Adopted Levels, Gammas

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

Q(β^-)=−3440 *30*; S(n)=8940 *30*; S(p)=2640 *30*; Q(α)=1160 *30* 2017Wa10
S(2n)=19910 *70*, S(2p)=8180 *30*, Q(εp)=972 *29*, Q(β^+)=7078 *29* (2017Wa10).
Observation of ^{138}Sm ε decay to ^{138}Pm was reported in 1973WeZK; the first study on the decay of ^{138}Pm was done by 1973VaYZ.
Experimental works on ^{138}Pm:
1983Al06, report a ε/β^+ decay level with $T_{1/2}$=10 s *2* and a Q(ε)=7090 keV 100.
1983GaZT, probably a preliminary version of 1983Al06; report the 10 s isomer and assign a $J^\pi=1^+$ to it. These authors also list the following γ ray energies: 340 keV (Iγ=100), 440 keV (Iγ=60), 540 keV (Iγ=40). The 540 keV line presumably corresponds to the 520 keV 2^+ to g.s. γ in ^{138}Nd, while the other two can not be consistently identified.
2000Be42, using a Penning Trap, observed only the 3.24 min level, indicating that the 10 s level should have been observed, but was not. Their measured mass excess is in agreement with the independent measurement of 2000Ra23.
2015Li15, 1998Pr04, 1990Be28, studied the high-spin levels of ^{138}Pm. The lowest energy state that was observed was assigned a $J^\pi=5^-$. Unfortunately, these works did not study the decay of this level.
Based on these findings, the 10 s level is tentatively adopted as g.s. without a spin assignment. The 3.24 min level is firmly adopted as an isomer without spin assignment. The lowest level observed in the high-spin work is assigned an unknown energy, even though it is likely to correspond to the 3.24 min level.
Mass measurements: 2000Be42, 2000Ra23, 1997Be63.

^{138}Pm Levels

Cross Reference (XREF) Flags

- A ^{138}Sm ε decay
- B ^{115}In(^{28}Si,2p3nγ)
- C ^{116}Cd(^{27}Al,5nγ)
- D ^{124}Te(^{19}F,5nγ)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0?	(1^+)	10 s *2*		%ε+%β^+=100 E(level): this isomer was not observed by 2000Be42 and as a consequence, its existence needs further proof. J$^\pi$: systematics of structures in neighboring even Pm; 1^+ also proposed in 1983GaZT. $T_{1/2}$: from 1983Al06. Q(ε)=7090 *100* (1983Al06).
x	(5^-)	3.24 min *5*	BCD	%ε+%β^+=100 Additional information 1. E(level): 20 *100* from observed β decay energy difference, between Q(ε)(2000Be42)=7105 *19* and Q(ε)(1983Al06)=7090 *100*. Note that 2000Be42 did not observe the 10 s level and thus this 3.24 min level observed in 2000Be42 could also be the g.s. of ^{138}Pm. E=30 *30* is suggested in 2017Au03 (NUBASE-16) based on β decay energies. J$^\pi$: 411.0γ Q from (7^-); systematics of structures in neighboring even mass Pm. But (3^+) proposed in 1973VaYZ and 1981De38 is inconsistent in the ^{138}Pm ε decay scheme. $T_{1/2}$: from 1981De38; other: 3.5 min *3* (1973VaYZ).
150.02+x *10*	(6^-)		BCD	J$^\pi$: 150.0γ D to (5^-) and 260.8γ D from (7^-).
327.45+x[#] *13*	(6^-)		BCD	J$^\pi$: predicted from shell-model calculations; band head of the $\pi h_{11/2}\nu 1/2[400]$ band; 177.4γ D+Q to (6^-).
410.75+x *13*	(7^-)		BCD	J$^\pi$: 173.6γ possible E1 from (8^+).

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Adopted Levels, Gammas (continued)

^{138}Pm Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	XREF	Comments
584.26+x[b] *15*	(8$^+$)	21 ns *5*	BCD	J$^{\pi}$: proposed in 1990Be28 in ^{116}Cd(^{27}Al,5nγ) based on systematics of neighbouring nuclei. $T_{1/2}$: from γ(t) in 1990Be28.
618.41+x[d] *14*	(8$^-$)		BCD	J$^{\pi}$: 468.3γ Q to (6$^-$), band member.
704.77+x[a] *17*	(9$^+$)		BCD	J$^{\pi}$: 120.6γ D to (8$^+$), band member.
762.89+x[#] *14*	(7$^-$)		BCD	J$^{\pi}$: 352.2γ D+Q to (7$^-$), 435.4γ D to (6$^-$), band member. Note: J^{π}=8$^-$ assigned by 1990Be28 in ^{116}Cd(^{27}Al,5nγ) is inconsistent with 435.4γ D to (6$^-$), and their J^{π} values of other member states in the same band differ from adopted ones by one or two units.
1044.67+x[d] *16*	(9$^-$)		BCD	J$^{\pi}$: 426.2γ D to (8$^-$), 633.6γ Q to (7$^-$), band member.
1061.52+x[b] *18*	(10$^+$)		BCD	J$^{\pi}$: 356.9γ D to (9$^+$), band member.
1088.6+x *3*	(7$^-$)		B D	J$^{\pi}$: tentative assignment by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ), 938.8γ D to (6$^-$).
1104.68+x *14*	(7$^-$)		B D	J$^{\pi}$: tentative assignment by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ), 954.7γ D to (6$^-$).
1164.76+x[#] *17*	(9$^-$)		BCD	J$^{\pi}$: 401.9γ Q to (7$^-$), band member.
1236.75+x[e] *16*	(8$^-$)		B D	
1383.36+x[d] *17*	(10$^-$)		BCD	J$^{\pi}$: 764.9γ Q to (8$^-$), band member.
1411.12+x[a] *18*	(11$^+$)		BCD	J$^{\pi}$: 706.3γ Q to (9$^+$), 349.5γ D to (10$^+$), band member.
1464.05+x[e] *19*	(9$^-$)		B D	J$^{\pi}$: 227.3γ D to (8$^-$), band member.
1615.91+x *19*	(10$^-$)		B	J$^{\pi}$: tentative assignment by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ).
1700.55+x[e] *22*	(10$^-$)		B D	J$^{\pi}$: 236.5γ D to (9$^-$), band member.
1858.35+x[d] *17*	(11$^-$)		BCD	J$^{\pi}$: 813.6γ Q to (9$^-$), 474.4γ D to (10$^-$), band member.
1863.16+x[#] *19*	(11$^-$)		BCD	J$^{\pi}$: 698.4γ Q to (9$^-$), band member.
1888.16+x[b] *19*	(12$^+$)		BCD	J$^{\pi}$: 826.7γ Q to (10$^+$), 477.0γ D to (11$^+$), band member.
2096.75+x[e] *24*	(11$^-$)		B D	J$^{\pi}$: 396.2γ D to (10$^-$), band member.
2280.34+x[a] *20*	(13$^+$)		BCD	J$^{\pi}$: 869.1γ Q to (11$^+$), band member.
2367.1+x[d] *4*	(12$^-$)		BCD	J$^{\pi}$: 983.7γ to (10$^-$), band member.
2459.56+x[&] *22*	(11$^+$)		B D	J$^{\pi}$: band assignment, 596.4γ D+Q to (11$^-$).
2473.86+x[@] *22*	(12$^-$)		BCD	J$^{\pi}$: 610.7γ D to (11$^-$), band member.
2532.1+x[e] *3*	(12$^-$)		B D	E(level),J$^{\pi}$: from band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15). 1998Pr04 in ^{115}In(^{28}Si,2p3nγ) consider a level at E=2496+x as the (12$^-$) band member feeding the 2097+x, J^{π}=(11$^-$) level by the 398.8γ, which however placed differently by 2015Li15.
2628.70+x *19*	(12$^-$)		B	
2784.3+x[f] *3*	(13$^-$)		D	J$^{\pi}$: band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15), 687.5γ to (11$^-$).
2795.77+x[#] *22*	(13$^-$)		BCD	J$^{\pi}$: 932.6γ Q to (11$^-$), band member.
2825.58+x[b] *25*	(14$^+$)		BCD	J$^{\pi}$: 938.1γ Q to (12$^+$), 545.6γ D to (13$^+$), band member.
2832.90+x[d] *18*	(13$^-$)		BCD	J$^{\pi}$: 974.5γ Q to (11$^-$), band member.
2869.85+x *21*	(13$^-$)		B	J$^{\pi}$: tentative assignment by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ). 241.3γ to (12$^-$), 1010.4γ to (11$^-$).
3004.46+x[&] *24*	(13$^+$)		BCD	J$^{\pi}$: 544.9γ Q to (11$^+$), band member.
3050.8+x[e] *5*	(13$^-$)		B D	J$^{\pi}$: 518.6γ to (12$^-$), band member; from band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15).
3064.05+x[d] *19*	(14$^-$)		BCD	J$^{\pi}$: 231.1γ D to (13$^+$), 195.6γ D+Q to (13$^-$), band member.
3072.35+x[@] *24*	(14$^-$)		BCD	J$^{\pi}$: 598.5γ Q to (12$^-$), band member.
3183.1+x[f] *3*	(14$^-$)		D	J$^{\pi}$: band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15).
3276.0+x[a] *3*	(15$^+$)		BCD	J$^{\pi}$: 995.2γ Q to (13$^+$), band member.
3305.35+x[d] *21*	(15$^-$)		BCD	J$^{\pi}$: 241.3γ to (14$^-$), band member.
3593.35+x[d] *24*	(16$^-$)		BCD	J$^{\pi}$: 288.0γ D to (15$^-$), band member.
3648.0+x[&] *11*	(15$^+$)		D	E(level),J$^{\pi}$: band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15). 1998Pr04 in

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Adopted Levels, Gammas (continued)

^{138}Pm Levels (continued)

E(level)†	Jπ‡	XREF	Comments
			^{115}In(^{28}Si,2p3nγ) assign this (15$^+$) band member at a 3688+x level, feeding the 3004+x level by a 684.0γ which is not observed by 2015Li15. The evaluator has adopted this band assignment by 2015Li15.
3651.0+x[f] *8*	(15$^-$)	D	Jπ: band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15).
3771.8+x[@] *3*	(16$^-$)	BCD	Jπ: 699.4γ to (14$^-$), band member.
3852.0+x[b] *4*	(16$^+$)	BCD	Jπ: 1025.9γ Q to (14$^+$), band member.
3975.9+x[d] *3*	(17$^-$)	BCD	Jπ: 382.6γ D to (16$^-$), band member.
4196.0+x[f] *13*	(16$^-$)	D	Jπ: band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15).
4338.0+x[a] *8*	(17$^+$)	BCD	Jπ: 485γ to (16$^+$), 1063γ to (15$^+$), band member.
4374.8+x[d] *3*	(18$^-$)	BCD	Jπ: 398.8γ to (17$^-$), band member.
4406.7+x[c] *11*	(18$^+$)	D	E(level): 1998Pr04 in ^{115}In(^{28}Si,2p3nγ) assign this (18$^+$) band head at a 4579+x level, feeding the 3852+x level by a 726.6γ and fed by a 554.6γ from the 5133 level. 2015Li15 in ^{124}Te(^{19}F,5nγ) have placed the 554.6γ+726.6γ cascade in reversed order, making a level at 4407+x. The evaluator has adopted this band assignment by 2015Li15. Jπ: 554.7γ Q to (16$^+$), band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15).
4536.6+x[&] *11*	(17$^+$)	D	E(level),Jπ: band assignment in ^{124}Te(^{19}F,5nγ) (2015Li15). 1998Pr04 in ^{115}In(^{28}Si,2p3nγ) assign this (17$^+$) band member at a 4538+x level, feeding a level at E=3688+x by a 850γ which is not observed by 2015Li15. The evaluator has adopted this band assignment by 2015Li15.
4623.5+x[@] *5*	(18$^-$)	BCD	Jπ: 851.7γ Q to (16$^-$), band member.
4869.3+x[d] *3*	(19$^-$)	B D	Jπ: 494.5γ to (18$^-$), band member.
4922.0+x[b] *11*	(18$^+$)	B	Jπ: band assignment.
5133.3+x[c] *11*	(20$^+$)	B D	E(level): See comments for 4407+x level. Jπ: 726.6γ to (18$^+$), band member. Other: (19$^+$) assigned by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ).
5386.1+x[d] *5*	(20$^-$)	B	Jπ: band assignment.
5456.4+x?[a]	(19$^+$)	B	Jπ: band assignment.
5695.5+x[@] *11*	(20$^-$)	B D	Jπ: band assignment.
5995.0+x[c] *11*	(22$^+$)	B D	Jπ: 861.7γ Q to (20$^+$), band member. Other: (20$^+$) assigned by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ).
6864.1+x[c] *11*		C	Jπ: (21$^+$) assigned by 1998Pr04 in ^{115}In(^{28}Si,2p3nγ) based on the assignments of J^π=(20$^+$) and (19$^+$) for 5995+x and 5133+x levels, respectively.

† From a least-squares fit to γ-ray energies. For fitting purpose only, uncertainties of 451.0γ, 545.6γ, and 995.2γ are increased to 0.2 keV due to poor fit.

‡ All assignments except for isomers are based on the assignment of J^π=8$^+$ to the bandhead of the yrast band together with deduced γ-ray multipolarities and band structures.

Band(A): $\pi h_{11/2}\nu 1/2[400]$. This band bifurcates into two bands above (11$^-$).

@ Band(B): Band based on (12$^-$). Favored doubly-decoupled band. Bifurcation of band based on (7$^-$). Possible configuration=$\pi h^3_{11/2}\otimes\nu 1/2[660]$; 1/2[600] from $\nu i_{13/2}$ orbital.

& Band(C): Band based on (11$^+$). Favored doubly-decoupled band. Bifurcation of band based on (7$^-$). Possible configuration=$\pi h^3_{11/2}\otimes\nu h_{9/2}1/2[530]$.

a Band(D): Configuration=$\pi h_{11/2}\otimes\nu h_{11/2}$ α=1.

b Band(d): Configuration=$\pi h_{11/2}\otimes\nu h_{11/2}$ α=0.

c Band(E): Band based on 18$^+$.

d Band(F): $\pi 5/2[413]\otimes\nu 9/2[514]$.

e Band(G): $\pi 3/2[411]\otimes\nu h_{11/2}$.

f Band(H): Band based on (13$^-$).

Adopted Levels, Gammas (continued)

$\gamma(^{138}Pm)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	Comments
150.02+x	(6$^-$)	150.0 *1*	100	x	(5$^-$)	D	Mult.: most likely M1 character.
327.45+x	(6$^-$)	177.4 *1*	100	150.02+x	(6$^-$)	D+Q	
410.75+x	(7$^-$)	260.8 *1*	100 *4*	150.02+x	(6$^-$)	D	
		411.0 *4*	<33	x	(5$^-$)	Q	E_γ: unweighted average of 410.6 *1* from ^{115}In(^{28}Si,2p3nγ) and 411.3 *2* from ^{116}Cd(^{27}Al,5nγ).
584.26+x	(8$^+$)	173.6 *1*	100	410.75+x	(7$^-$)	D	Mult.: 1990Be28 in ^{116}Cd(^{27}Al,5nγ) assign E1 from intensity arguments.
618.41+x	(8$^-$)	468.3 *1*	100	150.02+x	(6$^-$)	Q	E_γ: weighted average of 468.2 *1* from ^{115}In(^{28}Si,2p3nγ) and 468.5 *2* from ^{116}Cd(^{27}Al,5nγ).
704.77+x	(9$^+$)	120.6 *1*	100	584.26+x	(8$^+$)	D	
762.89+x	(7$^-$)	178.3[&] *2*		584.26+x	(8$^+$)		E_γ: observed in ^{116}Cd(^{27}Al,5nγ) (1990Be28) only. I_γ: Iγ(178.3γ)/I(352.2γ)=(100 *5*)/(68 *5*) (1990Be28).
		352.2 *1*	100[‡] *10*	410.75+x	(7$^-$)	D+Q	
		435.4 *1*	92[‡] *7*	327.45+x	(6$^-$)	D	
1044.67+x	(9$^-$)	426.2 *1*	100 *7*	618.41+x	(8$^-$)	D	
		633.6 *4*	75 *9*	410.75+x	(7$^-$)	Q	
1061.52+x	(10$^+$)	356.9 *1*	100	704.77+x	(9$^+$)	D	
1088.6+x	(7$^-$)	938.8 *4*	100	150.02+x	(6$^-$)	D	
1104.68+x	(7$^-$)	954.7 *1*	100	150.02+x	(6$^-$)	D	
1164.76+x	(9$^-$)	401.9 *1*	100 *4*	762.89+x	(7$^-$)	Q	
		459.6 *4*	7.2 *13*	704.77+x	(9$^+$)		
		580.6	13.0 *14*	584.26+x	(8$^+$)	D	E_γ,I_γ,Mult.: from ^{124}Te(^{19}F,5nγ) (2015Li15) only.
1236.75+x	(8$^-$)	132.1 *1*	100[‡] *19*	1104.68+x	(7$^-$)	D	
		148.4 *4*	65[‡] *13*	1088.6+x	(7$^-$)	D	
		618.3 *4*	51[‡] *6*	618.41+x	(8$^-$)	D+Q	
		825.2 *4*	65[‡] *6*	410.75+x	(7$^-$)	D+Q	
1383.36+x	(10$^-$)	764.9 *1*	100	618.41+x	(8$^-$)	Q	
1411.12+x	(11$^+$)	349.5 *1*	100 *5*	1061.52+x	(10$^+$)	D	
		706.3 *1*	85 *5*	704.77+x	(9$^+$)	Q	I_γ: weighted average of 92 *5* from ^{115}In(^{28}Si,2p3nγ), and 81 *4* from ^{124}Te(^{19}F,5nγ). Other: 65 *5* from ^{116}Cd(^{27}Al,5nγ),
1464.05+x	(9$^-$)	227.3 *1*	100	1236.75+x	(8$^-$)	D	
1615.91+x	(10$^-$)	554.6 *1*	100	1061.52+x	(10$^+$)		E_γ: doubly placed in ^{115}In(^{28}Si,2p3nγ) (1998Pr04); placed differently in ^{116}Cd(^{27}Al,5nγ) (1990Be28) and ^{124}Te(^{19}F,5nγ) (2015Li15).
1700.55+x	(10$^-$)	236.5 *1*	100	1464.05+x	(9$^-$)	D	
1858.35+x	(11$^-$)	474.4 *4*	34 *4*	1383.36+x	(10$^-$)	D	I_γ: Other: 59 *5* in ^{124}Te(^{19}F,5nγ) (2015Li15).
		813.6 *1*	100 *8*	1044.67+x	(9$^-$)	Q	
1863.16+x	(11$^-$)	452 *1*	15[‡] *3*	1411.12+x	(11$^+$)		
		698.4 *1*	100[‡] *14*	1164.76+x	(9$^-$)	Q	
		800.8 *10*	12[‡] *2*	1061.52+x	(10$^+$)		
1888.16+x	(12$^+$)	477.0 *1*	100[‡] *6*	1411.12+x	(11$^+$)	D	
		826.7 *1*	73[‡] *9*	1061.52+x	(10$^+$)	Q	I_γ: weighted average of 67 *7* from ^{116}Cd(^{27}Al,5nγ), and 87 *11* from ^{124}Te(^{19}F,5nγ). Other: <77 from ^{115}In(^{28}Si,2p3nγ).
2096.75+x	(11$^-$)	396.2 *1*	100	1700.55+x	(10$^-$)	D	
2280.34+x	(13$^+$)	392.0 *4*	100[‡] *8*	1888.16+x	(12$^+$)		E_γ: unweighted average of 391.6 *1* from ^{115}In(^{28}Si,2p3nγ) and 392.4 *2* from ^{116}Cd(^{27}Al,5nγ).

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Adopted Levels, Gammas (continued)

γ(^{138}Pm) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	Comments
							I_γ: Others: 100 *8* in ^{116}Cd(^{27}Al,5nγ), 26 *3* in ^{115}In(^{28}Si,2p3nγ).
2280.34+x	(13$^+$)	869.1 *1*	87[‡] *6*	1411.12+x	(11$^+$)	Q	E_γ: also placed from a level at E=6864+x with J^π=(21$^+$) in ^{115}In(^{28}Si,2p3nγ). I_γ: weighted average of 92 *8* from ^{116}Cd(^{27}Al,5nγ), and 84 *6* from ^{124}Te(^{19}F,5nγ). Other: <100 from ^{115}In(^{28}Si,2p3nγ).
2367.1+x	(12$^-$)	983.7 *4*	100	1383.36+x	(10$^-$)		
2459.56+x	(11$^+$)	596.4 *1*	100	1863.16+x	(11$^-$)	D+Q	
2473.86+x	(12$^-$)	586.1	12.3[‡] *14*	1888.16+x	(12$^+$)		E_γ,I_γ: from ^{124}Te(^{19}F,5nγ) only.
		610.7 *1*	100[‡] *6*	1863.16+x	(11$^-$)	D	E_γ: weighted average of 610.6 *1* from ^{115}In(^{28}Si,2p3nγ) and 610.9 *2* from ^{116}Cd(^{27}Al,5nγ).
2532.1+x	(12$^-$)	435.4 *1*	100	2096.75+x	(11$^-$)		
2628.70+x	(12$^-$)	1013.0 *1*	100	1615.91+x	(10$^-$)		E_γ: observed in ^{115}In(^{28}Si,2p3nγ) only.
2784.3+x	(13$^-$)	687.5	100	2096.75+x	(11$^-$)		E_γ: from ^{124}Te(^{19}F,5nγ) only.
2795.77+x	(13$^-$)	337[&] *1*	<14	2459.56+x	(11$^+$)		
		932.6 *1*	100 *7*	1863.16+x	(11$^-$)	Q	
2825.58+x	(14$^+$)	545.6 *1*	33 *4*	2280.34+x	(13$^+$)	D	
		938.1 *5*	100 *7*	1888.16+x	(12$^+$)	Q	E_γ: unweighted average of 937.6 *1* from ^{115}In(^{28}Si,2p3nγ) and 938.6 *2* from ^{116}Cd(^{27}Al,5nγ).
2832.90+x	(13$^-$)	465.5 *10*	<15	2367.1+x	(12$^-$)		
		974.5 *1*	100 *12*	1858.35+x	(11$^-$)	Q	
2869.85+x	(13$^-$)	241.3[@] *1*	<100[@]	2628.70+x	(12$^-$)		
		1010.4 *4*	>17	1858.35+x	(11$^-$)		
3004.46+x	(13$^+$)	544.9 *1*	100	2459.56+x	(11$^+$)	Q	
3050.8+x	(13$^-$)	518.6 *4*	100	2532.1+x	(12$^-$)		
3064.05+x	(14$^-$)	195.6 *4*	>23	2869.85+x	(13$^-$)	D+Q	
		231.1 *1*	>63	2832.90+x	(13$^-$)	D	
		435.4 *1*	<100	2628.70+x	(12$^-$)		
		696[&] *1*	>7	2367.1+x	(12$^-$)		
		782.2 *4*	>16	2280.34+x	(13$^+$)		
3072.35+x	(14$^-$)	276 *1*	<7	2795.77+x	(13$^-$)		
		598.5 *1*	100 *7*	2473.86+x	(12$^-$)	Q	
3183.1+x	(14$^-$)	398.8 *1*	100[‡] *14*	2784.3+x	(13$^-$)		E_γ: energy value is from 1998Pr04 in ^{115}In(^{28}Si,2p3nγ), placement is from ^{124}Te(^{19}F,5nγ) by 2015Li15. 1998Pr04 placed this γ ray from a level at E=2532+x, which is not adopted.
		651.0 *1*	43[‡] *14*	2532.1+x	(12$^-$)		E_γ: energy value is from 1998Pr04 in ^{115}In(^{28}Si,2p3nγ), placement is from ^{124}Te(^{19}F,5nγ) by 2015Li15. 1998Pr04 placed this γ ray from a level at E=3702+x, which is not adopted.
3276.0+x	(15$^+$)	451.0[@] *1*	<100[@]	2825.58+x	(14$^+$)		
		995.2 *1*	>97	2280.34+x	(13$^+$)	Q	
3305.35+x	(15$^-$)	241.3[@] *1*	100[@]	3064.05+x	(14$^-$)		
3593.35+x	(16$^-$)	288.0 *1*	100	3305.35+x	(15$^-$)	D	
3648.0+x	(15$^+$)	643.5	100	3004.46+x	(13$^+$)		E_γ: from ^{124}Te(^{19}F,5nγ) (2015Li15) only.
3651.0+x	(15$^-$)	468.1	100 *20*	3183.1+x	(14$^-$)		E_γ,I_γ: from ^{124}Te(^{19}F,5nγ) (2015Li15) only.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

γ(^{138}Pm) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	Comments
3651.0+x	(15$^-$)	599.9	<100	3050.8+x	(13$^-$)		E_γ,I_γ: from ^{124}Te(^{19}F,5nγ) (2015Li15) only.
3771.8+x	(16$^-$)	699.4 *1*	100	3072.35+x	(14$^-$)		
3852.0+x	(16$^+$)	576.3 *4*	43[‡] *7*	3276.0+x	(15$^+$)		
		1025.9 *4*	100[‡] *2*	2825.58+x	(14$^+$)	Q	
3975.9+x	(17$^-$)	382.6 *1*	100	3593.35+x	(16$^-$)	D	
4196.0+x	(16$^-$)	545.0	100	3651.0+x	(15$^-$)		E_γ: from ^{124}Te(^{19}F,5nγ) (2015Li15) only.
4338.0+x	(17$^+$)	485 *1*		3852.0+x	(16$^+$)		E_γ: weighted average of 486 *1* from ^{115}In(^{28}Si,2p3nγ) and 484 *1* from ^{116}Cd(^{27}Al,5nγ).
		1063 *1*		3276.0+x	(15$^+$)		
4374.8+x	(18$^-$)	398.8 *1*	100	3975.9+x	(17$^-$)		
4406.7+x	(18$^+$)	554.7	100	3852.0+x	(16$^+$)	Q	E_γ,Mult.: from ^{124}Te(^{19}F,5nγ) (2015Li15).
4536.6+x	(17$^+$)	764.8	100	3771.8+x	(16$^-$)		E_γ: from ^{124}Te(^{19}F,5nγ) (2015Li15).
4623.5+x	(18$^-$)	851.7 *4*	100	3771.8+x	(16$^-$)	Q	
4869.3+x	(19$^-$)	494.5 *1*	100 *16*	4374.8+x	(18$^-$)		
		895 *1*	32 *13*	3975.9+x	(17$^-$)		
4922.0+x	(18$^+$)	584[&] *1*		4338.0+x	(17$^+$)		
		1070 *1*		3852.0+x	(16$^+$)		
5133.3+x	(20$^+$)	726.6 *1*	100	4406.7+x	(18$^+$)	Q	E_γ: energy value is from 1998Pr04 in ^{115}In(^{28}Si,2p3nγ), placement is from ^{124}Te(^{19}F,5nγ) by 2015Li15. 1998Pr04 placed this γ ray from a level at E=4579+x, which is not adopted.
5386.1+x	(20$^-$)	516.8 *4*	96 *11*	4869.3+x	(19$^-$)		
		1013.0[&] *4*	100 *30*	4374.8+x	(18$^-$)		
5456.4+x?	(19$^+$)	534[&] *1*	100	4922.0+x	(18$^+$)		
		1118[&] *1*	100	4338.0+x	(17$^+$)		
5695.5+x	(20$^-$)	1072 *1*	100	4623.5+x	(18$^-$)		E_γ: other: 1075.0 from ^{124}Te(^{19}F,5nγ).
5995.0+x	(22$^+$)	861.7 *1*	100	5133.3+x	(20$^+$)	Q	Mult.: from ^{124}Te(^{19}F,5nγ) (2015Li15), but Mult=D from DCO ratio in ^{115}In(^{28}Si,2p3nγ) (1998Pr04) is inconsistent.
6864.1+x		869.1 *1*	100	5995.0+x	(22$^+$)		

[†] From 1998Pr04 in ^{115}In(^{28}Si,2p3nγ), unless otherwise noted.
[‡] From ^{124}Te(^{19}F,5nγ) (2015Li15).
[#] Deduced based on measured DCO ratios in ^{115}In(^{28}Si,2p3nγ) (1998Pr04) and in ^{124}Te(^{19}F,5nγ) (2015Li15).
[@] Multiply placed with undivided intensity.
[&] Placement of transition in the level scheme is uncertain.

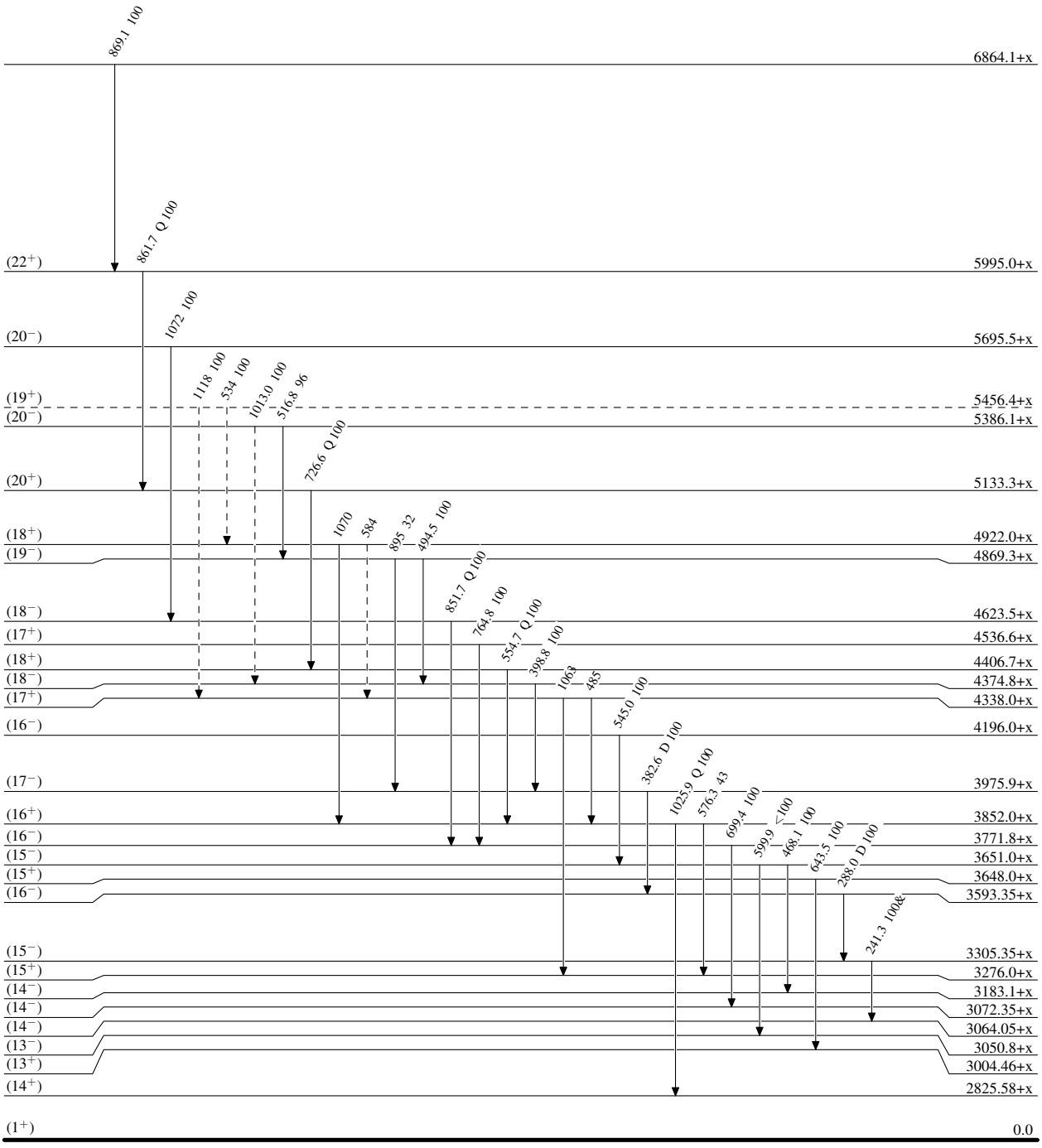
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

- - - - - - ► γ Decay (Uncertain)



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

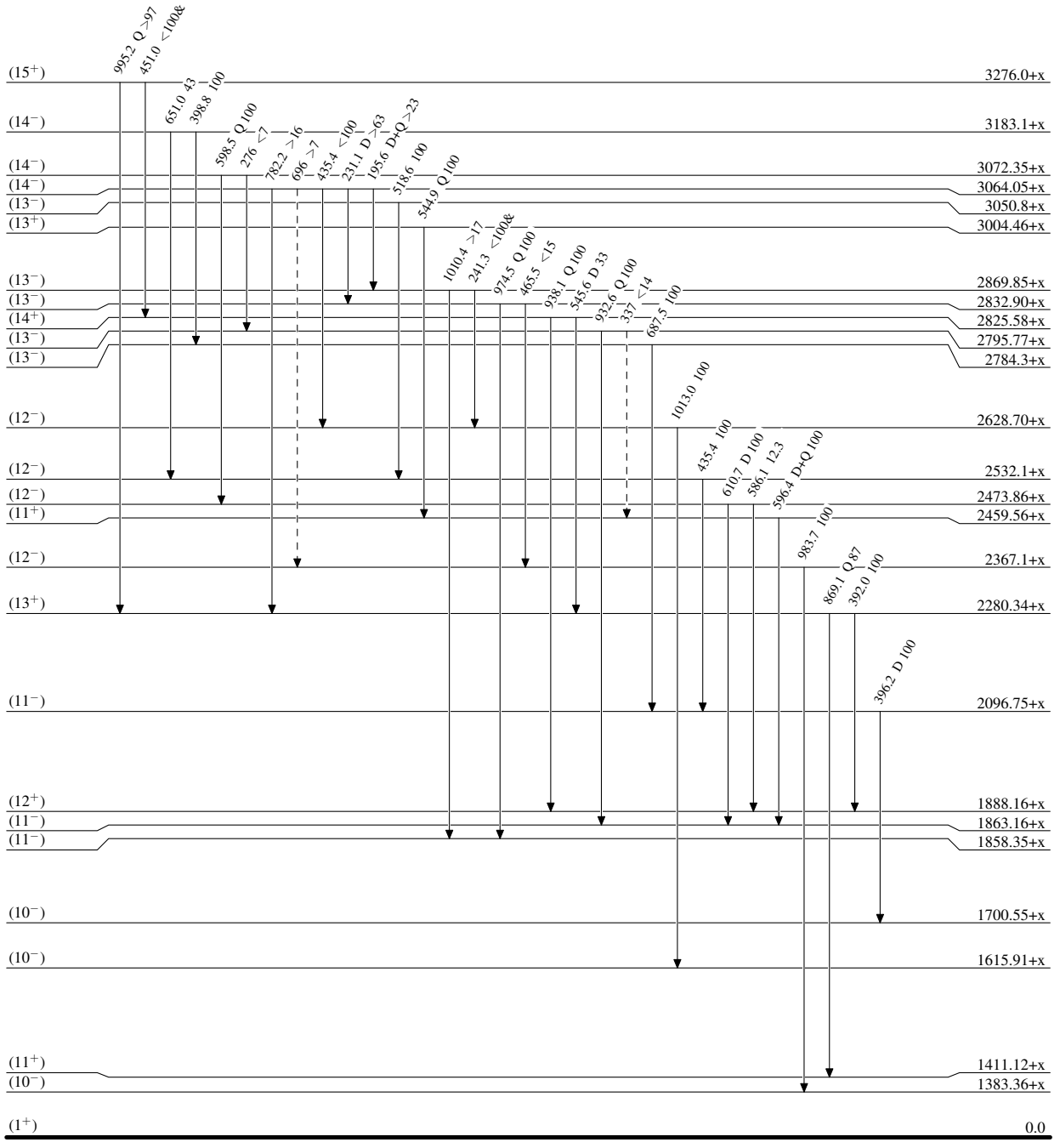
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

– – – – – – ► γ Decay (Uncertain)



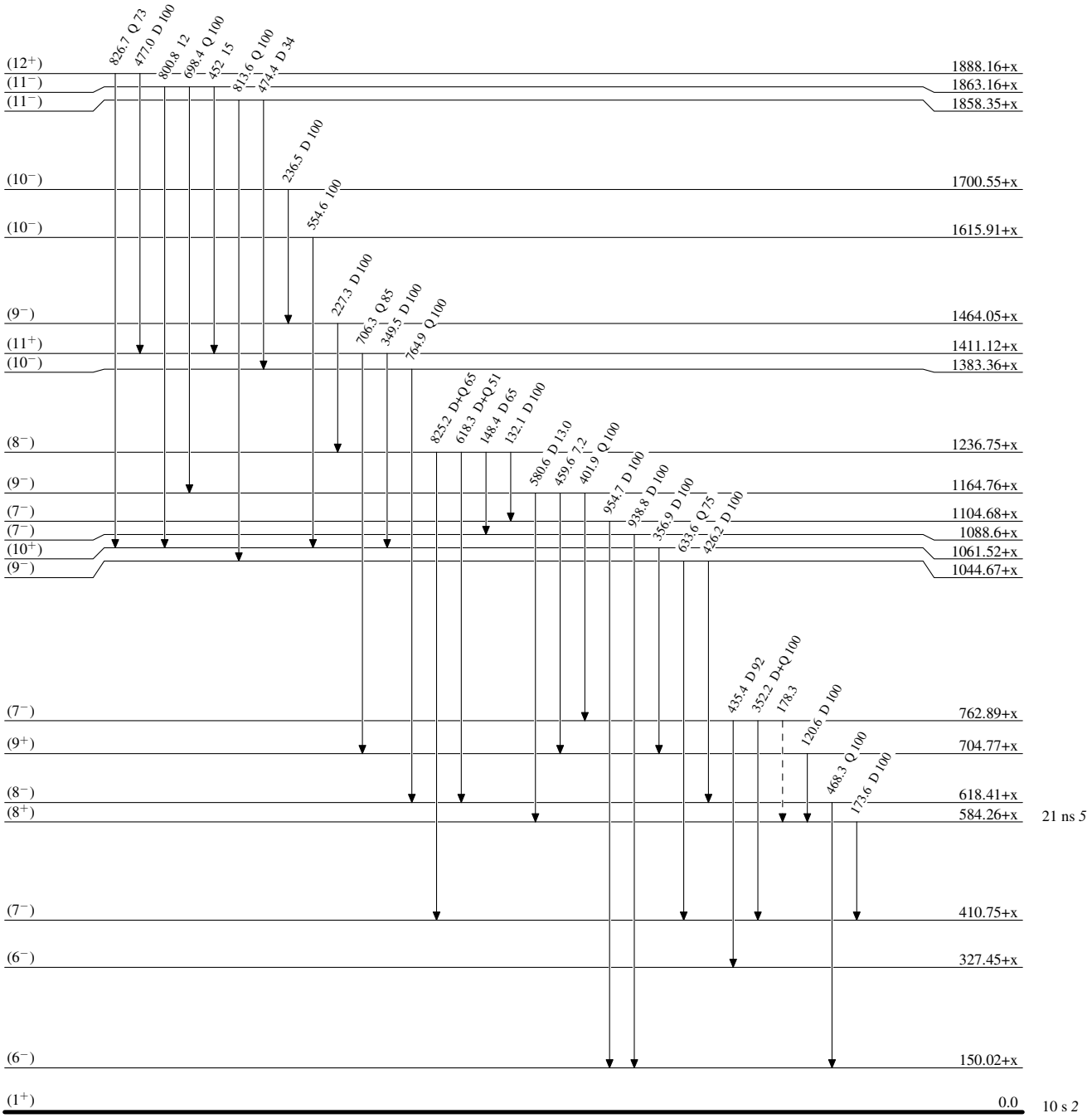
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

Legend

γ Decay (Uncertain)

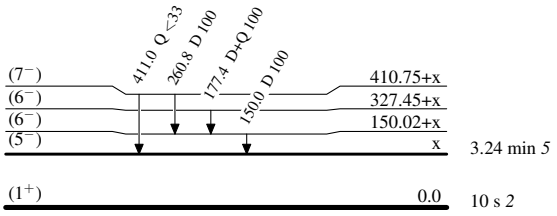


$^{138}_{61}Pm_{77}$

Adopted Levels, Gammas

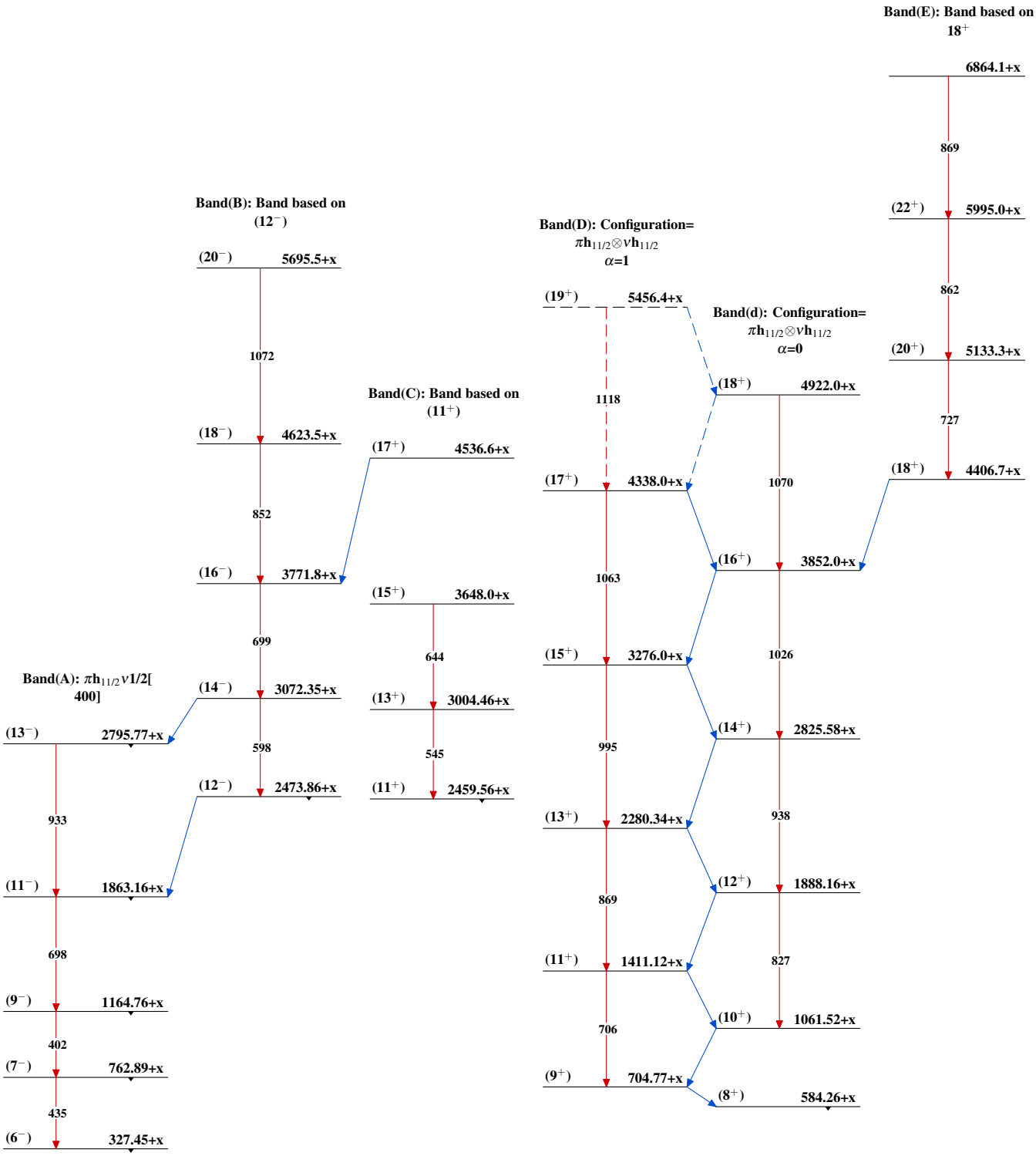
Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

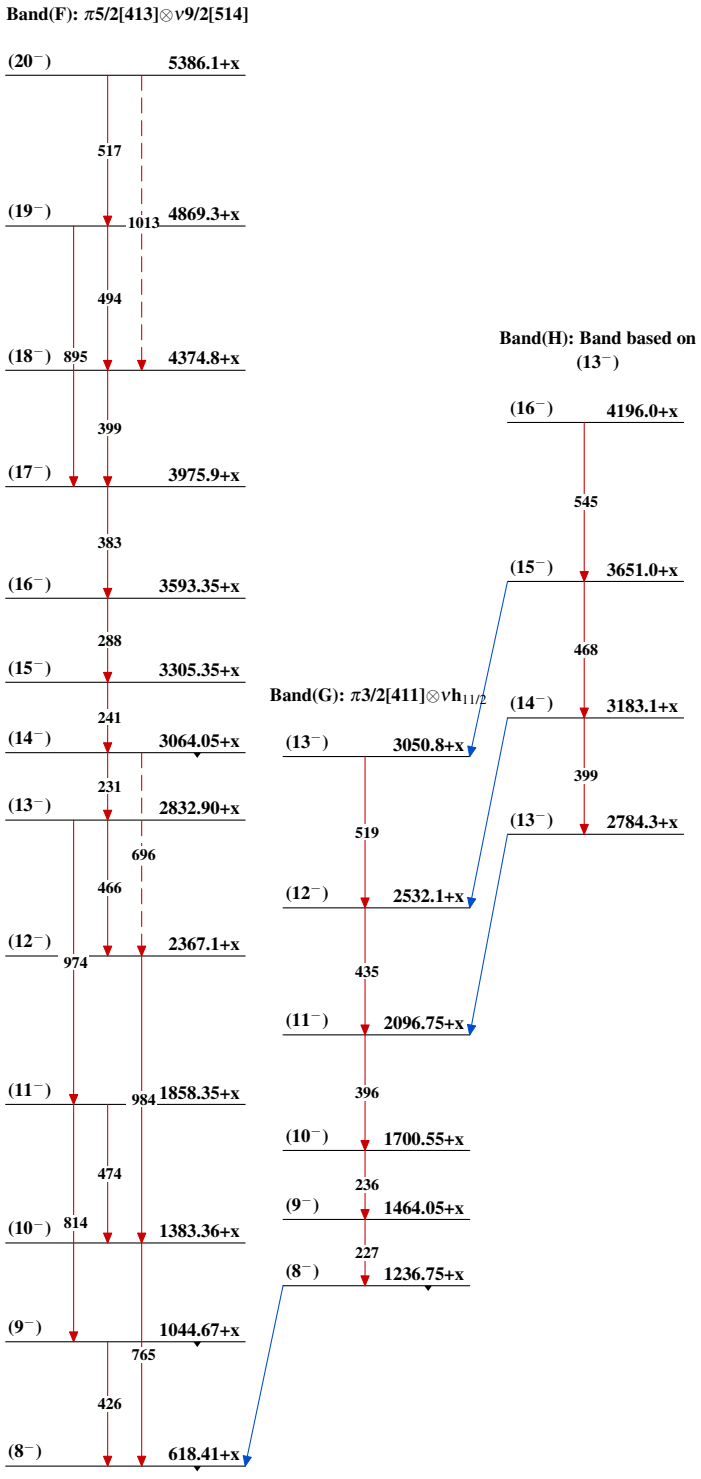


$^{138}_{61}Pm_{77}$

Adopted Levels, Gammas



Adopted Levels, Gammas (continued)



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