^{150}Nd(d,3nγ) 1996Jo19

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 185, 2 (2022)	23-Aug-2022

1996Jo19: E=18 MeV from the MP tandem at Orsay. Measured Eγ, Iγ, $\gamma\gamma$, ce. Deduced multi-particle configurations and octupole deformation.

^{149}Pm Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0.0[#]	7/2$^+$		
114.28[c] *15*	5/2$^+$		
188.55 *18*	3/2$^+$		
211.57 *23*	5/2$^+$		
240.28[&] *25*	11/2$^-$	35 μs *3*	$T_{1/2}$: from the Adopted Levels.
270.23 *17*	7/2$^-$		
288.48[#] *18*	9/2$^+$		
360.34[c] *18*	7/2$^+$		
387.57 *21*	1/2$^+$		
396.79 *23*	5/2$^+$		
497.89[#] *16*	11/2$^+$		
510.2[&] *3*	15/2$^-$		
515.7[a] *3*	(9/2$^-$)		
558.84[c] *19*	9/2$^+$		
651.3 *4*	(5/2$^+$)		J$^\pi$: from the Adopted Levels. 7/2$^+$ proposed by 1996Jo19.
771.5[a] *3*	(13/2$^-$)		
779.32[#] *19*	13/2$^+$		
791.49[@] *20*	11/2$^-$		
809.19[c] *24*	11/2$^+$		
956.9[&] *4*	(19/2$^-$)		
1006.63[@] *22*	13/2$^-$		
1008.50[#] *21*	15/2$^+$		
1145.71[@] *22*	15/2$^-$		
1162.9[b] *4*	(15/2$^+$)		
1211.1[a] *4*	(17/2$^-$)		
1229.53[#] *24*	17/2$^+$		
1406.99[@] *25*	17/2$^-$		
1477.0[b] *4*	(19/2$^+$)		
1504.7[&] *4*	(23/2$^-$)		
1549.58[#] *25*	19/2$^+$		
1591.0[@] *4*	(19/2$^-$)		
1612.7[a] *4*	(21/2$^-$)		
1739.0[#] *4*	21/2$^+$		
1885.3[@] *3*	(21/2$^-$)		
1923.6[b] *4*	(23/2$^+$)		
2112.3[&] *5*	(27/2$^-$)		
2122.3[#] *4*	23/2$^+$		

[†] From least-squares fit to Eγ data.

[‡] As proposed by 1996Jo19 based on multipolarity assignments from ce data and band structures, unless otherwise noted. The

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^{150}Nd(d,3nγ) 1996Jo19 (continued)

^{149}Pm Levels (continued)

assignments in the Adopted Levels are generally the same, except that some of these are placed in parentheses when strong arguments are lacking.

[#] Band(A): Band based on 7/2$^+$ ground state. Possibly based on π7/2[404] (1996Jo19), although Nilsson-model assignment is not quite valid here. See also comment for band based on 11/2$^-$.

[@] Band(B): Band based on 11/2$^-$. In comparison with a similar structure of opposite parity bands (probably reflection-asymmetric) in ^{147}Pm, this band may form a parity doublet with the band based on 7/2$^+$ g.s. (1996Jo19), the difference in energies of levels of similar spins (but of opposite parity) ranges from about 300 keV at J=11/2 to about 50 keV at J=19/2.

[&] Band(C): $\pi h_{11/2}$ isomer band.

[a] Band(D): (9/2$^-$) band.

[b] Band(E): Band based on (15/2$^+$). Possibly $\pi h_{11/2}\otimes(3^-)$. Only the 15/2$^+$, 19/2$^+$, 23/2$^+$ members reported.

[c] Band(F): Band based on 5/2$^+$.

$\gamma(^{149}Pm)$

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[a]	Comments
58.6 *3*	4[@] *1*	270.23	7/2$^-$	211.57	5/2$^+$			E1 in 1996Jo19. I_γ: 1996Jo19 give relative to 446.8γ; but from their Fig. 2, it should be relative to 246.9γ.
74.3 *2*	40[@] *3*	188.55	3/2$^+$	114.28	5/2$^+$	M1+E2	5.2 *16*	α(K)exp=2.4 *8* α(K)=2.83 *26*; α(L)=1.8 *14*; α(M)=0.42 *33*
114.3 *3*		114.28	5/2$^+$	0.0	7/2$^+$	M1+E2	1.23 *17*	α(K)exp=0.8 *2*; α(L)exp=0.11 *2* α(K)=0.86 *4*; α(L)=0.29 *16*; α(M)=0.07 *4*
139.3 *3*	1.4[#] *2*	1145.71	15/2$^-$	1006.63	13/2$^-$			M1+E2 in 1996Jo19.
142.7 *3*	1.1[#] *8*	1549.58	19/2$^+$	1406.99	17/2$^-$			E1 in 1996Jo19.
155.9 *2*	54[@] *4*	270.23	7/2$^-$	114.28	5/2$^+$	E1	0.0797 *12*	α(K)exp=0.05 *2* α(K)=0.0678 *10*; α(L)=0.00944 *14*; α(M)=0.002004 *29*
188.6 *3*		188.55	3/2$^+$	0.0	7/2$^+$	(E2)	0.246 *4*	α(K)exp=0.15 *7* α(K)=0.1772 *26*; α(L)=0.0540 *8*; α(M)=0.01215 *19* Mult.: α(K)exp overlaps α(K)theory for E2 and M1, ΔJ^π suggests E2. 1996Jo19 assign E2.
198.5 *2*	44[@] *4*	558.84	9/2$^+$	360.34	7/2$^+$	M1+E2	0.217 *10*	α(K)exp=0.17 *4* α(K)=0.172 *21*; α(L)=0.035 *9*; α(M)=0.0078 *21*
199.1 *2*	45[@] *4*	387.57	1/2$^+$	188.55	3/2$^+$	M1+E2	0.215 *10*	α(K)exp=0.16 *6* α(K)=0.170 *21*; α(L)=0.035 *8*; α(M)=0.0077 *21*
208.2 *2*	33[@] *3*	396.79	5/2$^+$	188.55	3/2$^+$	M1+E2	0.188 *11*	α(K)exp=0.15 *5* α(K)=0.150 *19*; α(L)=0.030 *6*; α(M)=0.0066 *16*
209.5 *2*	18[#] *1*	497.89	11/2$^+$	288.48	9/2$^+$	M1+E2	0.184 *11*	α(K)exp=0.15 *5* α(K)=0.147 *19*; α(L)=0.029 *6*; α(M)=0.0064 *15*
211.5 *3*		211.57	5/2$^+$	0.0	7/2$^+$			M1+E2 in 1996Jo19.
215.0 *3*	1.2[#] *3*	1006.63	13/2$^-$	791.49	11/2$^-$	M1+E2	0.170 *12*	α(K)exp=0.13 *7* α(K)=0.136 *18*; α(L)=0.027 *5*; α(M)=0.0059 *13*
221.0 *3*	1.3[#] *2*	1229.53	17/2$^+$	1008.50	15/2$^+$			M1+E2 in 1996Jo19.
229.2 *2*	7.3[#] *3*	1008.50	15/2$^+$	779.32	13/2$^+$	M1+E2	0.141 *12*	α(K)exp=0.14 *6* α(K)=0.113 *17*; α(L)=0.0215 *35*; α(M)=0.0047 *9*
232.6 *3*		791.49	11/2$^-$	558.84	9/2$^+$	E1	0.0273 *4*	α(K)exp=0.02 *1* α(K)=0.02327 *34*; α(L)=0.00317 *5*; α(M)=0.000672 *10* I_γ: 6 *1*, relative to 100 for 246.0γ from 360.3, 7/2$^+$ level.

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^{150}Nd(d,3nγ) 1996Jo19 (continued)

γ(^{149}Pm) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[a]	Comments
237.0 *3*	1.5[#] *4*	2122.3	23/2$^+$	1885.3	(21/2$^-$)			(E1) in 1996Jo19.
240.2 *3*		240.28	11/2$^-$	0.0	7/2$^+$	M2	0.664 *10*	Mult.: from the Adopted Gammas.
245.5 *3*	1.0[&] *7*	515.7	(9/2$^-$)	270.23	7/2$^-$			(M1+E2) in 1996Jo19.
246.0 *2*	100	360.34	7/2$^+$	114.28	5/2$^+$	M1+E2	0.114 *12*	α(K)exp=0.09 *2* α(K)=0.093 *15*; α(L)=0.0169 *21*; α(M)=0.0037 *5*
250.7 *3*	14[@] *2*	809.19	11/2$^+$	558.84	9/2$^+$	M1+E2	0.108 *12*	α(K)exp=0.07 *3* α(K)=0.088 *14*; α(L)=0.0159 *18*; α(M)=0.0035 *5*
254.3 *3*	5[&] *2*	1211.1	(17/2$^-$)	956.9	(19/2$^-$)	(M1+E2)	0.104 *12*	α(K)exp=0.12 *5* α(K)=0.084 *14*; α(L)=0.0152 *16*; α(M)=0.0033 *4*
254.5 *3*	5[@] *1*	651.3	(5/2$^+$)	396.79	5/2$^+$	M1+E2	0.103 *12*	α(K)exp=0.06 *3* α(K)=0.084 *14*; α(L)=0.0151 *16*; α(M)=0.0033 *4*
256.0 *3*	4[&] *2*	771.5	(13/2$^-$)	515.7	(9/2$^-$)			
261.4 *2*	20[&] *3*	771.5	(13/2$^-$)	510.2	15/2$^-$	(M1+E2)	0.096 *12*	α(K)exp=0.11 *4* α(K)=0.078 *13*; α(L)=0.0139 *13*; α(M)=0.00302 *34*
261.5 *3*	0.6[#] *2*	1406.99	17/2$^-$	1145.71	15/2$^-$			M1+E2 in 1996Jo19.
265.8 *3*	5[&] *1*	1477.0	(19/2$^+$)	1211.1	(17/2$^-$)			(E1) in 1996Jo19.
269.9 *3*		510.2	15/2$^-$	240.28	11/2$^-$	E2	0.0757 *11*	α(K)exp=0.06 *1* α(K)=0.0586 *8*; α(L)=0.01342 *20*; α(M)=0.00298 *4*
270.5 *3*		270.23	7/2$^-$	0.0	7/2$^+$			E1 in 1996Jo19.
273.2 *2*	18[@] *4*	387.57	1/2$^+$	114.28	5/2$^+$	(E2)	0.0729 *10*	α(K)exp=0.06 *4* α(K)=0.0565 *8*; α(L)=0.01283 *18*; α(M)=0.00285 *4* Mult.: α(K)exp gives M1 or E2, but ΔJ^π consistent with E2.
275.4 *3*	10[&] *3*	515.7	(9/2$^-$)	240.28	11/2$^-$			(M1+E2) in 1996Jo19.
281.5 *2*	12[#] *1*	779.32	13/2$^+$	497.89	11/2$^+$	M1+E2	0.077 *11*	α(K)exp=0.06 *3* α(K)=0.063 *12*; α(L)=0.0109 *6*; α(M)=0.00237 *18*
282.6 *3*	12[@] *2*	396.79	5/2$^+$	114.28	5/2$^+$	M1+E2	0.076 *11*	α(K)exp=0.08 *3* α(K)=0.063 *12*; α(L)=0.0108 *6*; α(M)=0.00234 *17*
288.5 *3*		288.48	9/2$^+$	0.0	7/2$^+$	M1+E2	0.072 *11*	α(K)exp=0.06 *1* α(K)=0.059 *11*; α(L)=0.0101 *5*; α(M)=0.00219 *14*
293.6 *3*	1.7[#] *5*	791.49	11/2$^-$	497.89	11/2$^+$			E1 in 1996Jo19.
310.8 *3*	1.5[#] *3*	1923.6	(23/2$^+$)	1612.7	(21/2$^-$)			(E1) in 1996Jo19.
314.2 *3*	3[&] *1*	1477.0	(19/2$^+$)	1162.9	(15/2$^+$)			(E2) in 1996Jo19.
320.0 *3*	2.1[#] *2*	1549.58	19/2$^+$	1229.53	17/2$^+$			M1+E2 in 1996Jo19.
335.8 *3*	1.2[#] *2*	1885.3	(21/2$^-$)	1549.58	19/2$^+$			(E1) in 1996Jo19. Eγ=355.8 in Table 1 and Fig. 1 of 1996Jo19 seem a misprint.
354.2 *3*	3.2[#] *4*	1145.71	15/2$^-$	791.49	11/2$^-$	E2	0.0327 *5*	α(K)exp=0.03 *1* α(K)=0.0262 *4*; α(L)=0.00510 *7*; α(M)=0.001121 *16*
360.1 *3*		360.34	7/2$^+$	0.0	7/2$^+$			

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^{150}Nd(d,3nγ) 1996Jo19 (continued)

γ(^{149}Pm) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[a]	Comments
366.4 *2*	19[#] *2*	1145.71	15/2$^-$	779.32	13/2$^+$	E1	0.00858 *12*	α(K)exp=0.012 *5* α(K)=0.00734 *10*; α(L)=0.000978 *14*; α(M)=0.0002074 *29*
391.4 *3*	4[&] *1*	1162.9	(15/2$^+$)	771.5	(13/2$^-$)			(E1) in 1996Jo19.
398.4 *2*	15.1[#] *2*	1406.99	17/2$^-$	1008.50	15/2$^+$	E1	0.00701 *10*	α(K)exp=0.008 *5* α(K)=0.00600 *8*; α(L)=0.000796 *11*; α(M)=0.0001687 *24*
401.6 *3*	1.0[&] *7*	1612.7	(21/2$^-$)	1211.1	(17/2$^-$)			(E2) in 1996Jo19.
419.0 *3*	2[#] *1*	1923.6	(23/2$^+$)	1504.7	(23/2$^-$)			(E1) in 1996Jo19.
439.6 *3*	6[&] *2*	1211.1	(17/2$^-$)	771.5	(13/2$^-$)			(E2) in 1996Jo19.
444.7 *2*	28[@] *2*	558.84	9/2$^+$	114.28	5/2$^+$	E2	0.01693 *24*	α(K)exp=0.016 *8* α(K)=0.01384 *19*; α(L)=0.002426 *34*; α(M)=0.000528 *7*
445.3 *3*	4.4[#] *6*	1591.0	(19/2$^-$)	1145.71	15/2$^-$			(E2) in 1996Jo19.
446.6 *3*	2.2[#] *5*	1923.6	(23/2$^+$)	1477.0	(19/2$^+$)			(E2) in 1996Jo19.
446.8 *2*	100	956.9	(19/2$^-$)	510.2	15/2$^-$	(E2)	0.01671 *23*	α(K)exp=0.011 *4* α(K)=0.01367 *19*; α(L)=0.002390 *34*; α(M)=0.000521 *7*
448.7 *2*	20[@] *2*	809.19	11/2$^+$	360.34	7/2$^+$	E2	0.01652 *23*	α(K)exp=0.013 *4* α(K)=0.01351 *19*; α(L)=0.002359 *33*; α(M)=0.000514 *7*
450.2 *2*	22[#] *1*	1229.53	17/2$^+$	779.32	13/2$^+$	E2	0.01636 *23*	α(K)exp=0.015 *7* α(K)=0.01339 *19*; α(L)=0.002334 *33*; α(M)=0.000508 *7*
478.2 *3*	0.9[#] *2*	1885.3	(21/2$^-$)	1406.99	17/2$^-$			(E2) in 1996Jo19.
490.8 *2*	63[#] *6*	779.32	13/2$^+$	288.48	9/2$^+$	E2	0.01292 *18*	α(K)exp=0.009 *3* α(K)=0.01064 *15*; α(L)=0.001792 *25*; α(M)=0.000389 *5*
497.9 *2*	100	497.89	11/2$^+$	0.0	7/2$^+$	E2	0.01243 *17*	α(K)exp=0.012 *3* α(K)=0.01025 *14*; α(L)=0.001716 *24*; α(M)=0.000372 *5*
502.9 *3*	3.4[#] *6*	791.49	11/2$^-$	288.48	9/2$^+$	E1	0.00407 *6*	α(K)exp=0.004 *2* α(K)=0.00349 *5*; α(L)=0.000458 *6*; α(M)=9.70×10^{-5} *14*
508.9 *2*	10[#] *2*	1006.63	13/2$^-$	497.89	11/2$^+$	E1	0.00396 *6*	α(K)exp=0.003 *2* α(K)=0.00340 *5*; α(L)=0.000446 *6*; α(M)=9.44×10^{-5} *13*
509.5 *3*	3.0[#] *9*	1739.0	21/2$^+$	1229.53	17/2$^+$	E2	0.01169 *16*	α(K)exp=0.014 *5* α(N)=7.75×10^{-5} *11*; α(O)=1.122×10^{-5} *16*; α(P)=5.61×10^{-7} *8*
510.5 *2*	67[#] *3*	1008.50	15/2$^+$	497.89	11/2$^+$	E2	0.01163 *16*	α(K)exp=0.009 *3* α(K)=0.00960 *13*; α(L)=0.001593 *22*; α(M)=0.000345 *5*
520.0 *3*	8[&] *2*	1477.0	(19/2$^+$)	956.9	(19/2$^-$)			(E1) in 1996Jo19.
531.2 *2*	14[&] *4*	771.5	(13/2$^-$)	240.28	11/2$^-$			(M1+E2) in 1996Jo19.
541.1 *2*	11.9[#] *8*	1549.58	19/2$^+$	1008.50	15/2$^+$	E2	0.00997 *14*	α(K)exp=0.009 *3* α(N)=6.49×10^{-5} *9*; α(O)=9.43×10^{-6} *13*; α(P)=4.83×10^{-7} *7*
547.8 *2*	37[&] *5*	1504.7	(23/2$^-$)	956.9	(19/2$^-$)	(E2)	0.00966 *14*	α(K)exp=0.007 *2* α(K)=0.00801 *11*; α(L)=0.001296 *18*; α(M)=0.000281 *4*

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^{150}Nd(d,3nγ) 1996Jo19 (continued)

$\gamma(^{149}Pm)$ (continued)

E_γ [†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [a]	Comments
572.8 *3*	3.2[#] *8*	2122.3	$23/2^+$	1549.58	$19/2^+$	E2	0.00861 *12*	α(K)exp=0.011 *5* α(K)=0.00716 *10*; α(L)=0.001141 *16*; α(M)=0.0002467 *35*
607.6 *2*	11[&] *3*	2112.3	$(27/2^-)$	1504.7	$(23/2^-)$			(E2) in 1996Jo19.
652.9 *3*	6[&] *2*	1162.9	$(15/2^+)$	510.2	$15/2^-$			(E1) in 1996Jo19.
655.7 *2*	11[&] *2*	1612.7	$(21/2^-)$	956.9	$(19/2^-)$			(M1+E2) in 1996Jo19.
700.8 *2*	13[&] *3*	1211.1	$(17/2^-)$	510.2	$15/2^-$			(M1+E2) in 1996Jo19.

[†] Uncertainties are 0.2 keV for Iγ>5 (relative to 100 for 497.9γ); Iγ>10 (relative to 100 for 446.8γ); Iγ>15 (relative to 100 for 246.0γ); and 0.3 keV otherwise.

[‡] From 1996Jo19 based on measured ce data. Other assignments, apparently from ΔJ^π, listed in authors′ Table 1 are given in comments.

[#] Normalized to 100 for 497.9γ from 497.9, $11/2^+$ level.

[@] Normalized to 100 for 246.0γ from 360.3, $7/2^+$ level.

[&] Normalized to 100 for 446.8γ from 957.0, $(19/2^-)$ level.

[a] 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.

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Level Scheme

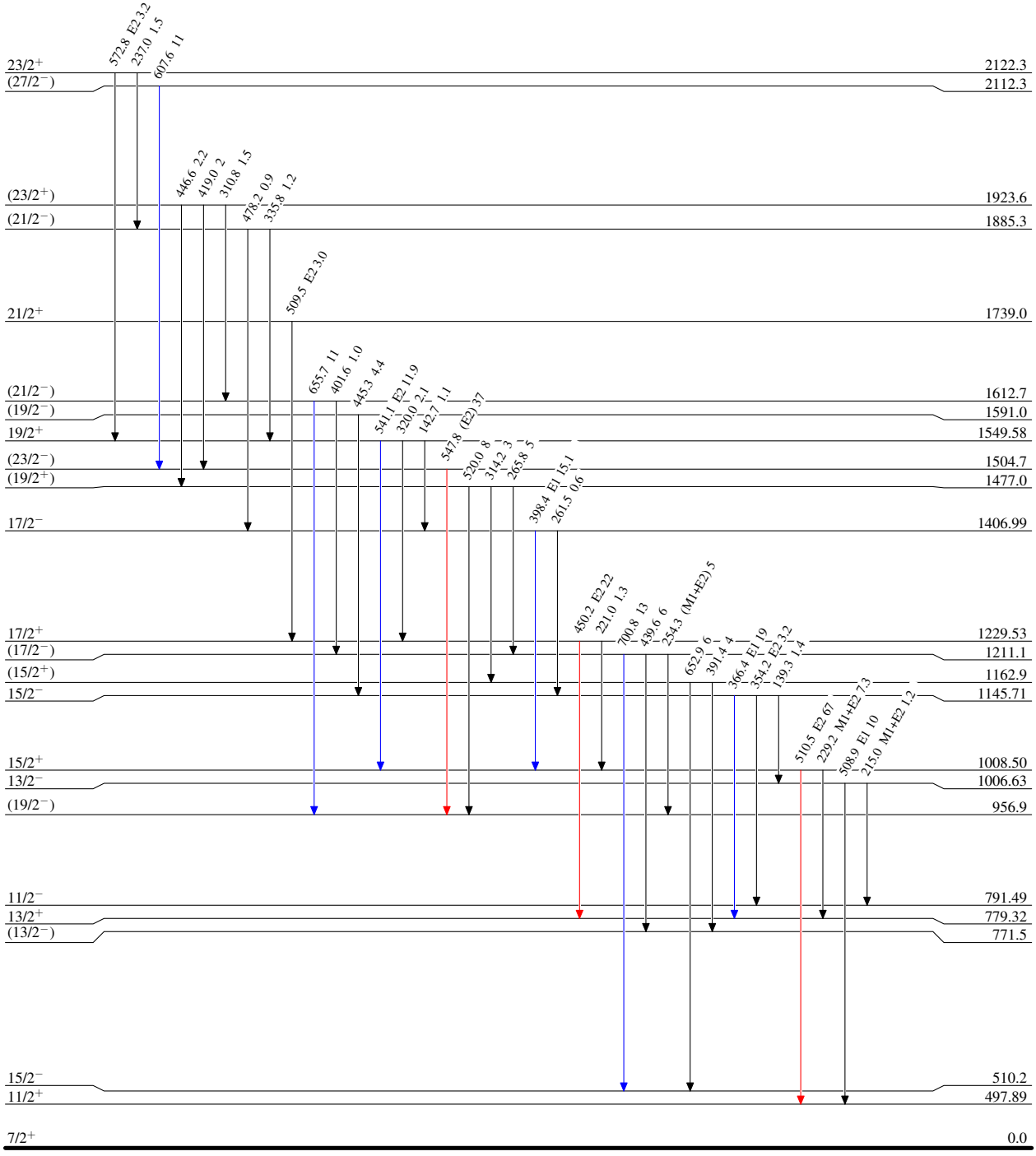
Intensities: Relative intensities within different band structures

Legend

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

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

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



$^{149}_{61}Pm_{88}$

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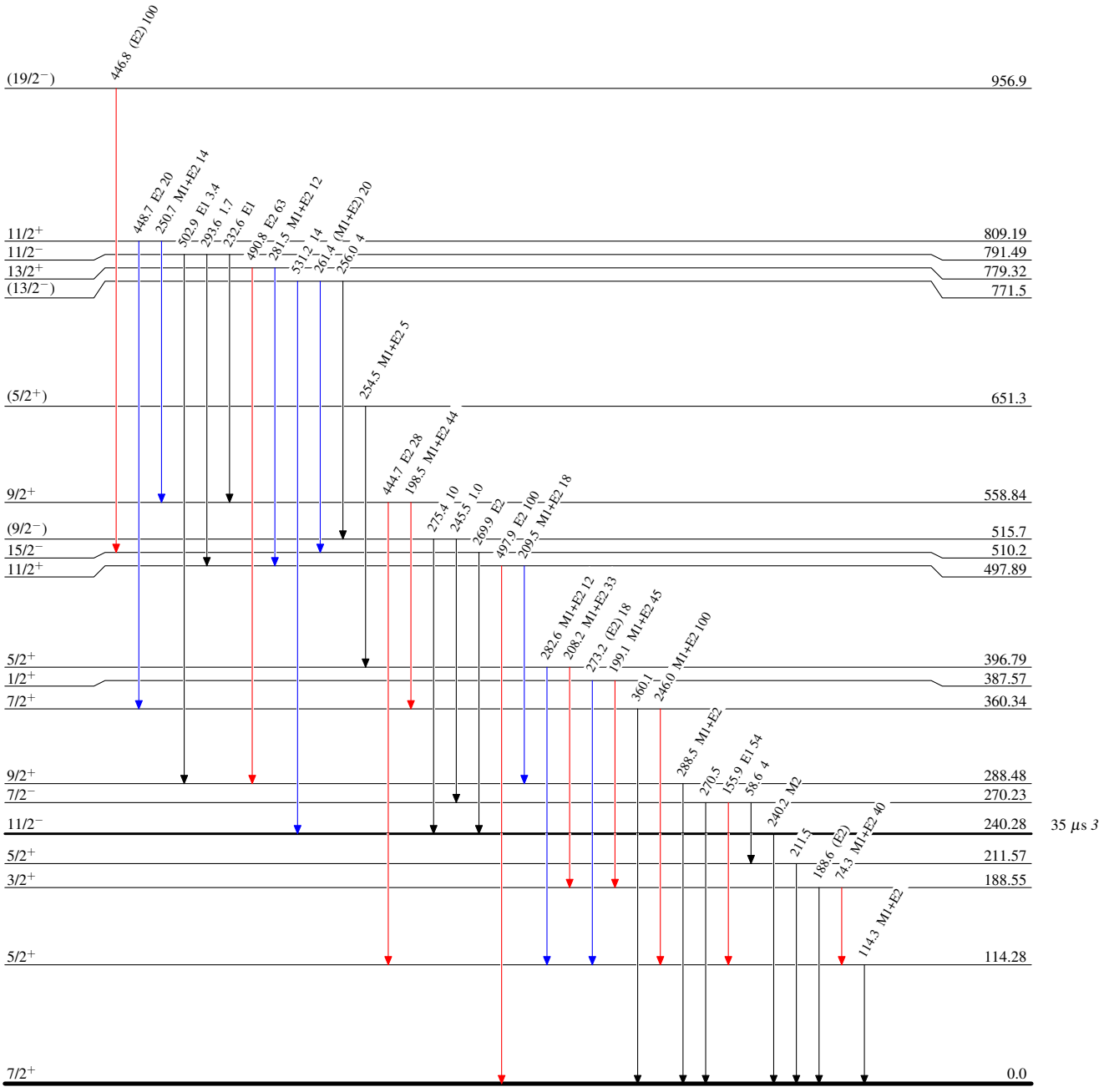
Level Scheme (continued)

Intensities: Relative intensities within different band structures

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



$^{149}_{61}Pm_{88}$

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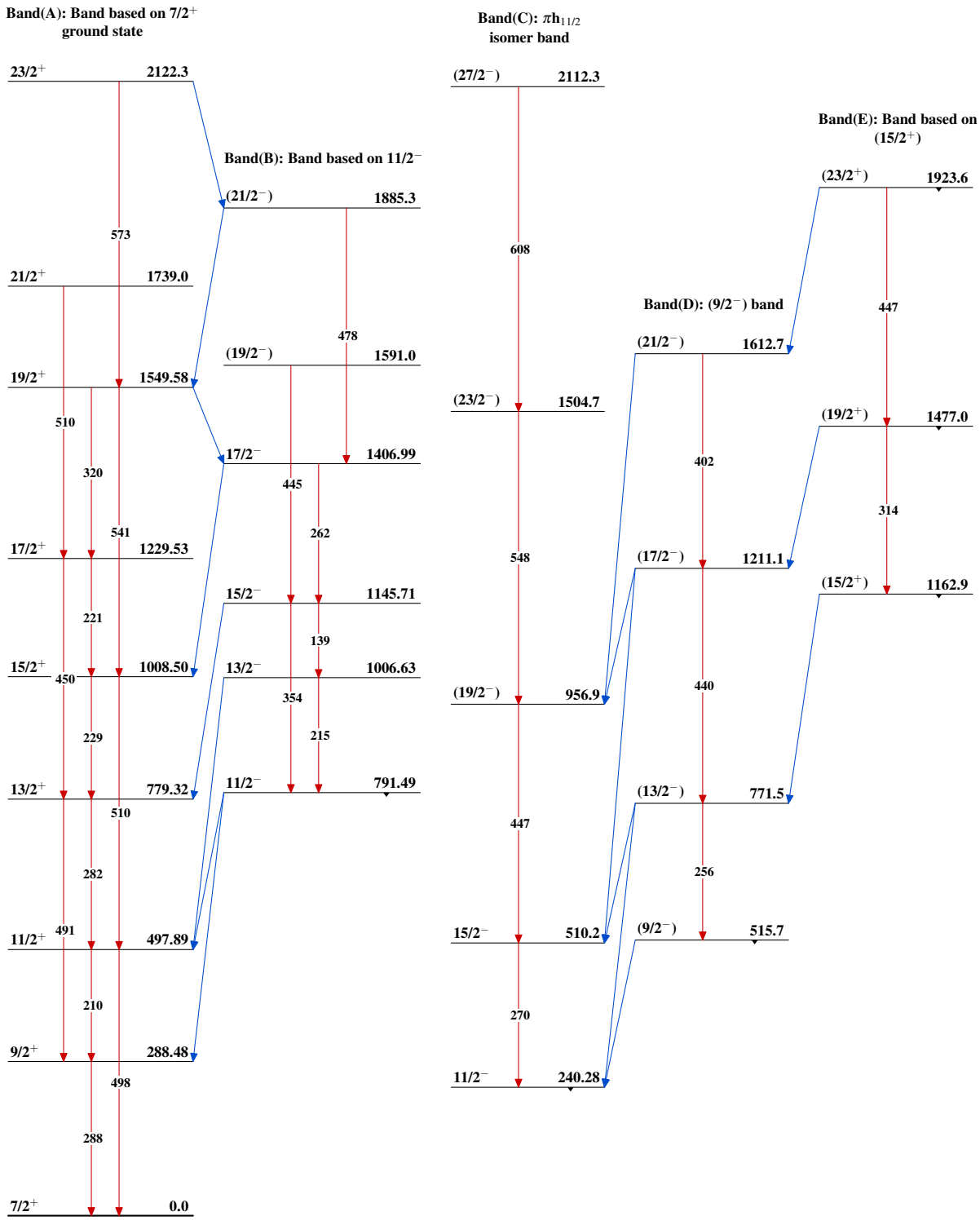
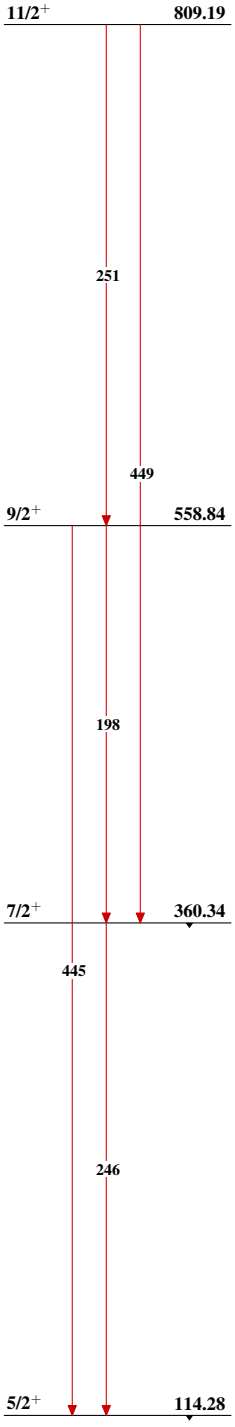


$^{149}_{61}Pm_{88}$

^{150}Nd(d,3nγ) 1996Jo19 (continued)

Band(F): Band based on 5/2$^+$



$^{149}_{61}Pm_{88}$