^{185}Re(^{13}C,4nγ),^{187}Re(^{13}C,6nγ) 2012Pa16

History

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

2012Pa16: two reactions ^{185}Re(^{13}C,4nγ) and ^{187}Re(^{13}C,6nγ) studied at the 14-UD BARC-TIFR Pelletron at Mumbai, India. ^{13}C beam at E=75 MeV. Target was 18.5 mg/cm^2 natural Re. γ rays were detected by the INGA array consisting of 15 clover HPGe detectors with BGO anti-Compton shields. Measured Eγ, Iγ, $\gamma\gamma$-coin, DCO, $\gamma\gamma$(lin pol). Deduced high-spin states, J, π, configurations, bands, multipolarity. Comparison with total Routhian surfaces (TRS) calculations using the Cranked shell model. Discussed magnetic rotational bands and band crossing. Comparison with neighboring odd-odd Tl isotopes.

Level scheme and the placements of transitions in 2012Pa16 are different from those in the Adopted Levels, Gammas, which are adopted from 2014Ma55 in (^{18}O,5nγ) by the evaluators because of higher statistics and completeness.

^{194}Tl Levels

E(level)[†]	J$^\pi$[#]	Comments
260 *14*	7$^+$	E(level): from mass measurement in 2013St25 (also 2014Bo26). The level energy kept fixed, without its uncertainty, in the least-squares adjustment procedure.
553.1[@] *1*	8$^-$	
594.0 *3*	9$^-$	
690.0[@] *2*	10$^-$	
968.3[&] *3*	11$^-$	
1213.1[@] *3*	12$^-$	
1616.6[&] *3*	13$^-$	
1899.8[@] *3*	14$^-$	
2368.2[&] *3*	15$^-$	
2659.6[@] *3*	16$^-$	
2776.2[b] *3*	16$^-$	
2938.7[‡b] *3*	17$^-$	E(level): corresponds to 2859, (17$^-$) level in Adopted Levels.
3137.5[&] *3*	17$^-$	
3145.8[‡b] *3*	18$^-$	
3385.8[@] *4*	18$^-$	
3420.7[a] *4*	18$^{(-)}$	
3473.5[‡b] *4*	19$^-$	
3742.9[‡a] *4*	19$^{(-)}$	
3850.4[‡b] *4*	20$^-$	
3958.4[‡a] *4*	20$^{(-)}$	
4279.0[‡b] *5*	21$^-$	
4339.7[‡a] *5*	(21$^-$)	

[†] From least-squares fit to Eγ data, by keeping the energy of the 260-keV level fixed, without its uncertainty of 14 keV. Quoted uncertainties are relative. Absolute uncertainty for each energy level is 14 keV, the same as for the 260-keV level.

[‡] Level energy is different in the Adopted dataset, due to the reordering of the γ cascades for bands B2 and B3 in 2012Pa16. The ordering of the two cascades is adopted from (^{18}O,5nγ) work of 2014Ma55 in the Adopted Levels, Gammas dataset.

[#] As assigned by 2012Pa16 based on multipolarity and ΔJ assignments from their DCO and linear polarization data. All assignments are the same in the Adopted Levels, except that these are in parentheses as the J^π assignment for the lowest state at 0+x is still not firmly assigned.

[@] Band(A): $\pi h_{9/2}\otimes\nu i_{13/2},\alpha$=0.

[&] Band(a): $\pi h_{9/2}\otimes\nu i_{13/2},\alpha$=1.

[a] Band(B): Possible 4-qp band based on 18$^{(-)}$. Tentative configuration from systematics= $\pi h_{9/2}\otimes\nu i_{13/2}\otimes\pi i^2_{13/2}$. The γ cascade

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^{185}Re(^{13}C,4nγ),^{187}Re(^{13}C,6nγ) 2012Pa16 (continued)

^{194}Tl Levels (continued)

429-377-328-207-163 in 2012Pa16 is ordered as 454-396-430-328-377-207-279-162-79 in 2014Ma55, which is also given in the Adopted dataset. The Adopted Levels corresponding to this band are 2780, 2859, 3022, 3301, 3508, 3884, 4212, 4642.

[b] Band(C): Possible magnetic rotational (shears) band. Configuration=$\pi h^2_{9/2}s^{-1}_{1/2}\otimes\nu i^{-2}_{13/2}p_{3/2}$. The γ cascade 381-216-322 in 2012Pa16 is ordered as 362-381-240-322-137-216 in 2014Ma55, which is also given in the Adopted dataset. The Adopted Levels corresponding to this band are 3641, 3778, 4100, 4341, 4721.

γ(^{194}Tl)

DCO values are for gates on ΔJ=2, quadrupole transitions unless otherwise specified. Expected DCO values are: 1.65 for ΔJ=1, dipole when gated by ΔJ=2, quadrupole; 0.61 for ΔJ=2, quadrupole when gated on ΔJ=1, dipole.

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	α[@]	Comments
(41 *1*)		594.0	9^-	553.1	8^-			E_γ: 45.4 *3* in the Adopted dataset.
96.1 *1*	5.95 *9*	690.0	10^-	594.0	9^-	(M1+E2)	8.3 *14*	DCO=1.59 *17* Mult.: M1+E2 in 2012Pa16.
136.9 *2*	2.73 *6*	690.0	10^-	553.1	8^-	(E2)	1.647	DCO=0.96 *14* This γ is placed from the 3378 level in Adopted Levels, Gammas, placed by 2014Ma55 in (^{18}O,5nγ). Mult.: ΔJ=2, Q from DCO data, no evidence from $\gamma\gamma$-coin that this level is long-lived. E2 given in 2012Pa16.
162.5[†] *1*	2.24 *4*	2938.7	17^-	2776.2	16^-	(M1)	2.16	DCO=1.67 *20* Mult.: M1 in 2012Pa16.
207.1[†] *1*	2.16 *4*	3145.8	18^-	2938.7	17^-	(M1)	1.09	DCO=1.72 *18* Mult.: M1 in 2012Pa16.
215.5[†] *2*	1.40 *2*	3958.4	$20^{(-)}$	3742.9	$19^{(-)}$	(M1+E2)	0.65 *33*	DCO=1.51 *14* Mult.: M1+E2 in 2012Pa16.
244.9 *1*	14.9 *4*	1213.1	12^-	968.3	11^-	M1(+E2)	0.45 *24*	DCO=1.61 *5*; pol=−0.10 *2*
248.6 *3*	0.94 *2*	3385.8	18^-	3137.5	17^-	M1+E2	0.43 *23*	DCO=1.64 *19*; pol=−0.13 *10*
278.4 *1*	41.9 *6*	968.3	11^-	690.0	10^-	M1(+E2)	0.31 *18*	DCO=1.62 *3*; pol=−0.14 *1*
283.2 *1*	10.00 *15*	1899.8	14^-	1616.6	13^-	M1(+E2)	0.30 *17*	DCO=1.85 *14*; pol=−0.24 *4*
291.9 *2*	3.06 *7*	2659.6	16^-	2368.2	15^-	(M1+E2)	0.27 *16*	DCO=1.46 *10* Mult.: M1+E2 in 2012Pa16.
293.1 *1*	100.0 *4*	553.1	8^-	260	7^+	E1	0.0302	DCO=1.69 *3*; pol=+0.07 *2*
322.2[†] *1*	2.04 *6*	3742.9	$19^{(-)}$	3420.7	$18^{(-)}$	(M1+E2)[#]	0.21 *12*	DCO=1.13 *9* Mult.: M1+E2 in 2012Pa16.
327.7[†] *2*	3.37 *5*	3473.5	19^-	3145.8	18^-	M1	0.308	DCO=1.71 *23*; pol=−0.25 *6*
373.8 *2*	1.17 *4*	968.3	11^-	594.0	9^-	(E2)	0.059	DCO=0.95 *14* Mult.: E2 in 2012Pa16. E_γ: in least-squares adjustment, uncertainty was increased to 0.3 keV to get χ^2 below the critical value. Mult.: ΔJ=2, Q from DCO, low-energy transition unlikely to be M2.
376.9[†] *1*	1.91 *5*	3850.4	20^-	3473.5	19^-	M1	0.211	DCO=1.67 *21*; pol=−0.22 *8*
381.3[†] *2*	0.40 *4*	4339.7	(21^-)	3958.4	$20^{(-)}$			
403.5 *1*	12.67 *19*	1616.6	13^-	1213.1	12^-	M1+E2[#]	0.112 *64*	DCO=1.85 *5*; pol=−0.05 *2*
428.6[†] *2*	1.03 *2*	4279.0	21^-	3850.4	20^-	(M1)	0.1498	DCO=1.7 *4* Mult.: M1 in 2012Pa16.
468.4 *1*	4.13 *7*	2368.2	15^-	1899.8	14^-	M1+E2	0.076 *43*	DCO=1.50 *7*; pol=−0.20 *8*
478.3 *2*	1.70 *3*	3137.5	17^-	2659.6	16^-	M1+E2	0.072 *41*	DCO=1.73 *24*; pol=−0.13 *10*

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^{185}Re(^{13}C,4nγ),^{187}Re(^{13}C,6nγ) 2012Pa16 (continued)

γ(^{194}Tl) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[@]	Comments
523.1 *1*	11.87 *18*	1213.1	12^-	690.0	10^-	E2[#]	0.0252	DCO=0.68 *2*; pol=+0.08 *3*
648.3 *1*	5.42 *8*	1616.6	13^-	968.3	11^-	E2[#]		DCO=0.65 *4*; pol=+0.39 *5*
686.7 *1*	13.62 *20*	1899.8	14^-	1213.1	12^-	E2[#]		DCO=0.58 *2*; pol=+0.08 *4*
725.8 *3*	2.27 *6*	3385.8	18^-	2659.6	16^-	Q[#]		DCO=0.57 *6* Mult.: E2 in 2012Pa16.
751.8 *2*	3.80 *6*	2368.2	15^-	1616.6	13^-	E2[#]		DCO=0.54 *4*; pol=+0.27 *8*
759.5 *2*	10.84 *24*	2659.6	16^-	1899.8	14^-	E2		DCO=1.03 *14*; pol=+0.30 *10*
761.1 *2*	10.2 *4*	3420.7	$18^{(-)}$	2659.6	16^-	Q		DCO=0.58 *9* Mult.: E2 in 2012Pa16. DCO for gate on 468, ΔJ=1, D+Q transition.
769.1 *2*	3.87 *6*	3137.5	17^-	2368.2	15^-	E2[#]		DCO=0.68 *3*; pol=+0.07 *4*
876.4 *1*	6.90 *11*	2776.2	16^-	1899.8	14^-	E2[#]		DCO=0.67 *4*; pol=+0.11 *3*

[†] The transition placed from a different level in the Adopted dataset, due to reordering of the γ cascades for bands B2 and B3 in 2012Pa16. The ordering is adopted from (^{18}O,5nγ) work of 2014Ma55.

[‡] From 2012Pa16 based on their DCO and polarization data, unless otherwise stated. When only the DCO data are available, evaluators assign (M1) or (M1+E2) for ΔJ=1 transitions, and Q for ΔJ=2 transitions, unless otherwise noted.

[#] DCO value for gate on 293, ΔJ=1, E1 transition.

[@] 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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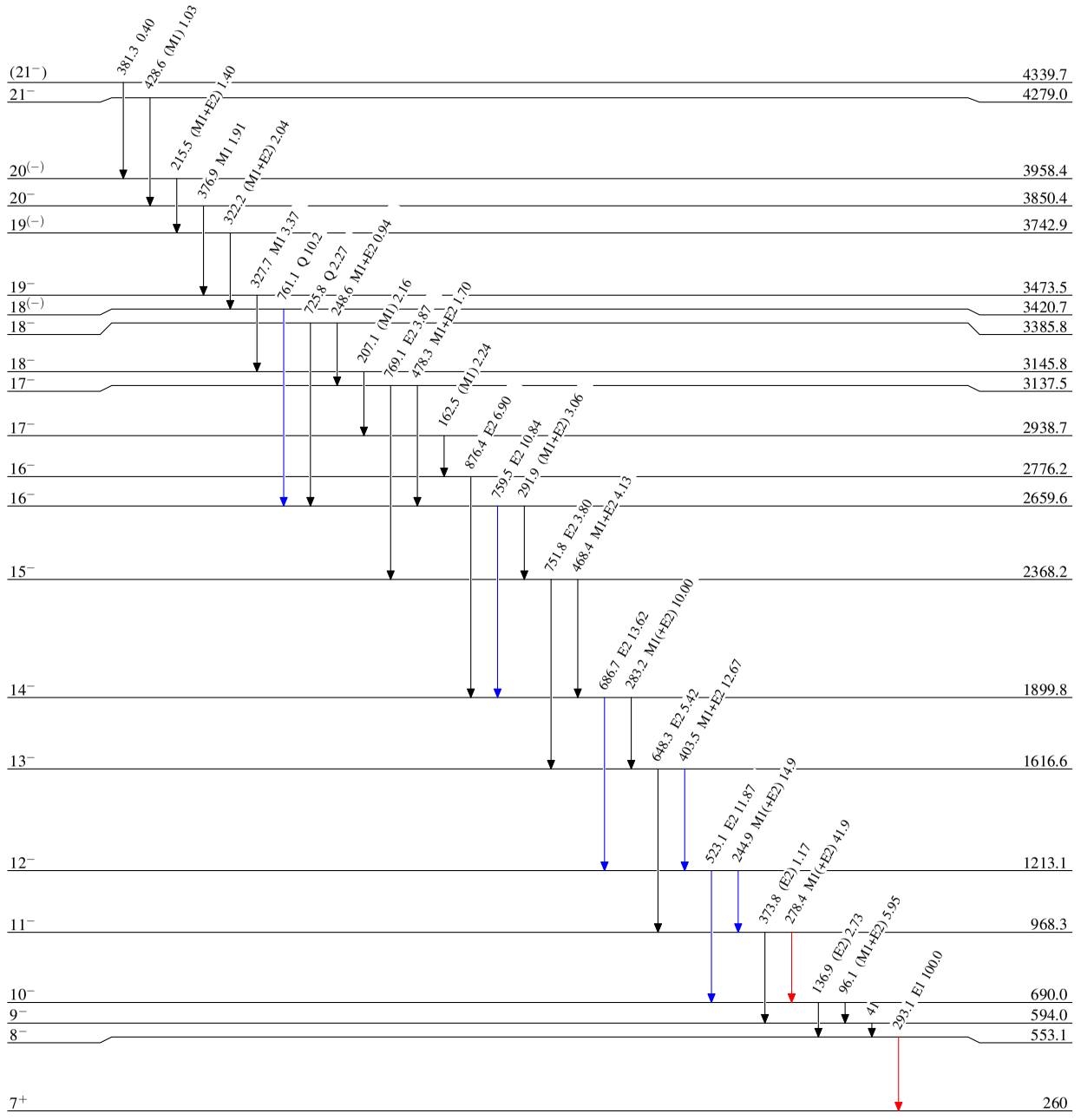
Level Scheme

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)



$^{194}_{81}Tl_{113}$

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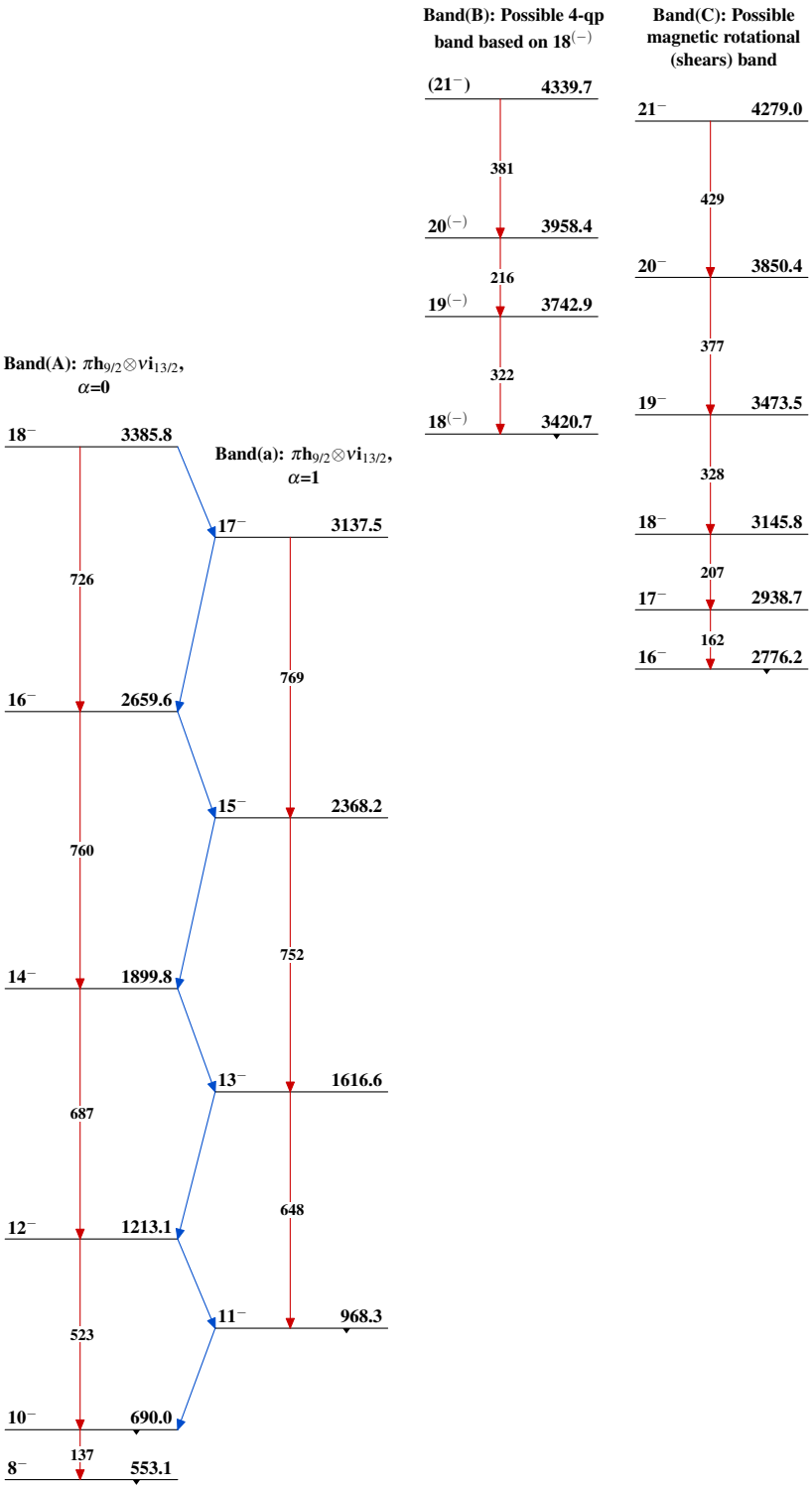

$^{194}_{81}Tl_{113}$