li10), 0.5 *2* (1974Ne16).
2040.8 *4*	17/2−		Branching: Iγ(321γ)/Iγ(737γ)=0.5 *1* (1978Li10).
2114.1[a] *4*	15/2+		Branching: Iγ(811γ)/Iγ(561γ)=0.19 *4* (1978Li10).
2266.3[a] *4*	17/2+		
2426.1[&] *4*	19/2−		
2462.2[a] *5*	19/2+		
2529.4 *5*		18 ns *4*	$T_{1/2}$: from 263γ(t) pulsed beam (1978Li10).
2597.1[&] *4*	21/2−		
2801.4[a] *5*	21/2+		
2860.8[&] *5*	23/2−		
3067.3[&] *5*	25/2−		
3147.2[a] *5*	23/2+		
3169.9[&] *5*	27/2(−)		E(level): 3174.7 if 102.6γ-107.2γ cascade is reversed.
3277.1[&] *6*	29/2(−)		
3568.4[a] *6*	25/2+		
3689.6 *6*			
3760.9[a] *6*	27/2+		
3965.5[a] *6*	29/2(+)		

† From level scheme and γ's by using least-squares fit to data.
‡ From $\gamma(\theta)$ and band configurations, except J^{π} for E(level)≤608.1.
# From Adopted Levels.
@ ≤3 ns for π=± band members (J>9/2).
& Band(A): Regular dipole band 1. ΔJ=1 sequence built up to J=29/2−. intraband B(E2)(crossover)/B(E2)(cascade) ratios (exp vs theory) compared, as for ^{195}Tl.
a Band(B): regular dipole band 2. 15/2+ three-particle Configuration=(π $h_{9/2}$)(ν $i_{13/2}$)(ν low-J). ΔJ=1 sequence populated up to J=29/2+.

^{197}Au(α,4nγ) 1978Li10 (continued)

γ(^{197}Tl)

$\gamma(\theta)$ spectra measured either at 4 angles (θ=90°−150°) or at 6 angles (θ=90°−165°).
Studied ce spectrum at E=51 MeV spectrum; α(K)exp, α(L)exp determined for prominent γ rays.

E_γ	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[@]	α[a]	Comments
102.6 *2*	0.6 *2*	3169.9	27/2$^{(-)}$	3067.3	25/2$^-$	(M1+E2)		6.9[&] *15*	α(K)= 4 *4*; α(L)= 2.4 *13*; α(M)= 0.6 *4*; α(N+..)= 0.20 *11* Additional information 4. $\gamma(\theta)$: A$_2$=−0.24 *3*.
107.2 *2*	0.6 *2*	3277.1	29/2$^{(-)}$	3169.9	27/2$^{(-)}$	(M1+E2)		5.9[&] *15*	α(K)= 3 *3*; α(L)= 2.0 *10*; α(M)= 0.5 *3*; α(N+..)= 0.16 *9* Additional information 5. $\gamma(\theta)$: A$_2$=−0.29 *4*.
152.2 *2*	4.7 *10*	2266.3	17/2$^+$	2114.1	15/2$^+$	M1+E2	≈−0.10	≈2.69	α(K)= 2.190; α(L)= 0.379; α(M)= 0.0887; α(N+..)= 0.0289 $\gamma(\theta)$: A$_2$=−0.27 *4*.
171.0 *2*	5.1 *5*	2597.1	21/2$^-$	2426.1	19/2$^-$	M1(+E2)		1.3[&] *6*	α(K)= 0.9 *7*; α(L)= 0.31 *5*; α(M)= 0.078 *15*; α(N+..)= 0.025 *5* Additional information 1. $\gamma(\theta)$: A$_2$=−0.33 *2*.
192.6 *2*	1.4 *3*	3760.9	27/2$^+$	3568.4	25/2$^+$	(M1+E2)		0.9[&] *5*	α(K)= 0.7 *5*; α(L)= 0.203 *10*; α(M)= 0.050 *5*; α(N+..)= 0.0162 *16* Additional information 7. $\gamma(\theta)$: A$_2$=−0.36 *11*.
195.9 *2*	4.2 *7*	2462.2	19/2$^+$	2266.3	17/2$^+$	M1+E2	≈−0.10	≈1.314	α(K)= 1.073; α(L)= 0.1844; α(M)= 0.0432; α(N+..)=0.01392 $\gamma(\theta)$: A$_2$=−0.31 *3*.
204.6 *2*	1.2 *2*	3965.5	29/2$^{(+)}$	3760.9	27/2$^+$	(M1+E2)		0.8[&] *4*	α(K)= 0.6 *4*; α(L)= 0.1641 *10*; α(M)= 0.0404 *23*; α(N+..)= 0.0130 *8* Additional information 8. $\gamma(\theta)$: A$_2$=−0.33 *6*.
206.5 *2*	2.1 *3*	3067.3	25/2$^-$	2860.8	23/2$^-$	M1+E2		0.8[&] *4*	α(K)= 0.5 *4*; α(L)=0.15883 *7*; α(M)= 0.0391 *20*; α(N+..)= 0.0126 *6* Additional information 3. $\gamma(\theta)$: A$_2$=−0.28 *3*.
222.5 *2*	30 *3*	608.1	9/2$^-$	385.60	3/2$^+$	E3		2.281	α(K)= 0.358; α(L)= 1.415; α(M)= 0.383; α(N+..)= 0.1249 $\gamma(\theta)$: A$_2$=+0.00 *2*.
263.1 *2*	1.4 *8*	2529.4		2266.3	17/2$^+$				γ-placement from γ(561γ)-coin, in-beam and off-beam.
263.7 *2*	4.8 *8*	2860.8	23/2$^-$	2597.1	21/2$^-$	(M1+E2)		0.37[&] *21*	α(K)= 0.28 *20*; α(L)= 0.070 *11*; α(M)= 0.0169 *19*; α(N+..)=

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^{197}Au(α,4nγ) 1978Li10 (continued)

γ(^{197}Tl) (continued)

E_γ	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[@]	α[a]	Comments
									0.0054 *6* Additional information 2. Doublet $\gamma(\theta)$: A_2=−0.36 *2*.
298.9 *2*	2.1 *3*	2018.5	17/2⁻	1719.6	15/2⁻	M1+E2	≈−0.14	≈0.406	α(K)= 0.332; α(L)= 0.0567; α(M)=0.01322; α(N+..)=0.00423 $\gamma(\theta)$: A_2=−0.52 *4*.
307.9 *2*	12.2 *14*	1303.5	13/2⁻	995.7	11/2⁻	M1+E2	−0.17 *3*	0.372 *3*	α(K)= 0.304 *3*; α(L)=0.05207 *22*; α(M)=0.01214 *5*; α(N+..)=0.00388 $\gamma(\theta)$: A_2=−0.32 *2*.
321.0 *2*	3.6 *7*	2040.8	17/2⁻	1719.6	15/2⁻	M1+E2	≈−0.09	≈0.337	α(K)= 0.276; α(L)= 0.0468; α(M)=0.01090; α(N+..)=0.00349 $\gamma(\theta)$: A_2=−0.38 *4*.
339.1 *2*	2.5 *4*	2801.4	21/2⁺	2462.2	19/2⁺	M1+E2	≈−0.14	≈0.288	α(K)= 0.2356; α(L)= 0.0401; α(M)=0.00934; α(N+..)=0.00299 $\gamma(\theta)$: A_2=−0.48 *3*.
345.8 *2*	1.4 *3*	3147.2	23/2⁺	2801.4	21/2⁺	M1+E2	−0.20 *5*	0.269 *5*	α(K)= 0.220 *4*; α(L)= 0.0377 *4*; α(M)=0.00878 *8*; α(N+..)=0.00281 $\gamma(\theta)$: A_2=−0.56 *4*.
347.9[b] *2*	0.5 *1*	2462.2	19/2⁺	2114.1	15/2⁺	(E2)		0.0731	α(K)= 0.0456; α(L)=0.02060; α(M)=0.00521; α(N+..)=0.00168 $\gamma(\theta)$: A_2=+0.30 *8*.
385.2 *2*	2.6 *10*	2426.1	19/2⁻	2040.8	17/2⁻				Doublet $\gamma(\theta)$: A_2=+0.01 *2*.
385.6 *2*	83 *7*	385.60	3/2⁺	0.0	1/2⁺	M1+E2	+1.7 *3*	0.094 *13*	α(K)= 0.070 *11*; α(L)= 0.0180 *12*; α(M)=0.00438 *25*; α(N+..)=0.00141 *8* γ-ray properties studied via 0.54-s ^{197}Tl IT decay.
387.6 *2*	51 *5*	995.7	11/2⁻	608.1	9/2⁻	M1+E2	−0.50 *16*	0.174 *16*	α(K)= 0.141 *14*; α(L)= 0.0253 *15*; α(M)= 0.0059 *4*; α(N+..)=0.00191 *10* $\gamma(\theta)$: A_2=−0.59 *2*.
407.8 *2*	3.6 *5*	2426.1	19/2⁻	2018.5	17/2⁻	M1+E2	−0.28 *6*	0.168 *4*	α(K)= 0.138 *4*; α(L)= 0.0236 *4*; α(M)=0.00551 *9*; α(N+..)=0.00177 *3* $\gamma(\theta)$: A_2=−0.56 *3*.
412.5 *2*	2.1 *7*	3689.6		3277.1	29/2$^{(-)}$				
416.1 *2*	9.2 *10*	1719.6	15/2⁻	1303.5	13/2⁻	M1+E2	−0.23 *3*	0.1624 *17*	α(K)= 0.1328 *15*; α(L)=0.02263 *16*; α(M)=0.00527 *4*; α(N+..)=0.00169 $\gamma(\theta)$: A_2=−0.49 *3*.
421.3 *2*	1.3 *5*	3568.4	25/2⁺	3147.2	23/2⁺	M1(+E2)		0.10[&] *6*	α(K)= 0.08 *6*; α(L)= 0.017 *6*; α(M)= 0.0039 *13*; α(N+..)= 0.0013 *5* Additional information 6. $\gamma(\theta)$: A_2=−0.26 *6*.
470.3[b] *2*	0.5 *2*	3067.3	25/2⁻	2597.1	21/2⁻	(E2)		0.0330	α(K)=0.02310; α(L)=0.00743; α(M)=0.00184;

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^{197}Au(α,4nγ) 1978Li10 (continued)

γ(^{197}Tl) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[@]	α[a]	Comments
									α(N+..)=0.00059 γ(θ): A_2=+0.18 *13*.
534.7[b] *5*	0.7 *3*	2801.4	21/2$^+$	2266.3	17/2$^+$	E2		0.02419	α(K)=0.01755; α(L)=0.00500 γ(θ): A_2=+0.51 *17*.
556.7 *4*	1.9 *10*	2597.1	21/2$^-$	2040.8	17/2$^-$	[E2][#]		0.02202	α(K)=0.01613; α(L)=0.00443
557.6 *2*	27.4 *30*	1553.3	13/2$^-$	995.7	11/2$^-$	M1+E2	−0.8 *2*	0.056 *7*	α(K)= 0.045 *6*; α(L)= 0.0082 *8* γ(θ): A_2=−0.79 *3*; corrected for 556.7γ(E2) contribution.
560.9 *2*	25.8 *26*	2114.1	15/2$^+$	1553.3	13/2$^-$	E1		0.00732	α(K)=0.00605; α(L)=0.00095 Mult.: from ce(K)/Iγ ratios (561γ vs 557.6γ). γ(θ): A_2=−0.20 *2*.
578.5 *2*	3.3 *9*	2597.1	21/2$^-$	2018.5	17/2$^-$	E2		0.02016	α(K)=0.01489; α(L)=0.00396 γ(θ): A_2=+0.39 *6*.
613.5 *2*	0.7 *4*	3760.9	27/2$^+$	3147.2	23/2$^+$				
685.3 *5*	0.7 *3*	3147.2	23/2$^+$	2462.2	19/2$^+$	E2		0.01387	α(K)=0.01057; α(L)=0.00248 γ(θ): A_2=+0.41 *17*.
695.4 *2*	17.3 *26*	1303.5	13/2$^-$	608.1	9/2$^-$	E2		0.01344	α(K)=0.01026; α(L)=0.00239 γ(θ): A_2=+0.27 *2*.
706.6 *2*	8.5 *11*	2426.1	19/2$^-$	1719.6	15/2$^-$	E2		0.01299	α(K)=0.00995; α(L)=0.00229 γ(θ): A_2=+0.26 *2*.
714.9 *2*	7.0 *10*	2018.5	17/2$^-$	1303.5	13/2$^-$	E2		0.01267	α(K)=0.00972; α(L)=0.00222 γ(θ): A_2=+0.35 *3*.
723.9 *2*	9.3 *14*	1719.6	15/2$^-$	995.7	11/2$^-$	E2		0.01234	α(K)=0.00948; α(L)=0.00215 γ(θ): A_2=+0.30 *2*.
737.3 *2*	5.4 *8*	2040.8	17/2$^-$	1303.5	13/2$^-$	E2		0.01187	α(K)=0.00915; α(L)=0.00205 γ(θ): A_2=+0.34 *3*.
767.0 *2*	2.1 *4*	3568.4	25/2$^+$	2801.4	21/2$^+$	E2		0.01093	α(K)=0.00847; α(L)=0.00185 γ(θ): A_2=+0.26 *5*.
810.6 *2*	4.8 *9*	2114.1	15/2$^+$	1303.5	13/2$^-$	E1		0.00355	α(K)=0.00295; α(L)=0.00045 γ(θ): A_2=−0.14 *3*.

[†] Relative photon intensity normalized to Iγ(385.6γ)=83 7. Values are from γ singles and γγ at Eα=50 MeV.

[‡] Deduced from angular distribution coef. Assigned E2 if A_2=0.3 to 0.5; M1+E2 if A_2=−0.24 to −0.6, supported by α(K)exp and quadrupole admixture.

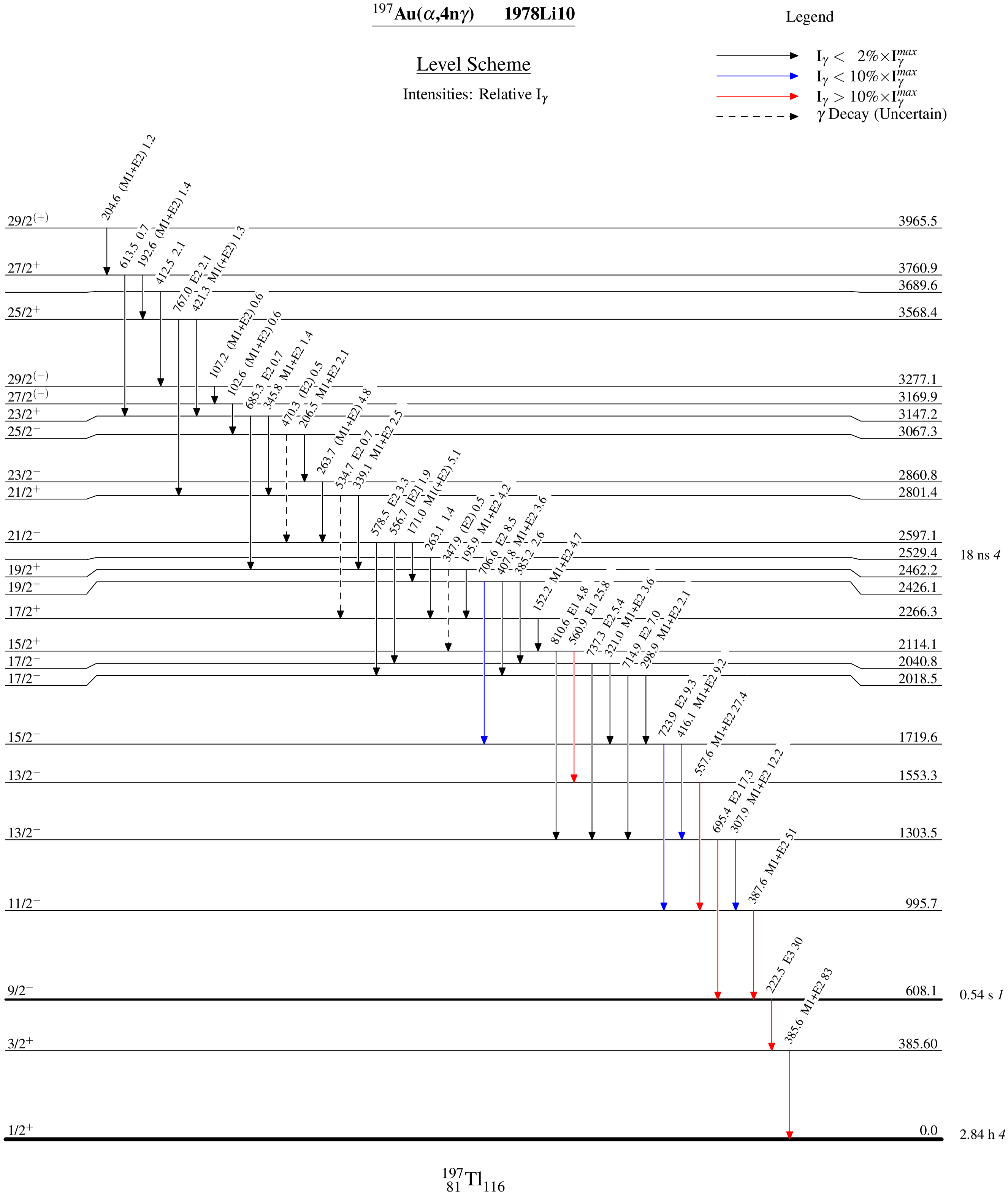
[#] From ΔJ and Δπ between transition levels.

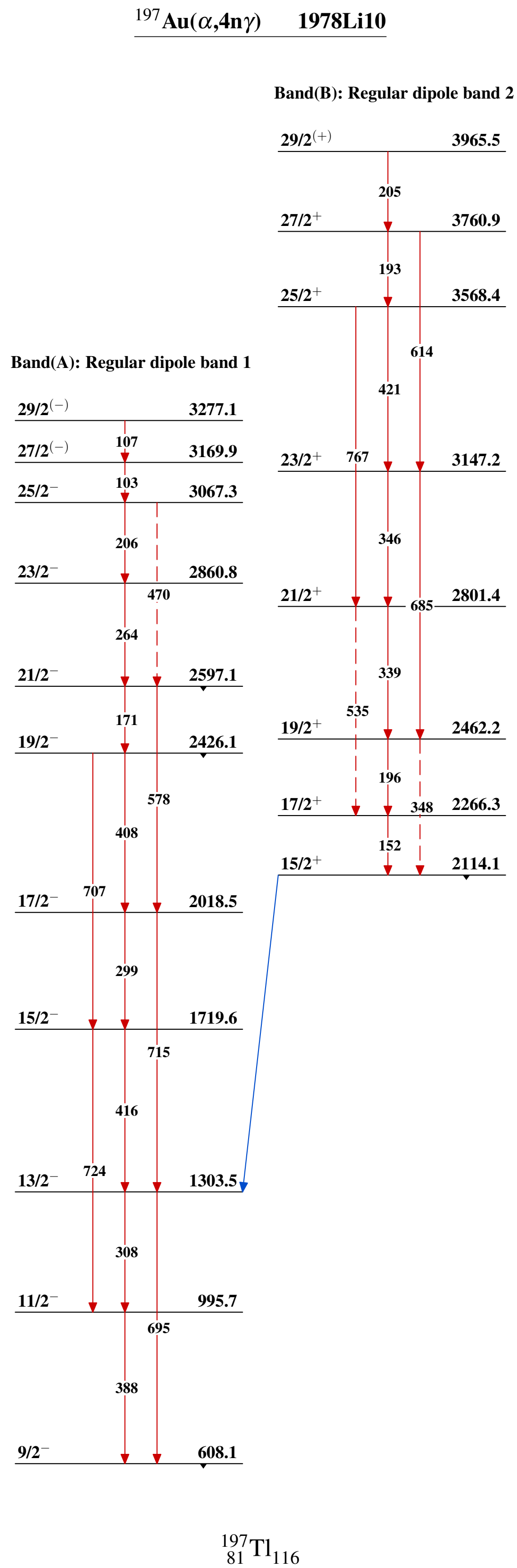
[@] M1+E2 mixing deduced from A_2 coef, except for 385.6γ (from adopted γ radiations).

[&] From α=[α(M1)+α(E2)]/2 and Δα=[α(M1)-α(E2)]/2.

[a] 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.

[b] Placement of transition in the level scheme is uncertain.


^{197}Au(α,4nγ) 1978Li10
Level Scheme
Intensities: Relative I_γ
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
29/2(+) 3965.5
27/2+ 3760.9
3689.6
25/2+ 3568.4
29/2(−) 3277.1
27/2(−) 3169.9
23/2+ 3147.2
25/2− 3067.3
23/2− 2860.8
21/2+ 2801.4
21/2− 2597.1
2529.4 18 ns 4
19/2+ 2462.2
19/2− 2426.1
17/2+ 2266.3
15/2+ 2114.1
17/2− 2040.8
17/2− 2018.5
15/2− 1719.6
13/2− 1553.3
13/2− 1303.5
11/2− 995.7
9/2− 608.1 0.54 s 1
3/2+ 385.60
1/2+ 0.0 2.84 h 4
204.6 (M1+E2) 1.2
613.5 0.7
192.6 (M1+E2) 1.4
412.5 2.1
767.0 E2 2.1
421.3 M1(+E2) 1.3
107.2 (M1+E2) 0.6
102.6 (M1+E2) 0.6
685.3 E2 0.7
345.8 M1+E2 1.4
470.3 (E2) 0.5
206.5 M1+E2 2.1
263.7 (M1+E2) 4.8
534.7 E2 0.7
339.1 M1+E2 2.5
578.5 E2 3.3
556.7 [E2] 1.9
171.0 M1(+E2) 5.1
263.1 1.4
347.9 (E2) 0.5
195.9 M1+E2 4.2
706.6 E2 8.5
407.8 M1+E2 3.6
385.2 2.6
152.2 M1+E2 4.7
810.6 E1 4.8
560.9 E1 25.8
737.3 E2 5.4
321.0 M1+E2 3.6
714.9 E2 7.0
298.9 M1+E2 2.1
723.9 E2 9.3
416.1 M1+E2 9.2
557.6 M1+E2 27.4
695.4 E2 17.3
307.9 M1+E2 12.2
387.6 M1+E2 51
222.5 E3 30
385.6 M1+E2 83
$^{197}_{81}Tl_{116}$


^{197}Au(α,4nγ) 1978Li10
Band(B): Regular dipole band 2
29/2(+) 3965.5
205
27/2+ 3760.9
193
25/2+ 3568.4
614
421
Band(A): Regular dipole band 1
29/2(−) 3277.1
107
27/2(−) 3169.9
103
25/2− 3067.3
23/2+ 767 3147.2
206
346
23/2− 2860.8
470
21/2+ 685 2801.4
264
21/2− 2597.1
339
171
535
19/2− 2426.1
19/2+ 2462.2
196
578
17/2+ 348 2266.3
408
152
15/2+ 2114.1
707
17/2− 2018.5
299
15/2− 1719.6
715
416
724
13/2− 1303.5
308
11/2− 995.7
695
388
9/2− 608.1
$^{197}_{81}Tl_{116}$