^{169}Tm(^{32}S,^{32}S′γ) 2019As06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 209,1 (2026)	1-Oct-2025

Edited/Adapted the XUNDL dataset compiled by B. Singh (McMaster), Oct 28, 2019.

2019As06: E(^{32}S)=164 MeV beam from the 14-UD BARC-TIFR Pelletron, Mumbai. Measured Eγ, Iγ, γγ-coin, γ(θ), γγ(θ)(DCO), and γγ(lin pol) using INGA array of 19 Compton-suppressed clover HPGe detectors. Deduced high-spin levels, J^{π}, bands. Comparison with projected and cranked shell model calculations. Authors also published the same work in 2017As01. In 2019As06, more and precise data are presented compared to those in 2017As01.

^{169}Tm Levels

E(level)†	J^{π}‡	Comments
0.0#	1/2+	
8.41017@ 15	3/2+	Additional information 1. E(level): from Adopted Levels.
117.93# 7	5/2+	
138.96@ 10	7/2+	
315.54 12	7/2+	
331.87# 12	9/2+	
367.68@ 12	11/2+	
379.27a 18	7/2−	
430.02& 13	9/2−	
473.25b 16	9/2−	
588.34a 19	11/2−	
602.88& 13	13/2−	
636.89# 13	13/2+	
690.70@ 14	15/2+	
725.29b 20	13/2−	
865.62& 15	17/2−	
883.30a 23	15/2−	
1027.52# 14	17/2+	
1063.11b 25	17/2−	
1103.52@ 15	19/2+	
1217.73& 19	21/2−	
1261.2a 3	19/2−	
1482.3b 3	21/2−	
1497.38# 15	21/2+	
1597.87@ 21	23/2+	
1657.7& 3	25/2−	
1706.1a 4	(23/2−)	
1956.8# 3	25/2+	
2024.5& 4	(29/2−)	
2034.8@ 3	27/2+	
2421.0# 4	29/2+	
2466.2@ 4	31/2+	

† Deduced by the evaluator from least-squares fit to Eγ data holding the 8.41017 level energy fixed and without considering the

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^{169}Tm(^{32}S,^{32}S′γ) 2019As06 (continued)

^{169}Tm Levels (continued)

tentative or expected Eγs. Reduced χ^2=3.2 is larger than critical χ^2=1.8. It is possible that some of the Eγ uncertainties are underestimated.

‡ As given in 2019As06, based on DCO ratios, linear polarization asymmetries, and band structures.

Band(A): π1/2[411],α=+1/2.

@ Band(a): π1/2[411],α=−1/2.

& Band(B): π1/2[541],α=+1/2. Band crossing observed.

a Band(C): π7/2[523],α=−1/2.

b Band(c): π7/2[523],α=+1/2.

γ(^{169}Tm)

DCO values are from gates on ΔJ=2, stretched quadrupole transitions.

E$_\gamma$	I$_\gamma$‡	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.#	Comments
(34)		636.89	13/2$^+$	602.88	13/2$^-$		
63.0		379.27	7/2$^-$	315.54	7/2$^+$		
87.7 *1*	1.89 *2*	690.70	15/2$^+$	602.88	13/2$^-$	D	DCO=0.66 *9* Mult.: other: E1 in 2019As06.
93.8 *2*	0.29 *2*	473.25	9/2$^-$	379.27	7/2$^-$	[M1+E2]	
109.6† *1*	100.00† *9*	117.93	5/2$^+$	8.41017	3/2$^+$	D+Q	DCO=0.86 *1* Mult.: other: M1+E2 in 2019As02.
115.0 *2*	0.98 *3*	588.34	11/2$^-$	473.25	9/2$^-$	[M1+E2]	
117.8† *1*	10.13† *3*	117.93	5/2$^+$	0.0	1/2$^+$	Q	DCO=0.94 *5* Mult.: other: E2 in 2019As02.
130.6† *1*	72.65† *8*	138.96	7/2$^+$	8.41017	3/2$^+$	Q	DCO=0.95 *3* Mult.: other: E2 in 2019As02.
136.8 *1*	1.02 *3*	725.29	13/2$^-$	588.34	11/2$^-$	[M1+E2]	
141.7 *2*	0.12 *4*	473.25	9/2$^-$	331.87	9/2$^+$	[E1]	
157.8 *2*	0.33 *2*	883.30	15/2$^-$	725.29	13/2$^-$	[M1+E2]	
162&	0.03 *1*	1027.52	17/2$^+$	865.62	17/2$^-$		E$_\gamma$: observed (inset of Fig. 4(a)), listed in parentheses in Table 1. The evaluator interpret it as a tentative placement and not adopted.
173.1 *1*	1.75 *3*	602.88	13/2$^-$	430.02	9/2$^-$	[E2]	
174.6 *2*	0.20 *1*	865.62	17/2$^-$	690.70	15/2$^+$	D	DCO=0.58 *12* Mult.: other: E1 in 2019As02.
179.6 *2*	0.20 *2*	1063.11	17/2$^-$	883.30	15/2$^-$	[M1+E2]	
192.9† *1*	61.49† *7*	331.87	9/2$^+$	138.96	7/2$^+$	M1+E2	DCO=0.88 *1* Pol=−0.026 *1*.
197.6@ *1*	1.72@ *2*	315.54	7/2$^+$	117.93	5/2$^+$	[M1+E2]	
197.6@ *2*	1.72@ *2*	1261.2	19/2$^-$	1063.11	17/2$^-$	[M1+E2]	
209.0 *2*	0.21 *2*	588.34	11/2$^-$	379.27	7/2$^-$	[E2]	
213.6† *3*	25.55† *5*	331.87	9/2$^+$	117.93	5/2$^+$	E2	DCO=0.96 *1* Pol=+0.046 *3*.
221.1 *2*	0.15 *2*	1482.3	21/2$^-$	1261.2	19/2$^-$	[M1+E2]	
223.8 *2*	0.08 *2*	1706.1	(23/2$^-$)	1482.3	21/2$^-$	[M1+E2]	
228.6† *1*	54.36† *7*	367.68	11/2$^+$	138.96	7/2$^+$	E2	DCO=0.99 *1* Pol=+0.038 *1*.
235.0 *1*	2.99 *3*	602.88	13/2$^-$	367.68	11/2$^+$	E1	DCO=0.59 *2* δ(M2/E1)=0.00 *5* from DCO and Pol values. Pol=+0.09 *2*.
237.9 *2*	0.10 *2*	1103.52	19/2$^+$	865.62	17/2$^-$	[E1]	DCO=0.55 *6*
240.1 *2*	0.02 *1*	379.27	7/2$^-$	138.96	7/2$^+$	[E1]	

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^{169}Tm(^{32}S,^{32}S′γ) 2019As06 (continued)

γ(^{169}Tm) (continued)

E_γ	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	Comments
252.2 *2*	0.18 *1*	725.29	13/2$^-$	473.25	9/2$^-$	[E2]		
262.9 *1*	1.33 *4*	865.62	17/2$^-$	602.88	13/2$^-$	Q		DCO=0.94 *14* Mult.: other: E2 in 2019As02.
269.4[†] *1*	25.01[†] *4*	636.89	13/2$^+$	367.68	11/2$^+$	M1+E2		DCO=0.64 *1* Pol=−0.034 *1*.
280.1 *2*	0.05 *1*	1497.38	21/2$^+$	1217.73	21/2$^-$	[E1]		
291.3 *1*	1.98 *5*	430.02	9/2$^-$	138.96	7/2$^+$	E1		DCO=0.60 *5* Pol=+0.02 *1*.
295.4 *2*	0.22 *1*	883.30	15/2$^-$	588.34	11/2$^-$	[E2]		
304.9[†] *1*	20.88[†] *4*	636.89	13/2$^+$	331.87	9/2$^+$	E2		DCO=1.06 *1* Pol=+0.089 *2*.
322.9[†] *1*	16.87[†] *4*	690.70	15/2$^+$	367.68	11/2$^+$	E2		DCO=1.01 *1* A_2=+0.243 *9*; A_4=−0.042 *13* Pol=+0.081 *2*.
334.2 *2*	0.05 *1*	473.25	9/2$^-$	138.96	7/2$^+$	[E1]		
336.8[†] *1*	4.55[†] *2*	1027.52	17/2$^+$	690.70	15/2$^+$	M1+E2	−0.13 *4*	DCO=0.45 *2* A_2=−0.311 *48*; A_4=+0.002 *75* δ: from $\gamma(\theta)$, with alignment parameter σ/J≈0.42 *3*. δ(E2/M1)=−0.15 *2* from DCO and POL data. Pol=−0.037 *1*.
337.6 *2*	0.10 *1*	1063.11	17/2$^-$	725.29	13/2$^-$	[E2]		
352.4 *2*	0.30 *1*	1217.73	21/2$^-$	865.62	17/2$^-$	[E2]		
359.0[&]		1956.8	25/2$^+$	1597.87	23/2$^+$			E_γ: observed (Fig. 5(a)), listed without parentheses and intensity in Table 1. The evaluator interpret it as a tentative placement.
366.8 *2*	0.08 *2*	2024.5	(29/2$^-$)	1657.7	25/2$^-$	[E2]		
378.3 *2*	0.05 *1*	1261.2	19/2$^-$	883.30	15/2$^-$	[E2]		
380.0 *2*	0.08 *2*	1597.87	23/2$^+$	1217.73	21/2$^-$	[E1]		
390.7[†] *1*	9.49[†] *3*	1027.52	17/2$^+$	636.89	13/2$^+$	E2		DCO=1.02 *2* Pol=+0.093 *3*.
393.7[†] *1*	1.12[†] *1*	1497.38	21/2$^+$	1103.52	19/2$^+$	M1+E2		DCO=0.47 *3* Pol=−0.136 *15*.
412.7[†] *1*	4.89[†] *2*	1103.52	19/2$^+$	690.70	15/2$^+$	E2		DCO=1.02 *5* Pol=+0.098 *3*.
419.2 *2*	0.08 *1*	1482.3	21/2$^-$	1063.11	17/2$^-$	[E2]		
431.4[†] *2*	0.018[†] *2*	2466.2	31/2$^+$	2034.8	27/2$^+$	[E2]		
436.9[†] *2*	0.053[†] *1*	2034.8	27/2$^+$	1597.87	23/2$^+$	[E2]		
440.0 *2*	0.14 *2*	1657.7	25/2$^-$	1217.73	21/2$^-$	[E2]		
445[&]		1706.1	(23/2$^-$)	1261.2	19/2$^-$			E_γ: observed (Fig. 5(b)), listed in parentheses in Table 1. The evaluator interpret it as a tentative placement.
459.4[†] *2*	0.030[†] *1*	1956.8	25/2$^+$	1497.38	21/2$^+$	[E2]		
464.2[†] *2*	0.047[†] *1*	2421.0	29/2$^+$	1956.8	25/2$^+$	[E2]		
469.9[†] *1*	2.18[†] *2*	1497.38	21/2$^+$	1027.52	17/2$^+$	E2		DCO=1.01 *5* Pol=+0.059 *6*.
494.5[†] *2*	0.12[†] *2*	1597.87	23/2$^+$	1103.52	19/2$^+$	[E2]		

[†] From 2017As01 and also listed in 2019As06.

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^{169}Tm(^{32}S,^{32}S′γ) 2019As06 (continued)

γ(^{169}Tm) (continued)

‡ In 2019As06, relative intensities are presented with respect to Iγ(109.6γ)=1000, in this dataset values are scaled down by a factor of 10. It appears that some of the uncertainties for relative Iγ values listed in Table 1 of 2019As06 are too small to be realistic, e.g. 0.1% for the 109.6, 130.6, 192.9, 228.6 gamma rays. The quoted uncertainties are probably only statistical.

Assignments given in parentheses in Table I of 2019As06 are from ΔJ^{π} values. The evaluator treated these as assumed and placed in square brackets. D or D+Q are assigned based on the DCO ratio, pure electric or mixed with magnetic are presented in 2019As02.

@ Multiply placed with undivided intensity.

& Placement of transition in the level scheme is uncertain.

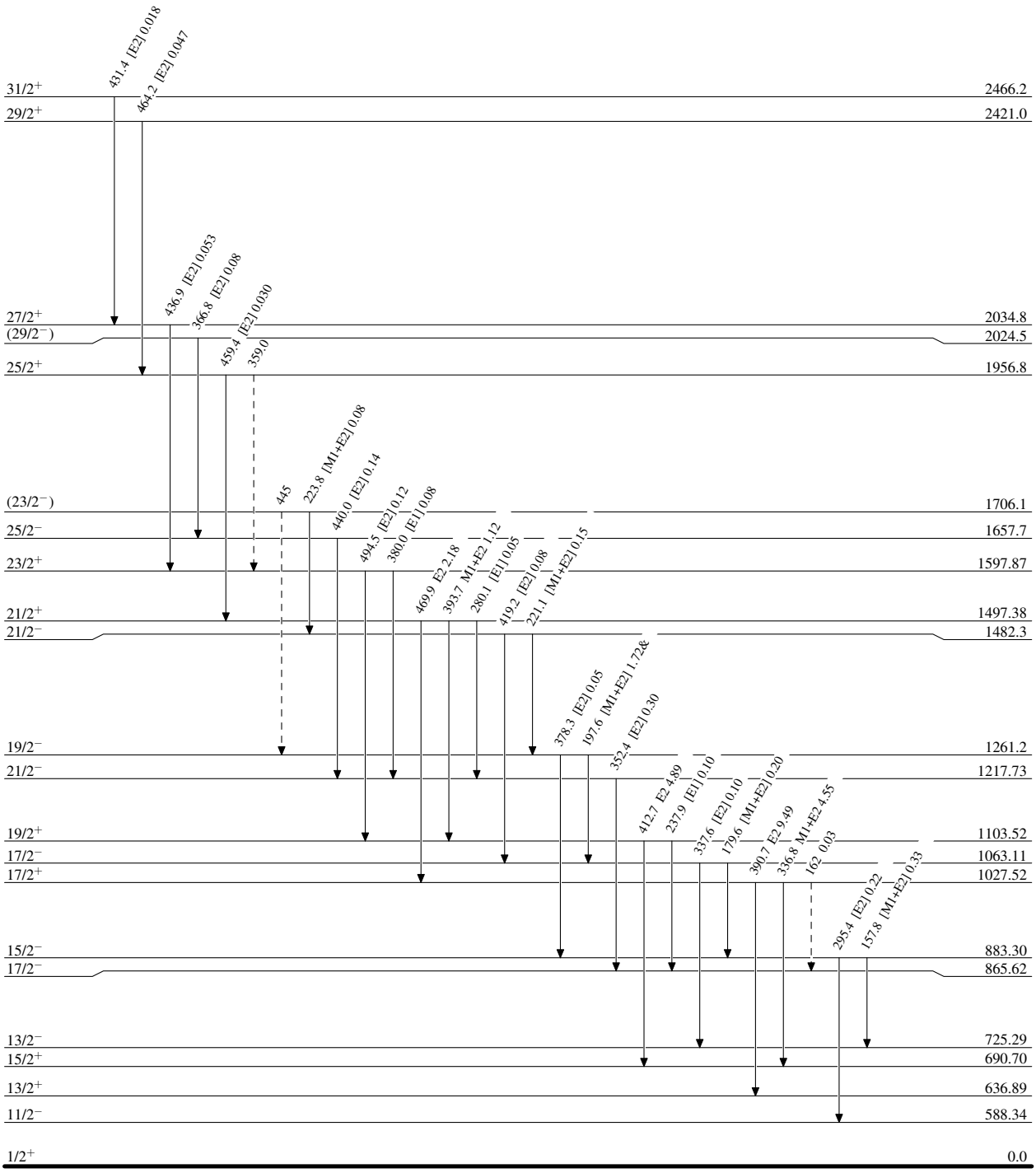
^{169}Tm(^{32}S,^{32}S′γ) **2019As06**

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)

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



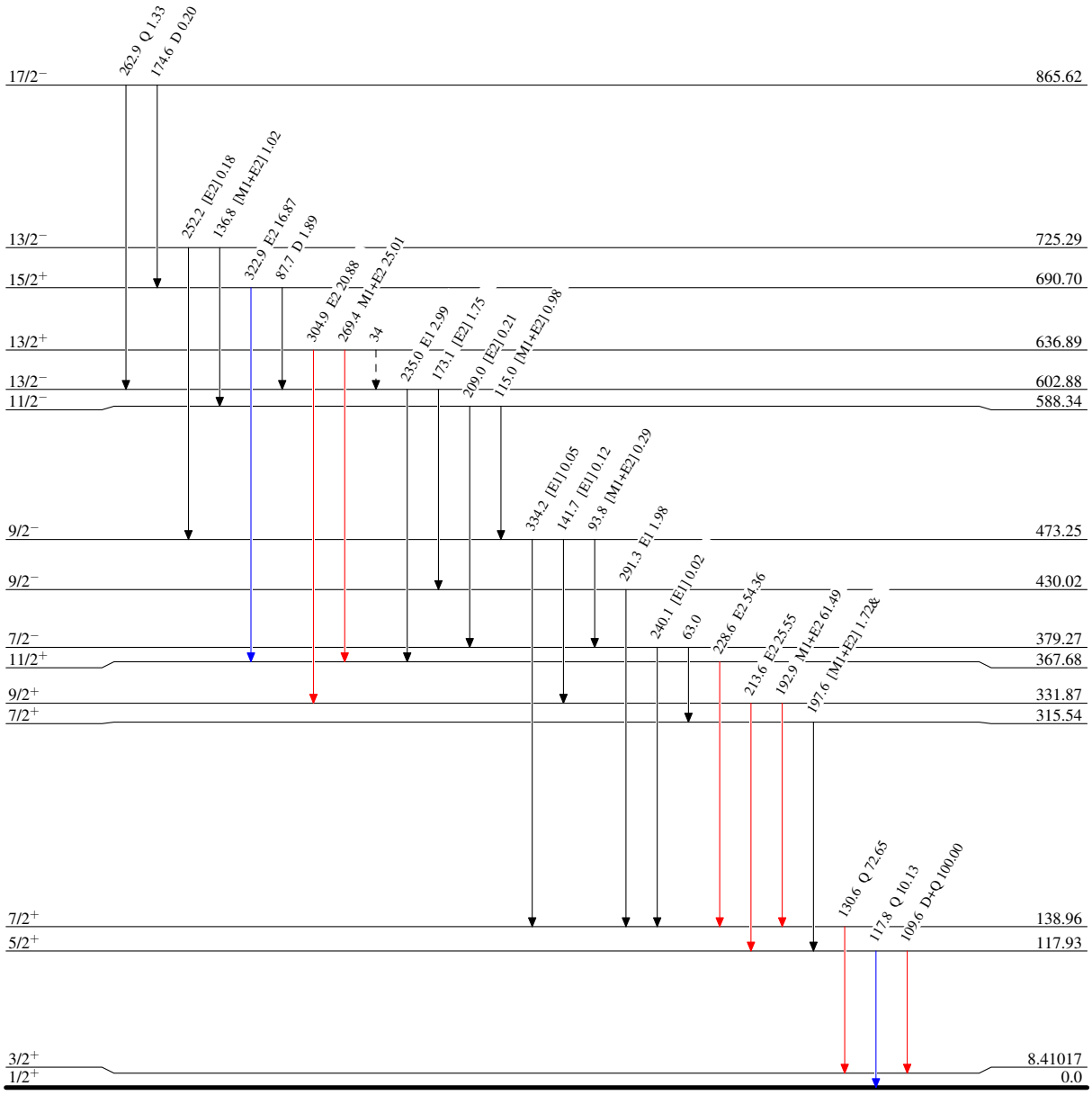
$^{169}_{69}Tm_{100}$

^{169}Tm(^{32}S,^{32}S′γ) 2019As06

Level Scheme (continued)

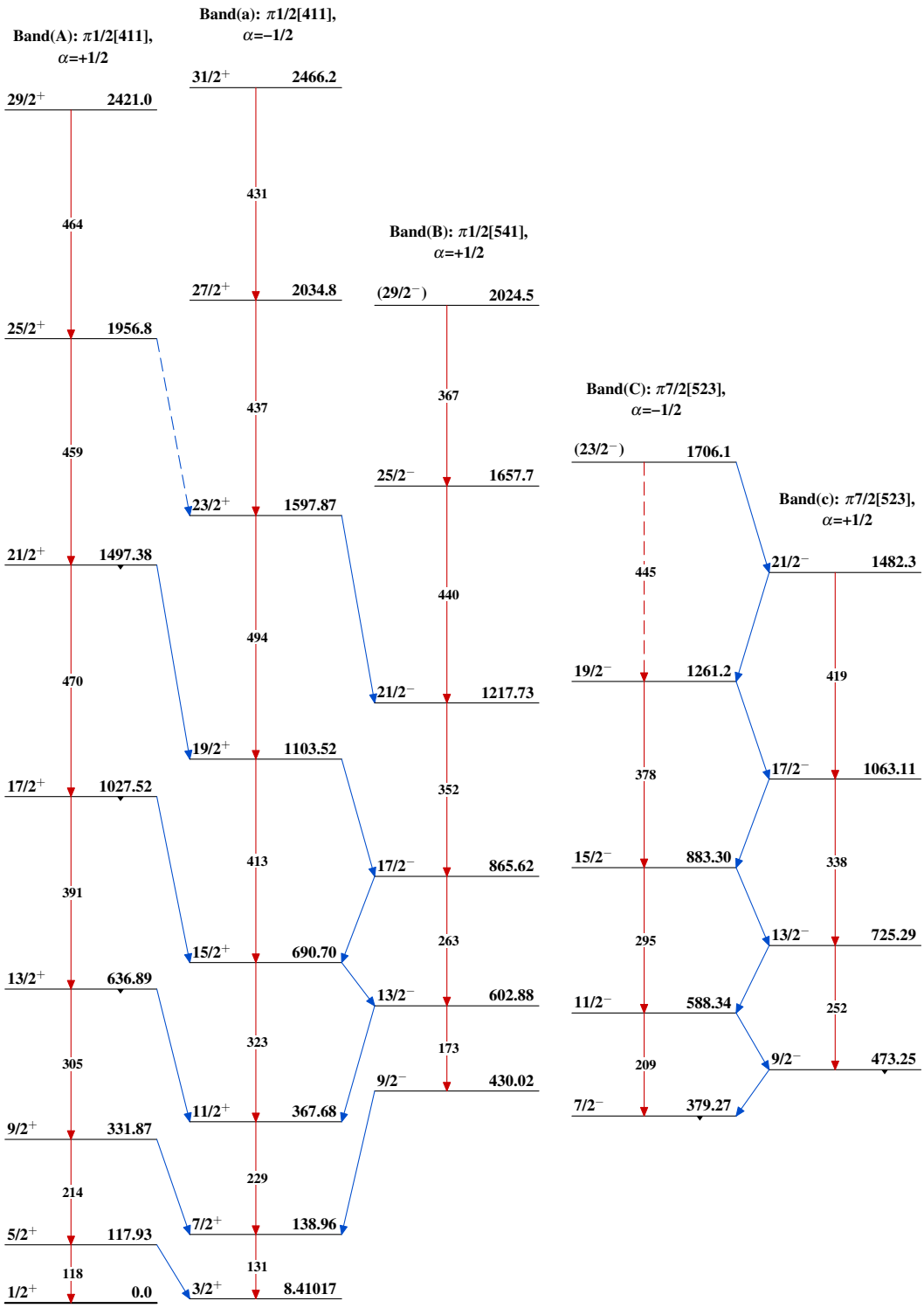
Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)



$^{169}_{69}Tm_{100}$

^{169}Tm(^{32}S,^{32}S′γ) 2019As06



$^{169}_{69}Tm_{100}$