(HI,xnγ) 1989Xu01,1992Dr04

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 108,2173 (2007)	1-Oct-2006

Additional information 1.

1989Xu01: ^{122}Sn(^{19}F,4nγ), E=81 MeV; measured γ, γγ, γ(t), γ(θ), excit.

1987Dr12, 1992Dr04: ^{126}Te(^{14}N,3nγ), E=52-56 MeV; ^{122}Sn(^{19}F,4n), E=68-76 MeV; measured γ, γγ, γγ(t), Xγ(t), γ(θ), excit.

Others: ^{139}La(α,6nγ), E=85 MeV (1975Kl02).

Most of the Eγ given in 1992Dr04 are also seen in 1989Xu01 within a few keV. The level scheme given here is from 1989Xu01. For some transitions 1992Dr04 suggested different placements. Band assignments are those given in 1989Xu01. For cranked shell-model calculations see 1989Xu01. For interacting boson-fermion model calculations see 1992Dr04.

^{137}Pr Levels

E(level)	Jπ‡	$T_{1/2}$	Comments
0.0[a]	5/2+		Jπ: Configuration=(π $d_{5/2}$).
229.88 *16*	7/2+		
561.22[c] *23*	11/2−	2.66 μs *7*	$T_{1/2}$: from 1987Dr12, 1992Dr04. Others:>2 μs (1989Xu01), 300 ns *100* (1975Kl02). Jπ: Configuration=(π $h_{11/2}$).
562.13[a] *16*	9/2+		
824.6?[†] *3*	(11/2+)		
1078.41[c] *25*	15/2−		
1188.9[e] *3*	13/2−		
1348.91[a] *23*	13/2+		
1745.6[†] *4*	(15/2−)		
1836.8[e] *3*	17/2−		
1871.4[c] *3*	19/2−		
2286.6 *3*	17/2+		Jπ: from 1992Dr04.
2306.98[a] *25*	17/2+		
2434.8 *3*	19/2+		
2506.9[†] *4*			
2622.7[f] *3*	21/2−		Jπ: 1992Dr04 assign 23/2−.
2643.5[a] *3*	21/2+		
2713.8[e] *3*	21/2−		
2776.3[c] *3*	23/2−		
2842.9 *3*	23/2+		
2920.5 *4*	23/2+		
2961.5[†] *4*			
3000.8 *4*	(21/2+)		
3031.2[#] *3*	25/2+		
3050.1 *4*			
3095.8 *4*	(25/2+)		
3177.3[@] *4*	25/2+		
3308.4[f] *3*	25/2−		
3363.3[b] *4*	23/2+		Jπ: (25/2+) in 1992Dr04.
3439.7[d] *3*	25/2−		Jπ: 27/2− in 1992Dr04. There is discrepancy in M(662.5γ) between two works. Also, 1992Dr04 show 598γ between 27/2− and 23/2+ levels but their A_2(598γ)=−0.82 is not likely to be M2.
3520.9[a] *3*	25/2+		Jπ: (27/2−) in 1992Dr04.
3551.2[d] *4*	27/2−		Jπ: 29/2− in 1992Dr04.
3614.2[@] *5*	27/2+		
3687.3[c] *4*	27/2−		

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(HI,xnγ) 1989Xu01,1992Dr04 (continued)

^{137}Pr Levels (continued)

E(level)	J$^{\pi}$‡	Comments
3746.4† *11*	(27/2$^+$)	
3791.9# *4*	29/2$^+$	
3845.5 *4*		
3871.9d *4*	29/2$^-$	
3904.3b *4*	27/2$^+$	
3953.3& *4*		
4102.6† *5*		
4118.0a *4*	29/2$^+$	
4213.2d *5*	31/2$^-$	
4221.9f *4*	(29/2$^-$)	J$^{\pi}$: 33/2$^-$ in 1992Dr04.
4304.1@ *5*		
4318.1& *5*		
4579.5b *4*	31/2$^+$	
4622.4c *4*	31/2$^-$	
4696.5d *5*	33/2$^-$	
4700.1& *5*		
4735.4# *4*	33/2$^+$	
4813.4f *5*	33/2$^-$	
4969.7f *5*		
5024.1a *5*	(33/2$^+$)	
5131.3& *6*		
5171.0@ *5*		
5174.7d *5*	35/2$^-$	
5470.5b *5*	(35/2$^+$)	
5471.2f *5*		
5515.4d *6*	37/2$^-$	
5615?&		
5624?#	(37/2$^+$)	
5657.5c *5*	(35/2$^-$)	
5719.0f *6*		
5923.6d *6*	39/2$^-$	
6016.0f *6*		
6070.1a *11*	(37/2$^+$)	
6388.7d *7*	(41/2$^-$)	
6445.6b *5*	(39/2$^+$)	
7434?b	(43/2$^+$)	

† From 1992Dr04, level not given in 1989Xu01.

‡ Unless given otherwise, J$^{\pi}$ are based upon $\gamma(\theta)$, excit, and band assignments. The higher-energy levels are divided into the following two categories: a group of levels that decay to the 11/2$^-$ level, which are assumed to have negative parity, and another group of positive parity levels that decay to the 9/2$^+$ level (1992Dr04). Band assignments are from 1989Xu01, they suggest triaxial shape for the g.s. band.

Band(A): band 1, π=+.

@ Band(B): band 2, π=+.

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(HI,xnγ) 1989Xu01,1992Dr04 (continued)

^{137}Pr Levels (continued)

[&] Band(C): band 3.
[a] Band(D): band 4, (π,α)=(+,+1/2).
[b] Band(E): band 4a, (π,α)=(+,−1/2).
[c] Band(F): band 5, (π,α)=(-,−1/2).
[d] Band(G): band 6, ΔJ=1 Based on Configuration=((π $h_{11/2}$)(ν $h_{11/2}$)^2). Collective oblate shape. Magnetic Dipole Rotational Band (2000Am02).
[e] Band(H): band 6a. Possible unfavored (π,$H_{11/2}$).
[f] Band(I): band 7.

γ(^{137}Pr)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[@]	Comments
111.5 *2*	25.9 *6*	3551.2	27/2$^-$	3439.7	25/2$^-$	D		
127.6 *2*	35.8 *7*	2434.8	19/2$^+$	2306.98	17/2$^+$	D		
131.1 *2*	8.9 *2*	3439.7	25/2$^-$	3308.4	25/2$^-$	D		
148.1 *2*	18.2 *5*	2434.8	19/2$^+$	2286.6	17/2$^+$	D		
156.3[&] *2*	≤2	4969.7		4813.4	33/2$^-$			I_γ: intensity balance at 4969.7 level makes this placement questionable.
157.2 *2*	11.7 *4*	3520.9	25/2$^+$	3363.3	23/2$^+$	D		
186.2 *2*	29.6 *7*	3031.2	25/2$^+$	2842.9	23/2$^+$	D		
198.3 *2*	79.0 *9*	2842.9	23/2$^+$	2643.5	21/2$^+$	D		
205.3[&] *2*	9.5 *3*	5174.7	35/2$^-$	4969.7				
208.3 *2*	104.1 *11*	2643.5	21/2$^+$	2434.8	19/2$^+$	D		
214[&]		4118.0	29/2$^+$	3904.3	27/2$^+$			E_γ: given in level scheme but not in a table (1989Xu01).
229.7 *2*	164 *5*	229.88	7/2$^+$	0.0	5/2$^+$	M1	0.1279	α(K)=0.1091 *16*; α(L)=0.01481 *21*; α(M)=0.00312 *5*; α(N+..)=0.000818 *12* α(N)=0.000697 *10*; α(O)=0.0001124 *16*; α(P)=8.33×10^{-6} *12* Mult.: from 1975Kl02: α(K)exp=0.12 *5*, K/L=7.4 *11*.
230.7[#] *2*	2.2	4102.6		3871.9	29/2$^-$			
247.8 *2*	5.7 *2*	5719.0		5471.2				
252.7[#] *2*		3095.8	(25/2$^+$)	2842.9	23/2$^+$	D		
277.8 *2*	21.2 *2*	2920.5	23/2$^+$	2643.5	21/2$^+$	D		
297.0 *2*	4.0 *1*	6016.0		5719.0				
320.7 *2*	55.1 *14*	3871.9	29/2$^-$	3551.2	27/2$^-$	D		
331.3 *2*	119 *7*	561.22	11/2$^-$	229.88	7/2$^+$	M2	0.196	B(M2)(W.u.)=0.078 *7* α(K)=0.1623 *23*; α(L)=0.0261 *4*; α(M)=0.00562 *8*; α(N+..)=0.001472 *21* α(N)=0.001257 *18*; α(O)=0.000201 *3*; α(P)=1.412×10^{-5} *20* Mult.: from 1975Kl02: α(K)exp=0.16 *6*, K/L=5.8 *9*.
332.1 *2*	≤2	562.13	9/2$^+$	229.88	7/2$^+$			I_γ: Iγ(332.1)/Iγ(562.3γ)=6.8 *34*/100 *10* (1992Dr04).
334.4 *2*	25.5 *7*	3177.3	25/2$^+$	2842.9	23/2$^+$	D		
340.7 *2*	13.2 *5*	5515.4	37/2$^-$	5174.7	35/2$^-$			1992Dr04 placed a 341γ from a 2966.5 level.
341.3 *2*	40.4 *7*	4213.2	31/2$^-$	3871.9	29/2$^-$	D		
364.8 *2*	7.1 *2*	4318.1		3953.3		D		
382.0 *2*	8.0 *2*	4700.1		4318.1		D		
383.1	≤2	3746.4	(27/2$^+$)	3363.3	23/2$^+$			
383.1 *2*	≤2	3904.3	27/2$^+$	3520.9	25/2$^+$			

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(HI,xnγ) 1989Xu01,1992Dr04 (continued)

γ(^{137}Pr) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[@]	Comments
408.2 *2*	11.1 *3*	5923.6	39/2$^-$	5515.4	37/2$^-$	D		E_γ: 1992Dr04 placed a 409.9γ from a 3445.7 (perhaps same as 3440) level.
431.2 *2*	5.5 *2*	5131.3		4700.1				
436.9 *2*	9.9 *2*	3614.2	27/2$^+$	3177.3	25/2$^+$	D		
442.9 *2*	14.6 *4*	3363.3	23/2$^+$	2920.5	23/2$^+$	D		
461		4579.5	31/2$^+$	4118.0	29/2$^+$			E_γ: shown in 1989Xu01 level scheme but not given in their list of γ rays.
465.1 *2*	4.4 *1*	6388.7	(41/2$^-$)	5923.6	39/2$^-$			
478.2 *2*	20.4 *6*	5174.7	35/2$^-$	4696.5	33/2$^-$	D		E_γ: 1992Dr04 placed a 479.2γ from 3445.7 (perhaps same as 3440) level.
483.3 *2*	30.3 *7*	4696.5	33/2$^-$	4213.2	31/2$^-$	D		
484.1[&] *2*	≤2	5615?		5131.3				
487.5 *2*	3.9 *1*	3520.9	25/2$^+$	3031.2	25/2$^+$			
501.5 *2*	5.4 *1*	5471.2		4969.7				
517.1 *2*	100.0 *10*	1078.41	15/2$^-$	561.22	11/2$^-$	E2	0.01029	α(K)=0.00857 *12*; α(L)=0.001357 *19*; α(M)=0.000290 *4*; α(N+..)=7.47×10^{-5} *11* α(N)=6.42×10^{-5} *9*; α(O)=9.99×10^{-6} *14*; α(P)=5.98×10^{-7} *9* Mult.: from 1975Kl02: α(K)exp=0.012 *4*, A_2=+0.19 *4*, A_4=−0.09 *7*.
541.3 *2*	4.4 *2*	3904.3	27/2$^+$	3363.3	23/2$^+$			
556.7[#] *2*	9.3	1745.6	(15/2$^-$)	1188.9	13/2$^-$			
562.3 *2*	94.5 *9*	562.13	9/2$^+$	0.0	5/2$^+$	Q		
563.4 *2*	23 *15*	561.22	11/2$^-$	0.0	5/2$^+$			E_γ: from 1992Dr04. Shown in their figure but not in the table of 1989Xu01. I_γ: from Iγ(563 from 11/2$^-$)/Iγ(332 from 11/2$^-$)=0.19 *13* (1992Dr04).
589.9 *2*	8.7 *2*	3953.3		3363.3	23/2$^+$			
594.7[#] *2*		824.6?	(11/2$^+$)	229.88	7/2$^+$			
597.1 *2*	21.9 *3*	4118.0	29/2$^+$	3520.9	25/2$^+$	Q		Mult.: Q stated in 1989Xu01, from γ(θ).
598.0 *2*	26.1 *4*	3439.7	25/2$^-$	2842.9	23/2$^+$			
601.1 *2*		3520.9	25/2$^+$	2920.5	23/2$^+$			
627.7 *2*	2.1 *1*	1188.9	13/2$^-$	561.22	11/2$^-$			Mult.: A_2=−0.82 *11*, 0.19≤δ≤2.36 (1992Dr04).
648.0 *2*	3.1 *1*	1836.8	17/2$^-$	1188.9	13/2$^-$			
662.5 *2*	19.0 *5*	3439.7	25/2$^-$	2776.3	23/2$^-$	D		
675.2 *2*	42 *1*	4579.5	31/2$^+$	3904.3	27/2$^+$	Q		
685.5 *2*	9.1 *4*	3308.4	25/2$^-$	2622.7	21/2$^-$	Q		
689.9 *2*	≤2	4304.1		3614.2	27/2$^+$			
695.9 *2*	10.0 *2*	3791.9	29/2$^+$	3095.8	(25/2$^+$)			
725.8 *2*	22.3 *7*	3439.7	25/2$^-$	2713.8	21/2$^-$	Q		
745.9 *2*	10.5 *3*	3520.9	25/2$^+$	2776.3	23/2$^-$			
751.0 *2*	6.2 *4*	2622.7	21/2$^-$	1871.4	19/2$^-$	D		
758.5 *2*	15.7 *5*	1836.8	17/2$^-$	1078.41	15/2$^-$	D		
760.8 *2*	13.7 *3*	3791.9	29/2$^+$	3031.2	25/2$^+$	Q		
761.3[#] *2*		2506.9		1745.6	(15/2$^-$)	Q		
774.9 *2*	10.6 *5*	3551.2	27/2$^-$	2776.3	23/2$^-$	Q		
786.0 *2*	5.2 *2*	2622.7	21/2$^-$	1836.8	17/2$^-$			
786.8 *2*	107.7 *11*	1348.91	13/2$^+$	562.13	9/2$^+$	Q		
793.2 *2*	68.6 *9*	1871.4	19/2$^-$	1078.41	15/2$^-$	E2	0.00355	α(K)=0.00301 *5*; α(L)=0.000427 *6*; α(M)=9.01×10^{-5} *13*; α(N+..)=2.35×10^{-5} *4* α(N)=2.01×10^{-5} *3*; α(O)=3.18×10^{-6} *5*; α(P)=2.15×10^{-7} *3* Mult.: from α(K)exp=0.0037 *13* (1975Kl02).

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(HI,xnγ) 1989Xu01,1992Dr04 (continued)

γ(^{137}Pr) (continued)

E_γ [†]	I_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
842.2 *2*	20.8 *7*	2713.8	21/2$^-$	1871.4	19/2$^-$	D	
866.9 *2*	4.7 *1*	5171.0		4304.1			
877.0 *2*	4.2 *1*	2713.8	21/2$^-$	1836.8	17/2$^-$		
891.0 *2*	5.6 *2*	5470.5	(35/2$^+$)	4579.5	31/2$^+$		
891.9[&] *2*	5.6 *2*	5624?	(37/2$^+$)	4735.4	33/2$^+$		
905.4 *2*	49.3 *9*	2776.3	23/2$^-$	1871.4	19/2$^-$	Q	
906.1 *2*	12.1 *5*	5024.1	(33/2$^+$)	4118.0	29/2$^+$		
911.0 *2*	12.3 *3*	3687.3	27/2$^-$	2776.3	23/2$^-$		
913.5 *2*	≤2	4221.9	(29/2$^-$)	3308.4	25/2$^-$		
935.1 *2*	5.1 *2*	4622.4	31/2$^-$	3687.3	27/2$^-$		
937.6 *2*	30.3 *5*	2286.6	17/2$^+$	1348.91	13/2$^+$	Q	
941.5 *2*	14.6 *7*	4813.4	33/2$^-$	3871.9	29/2$^-$	Q	
943.5 *2*	18.4 *2*	4735.4	33/2$^+$	3791.9	29/2$^+$	Q	
958.2 *2*	55.5 *9*	2306.98	17/2$^+$	1348.91	13/2$^+$	Q	
[x]966.0 *2*							E_γ: 1992Dr04 suggest placement from a 3932.5 level. γ not seen by 1989Xu01.
975.1 *2*	≤2	6445.6	(39/2$^+$)	5470.5	(35/2$^+$)		
988.1[&] *2*	≤2	7434?	(43/2$^+$)	6445.6	(39/2$^+$)		
1035.1 *2*	≤2	5657.5	(35/2$^-$)	4622.4	31/2$^-$		
1046 *1*	≤2	6070.1	(37/2$^+$)	5024.1	(33/2$^+$)		
1069.2 *2*	6.4 *1*	3845.5		2776.3	23/2$^-$		
1164.0 *2*	8.1 *3*	3000.8	(21/2$^+$)	1836.8	17/2$^-$		
1178.7 *2*	3.9 *2*	3050.1		1871.4	19/2$^-$		
1208[&] *1*	≤2	2286.6	17/2$^+$	1078.41	15/2$^-$		
1228.2 *2*	11.7 *5*	2306.98	17/2$^+$	1078.41	15/2$^-$	D	

[†] From 1989Xu01, unless stated otherwise.
[‡] From γ(θ) in 1989Xu01, 1992Dr04, unless given otherwise. Transitions given as D could be D+Q. See 1992Dr04 for limits on δ.
[#] Placement given in 1992Dr04. Not seen, reported in 1989Xu01.
[@] 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.
[&] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

(HI,xnγ) 1989Xu01,1992Dr04

Level Scheme

Intensities: Relative I_γ

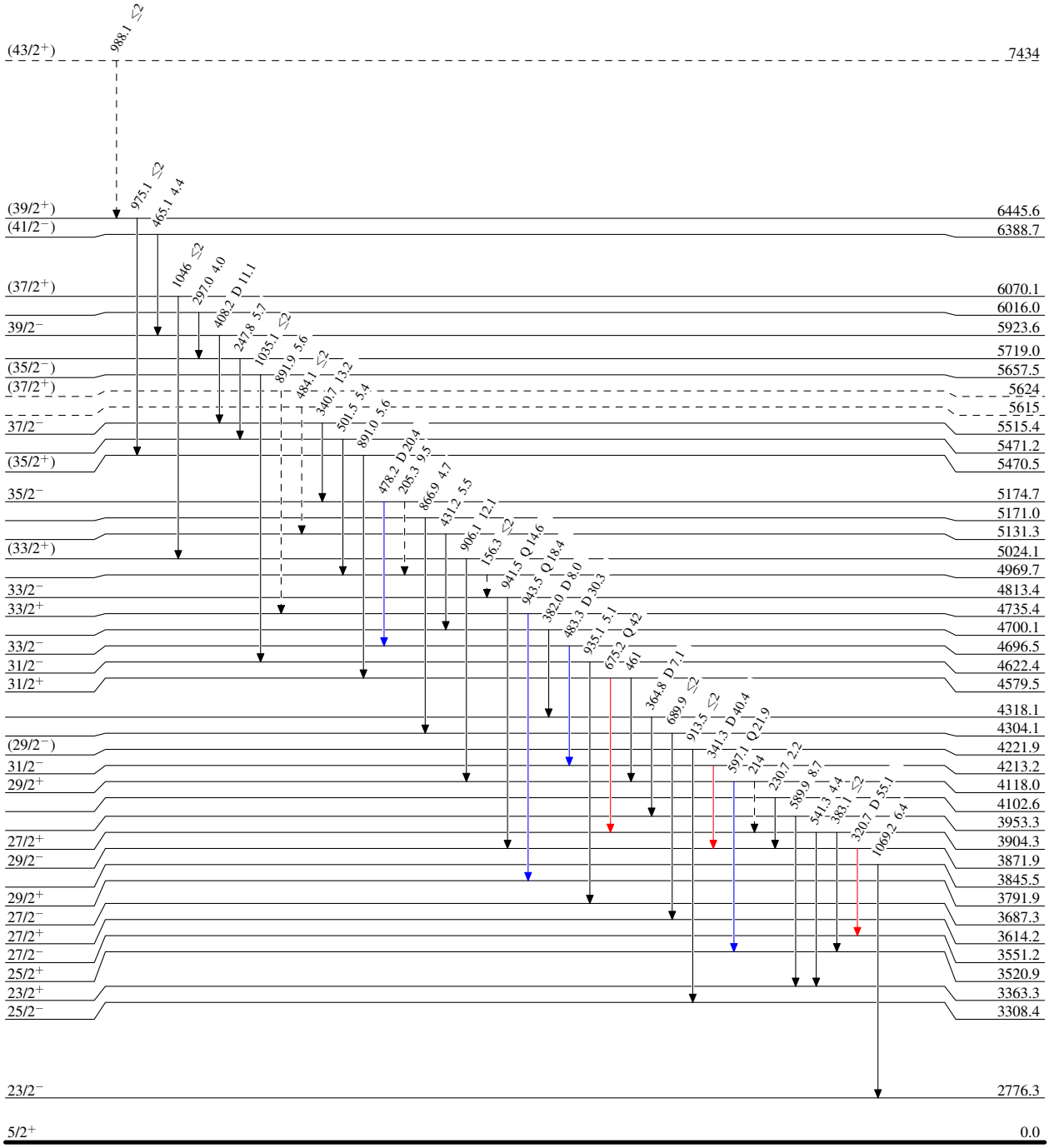
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



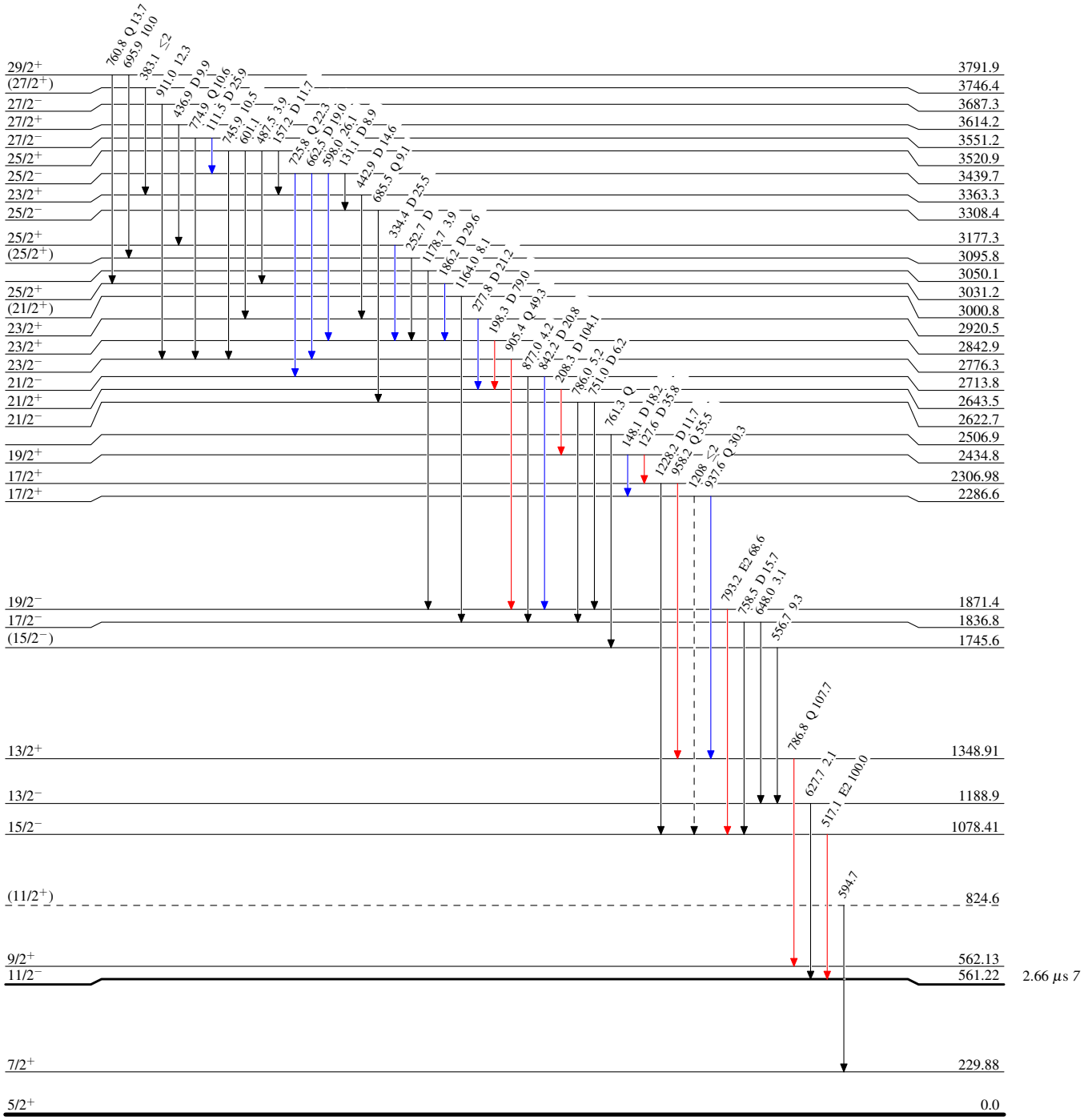
$^{137}_{59}Pr_{78}$

(HI,xnγ) 1989Xu01,1992Dr04

Level Scheme (continued)

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)

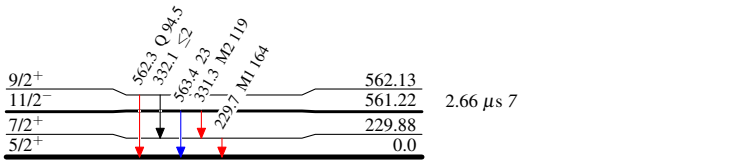


$^{137}_{59}Pr_{78}$

(HI,xnγ) 1989Xu01,1992Dr04

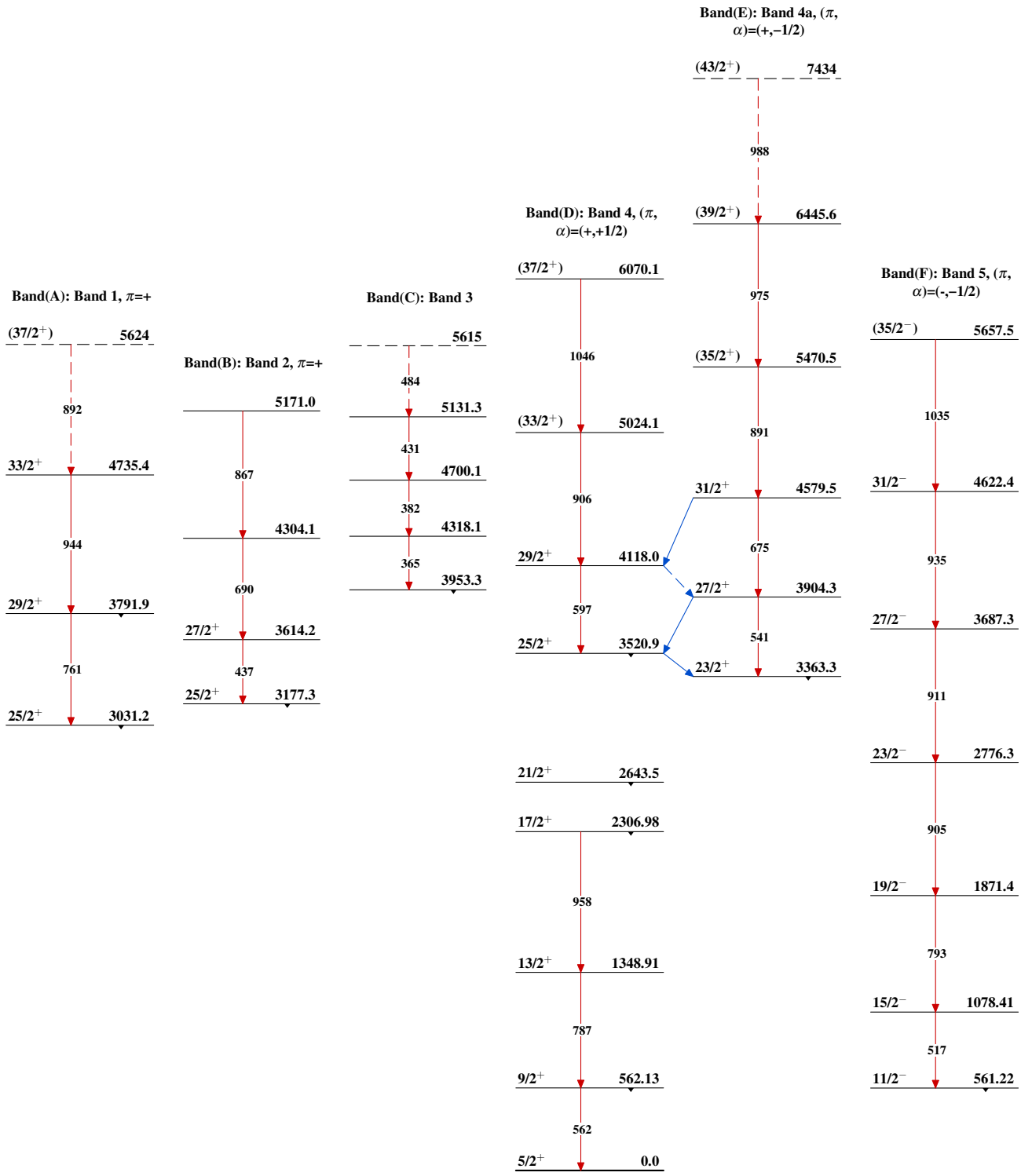
Level Scheme (continued)

Intensities: Relative I_γ



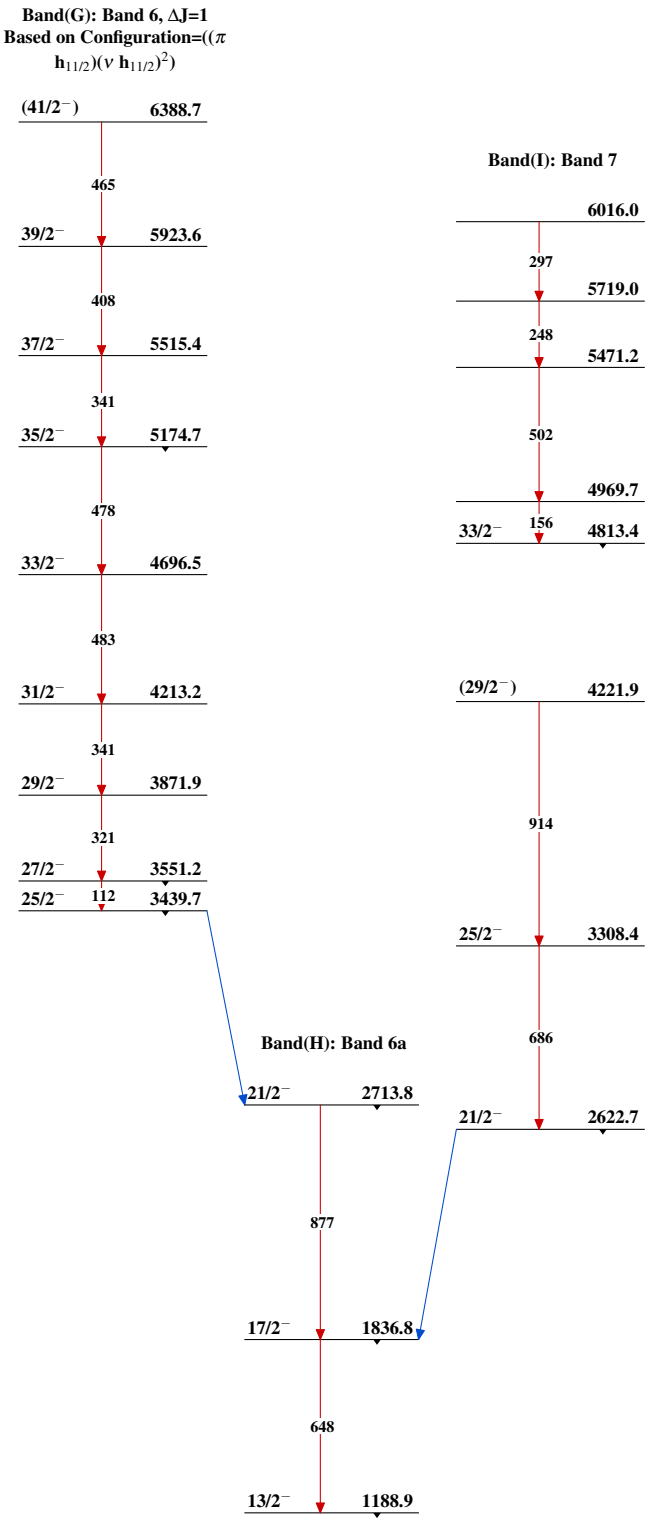
$^{137}_{59}Pr_{78}$

(HI,xnγ) 1989Xu01,1992Dr04



$^{137}_{59}Pr_{78}$

(HI,xnγ) 1989Xu01,1992Dr04 (continued)



$^{137}_{59}Pr_{78}$