^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 157 (2012)	31-Dec-2010

Additional information 1.

These studies are ^{159}Tb(α,4nγ) at 43-51 MeV (1975Fo11) and ^{159}Tb(^{3}He,3nγ) at 20-28 MeV (1977Sp04 and 1976AdZW, by same authors). The authors of 1975Fo11 are also authors of 1977Sp04.

γ-γ coincidences are from 1977Sp04 and 1975Fo11.

Experimental methods:

1975Fo11: ^{159}Tb(α,4nγ) at 43-51 MeV. Eγ, Iγ, $\gamma(\theta)$, and $\gamma\gamma$ coincidences.

1977Sp04: ^{159}Tb(^{3}He,3nγ) at 20-28 MeV. Eγ, Iγ, $\gamma\gamma$ coincidences, and Iγ(beam on)/Iγ(beam off) measured. Eγ and Iγ uncertainties are 0.1 keV and 10% for strong singlets and 0.3 keV and 30% for weak or multiple lines, respectively.

^{159}Ho Levels

Level scheme is from 1977Sp04; other: 1975Fo11 (only ground-state band).

E(level)†	J$^\pi$‡	Comments
0#	7/2$^-$	
97.5#	9/2$^-$	
166.0@	7/2$^+$	
206.0&	1/2$^+$	
212.4&	3/2$^+$	E(level): From ^{159}Ho Adopted Levels; 1977Sp04 place a level at 222.7.
219.0#	11/2$^-$	
342.3&	7/2$^+$	
369.4#	13/2$^-$	
536.8#	15/2$^-$	
587.5a	9/2$^-$	
595.4&	11/2$^+$	
740.3#	17/2$^-$	
775.7@	(15/2$^+$)	E(level),J$^\pi$: This level not given in the ^{152}Sm(^{11}B,4nγ) study of 2000Ma06; and the 15/2$^+$ member of this band is assigned in that study to a level at 819 keV.
803.0a	13/2$^-$	
944.8&	15/2$^+$	
945.1#	19/2$^-$	
1107.0a	17/2$^-$	
1198.2#	21/2$^-$	
1364.2	(17/2$^+$)	E(level),J$^\pi$: This level is not given in the ^{152}Sm(^{11}B,4nγ) study of 2000Ma06 and would be the only signature=+1/2 member of the π1/2[411] band thus far reported in this nucleus in the high-spin studies. The evaluator regards it, or at least its assignment, as questionable.
1372.6&	19/2$^+$	
1431.6#	23/2$^-$	
1496.0a	21/2$^-$	
1726.8#	25/2$^-$	
1863.4&	23/2$^+$	
1964.4a	25/2$^-$	
1981.9#	27/2$^-$	
2305.0#	29/2$^-$	
2400.1&	27/2$^+$	

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^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04 (continued)

^{159}Ho Levels (continued)

E(level)[†]	Jπ[‡]
2505.5[a]	29/2⁻
2574.0[#]	31/2⁻
2892.9[#]	33/2⁻
3160.3[#]	35/2⁻
3707.6[#]	39/2⁻

† From 1977Sp04 for levels in π7/2[523] and π7/2[404] bands and the π1/2[411] bandhead. For the remaining levels in the π1/2[411] and π1/2[541] bands, the energies of 1977Sp04 have been reduced 10.3 keV to place the 3/2⁺ level at 212.4 keV, as in the ^{159}Ho Adopted Levels.

‡ Jπ and band assignments are from 1977Sp04 and are based on expected presence of certain Nilsson states, expected band structure, and multipolarities from γ(θ) results. These assignments agree with those in ^{159}Ho Adopted Levels. Significant differences from the assignments in the new ^{152}Sm(^{11}B,4nγ) study of 2000Ma06 are noted.

Band(A): π7/2[523] band.

@ Band(B): π7/2[404] band.

& Band(C): π1/2[411] band.

a Band(D): π1/2[541] band.

γ(^{159}Ho)

E_γ[†‡]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
x66.1	20.7					D	
x89.2	9.8						
97.5	100	97.5	9/2⁻	0	7/2⁻	D	
x119.8	34						
121.2	297	219.0	11/2⁻	97.5	9/2⁻	D	I_γ: Includes contribution from radioactivity.
x127.5	9.7					Q	
x129.6	8.6						
130.0	13.4	342.3	7/2⁺	212.4	3/2⁺		
x130.6	13.4						
141.8	10.6	944.8	15/2⁺	803.0	13/2⁻	D	
x149.0	17.3						
150.4	114	369.4	13/2⁻	219.0	11/2⁻	D	
162.7		1107.0	17/2⁻	944.8	15/2⁺		
x165.0	8.6						
166.0	39	166.0	7/2⁺	0	7/2⁻	(D)	
167.4	91	536.8	15/2⁻	369.4	13/2⁻	D	
x176.0	12.2					D	
x191.2	8.4					(Q)	
x195.3	14.2						
x199.4	10.4						
x201.8	13.8						
203.6	91	740.3	17/2⁻	536.8	15/2⁻	D	
204.8	55	945.1	19/2⁻	740.3	17/2⁻	(D)	
206.3	18.0	206.0	1/2⁺	0	7/2⁻		
207.5		803.0	13/2⁻	595.4	11/2⁺		
215.6	18.6	803.0	13/2⁻	587.5	9/2⁻	Q	
219.0	23.2	219.0	11/2⁻	0	7/2⁻		
233.4	30	1431.6	23/2⁻	1198.2	21/2⁻	D	
239[&b]		775.7	(15/2⁺)	536.8	15/2⁻		

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^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04 (continued)

γ(^{159}Ho) (continued)

E_γ †‡	I_γ #	E_i(level)	J_i^π	E_f	J_f^π	Mult. @	Comments
x251.3	22.1						
253.0 a	166 a	595.4	11/2$^+$	342.3	7/2$^+$		I_γ: Includes contribution from radioactivity. Mult.: Measurements give (D), but J^π's require E2 and γ is doubly placed.
253.0 a	166 a	1198.2	21/2$^-$	945.1	19/2$^-$		I_γ: Includes contribution from radioactivity.
255.0	17.8	1981.9	27/2$^-$	1726.8	25/2$^-$	D	
x257.2	20.7					(Q)	
257.2	20.7	1364.2	(17/2$^+$)	1107.0	17/2$^-$	Q	
x258.8	8.7						I_γ: Includes contribution from radioactivity.
267.5	6.9	3160.3	35/2$^-$	2892.9	33/2$^-$	(D)	
269.2	16.6	2574.0	31/2$^-$	2305.0	29/2$^-$		
271.9	52	369.4	13/2$^-$	97.5	9/2$^-$	Q	
x283.1	5.8						
x284.5	7.4						
x289.4	5.6						
x292.2	6.4						
295.2	34	1726.8	25/2$^-$	1431.6	23/2$^-$	D	
x297.0	43					D	
x302.5	8.2						
304.0	25.1	1107.0	17/2$^-$	803.0	13/2$^-$	Q	
x308.0	9.7						
x315.6	11.6					Q	
317.8 a	73 a	536.8	15/2$^-$	219.0	11/2$^-$		
317.8 ab	73 a	2892.9	33/2$^-$	2574.0	31/2$^-$		
323.4	11.7	2305.0	29/2$^-$	1981.9	27/2$^-$	D	
349.4	22.0	944.8	15/2$^+$	595.4	11/2$^+$	Q	
x353.0	23.0					D	
370.8	74	740.3	17/2$^-$	369.4	13/2$^-$	Q	
x385.5	20.9					Q	
388.8	25.5	1496.0	21/2$^-$	1107.0	17/2$^-$	Q	
406.3		775.7	(15/2$^+$)	369.4	13/2$^-$		
408.2 2	95	945.1	19/2$^-$	536.8	15/2$^-$	Q	
427.9	29	1372.6	19/2$^+$	944.8	15/2$^+$	Q	
x451.1	12.3						
457.9	79	1198.2	21/2$^-$	740.3	17/2$^-$	Q	
x461.8	16.7						
468.4	16.9	1964.4	25/2$^-$	1496.0	21/2$^-$	Q	
x471.0	20.0					Q	
x484.4	19.2					Q	
486.5	72	1431.6	23/2$^-$	945.1	19/2$^-$	Q	
490.8	13.0	1863.4	23/2$^+$	1372.6	19/2$^+$	Q	
x496.2	31					Q	
x505.4	11.0						
x518.1	11.2						
528.8	54	1726.8	25/2$^-$	1198.2	21/2$^-$	Q	
536.7	9.1	2400.1	27/2$^+$	1863.4	23/2$^+$	Q	
541.1	5.6	2505.5	29/2$^-$	1964.4	25/2$^-$	Q	
547.4	20.1	3707.6	39/2$^-$	3160.3	35/2$^-$	Q	
550.3	54	1981.9	27/2$^-$	1431.6	23/2$^-$	Q	
x559.0	17.1					D	
x575.8	6.8						
578.0	24.6	2305.0	29/2$^-$	1726.8	25/2$^-$	Q	
586.2	12.1	3160.3	35/2$^-$	2574.0	31/2$^-$	Q	
587.9	13.2	2892.9	33/2$^-$	2305.0	29/2$^-$		
592.0	22.4	2574.0	31/2$^-$	1981.9	27/2$^-$		

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^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04 (continued)

$\gamma(^{159}Ho)$ (continued)

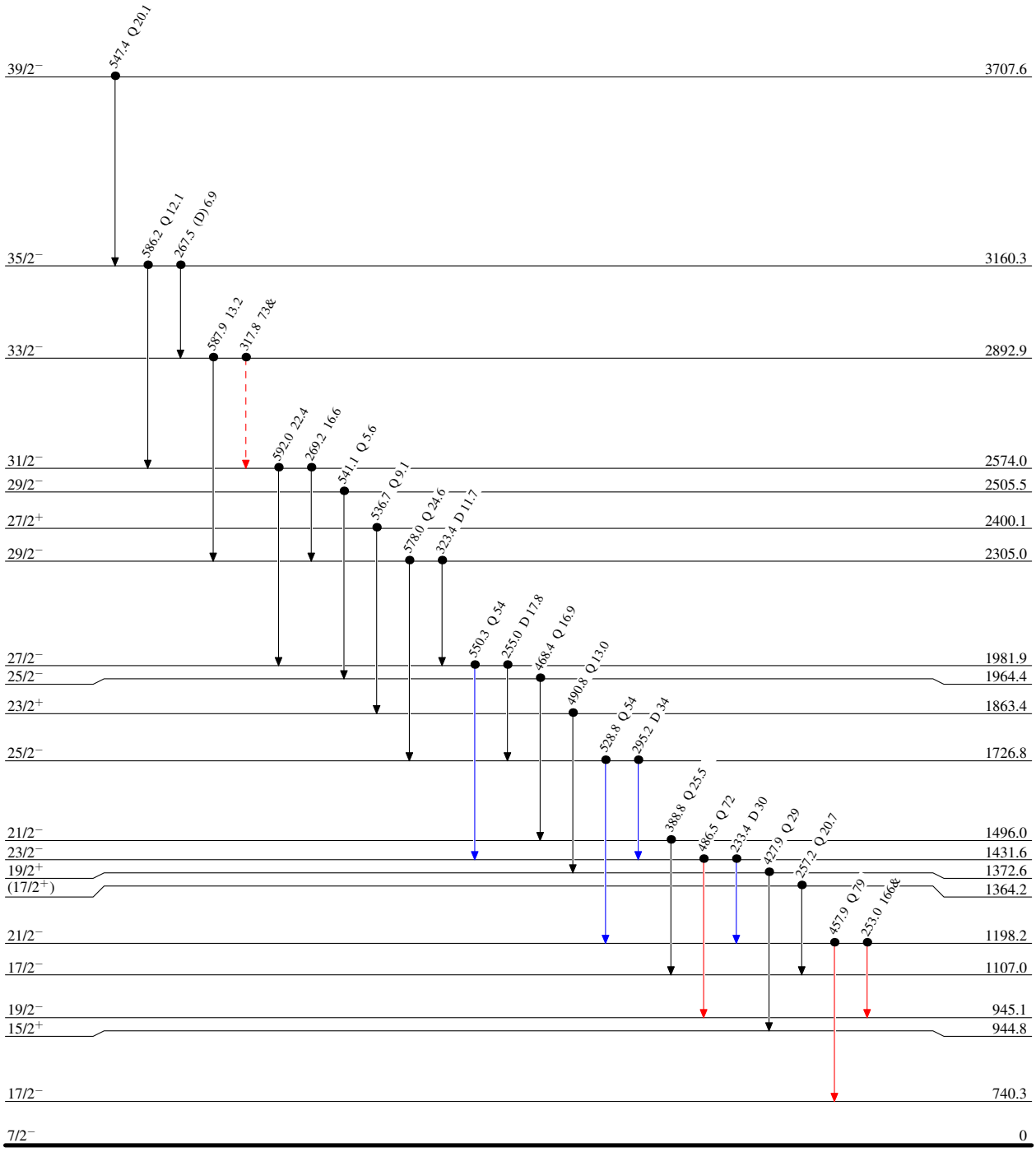
† From average of values from 1975Fo11 and 1977Sp04. Uncertainties are 0.1 to 0.3 keV from general statement (1977Sp04), but the evaluator has not made specific assignments.
‡ The unplaced γ's are from the list of 1975Fo11; those with uncertain assignments to ^{159}Ho are omitted. The Eγ are averaged with the values of 1977Sp04.
# From 1975Fo11 for (α,4nγ) at 49 MeV, unless otherwise noted. Other values are available from 1977Sp04 for (^{3}He,3nγ) at 28 MeV with uncertainties of 10% to 30%.
@ Evaluator's assignment, based on $\gamma(\theta)$ data of 1975Fo11; Q assigned if A_2 is large (especially if A_4 is small and negative) and D if A_2 is small. Since the authors do not make any assignments, these are not given in the ^{159}Ho Adopted γ's.
& From 1977Sp04 level scheme drawing, but not in γ table.
a Multiply placed with undivided intensity.
b Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04

Level Scheme

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)
- Coincidence



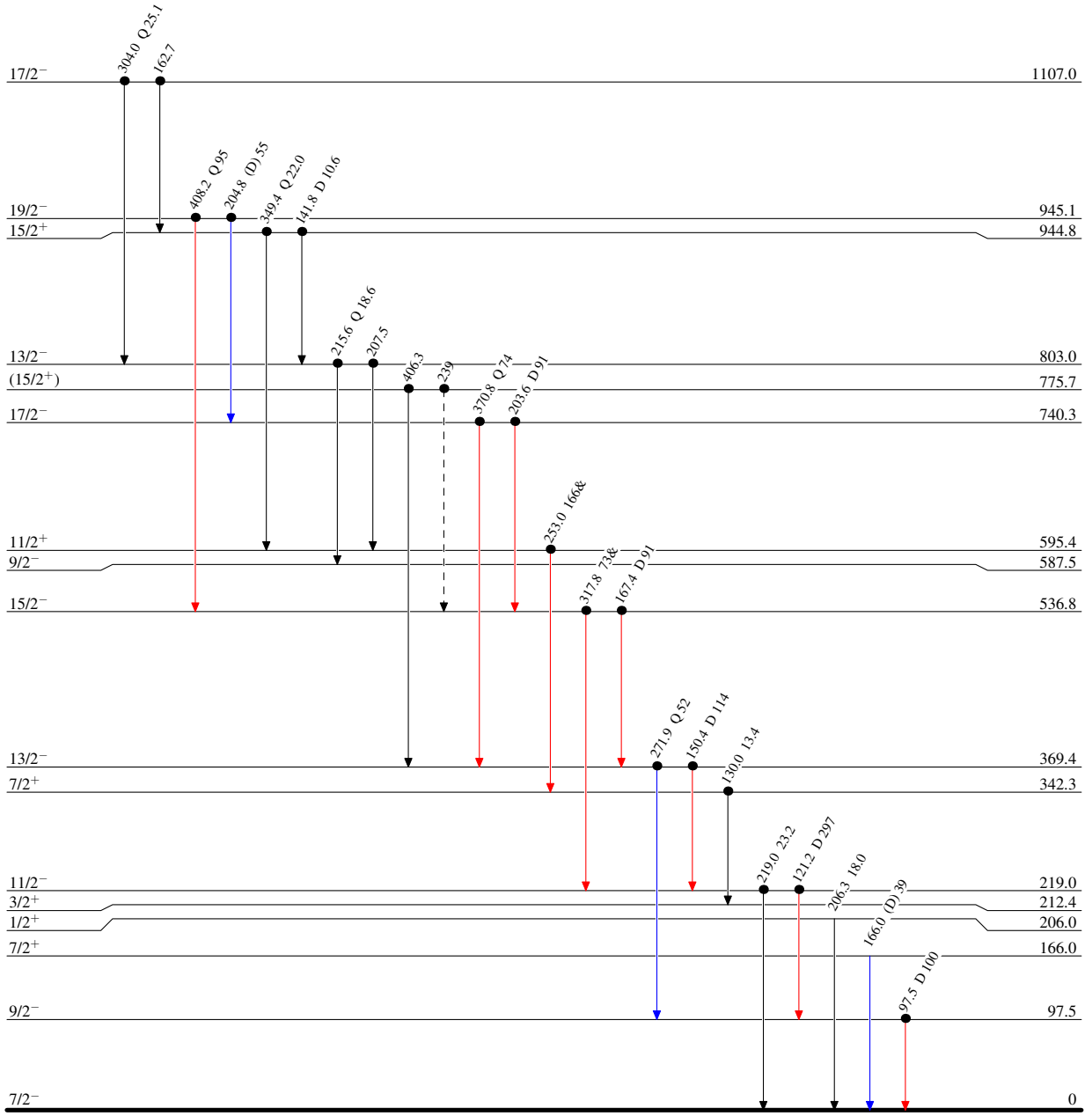
$^{159}_{67}Ho_{92}$

^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04

Level Scheme (continued)

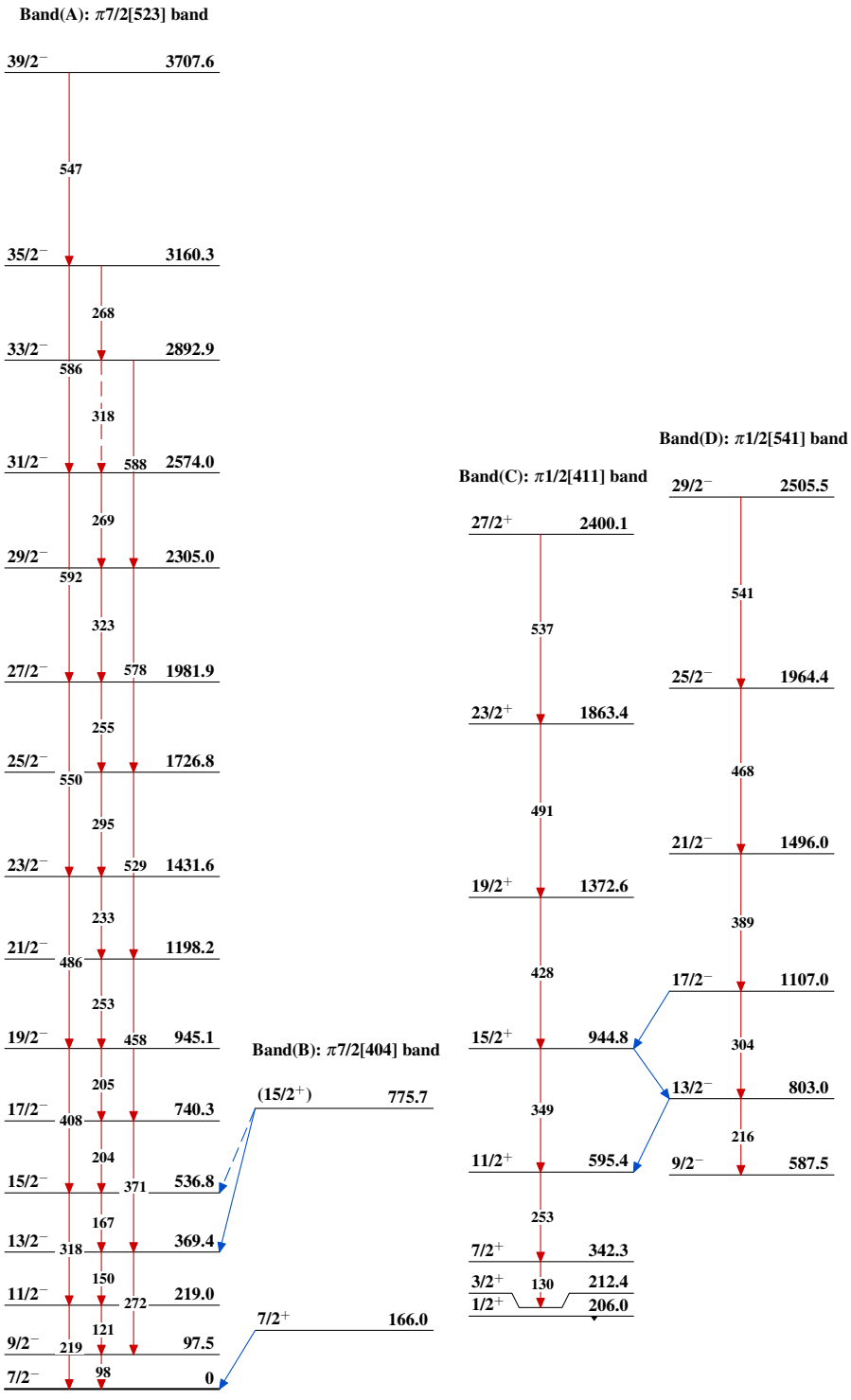
Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)
Coincidence



$^{159}_{67}Ho_{92}$

^{159}Tb(α,4nγ),(^{3}He,3nγ) 1975Fo11,1977Sp04



$^{159}_{67}Ho_{92}$