

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 170, 1 (2020)	16-Aug-2020

$Q(\beta^-)=1912$ 9; $S(n)=7465$ 27; $S(p)=7787$ 26; $Q(\alpha)=-2033$ 13 [2017Wa10](#)

 ^{153}Pm LevelsCross Reference (XREF) Flags

- A** ^{153}Nd β^- decay
B ^{252}Cf SF decay
C $^{154}\text{Sm}(d,^3\text{He})$
D $^{154}\text{Sm}(\text{pol } t, \alpha)$

E(level) ^{†‡}	J ^π #	T _{1/2} [@]	XREF	Comments
0.0 ^{&}	5/2 ⁻	5.25 min 2	AB D	$\% \beta^- = 100$ T _{1/2} : From 1988GrZY and 1990An31 (same authors); others: 5.3 m 3 (1969Sm04), 5.5 m 2 (1962Ko10), and 5.4 m (1982Ba76 , same authors as 1988GrZY and 1990An31).
32.194 ^a 10	5/2 ⁺	1.2 ns 1	A CD	XREF: C(37).
65.552 ^{&} 19	7/2 ⁻		ABCD	XREF: C(70). J ^π : From M1 γ to 5/2 ⁻ level as well as charged-particle data.
105.474 ^a 18	7/2 ⁺	0.44 ns 2	A CD	XREF: C(111). J ^π : From E1 γ to 5/2 ⁻ level as well as charged-particle data.
150.70 ^{&} 8	9/2 ⁻		ABCD	
198.84 ^a 7	(9/2 ⁺)		ABCD	
252.69 ^{&} 14	11/2 ⁻		BCD	XREF: C(260)D(255).
311.06 ^a 18	(11/2 ⁺)		AB D	
376.59 ^{&} 22	(13/2 ⁻)		B D	XREF: D(378).
430.51 ^a 23	(13/2 ⁺)		B	
450.520 ^b 23	3/2 ⁺		A CD	XREF: C(461). J ^π : From M1 γ to 5/2 ⁺ level as well as charged-particle data.
507.35 ^b 3	5/2 ⁺		A CD	XREF: C(520). J ^π : From M1 γ to 5/2 ⁺ level as well as charged-particle data.
512.4 ^{&} 3	(15/2 ⁻)		B	
560			C	
585.55 5	7/2 ⁺		A D	
628?			C	
677.7 ^{&} 3	(17/2 ⁻)		B	
682 4			D	
705.82 6	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺		A CD	J ^π : Assigned 3/2 ⁺ , 5/2 ⁺ from L=2 in $^{154}\text{Sm}(d,^3\text{He})$ (1981Le21) and J=1/2 ⁺ from tentative L=0 in (pol t, α) (1978Bu18).
770.79 5	5/2 ⁺		A D	J ^π : From M1 γ 's to 5/2 ⁺ and 7/2 ⁺ levels as well as charged-particle data.
780	3/2 ⁺ , 5/2 ⁺		C	
791.19 4	3/2 ⁺		A D	J ^π : From M1 γ 's to 3/2 ⁺ and 5/2 ⁺ levels as well as charged-particle data.
844.7 ^{&} 4	(19/2 ⁻)		B	
850	(7/2 ⁺)		C	
935 4			CD	XREF: C(920). J ^π : Assigned 7/2 ⁺ or 9/2 ⁺ in (d, ^3He) and 9/2 ⁺ and 3/2 ⁻ in (pol t, α).
960	(3/2 ⁻)		C	
967.01 8	7/2 ⁺		A D	
1000	(7/2 ⁻)		C	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{153}Pm Levels (continued)

E(level) ^{†‡}	J ^π #	XREF	Comments
1013.53 10		A	
1018.58 22		A	
1022 ^c 4	7/2 ⁻	D	
1051.1 ^{&} 5	(21/2 ⁻)	B	
1113.22 7	(1/2,3/2,5/2) ⁺	A	J ^π : From M1 γ to 3/2 ⁺ level.
1114.93 15		A	
1152 ^c 4	11/2 ⁻	CD	
1160.53 11		A	
1175.93 8		A	
1179 4	(3/2 ⁺)	CD	E(level): Could be same as 1175.93 level.
1202.29 6		A	
1208 ^d 4	3/2 ⁺	CD	XREF: C(1211).
1213.13 11		A	
1226.19 17		A	
1242.9 ^{&} 5	(23/2 ⁻)	B	
1257.05 19		A	
1262 ^d 4	(5/2 ⁺)	D	
1273	7/2 ⁺ , 9/2 ⁺	C	
1296.12 7		A	
1311 4		D	
1345 ^d 4	7/2 ⁺	CD	XREF: C(1352).
1376 4		D	
1437 4		D	
1476 4		D	
1490.8 ^{&} 6	(25/2 ⁻)	B	
1629		D	
≈1702		D	
1703.3 ^{&} 6	(27/2 ⁻)	B	
1731.87 16		A	
≈1737		D	
≈1763		D	
1775.56 16		A	
≈1794		D	
1824.55 18		A	
≈1829		D	
1837.49 15		A	
1850.46 11		A	
≈1869		D	
1953		D	
1987.72 6		A	
1989.0 ^{&} 7	(29/2 ⁻)	B	
1997.80 7		A	
2004.89 8		A	
2008.51 25		A	
2031.95 9		A	
2034.51 22		A	
2060.33 15		A	
2138		D	
2221		D	
2280		D	
2333		D	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

 ^{153}Pm Levels (continued)

[†] From least-squares fit to gamma-ray data from ^{153}Nd β - decay and ^{252}Cf SF datasets, otherwise from average of values from transfer reaction studies.

[‡] From total absorption γ -ray spectrometer measurements, it is known that there several other levels weakly fed in the ^{153}Nd β -decay. However, since the number of levels and their energies are not determined, they are not included here.

[#] Unless otherwise noted, the J^π are from L values and analyzing powers in (pol t, α) and L values from (d, ^3He). For levels from ^{252}Cf SF dataset, tentatively assigned in [2018Bh07](#) from band assignments and systematics of odd-A Pm isotopes.

[@] From ^{153}Nd β - decay ([1992TaZN](#)) for excited levels.

[&] Band(A): 5/2[532] band.

^a Band(B): 5/2[413] band.

^b Band(C): 3/2[411] band.

^c Band(D): 3/2[541] band.

^d Band(E): 3/2[422] band.

Adopted Levels, Gammas (continued)

$\gamma(^{153}\text{Pm})$

For unplaced γ 's see ¹⁵³Nd β - decay dataset.

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [†]	$\delta^\dagger \&$	$\alpha^@$	Comments
32.194	5/2 ⁺	32.20 1	100	0.0	5/2 ⁻	[E1]		1.019	$\alpha(\text{L})=0.805$ 12; $\alpha(\text{M})=0.1724$ 25 $\alpha(\text{N})=0.0373$ 6; $\alpha(\text{O})=0.00487$ 7; $\alpha(\text{P})=0.000179$ 3 B(E1)(W.u.)=0.00292 +27-23
65.552	7/2 ⁻	33.3 2 65.54 2	17 6 100.0 24	32.194 5/2 ⁺ 0.0 5/2 ⁻		M1+E2	0.28 +11-18	5.6 4	$\alpha(\text{K})=4.36$ 10; $\alpha(\text{L})=1.01$ 33; $\alpha(\text{M})=0.223$ 77 $\alpha(\text{N})=0.049$ 17; $\alpha(\text{O})=0.0069$ 21; $\alpha(\text{P})=0.000276$ 10 B(E1)(W.u.)=6.0×10 ⁻⁴ +17-13
105.474	7/2 ⁺	39.8 1 73.32 6	16.3 10 14.2 7	65.552 7/2 ⁻ 32.194 5/2 ⁺		[E1] [M1,E2]		5.4 17	$\alpha(\text{K})=2.9$ 3; $\alpha(\text{L})=2.0$ 15; $\alpha(\text{M})=0.45$ 36 $\alpha(\text{N})=0.098$ 76; $\alpha(\text{O})=0.0125$ 93; $\alpha(\text{P})=1.59 \times 10^{-4}$ 48
		105.47 2	100.0 23	0.0 5/2 ⁻		E1		0.231	$\alpha(\text{K})=0.196$ 3; $\alpha(\text{L})=0.0282$ 4; $\alpha(\text{M})=0.00599$ 9 $\alpha(\text{N})=0.001328$ 19; $\alpha(\text{O})=0.000190$ 3; $\alpha(\text{P})=9.68 \times 10^{-6}$ 14 B(E1)(W.u.)=1.99×10 ⁻⁴ +42-34
150.70	9/2 ⁻	45.5 2 85.1 1	23.0 17 100 6	105.474 7/2 ⁺ 65.552 7/2 ⁻					
198.84	(9/2 ⁺)	150.7 [‡] 2 133.27 7	36 [‡] 20 100	0.0 5/2 ⁻ 65.552 7/2 ⁻					
252.69	11/2 ⁻	102.0 [‡] 2 187.1 [‡] 2	100 [‡] 16 41 [‡] 8	150.70 9/2 ⁻ 65.552 7/2 ⁻					
311.06	(11/2 ⁺)	112.2 [‡] 2 160.4 3	25 [‡] 14 100 22	198.84 (9/2 ⁺) 150.70 9/2 ⁻					
376.59	(13/2 ⁻)	123.9 [‡] 2 225.9 [‡] 5	100 [‡] 9 48 [‡] 11	252.69 11/2 ⁻ 150.70 9/2 ⁻					
430.51	(13/2 ⁺)	177.8 [‡] 2 231.8 [‡] 5	100 [‡] 30 70 [‡] 25	252.69 11/2 ⁻ 198.84 (9/2 ⁺)					
450.520	3/2 ⁺	344.97 5 418.34 3	16.8 6 100 3	105.474 7/2 ⁺ 32.194 5/2 ⁺		E2 M1(+E2)	≤ 0.3	0.0354 0.0308 7	$\alpha(\text{K})=0.0283$ 4; $\alpha(\text{L})=0.00559$ 8; $\alpha(\text{M})=0.001228$ 18 $\alpha(\text{N})=0.000272$ 4; $\alpha(\text{O})=3.83 \times 10^{-5}$ 6; $\alpha(\text{P})=1.569 \times 10^{-6}$ 22 $\alpha(\text{K})=0.0262$ 6; $\alpha(\text{L})=0.00359$ 6; $\alpha(\text{M})=0.000765$ 12 $\alpha(\text{N})=0.000172$ 3; $\alpha(\text{O})=2.60 \times 10^{-5}$ 5; $\alpha(\text{P})=1.66 \times 10^{-6}$ 4
507.35	5/2 ⁺	450.40 7 56.82 2 308.5 3 401.8 3 475.12 7	0.4 3 29.1 14 2.9 6 11.9 8 100 4	0.0 5/2 ⁻ 450.520 3/2 ⁺ 198.84 (9/2 ⁺) 105.474 7/2 ⁺ 32.194 5/2 ⁺		M1(+E2)	≤ 1.15	0.0202 25	$\alpha(\text{K})=0.0171$ 22; $\alpha(\text{L})=0.00243$ 19; $\alpha(\text{M})=0.00052$ 4 $\alpha(\text{N})=0.000117$ 9; $\alpha(\text{O})=1.75 \times 10^{-5}$ 15; $\alpha(\text{P})=1.06 \times 10^{-6}$ 16
		507.5 3	3.4 8	0.0 5/2 ⁻					

Adopted Levels, Gammas (continued)

$\gamma(^{153}\text{Pm})$ (continued)									
$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. †	$\delta^\dagger\&$	$\alpha^@$	Comments
512.4	(15/2 ⁻)	135.8 ‡ 2	100 ‡ 2	376.59	(13/2 ⁻)				
		259.7 ‡ 5	78 ‡ 9	252.69	11/2 ⁻				
585.55	7/2 ⁺	78.23 5	63 4	507.35	5/2 ⁺				
		135.0 3	6.7 19	450.520	3/2 ⁺				
		480.14 15	100 7	105.474	7/2 ⁺				
		553.5 3	35 4	32.194	5/2 ⁺				
		585.6 4	9 3	0.0	5/2 ⁻				
677.7	(17/2 ⁻)	165.3 ‡ 2	<172 ‡ #	512.4	(15/2 ⁻)				I_γ : Relative $I_{(165\gamma+167\gamma)}=158$ 9 (2018Bh07).
		301.1 ‡ 5	100 ‡	376.59	(13/2 ⁻)				I_γ : Relative $I_{301\gamma}=92$ 8 (2018Bh07).
705.82	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺	255.33 6	100 4	450.520	3/2 ⁺	M1(+E2)	≤0.87	0.109 6	$\alpha(\text{K})=0.091$ 7; $\alpha(\text{L})=0.0141$ 7; $\alpha(\text{M})=0.00303$ 18 $\alpha(\text{N})=0.00068$ 4; $\alpha(\text{O})=0.000100$ 4; $\alpha(\text{P})=5.7\times 10^{-6}$ 6
770.79	5/2 ⁺	673.67 15	7.8 8	32.194	5/2 ⁺				
		185.25 5	100 4	585.55	7/2 ⁺	M1(+E2)	≤0.48	0.272	$\alpha(\text{K})=0.228$ 6; $\alpha(\text{L})=0.0347$ 25; $\alpha(\text{M})=0.0075$ 6 $\alpha(\text{N})=0.00168$ 13; $\alpha(\text{O})=0.000249$ 15; $\alpha(\text{P})=1.44\times 10^{-5}$ 6
		263.38 7	80 3	507.35	5/2 ⁺	M1(+E2)	≤0.81	0.101 5	$\alpha(\text{K})=0.084$ 6; $\alpha(\text{L})=0.0128$ 5; $\alpha(\text{M})=0.00275$ 14 $\alpha(\text{N})=0.00062$ 3; $\alpha(\text{O})=9.15\times 10^{-5}$ 23; $\alpha(\text{P})=5.2\times 10^{-6}$ 5
		320.5 2	13.6 14	450.520	3/2 ⁺				
		571.2 4	3.7 17	198.84	(9/2 ⁺)				
		665.33 25	50 3	105.474	7/2 ⁺				
		738.4 3	21.6 20	32.194	5/2 ⁺				
		770.9 4	<1.4	0.0	5/2 ⁻				
791.19	3/2 ⁺	85.5 3	4.1 6	705.82	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺				
		283.82 6	100 5	507.35	5/2 ⁺	M1(+E2)	≤0.14	0.0859 13	$\alpha(\text{K})=0.0731$ 11; $\alpha(\text{L})=0.01009$ 15; $\alpha(\text{M})=0.00215$ 3 $\alpha(\text{N})=0.000485$ 7; $\alpha(\text{O})=7.32\times 10^{-5}$ 11; $\alpha(\text{P})=4.66\times 10^{-6}$ 7
		340.66 6	59 3	450.520	3/2 ⁺	M1(+E2)	≤0.54	0.0514 20	$\alpha(\text{K})=0.0435$ 20; $\alpha(\text{L})=0.00616$ 10; $\alpha(\text{M})=0.001316$ 19 $\alpha(\text{N})=0.000296$ 5; $\alpha(\text{O})=4.45\times 10^{-5}$ 9; $\alpha(\text{P})=2.74\times 10^{-6}$ 15
		685.70 15	32 3	105.474	7/2 ⁺				
		759.10 12	28.5 20	32.194	5/2 ⁺				
844.7	(19/2 ⁻)	167.0 ‡ 2	<161 ‡ #	677.7	(17/2 ⁻)				I_γ : Relative $I_{(165\gamma+167\gamma)}=158$ 9 (2018Bh07).
		332.4 ‡ 5	100 ‡	512.4	(15/2 ⁻)				I_γ : Relative $I_{332\gamma}=98$ 9 (2018Bh07).
967.01	7/2 ⁺	967.08 8	100	0.0	5/2 ⁻				
1013.53		947.96 12	100 4	65.552	7/2 ⁻				
		1013.54 15	14 3	0.0	5/2 ⁻				
1018.58		868.1 3	100 12	150.70	9/2 ⁻				

Adopted Levels, Gammas (continued)

<u>$\gamma(^{153}\text{Pm})$ (continued)</u>									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [†]	$\delta^\dagger \&$	$\alpha^@$	Comments
1018.58		952.8 3	10 3	65.552	7/2 ⁻				
1051.1	(21/2 ⁻)	206.4 [‡] 5	100 [‡] 11	844.7	(19/2 ⁻)				
		373.4 [‡] 5	79 [‡] 11	677.7	(17/2 ⁻)				
1113.22	(1/2,3/2,5/2) ⁺	322.0 1	95 6	791.19	3/2 ⁺	M1+E2	2.4 19	0.046 12	$\alpha(\text{K})=0.037$ 12; $\alpha(\text{L})=0.00711$ 12; $\alpha(\text{M})=0.00156$ 3 $\alpha(\text{N})=0.000346$ 5; $\alpha(\text{O})=4.9 \times 10^{-5}$ 3; $\alpha(\text{P})=2.11 \times 10^{-6}$ 95
		407.47 10	100 6	705.82	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
1114.93		662.8 3	31.5 23	450.520	3/2 ⁺				
		343.9 2	84 18	770.79	5/2 ⁺				
		409.6 3	100 6	705.82	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		1115.0 3	47 5	0.0	5/2 ⁻				
1160.53		710.00 12	100 9	450.520	3/2 ⁺				
		1128.3 4	14 4	32.194	5/2 ⁺				
		1160.5 4	15 3	0.0	5/2 ⁻				
1175.93		668.43 15	100 6	507.35	5/2 ⁺				
		725.22 15	76 6	450.520	3/2 ⁺				
		1070.8 3	22 5	105.474	7/2 ⁺				
		1143.9 3	19 3	32.194	5/2 ⁺				
		1176.3 4	6 3	0.0	5/2 ⁻				
1202.29		236.3 3	9.0 17	967.01	7/2 ⁺				
		1136.65 20	62 6	65.552	7/2 ⁻				
		1170.70 15	35 3	32.194	5/2 ⁺				
		1202.17 7	100 4	0.0	5/2 ⁻				
1213.13		1107.46 25	24 4	105.474	7/2 ⁺				
		1180.97 12	100 8	32.194	5/2 ⁺				
1226.19		435.0 4	15 3	791.19	3/2 ⁺				
		1120.7 4	21 4	105.474	7/2 ⁺				
		1194.0 2	100 5	32.194	5/2 ⁺				
1242.9	(23/2 ⁻)	191.8 [‡] 2	100 [‡] 8	1051.1	(21/2 ⁻)				
		398.2 [‡] 5	99 [‡] 14	844.7	(19/2 ⁻)				
1257.05		1106.3 3	70 14	150.70	9/2 ⁻				
		1191.5 3	100 7	65.552	7/2 ⁻				
		1257.1 4	33 6	0.0	5/2 ⁻				
1296.12		1190.4 3	9.5 6	105.474	7/2 ⁺				
		1230.50 10	100 5	65.552	7/2 ⁻				
		1264.20 20	15.7 18	32.194	5/2 ⁺				
		1296.15 12	32.8 14	0.0	5/2 ⁻				
1490.8	(25/2 ⁻)	247.8 [‡] 5	59 [‡] 11	1242.9	(23/2 ⁻)				
		439.7 [‡] 5	100 [‡] 16	1051.1	(21/2 ⁻)				
1703.3	(27/2 ⁻)	212.4 [‡] 5	75 [‡] 8	1490.8	(25/2 ⁻)				
		460.4 [‡] 5	100 [‡] 11	1242.9	(23/2 ⁻)				

Adopted Levels, Gammas (continued)

$\gamma(^{153}\text{Pm})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π
1731.87		555.8 2	100 12	1175.93		1989.0	(29/2 ⁻)	498.4 [‡] 5	100 [‡] 18	1490.8	(25/2 ⁻)
		571.4 4	71 14	1160.53		1997.80		795.63 10	28.9 17	1202.29	
		1026.0 3	74 20	705.82	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺			1547.0 2	5.3 10	450.520	3/2 ⁺
		1282.2 5	10 6	450.520	3/2 ⁺			1892.2 2	10.0 17	105.474	7/2 ⁺
1775.56		615.00 15	100 9	1160.53				1965.58 15	100 3	32.194	5/2 ⁺
		1004.9 3	25 7	770.79	5/2 ⁺			1997.75 12	28 3	0.0	5/2 ⁻
1824.55		1759.0 2	100 33	65.552	7/2 ⁻	2004.89		828.86 15	22.4 21	1175.93	
		1824.5 4	13 4	0.0	5/2 ⁻			891.74 12	56 4	1113.22	(1/2,3/2,5/2) ⁺
1837.49		1732.0 2	63 11	105.474	7/2 ⁺			1213.75 10	100 5	791.19	3/2 ⁺
		1805.29 20	100 11	32.194	5/2 ⁺			1554.1 2	7.7 21	450.520	3/2 ⁺
1850.46		1745.4 2	100 21	105.474	7/2 ⁺	2008.51		1237.8 4	100 11	770.79	5/2 ⁺
		1784.9 2	63 16	65.552	7/2 ⁻			1302.7 5	17 6	705.82	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1817.9 2	68 16	32.194	5/2 ⁺			2008.4 4	51 7	0.0	5/2 ⁻
		1850.3 3	32 16	0.0	5/2 ⁻	2031.95		1325.8 4	24 5	705.82	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
1987.72		785.50 20	63 8	1202.29				1524.5 1	74 8	507.35	5/2 ⁺
		1402.45 20	76 10	585.55	7/2 ⁺			2032.20 15	100 3	0.0	5/2 ⁻
		1480.3 1	86 10	507.35	5/2 ⁺	2034.51		1243.3 3	100 12	791.19	3/2 ⁺
		1537.1 1	100 14	450.520	3/2 ⁺			1328.7 3	99 22	705.82	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1882.4 2	55 10	105.474	7/2 ⁺	2060.33		1954.8 3	67 8	105.474	7/2 ⁺
		1922.3 4	17 10	65.552	7/2 ⁻			1994.8 2	100 10	65.552	7/2 ⁻
		1987.84 25	92 6	0.0	5/2 ⁻			2027.9 4	29.2 19	32.194	5/2 ⁺
1989.0	(29/2 ⁻)	285.6 [‡] 5	18 [‡] 4	1703.3	(27/2 ⁻)			2060.5 4	<5	0.0	5/2 ⁻

[†] From ¹⁵³Nd β^- decay unless mentioned otherwise.

[‡] From ²⁵²Cf SF dataset.

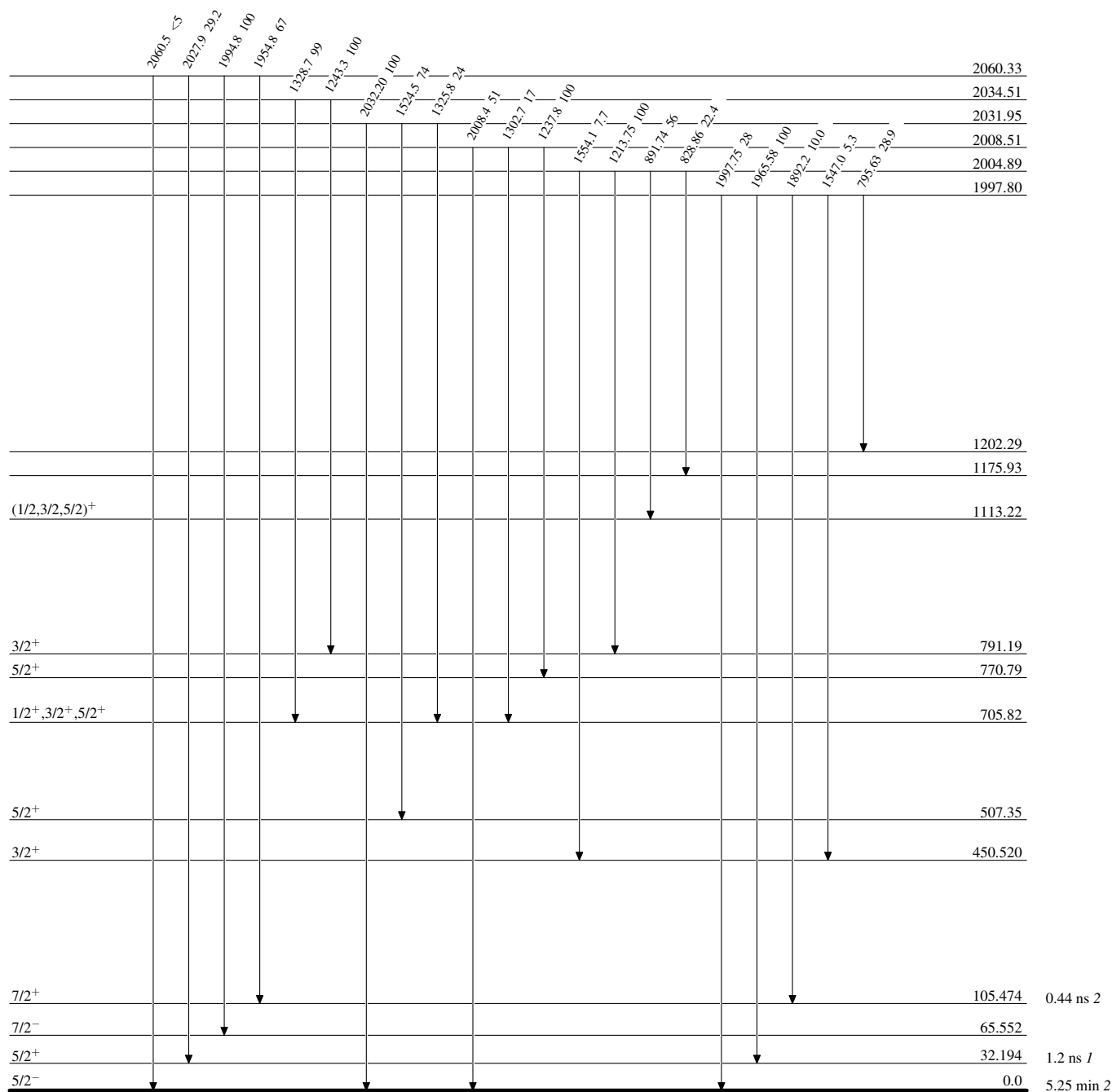
Doubly placed, undivided intensity.

@ [Additional information 1.](#)

& [Additional information 2.](#)

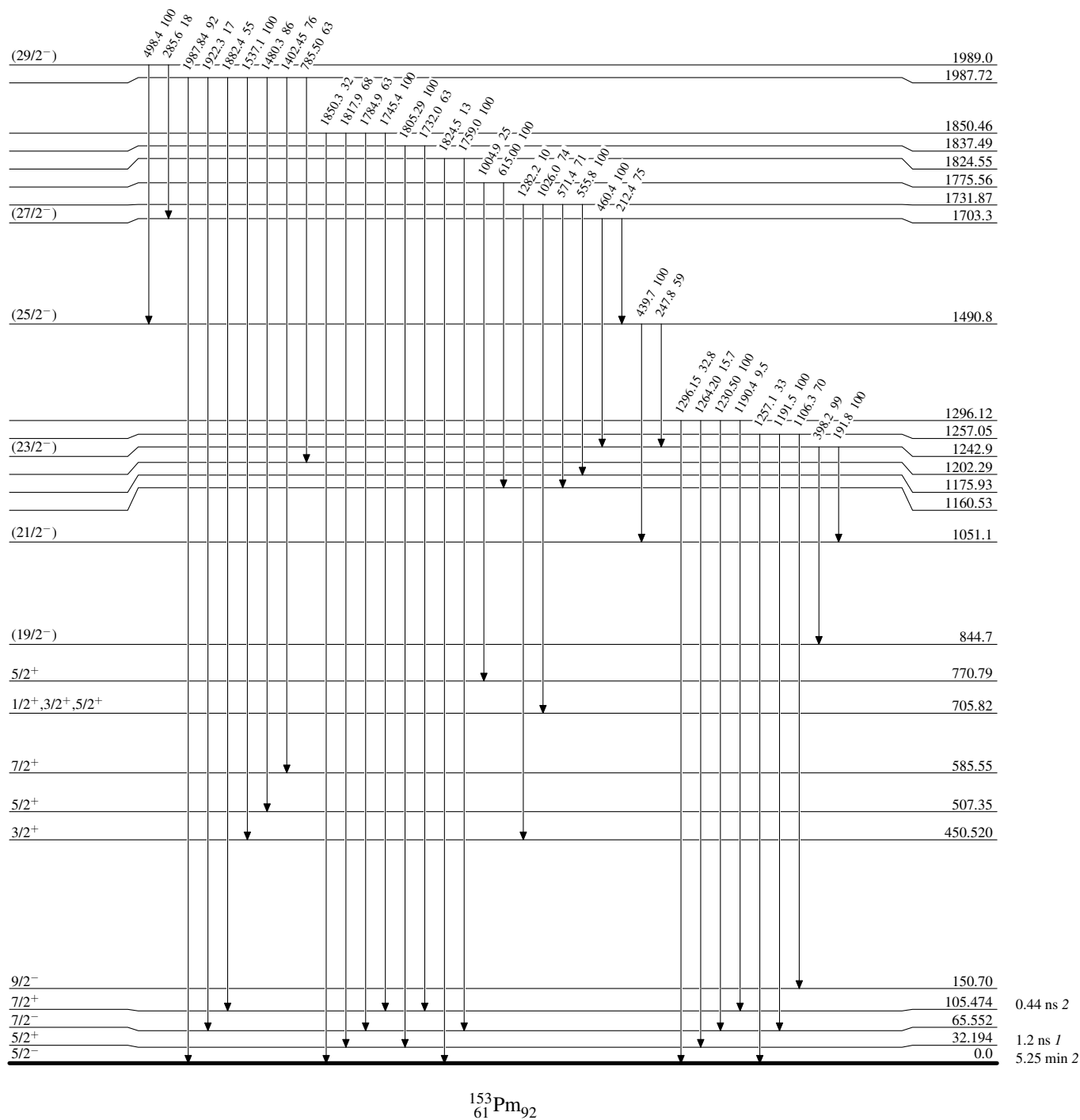
Adopted Levels, Gammas**Level Scheme**

Intensities: Relative photon branching from each level



Adopted Levels, GammasLevel Scheme (continued)

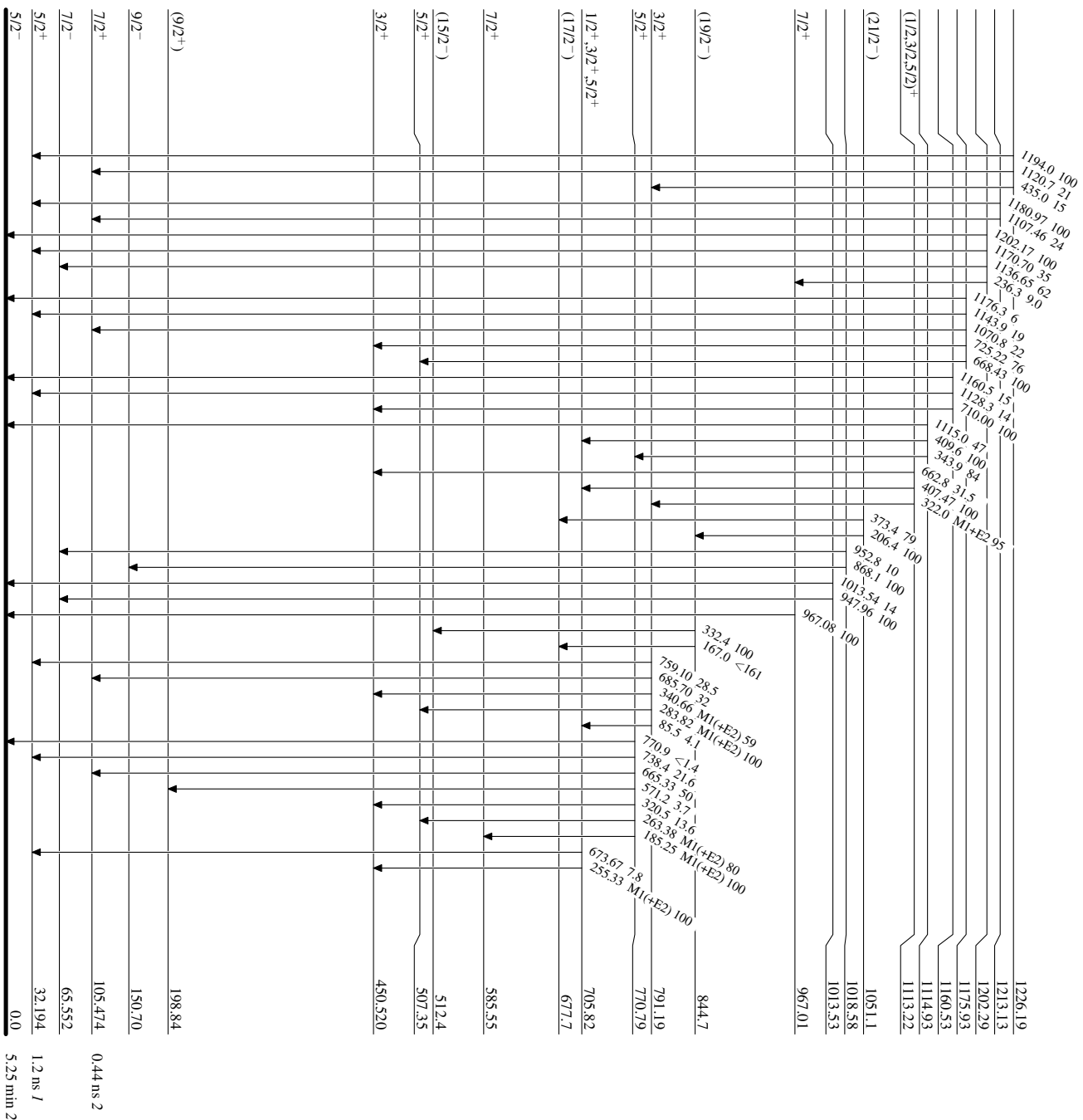
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

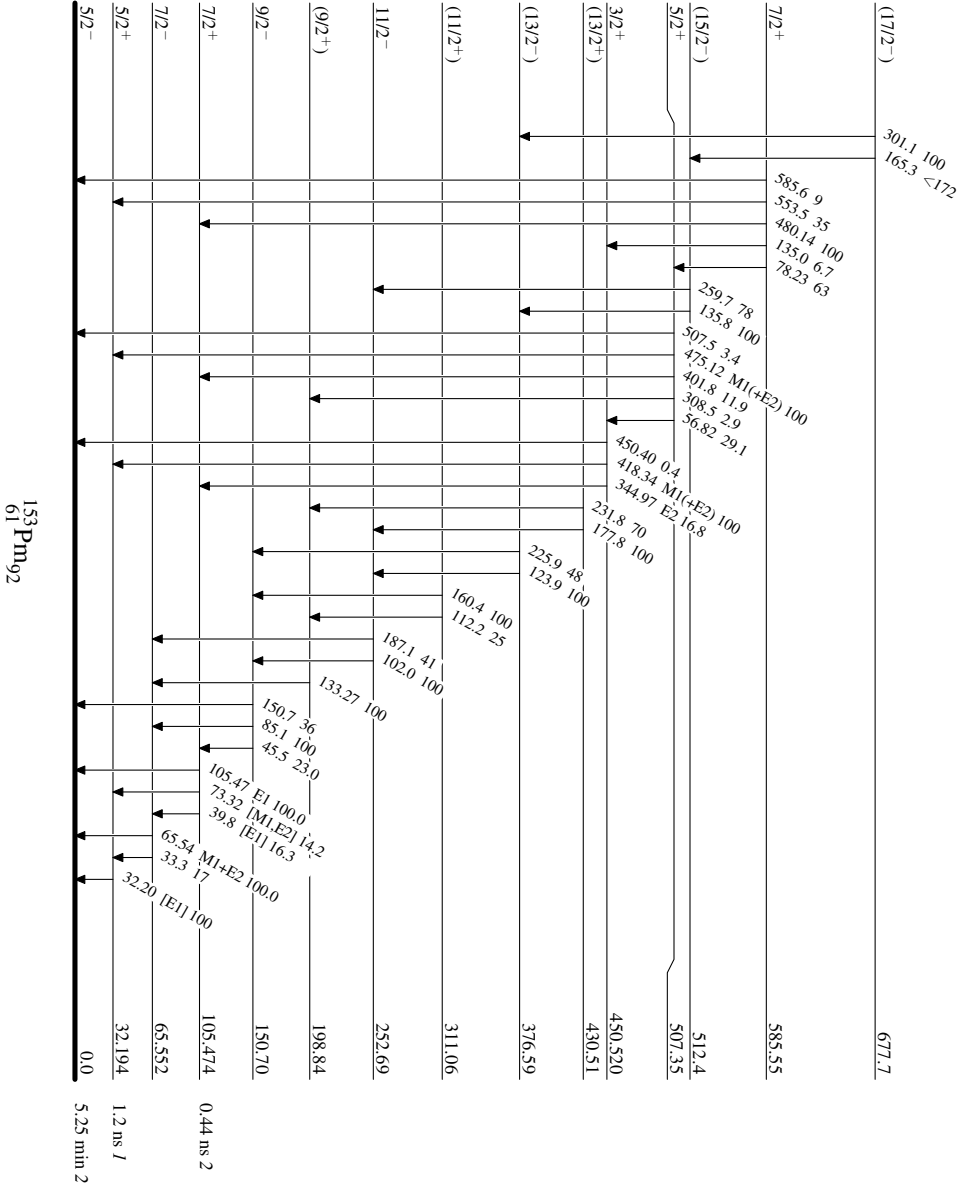
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



Adopted Levels, Gammas

