^{124}Te(^{19}F,5nγ) 2015Li15

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

2015Li15: E=103 MeV ^{19}F beam was produced from the HI-13 tandem accelerator at the China Institute of Atomic Energy (CIAE). Target was 3 mg/cm^2 thick enriched ^{124}Te on a 4 mg/cm^2 gold backing. γ rays were detected with an array of nine Compton-suppressed HPGe detectors, two planar HPGe detectors and one clover-type detector. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO). Deduced high-spin levels, J, π, multipolarity, bands, configuration, B(M1)/B(E2). Comparison with particle-rotor model predictions and total Routhian surfaces.

^{138}Pm Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	Comments
0+x	5$^-$		Additional information 1. E(level): 30 *30* suggested in 2017Au03 (NUBASE-16) based on β decay energies; could be the g.s. of ^{138}Pm.
150.0+x *4*	6$^-$		
327.5+x *6*	6$^-$		
410.8+x *4*	7$^-$		
584.3+x[#] *6*	8$^+$	21 ns *5*	T$_{1/2}$: from Adopted Levels.
618.2+x[@] *5*	8$^-$		
704.9+x[#] *6*	9$^+$		
762.9+x[a] *5*	7$^-$		
1044.4+x[@] *6*	9$^-$		
1061.8+x[#] *7*	10$^+$		
1088.5+x *6*	(7$^-$)		
1105.0+x[d] *6*	7$^-$		
1164.9+x[a] *6*	9$^-$		
1236.9+x[d] *5*	(8$^-$)		
1383.4+x[@] *6*	10$^-$		
1411.4+x[#] *7*	11$^+$		
1464.0+x[d] *7*	(9$^-$)		
1700.5+x[d] *9*	(10$^-$)		
1858.0+x[@] *6*	11$^-$		
1863.7+x[a] *7*	11$^-$		
1888.4+x[#] *7*	12$^+$		
2096.7+x[d] *10*	(11$^-$)		
2280.6+x[#] *7*	13$^+$		
2367.4+x[@] *7*	12$^-$		
2460.2+x[c] *8*	11$^+$		
2474.5+x[b] *7*	12$^-$		
2531.9+x[d] *11*	(12$^-$)		
2784.2+x[f] *11*	(13$^-$)		
2796.8+x[a] *8*	13$^-$		
2826.7+x[#] *8*	14$^+$		
2832.5+x[@] *7*	13$^-$		B(M1)/B(E2)=0.73 *46*.
3005.1+x[c] *10*	13$^+$		
3050.8+x[d] *12*	(13$^-$)		
3063.6+x[&] *7*	14$^-$		
3073.0+x[b] *9*	14$^-$		

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^{124}Te(^{19}F,5nγ) 2015Li15 (continued)

^{138}Pm Levels (continued)

E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]
3182.6+x[f] *11*	(14$^-$)	3650.7+x[f] *12*	(15$^-$)	4336.8+x[#] *10*	17$^+$	4869.0+x[&] *13*	(19$^-$)
3276.2+x[#] *8*	15$^+$	3771.4+x[b] *10*	16$^-$	4374.4+x[&] *12*	18$^-$	5134.6+x[e] *11*	20$^+$
3304.9+x[&] *9*	15$^-$	3853.0+x[#] *8*	16$^+$	4407.7+x[e] *10*	18$^+$	5698.5+x[b] *13*	20$^-$
3592.7+x[&] *10*	16$^-$	3975.3+x[&] *11*	17$^-$	4413.4+x[c] *12*	(17$^+$)	5996.5+x[e] *12*	22$^+$
3648.6+x[c] *11*	(15$^+$)	4195.7+x[f] *13*	(16$^-$)	4623.5+x[b] *12*	18$^-$		

[†] From least-squares fit to γ-ray energies, assuming 0.5 keV uncertainty for each γ ray in the fitting procedure.
[‡] As given by 2015Li15 based on assignments in 1998Pr04, γ-ray multipolarities and band structures.
[#] Band(A): π3/2[541]⊗ν9/2[514], yrast band. 3/2[541] from $\pi h_{11/2}$ and 9/2[514] from $\nu h_{11/2}$ orbitals.
[@] Band(B): π5/2[413]⊗ν9/2[514]. 5/2[413] from $\pi g_{7/2}$ and 9/2[514] from $\nu h_{11/2}$ orbitals.
[&] Band(C): Band based on 14$^-$. Possible configuration=π5/2[413]⊗ν($h^2_{11/2}$,9/2[514]). 5/2[413] from $\pi g_{7/2}$ and 9/2[514] from $\nu h_{11/2}$ orbitals. Continuation of band based on 618, 8$^-$.
[a] Band(D): $\pi h_{11/2}$⊗ν1/2[400]. 1/2[400] from $\nu d_{3/2}$ orbital. This band bifurcates into two bands above 11$^-$.
[b] Band(E): Band based on 12$^-$. Favored doubly-decoupled band. Bifurcation of band based on 7$^-$. Possible configuration=$\pi h^3_{11/2}$⊗ν1/2[660]; 1/2[600] from $\nu i_{13/2}$ orbital.
[c] Band(F): $\pi h_{11/2}$⊗ν1/2[530]. Favored doubly-decoupled band. Bifurcation of band based on 7$^-$. Possible configuration=$\pi h^3_{11/2}$⊗$\nu h_{9/2}$1/2[530].
[d] Band(G): π3/2[411]⊗$\nu h_{11/2}$. 3/2[411] from $\pi d_{5/2}$ orbital.
[e] Band(H): Band based on 18$^+$. Possible 6-qp configuration.
[f] Band(I): Band based on (13$^-$).

γ(^{138}Pm)

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[‡#]	Comments
120.6	38.7 *28*	704.9+x	9$^+$	584.3+x	8$^+$		
131.9	6.3 *12*	1236.9+x	(8$^-$)	1105.0+x	7$^-$		
148.4	4.1 *8*	1236.9+x	(8$^-$)	1088.5+x	(7$^-$)		
150.0	125.3 *30*	150.0+x	6$^-$	0+x	5$^-$		
173.5	100	584.3+x	8$^+$	410.8+x	7$^-$		
177.5	7.3 *23*	327.5+x	6$^-$	150.0+x	6$^-$		
227.1	17.5 *16*	1464.0+x	(9$^-$)	1236.9+x	(8$^-$)		
231.1	6.1 *10*	3063.6+x	14$^-$	2832.5+x	13$^-$		
236.5	11.5 *15*	1700.5+x	(10$^-$)	1464.0+x	(9$^-$)		
241.3	5.9 *7*	3304.9+x	15$^-$	3063.6+x	14$^-$		
260.8	87.7 *40*	410.8+x	7$^-$	150.0+x	6$^-$		
287.8	5.6 *6*	3592.7+x	16$^-$	3304.9+x	15$^-$		
349.6	12.7 *9*	1411.4+x	11$^+$	1061.8+x	10$^+$	M1+E2	DCO=1.62 *12*
352.1	7.7 *8*	762.9+x	7$^-$	410.8+x	7$^-$	M1+E2	DCO=1.88 *11*
356.9	25.1 *8*	1061.8+x	10$^+$	704.9+x	9$^+$	M1+E2	DCO=2.17 *16*
382.6	2.6 *2*	3975.3+x	17$^-$	3592.7+x	16$^-$		
392.2	8.7 *8*	2280.6+x	13$^+$	1888.4+x	12$^+$		
396.2	6.0 *3*	2096.7+x	(11$^-$)	1700.5+x	(10$^-$)		
398.4	1.4 *2*	3182.6+x	(14$^-$)	2784.2+x	(13$^-$)		
399.1	1.5 *2*	4374.4+x	18$^-$	3975.3+x	17$^-$		
402.0	14.6 *14*	1164.9+x	9$^-$	762.9+x	7$^-$	E2	DCO=0.77 *4* Note: DCO is lower than expected ≈1.0 for stretched E2.
410.8	27.9 *20*	410.8+x	7$^-$	0+x	5$^-$	E2	DCO=0.87 *8*
426.2	4.9 *5*	1044.4+x	9$^-$	618.2+x	8$^-$	M1+E2	DCO=1.47 *15*

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^{124}Te(^{19}F,5nγ) 2015Li15 (continued)

γ(^{138}Pm) (continued)

$E_γ$ †	$I_γ$ †	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.‡#	Comments
435.2	1.7 *2*	2531.9+x	(12⁻)	2096.7+x	(11⁻)		
435.4	7.1 *5*	762.9+x	7⁻	327.5+x	6⁻		
449.5@	<0.5	3276.2+x	15⁺	2826.7+x	14⁺		
452.3	2.0 *4*	1863.7+x	11⁻	1411.4+x	11⁺		
460.0	2.0 *2*	1164.9+x	9⁻	704.9+x	9⁺		
465.1	0.8 *5*	2832.5+x	13⁻	2367.4+x	12⁻		
468.1	0.5 *1*	3650.7+x	(15⁻)	3182.6+x	(14⁻)		
468.2	16.3 *13*	618.2+x	8⁻	150.0+x	6⁻	E2	DCO=1.09 *10*
474.6	4.8 *4*	1858.0+x	11⁻	1383.4+x	10⁻		
477.0	9.1 *5*	1888.4+x	12⁺	1411.4+x	11⁺	M1+E2	DCO=2.01 *15*
494.6	1.0 *1*	4869.0+x	(19⁻)	4374.4+x	18⁻		
518.9	1.1 *2*	3050.8+x	(13⁻)	2531.9+x	(12⁻)	[M1+E2]	
544.9	3.0 *4*	3005.1+x	13⁺	2460.2+x	11⁺	E2	DCO=1.14 *10*
545.0	<0.5	4195.7+x	(16⁻)	3650.7+x	(15⁻)		
546.1	8.6 *10*	2826.7+x	14⁺	2280.6+x	13⁺	M1+E2	DCO=1.63 *17*
554.7	7.8 *8*	4407.7+x	18⁺	3853.0+x	16⁺	E2	DCO=0.84 *8*
576.8	2.5 *4*	3853.0+x	16⁺	3276.2+x	15⁺		
580.6	1.9 *2*	1164.9+x	9⁻	584.3+x	8⁺	E1	DCO=1.53 *17*
586.1	0.9 *1*	2474.5+x	12⁻	1888.4+x	12⁺	[E1]	
596.5	3.1 *3*	2460.2+x	11⁺	1863.7+x	11⁻	E1	DCO=1.02 *10* ΔJ=0, dipole transition.
598.5	7.9 *4*	3073.0+x	14⁻	2474.5+x	12⁻	E2	DCO=0.93 *5*
599.9	<0.5	3650.7+x	(15⁻)	3050.8+x	(13⁻)		
610.8	7.3 *4*	2474.5+x	12⁻	1863.7+x	11⁻	M1+E2	DCO=1.96 *12*
618.7	3.2 *4*	1236.9+x	(8⁻)	618.2+x	8⁻		
633.6	3.6 *5*	1044.4+x	9⁻	410.8+x	7⁻	E2	DCO=0.75 *8* Note: DCO is lower than expected ≈1.0 for stretched E2.
643.5	1.8 *2*	3648.6+x	(15⁺)	3005.1+x	13⁺	[E2]	
650.7	0.6 *2*	3182.6+x	(14⁻)	2531.9+x	(12⁻)		
687.5	1.8 *2*	2784.2+x	(13⁻)	2096.7+x	(11⁻)		
698.4	7.3 *10*	3771.4+x	16⁻	3073.0+x	14⁻		
698.8	13.7 *19*	1863.7+x	11⁻	1164.9+x	9⁻	E2	DCO=1.14 *5*
706.5	10.3 *5*	1411.4+x	11⁺	704.9+x	9⁺	E2	DCO=0.82 *7*
726.9	3.7 *3*	5134.6+x	20⁺	4407.7+x	18⁺	E2	DCO=0.99 *11*
764.8	0.8 *2*	4413.4+x	(17⁺)	3648.6+x	(15⁺)	[E2]	
765.2	8.6 *7*	1383.4+x	10⁻	618.2+x	8⁻	E2	DCO=0.90 *17*
783.0	1.9 *2*	3063.6+x	14⁻	2280.6+x	13⁺		
801.9	1.6 *3*	1863.7+x	11⁻	1061.8+x	10⁺		
813.6	8.1 *7*	1858.0+x	11⁻	1044.4+x	9⁻	E2	DCO=1.00 *13*
826.1	4.1 *4*	1236.9+x	(8⁻)	410.8+x	7⁻		
826.6	7.9 *10*	1888.4+x	12⁺	1061.8+x	10⁺	E2	DCO=0.83 *14*
852.1	3.0 *3*	4623.5+x	18⁻	3771.4+x	16⁻	E2	DCO=0.92 *8*
861.9	2.1 *5*	5996.5+x	22⁺	5134.6+x	20⁺	E2	DCO=1.12 *18*
869.2	7.3 *5*	2280.6+x	13⁺	1411.4+x	11⁺	E2	DCO=0.83 *8*
933.1	2.7 *3*	2796.8+x	13⁻	1863.7+x	11⁻		
938.3	6.1 *8*	2826.7+x	14⁺	1888.4+x	12⁺	E2	DCO=1.26 *16*
938.5	7.3 *3*	1088.5+x	(7⁻)	150.0+x	6⁻		
955.0	6.7 *2*	1105.0+x	7⁻	150.0+x	6⁻	M1+E2	DCO=1.74 *23*
974.5	6.9 *9*	2832.5+x	13⁻	1858.0+x	11⁻	E2	DCO=0.87 *13*
984.0	3.5 *4*	2367.4+x	12⁻	1383.4+x	10⁻		
995.6	4.8 *8*	3276.2+x	15⁺	2280.6+x	13⁺	E2	DCO=0.90 *10*
1026.3	5.8 *1*	3853.0+x	16⁺	2826.7+x	14⁺	E2	DCO=0.89 *13*
1060.6	<0.5	4336.8+x	17⁺	3276.2+x	15⁺	[E2]	
1075.0	<0.5	5698.5+x	20⁻	4623.5+x	18⁻	[E2]	

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^{124}Te(^{19}F,5nγ) 2015Li15 (continued)

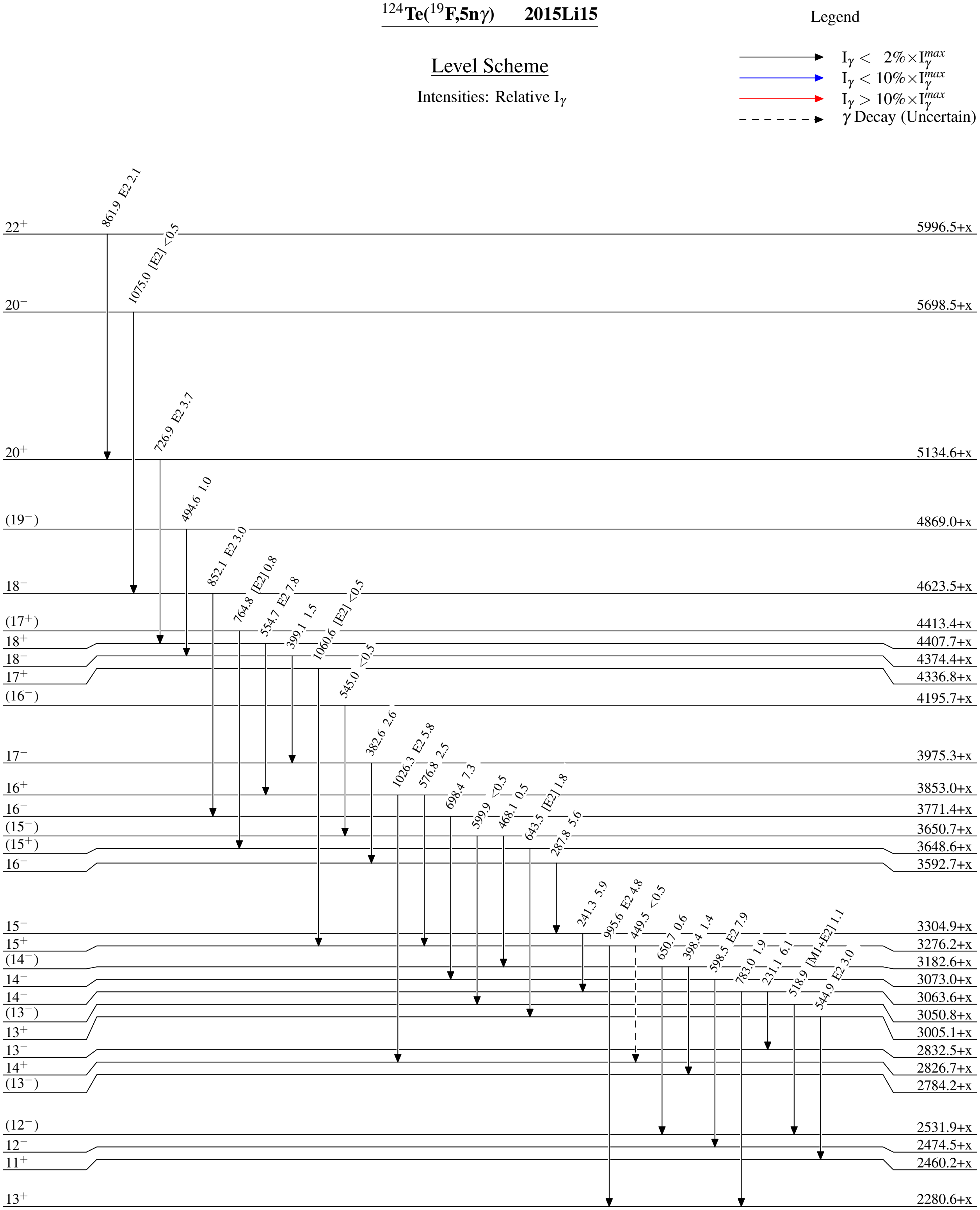
γ(^{138}Pm) (continued)

† From 2015Li15.
‡ As assigned by 2015Li15 based on measured DCO ratios, obtained as R(DCO)=Iγ(90°,θ)/Iγ(θ,90°) by gating on ΔJ=2, quadrupole transitions. Expected DCO≈1 for stretched quadrupole, and ≈1.7 for stretched dipole; stretched quadrupole transitions are assigned E2 and stretched dipole transitions are assigned M1+E2 or E1 by 2015Li15 based on band structures.
# Additional information 2.
@ Placement of transition in the level scheme is uncertain.

$^{124}Te(^{19}F,5n\gamma)$ 2015Li15

Level Scheme

Intensities: Relative I_γ



$^{138}_{61}Pm_{77}$

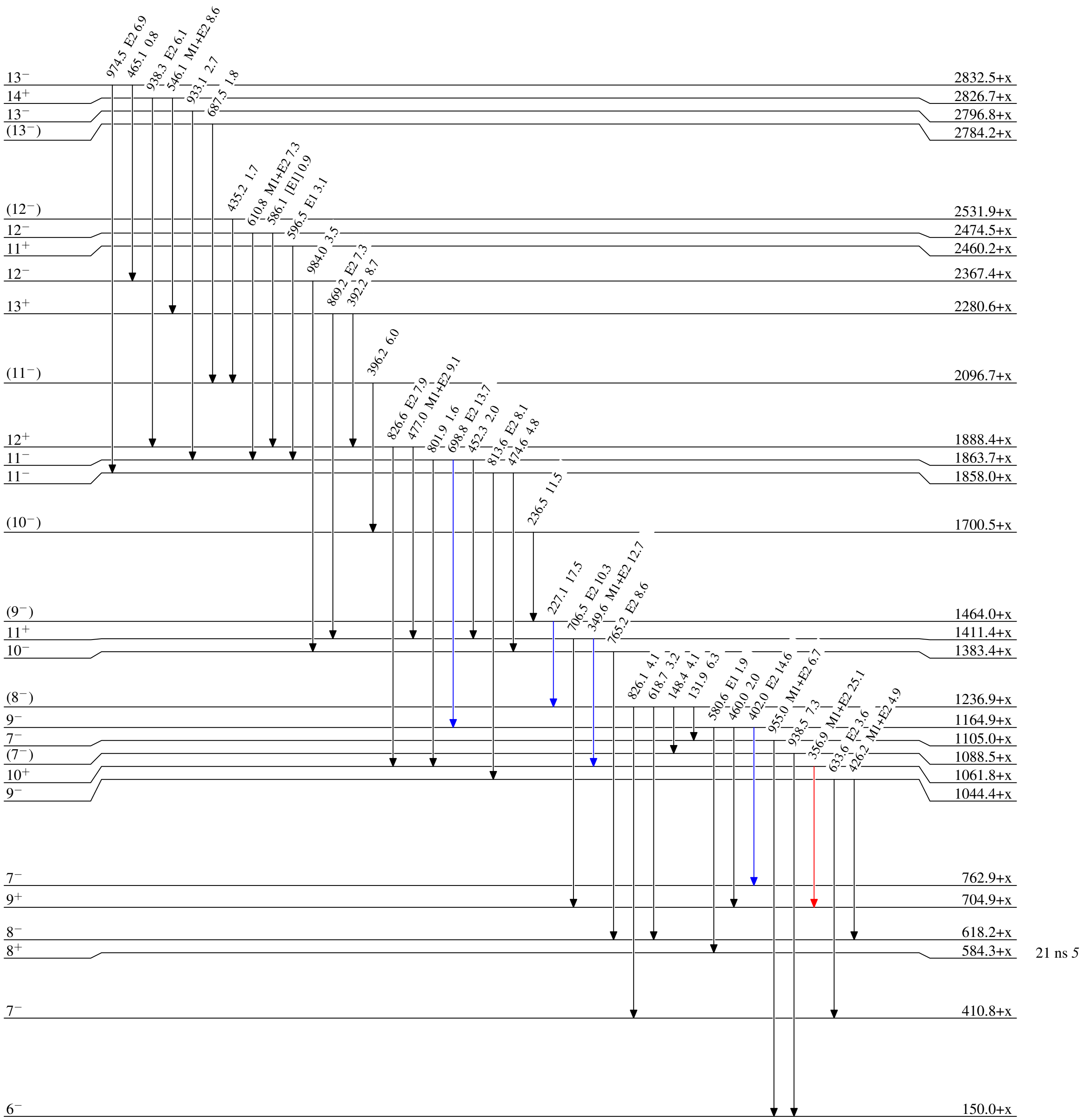
$^{124}Te(^{19}F,5n\gamma)$ **2015Li15**

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



$^{138}_{61}Pm_{77}$

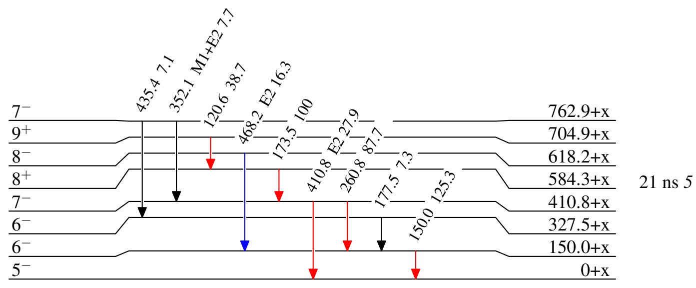
$^{124}Te(^{19}F,5n\gamma)$ **2015Li15**

Level Scheme (continued)

Intensities: Relative I_γ

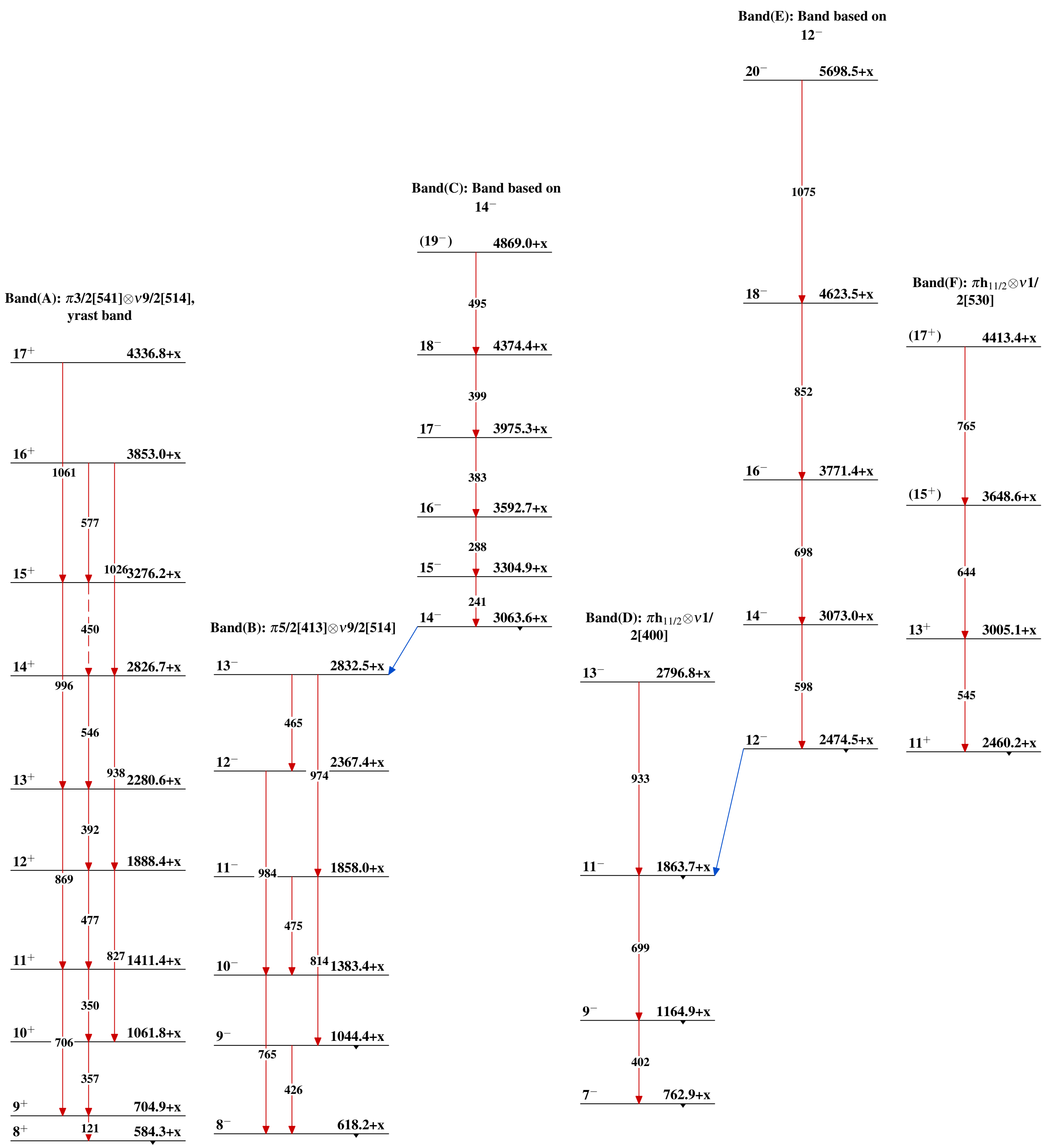
Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



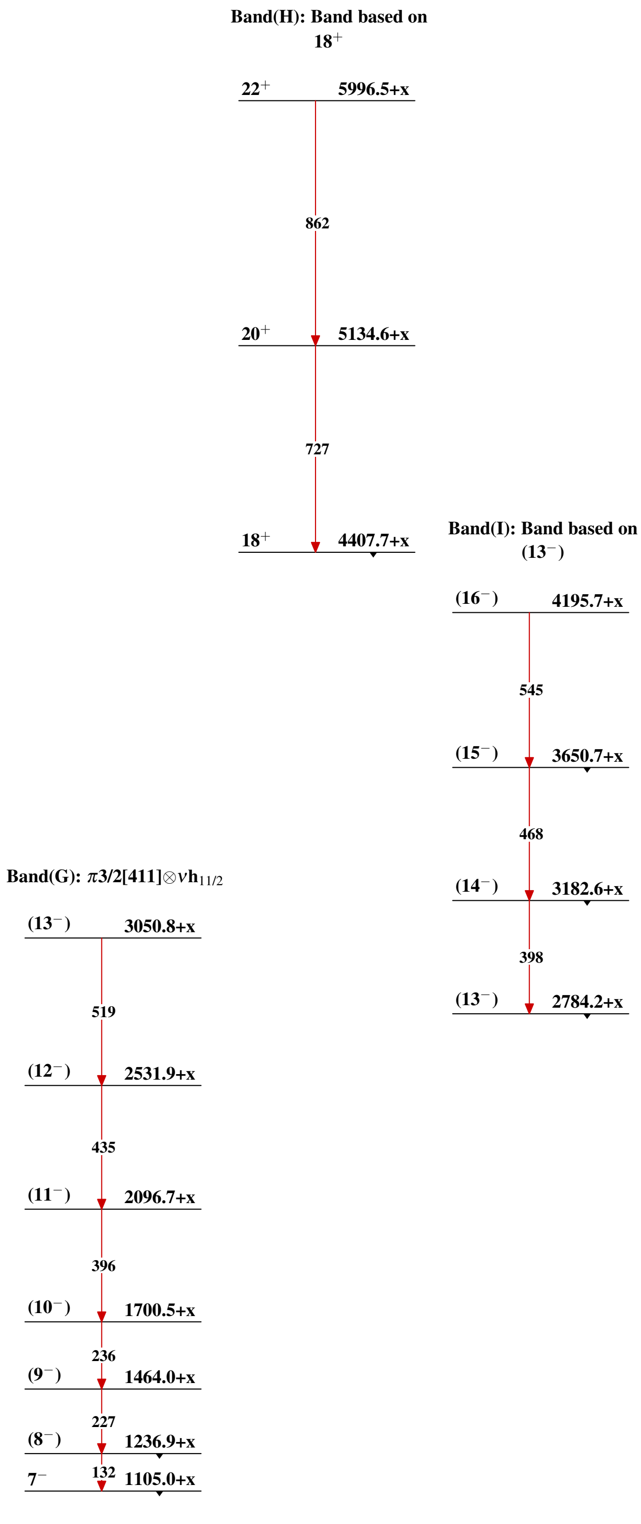
$^{138}_{61}Pm_{77}$

$^{124}Te(^{19}F,5n\gamma)$ 2015Li15



$^{138}_{61}Pm_{77}$

$^{124}Te(^{19}F,5n\gamma)$ 2015Li15 (continued)



$^{138}_{61}Pm_{77}$