^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13

History

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

Additional information 1.

1989Ma32: Measured: γ rays, $\gamma\gamma$ coin, $\gamma(\theta)$, DCO, γ(t).

1997Ro13: Measured: γ rays, $\gamma\gamma$ coin, $\gamma(\theta)$, DCO. Detector: Gamma spectrometer GASP, an array of 40 Compton-suppressed germanium detectors and an inner ball of 80 BGO crystals. Preliminary results: 1988Pa09. Other: 1995Ro15. Other: ^{74}Se(^{66}Zn,2pnγ) E=290 MeV (1987Bi11).

^{137}Sm Levels

No levels with $T_{1/2}$>8 ns observed (1989Ma32).

E(level)†	Jπ	$T_{1/2}$‡	E(level)†	Jπ	$T_{1/2}$‡	E(level)†	Jπ	$T_{1/2}$‡
0.0&	(9/2$^-$)	45 s *1*	2439.5@ *3*	(21/2$^+$)		4183.9[a] *13*	(35/2$^-$)	
209.24& *16*	(11/2$^-$)		2510.95[a] *25*	(21/2$^-$)		4214.7@ *8*	(33/2$^+$)	
290.0[c] *8*	7/2$^+$		2587.9[a] *10*	(23/2$^-$)		4515.5[b] *24*	(35/2$^-$)	
541.37& *16*	(13/2$^-$)		2647.3@ *4*	(23/2$^+$)		4537.6[c] *22*	33/2$^+$	
583.0[c] *8*	9/2$^+$		2713.3[a] *11*	(25/2$^-$)		4569.1@ *9*	(35/2$^+$)	
764.66& *19*	(15/2$^-$)		2789.5[b] *16*	(23/2$^-$)		4645.1[a] *13*	(37/2$^-$)	
890.8[b] *8*	(11/2$^-$)		2826.4# *6*	(25/2$^+$)		4713.7# *9*	(37/2$^+$)	2.8 ps
1160.8[c] *10*	13/2$^+$		2872.3[a] *11*	(27/2$^-$)		4974.4@ *10*	(37/2$^+$)	
1202.79& *21*	(17/2$^-$)		2880.5@ *4*	(25/2$^+$)		5133.5[a] *15*	(39/2$^-$)	
1412.9 *8*	(15/2)		3009.6[c] *17*	25/2$^+$		5324.2@ *12*	(39/2$^+$)	
1427.5[b] *7*	(15/2$^-$)		3126.8[a] *11*	(29/2$^-$)		5338[b] *3*	(39/2$^-$)	
1449.03& *22*	(19/2$^-$)		3156.9@ *5*	(27/2$^+$)		5360?[c]	(37/2$^+$)	
1789.6[c] *10*	17/2$^+$		3364.9# *6*	(29/2$^+$)	3.1 ps *4*	5520.0# *11*	(41/2$^+$)	1.5 ps
1987.09& *24*	(21/2$^-$)		3381.5[b] *19*	(27/2$^-$)		5655.3[a] *15*	(41/2$^-$)	
1996.4# *5*	(17/2$^+$)		3408.1[a] *11*	(31/2$^-$)		6262[b] *3*	(43/2$^-$)	
2076.5[b] *12*	(19/2$^-$)		3492.4@ *5*	(29/2$^+$)		6410.0# *12*	(45/2$^+$)	0.55 ps
2228.4@ *3*	(19/2$^+$)		3742.6[c] *20*	29/2$^+$		7380.0# *13*	(49/2$^+$)	0.40 ps
2254.1& *3*	(23/2$^-$)		3783.9[a] *11*	(33/2$^-$)		8425.0# *16*	(53/2$^+$)	0.27 ps
2365.6[c] *14*	21/2$^+$		3817.1@ *5*	(31/2$^+$)		9540.0# *19*	(57/2$^+$)	0.15 ps
2375.4# *5*	(21/2$^+$)		3848.5[b] *21*	(31/2$^-$)				
2406.9[a] *3*	(19/2$^-$)		3994.0# *8*	(33/2$^+$)				

† From least-squares fit to Eγ, using ΔE=1 keV for γ rays without uncertainties.

‡ From Adopted Levels.

Band(A): highly deformed (hd) band. Configuration=(ν $i_{13/2}2^+$[660]). Q=4.8 eb 4 (2001Ri20, 2002La09). Q=5.0 eb 7, β_2=0.27 *3* (1992Re05).

@ Band(B): Configuration=((ν $h_{11/2}$)(π $h_{11/2}$)(π $g_{7/2}$)) band.

& Band(C): yrast band. Configuration=(ν $h_{11/2}2^-$[514]).

[a] Band(D): Configuration=((ν $h_{11/2}$)(π $h_{11/2}$)^2) band.

[b] Band(E): Configuration=(ν $h_{9/2}2^-$[530]) band.

[c] Band(F): Configuration=(ν $d_{3/2}2^+$[400]) band.

^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13 (continued)

$\gamma(^{137}Sm)$

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
77 *1*		2587.9	(23/2$^-$)	2510.95	(21/2$^-$)		
104.2 *2*		2510.95	(21/2$^-$)	2406.9	(19/2$^-$)	D	DCO=0.81 *2* (1989Ma32).
125.4 *2*	45 *5*	2713.3	(25/2$^-$)	2587.9	(23/2$^-$)	D	DCO=0.80 *2* (1989Ma32).
159.0 *2*	34 *4*	2872.3	(27/2$^-$)	2713.3	(25/2$^-$)	D	DCO=0.73 *2* (1989Ma32).
208.0 *5*	<171[@]	2647.3	(23/2$^+$)	2439.5	(21/2$^+$)	D[@]	DCO(208γ + 209γ + 211γ)=0.60 *1* (1989Ma32).
209.3 *2*	<207[@]	209.24	(11/2$^-$)	0.0	(9/2$^-$)	D[@]	DCO(208γ + 209γ + 211γ)=0.60 *1* (1989Ma32).
211.0 *2*	<171[@]	2439.5	(21/2$^+$)	2228.4	(19/2$^+$)	D[@]	DCO(208γ + 209γ + 211γ)=0.60 *1* (1989Ma32).
223.4 *2*	27 *3*	764.66	(15/2$^-$)	541.37	(13/2$^-$)	D	DCO=0.55 *2* (1989Ma32).
233.2 *2*	34 *4*	2880.5	(25/2$^+$)	2647.3	(23/2$^+$)	D	DCO=0.63 *2* (1989Ma32).
246.0 *2*	17.2 *20*	1449.03	(19/2$^-$)	1202.79	(17/2$^-$)	D	DCO=0.60 *2* (1989Ma32).
254.4 *2*	34 *4*	3126.8	(29/2$^-$)	2872.3	(27/2$^-$)	D	DCO=0.69 *2* (1989Ma32).
267.0 *5*	<5	2254.1	(23/2$^-$)	1987.09	(21/2$^-$)	D[a]	DCO=0.66 *3* (1989Ma32).
276.4 *2*	24 *4*	3156.9	(27/2$^+$)	2880.5	(25/2$^+$)	D	DCO=0.59 *2* (1989Ma32).
281.4 *2*	28 *3*	3408.1	(31/2$^-$)	3126.8	(29/2$^-$)	D	DCO=0.66 *2* (1989Ma32).
284.1 *5*	<5	2872.3	(27/2$^-$)	2587.9	(23/2$^-$)		
290	13[d] *3*	290.0	7/2$^+$	0.0	(9/2$^-$)	D	Mult.: DCO=0.58 *10* (1997Ro13).
293	13[d] *5*	583.0	9/2$^+$	290.0	7/2$^+$	D	Mult.: DCO=0.25 *10* (1997Ro13).
324.9 *2*	12.0 *12*	3817.1	(31/2$^+$)	3492.4	(29/2$^+$)	D	DCO=0.53 *2* (1989Ma32).
332.1 *2*	47 *7*	541.37	(13/2$^-$)	209.24	(11/2$^-$)	D	DCO=0.48 *2* (1989Ma32).
335.7 *2*	18 *3*	3492.4	(29/2$^+$)	3156.9	(27/2$^+$)	D	DCO=0.89 *2*, affected by contamination (1989Ma32).
350 *1*	<5	5324.2	(39/2$^+$)	4974.4	(37/2$^+$)		
354 *1*	<5	4569.1	(35/2$^+$)	4214.7	(33/2$^+$)		
374	6[d] *2*	583.0	9/2$^+$	209.24	(11/2$^-$)	D	Mult.: DCO=0.58 *15* (1997Ro13).
375.8 *2*	15.0 *19*	3783.9	(33/2$^-$)	3408.1	(31/2$^-$)	D	DCO=0.73 *2* (1989Ma32).
379.0 *2*	16 *3*	2375.4	(21/2$^+$)	1996.4	(17/2$^+$)	Q	DCO=1.08 *15* (1997Ro13), DCO=1.11 *3* (1989Ma32).
398 *1*	<5	4214.7	(33/2$^+$)	3817.1	(31/2$^+$)	D[&]	DCO(400γ + 398γ)=0.63 *2* (1989Ma32).
400 *1*	9.0 *9*	4183.9	(35/2$^-$)	3783.9	(33/2$^-$)	D[&]	DCO(400γ + 398γ)=0.63 *2* (1989Ma32).
405 *1*	<5	4974.4	(37/2$^+$)	4569.1	(35/2$^+$)		
413.8 *5*	3.4 *5*	3126.8	(29/2$^-$)	2713.3	(25/2$^-$)		
419.0 *5*	<5	2647.3	(23/2$^+$)	2228.4	(19/2$^+$)		
438.0 *2*	39 *4*	1202.79	(17/2$^-$)	764.66	(15/2$^-$)	D	DCO=0.43 *2* (1989Ma32).
440.7 *5*	6.2 *14*	2880.5	(25/2$^+$)	2439.5	(21/2$^+$)		
451.0 *2*	12 *2*	2826.4	(25/2$^+$)	2375.4	(21/2$^+$)	Q	DCO=0.82 *15* (1997Ro13), DCO=1.3 *3* (1989Ma32).
461 *1*	7.3 *7*	4645.1	(37/2$^-$)	4183.9	(35/2$^-$)		
467	3[d] *1*	3848.5	(31/2$^-$)	3381.5	(27/2$^-$)	Q	Mult.: DCO=1.00 *5* (1997Ro13).
488 *1*	<5	5133.5	(39/2$^-$)	4645.1	(37/2$^-$)		
509.5 *5*	<5	3156.9	(27/2$^+$)	2647.3	(23/2$^+$)		
522[e] *1*	<5	5655.3	(41/2$^-$)	5133.5	(39/2$^-$)		
523.8 *2*	14.0 *15*	2510.95	(21/2$^-$)	1987.09	(21/2$^-$)	D	DCO=0.80 *4* (1989Ma32).
536.0[e] *5*	<5	3408.1	(31/2$^-$)	2872.3	(27/2$^-$)		
537	7[d] *3*	1427.5	(15/2$^-$)	890.8	(11/2$^-$)	Q	Mult.: DCO=1.05 *10* (1997Ro13).
537.9 *2*	25 *3*	1987.09	(21/2$^-$)	1449.03	(19/2$^-$)		
538.5 *2*	11.4 *16*	3364.9	(29/2$^+$)	2826.4	(25/2$^+$)	Q	DCO=1.14 *10* (1997Ro13).
541.3 *2*	52 *5*	541.37	(13/2$^-$)	0.0	(9/2$^-$)	Q	DCO=1.10 *7*, gating on 661γ (1989Ma32).
555.5 *2*	99	764.66	(15/2$^-$)	209.24	(11/2$^-$)	Q	DCO=0.99 *2* (1989Ma32).
569[†]	3.2[†] *1*	1996.4	(17/2$^+$)	1427.5	(15/2$^-$)	D	DCO=0.44 *12* (1997Ro13).
576	11[d] *2*	2365.6	21/2$^+$	1789.6	17/2$^+$	Q	Mult.: DCO=1.03 *10* (1997Ro13).
578	20[d] *5*	1160.8	13/2$^+$	583.0	9/2$^+$	Q	Mult.: DCO=1.09 *10* (1997Ro13).
584[†]	1.0[†] *1*	1996.4	(17/2$^+$)	1412.9	(15/2)	D	DCO=0.47 *10* (1997Ro13).
586[†]	3.2[†] *1*	2375.4	(21/2$^+$)	1789.6	17/2$^+$	Q	DCO=0.98 *8* (1997Ro13).
592	4[d] *1*	3381.5	(27/2$^-$)	2789.5	(23/2$^-$)	Q	Mult.: DCO=0.94 *16* (1997Ro13).

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^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13 (continued)

γ(^{137}Sm) (continued)

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
612.0 *5*	4.5 *5*	3492.4	(29/2$^+$)	2880.5	(25/2$^+$)		
629	17[d] *3*	1789.6	17/2$^+$	1160.8	13/2$^+$	Q	Mult.: DCO=0.94 *8* (1997Ro13).
629.1 *5*	8.4 *8*	3994.0	(33/2$^+$)	3364.9	(29/2$^+$)	Q	DCO=1.01 *5* (1997Ro13).
644	8[d] *2*	3009.6	25/2$^+$	2365.6	21/2$^+$	Q	Mult.: DCO=0.98 *10* (1997Ro13).
649	7[d] *2*	2076.5	(19/2$^-$)	1427.5	(15/2$^-$)	Q	Mult.: DCO=0.95 *7* (1997Ro13).
657.0 *5*	4.2 *8*	3783.9	(33/2$^-$)	3126.8	(29/2$^-$)		
659.0 *5*	<5	3817.1	(31/2$^+$)	3156.9	(27/2$^+$)		
661.2 *2*	71 *7*	1202.79	(17/2$^-$)	541.37	(13/2$^-$)	Q	DCO=1.01 *2* (1989Ma32).
667	3[d] *1*	4515.5	(35/2$^-$)	3848.5	(31/2$^-$)	Q	Mult.: DCO=0.98 *10* (1997Ro13).
684.7 *2*	69 *7*	1449.03	(19/2$^-$)	764.66	(15/2$^-$)	Q	DCO=1.05 *2* (1989Ma32).
713	5[d] *2*	2789.5	(23/2$^-$)	2076.5	(19/2$^-$)	Q	Mult.: DCO=1.09 *15* (1997Ro13).
719.7 *5*	5.1 *5*	4713.7	(37/2$^+$)	3994.0	(33/2$^+$)		
722 *1*	<5	4214.7	(33/2$^+$)	3492.4	(29/2$^+$)		
733	4[d] *2*	3742.6	29/2$^+$	3009.6	25/2$^+$	Q	Mult.: DCO=1.15 *25* (1997Ro13).
752 *1*	<5	4569.1	(35/2$^+$)	3817.1	(31/2$^+$)		
755 *1*	<5	5324.2	(39/2$^+$)	4569.1	(35/2$^+$)		
760 *1*	<5	4974.4	(37/2$^+$)	4214.7	(33/2$^+$)		
776 *1*	<5	4183.9	(35/2$^-$)	3408.1	(31/2$^-$)		
784.4 *2*	27 *3*	1987.09	(21/2$^-$)	1202.79	(17/2$^-$)	Q	DCO=1.05 *2* (1989Ma32).
795	2[d] *1*	4537.6	33/2$^+$	3742.6	29/2$^+$	Q	Mult.: DCO=0.84 *20* (1997Ro13).
805.1 *2*	26 *4*	2254.1	(23/2$^-$)	1449.03	(19/2$^-$)	Q	DCO(805γ + 806γ)=1.07 *2* (1989Ma32).
806.3 *5*	4.4 *7*	5520.0	(41/2$^+$)	4713.7	(37/2$^+$)	(Q)[a]	DCO(805γ + 806γ)=1.07 *2* (1989Ma32).
822	2.0[d] *5*	5338	(39/2$^-$)	4515.5	(35/2$^-$)		
822[e]	1[d] *1*	5360?	(37/2$^+$)	4537.6	33/2$^+$		
861 *1*	<5	4645.1	(37/2$^-$)	3783.9	(33/2$^-$)		
872[†]	0.4[†] *1*	1412.9	(15/2)	541.37	(13/2$^-$)	D	Mult.: DCO=0.91 *10*, gating on 332γ, ΔJ=1 transition (1997Ro13).
886		1427.5	(15/2$^-$)	541.37	(13/2$^-$)		
890.0 *5*	4.9 *8*	6410.0	(45/2$^+$)	5520.0	(41/2$^+$)		
891	7[d] *2*	890.8	(11/2$^-$)	0.0	(9/2$^-$)	D	Mult.: DCO=0.52 *15* (1997Ro13).
924	1.0 *5*	6262	(43/2$^-$)	5338	(39/2$^-$)		
950 *1*	<5	5133.5	(39/2$^-$)	4183.9	(35/2$^-$)		
958.1 *2*	11.6 *21*	2406.9	(19/2$^-$)	1449.03	(19/2$^-$)		
970.0 *5*	3.2 *5*	7380.0	(49/2$^+$)	6410.0	(45/2$^+$)		
990.5 *2*	28 *5*	2439.5	(21/2$^+$)	1449.03	(19/2$^-$)	D	DCO=0.88 *2* (1989Ma32).
1010[e] *1*	<5	5655.3	(41/2$^-$)	4645.1	(37/2$^-$)		
1025.6 *2*	21 *4*	2228.4	(19/2$^+$)	1202.79	(17/2$^-$)	(D)[b]	DCO=0.7 *3* (1989Ma32).
1045 *1*	<5	8425.0	(53/2$^+$)	7380.0	(49/2$^+$)		
1062.0 *5*	<5	2510.95	(21/2$^-$)	1449.03	(19/2$^-$)		
1115 *1*	<5	9540.0	(57/2$^+$)	8425.0	(53/2$^+$)		
1139 *5*	8.8 *12*	2587.9	(23/2$^-$)	1449.03	(19/2$^-$)	Q[c]	DCO=1.0 *4* (1989Ma32).
1231.5 *5*	4.8 *8*	1996.4	(17/2$^+$)	764.66	(15/2$^-$)	D	DCO=0.47 *9* (1997Ro13), DCO<0.6 (1989Ma32).
1308.0 *2*	13.7 *23*	2510.95	(21/2$^-$)	1202.79	(17/2$^-$)	Q	DCO=1.25 *5* (1989Ma32).

[†] From 1997Ro13. Iγ renormalized by evaluators to 12 for 451γ.

[‡] Mult are implied D or Q for most transitions. Assignments given here are from DCO ratio. DCO intensity ratios≥1.0 are assumed to indicate Q transition, whereas values≤0.8 are taken to be D. DCO ratios overlapping the two limits are indicated and mult are shown in parentheses.

[#] Original values given in 1989Ma32 are total intensities I(γ+ce) (photons plus conversion electrons). Values given here are Iγ,

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^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13 (continued)

$\gamma(^{137}Sm)$ (continued)

corrected by evaluators using theoretical conversion coefficients, unless otherwise specified.

[@] DCO gives ΔJ=1, D for Eγ=208.0+209.3+211.0. Iγ(208.0+209.3+211.0)=207 *21*. From intensity balance 43 *6*≥Ti(208.0γ)≥39 *5* or Ti(208.0γ)=41 *7*, Iγ(208.0)=34 *6* (α(M1)=0.216); 21 *4*≥Ti(211.0γ)≥19 *8* or Ti(211.0γ)=18 *7*, Iγ(211.0)=15 *6*; Ti(209.3γ)=207 *21*-Ti(208γ+211γ)=148 *23*, Iγ(209.3γ)=122 *19* (1989Ma32).

[&] DCO gives ΔJ=1, D for Eγ=398+400 (1989Ma32).

[a] DCO gives ΔJ=2, Q for Eγ=805.1+806.3. Since Iγ(805)>>Iγ(806) dominating contribution to DCO is from 805γ (1989Ma32).

[b] DCO=0.7 *3* (1989Ma32).

[c] DCO=1.0 *4* (1989Ma32).

[d] Arbitrary scale for intraband γ rays (1997Ro13).

[e] Placement of transition in the level scheme is uncertain.

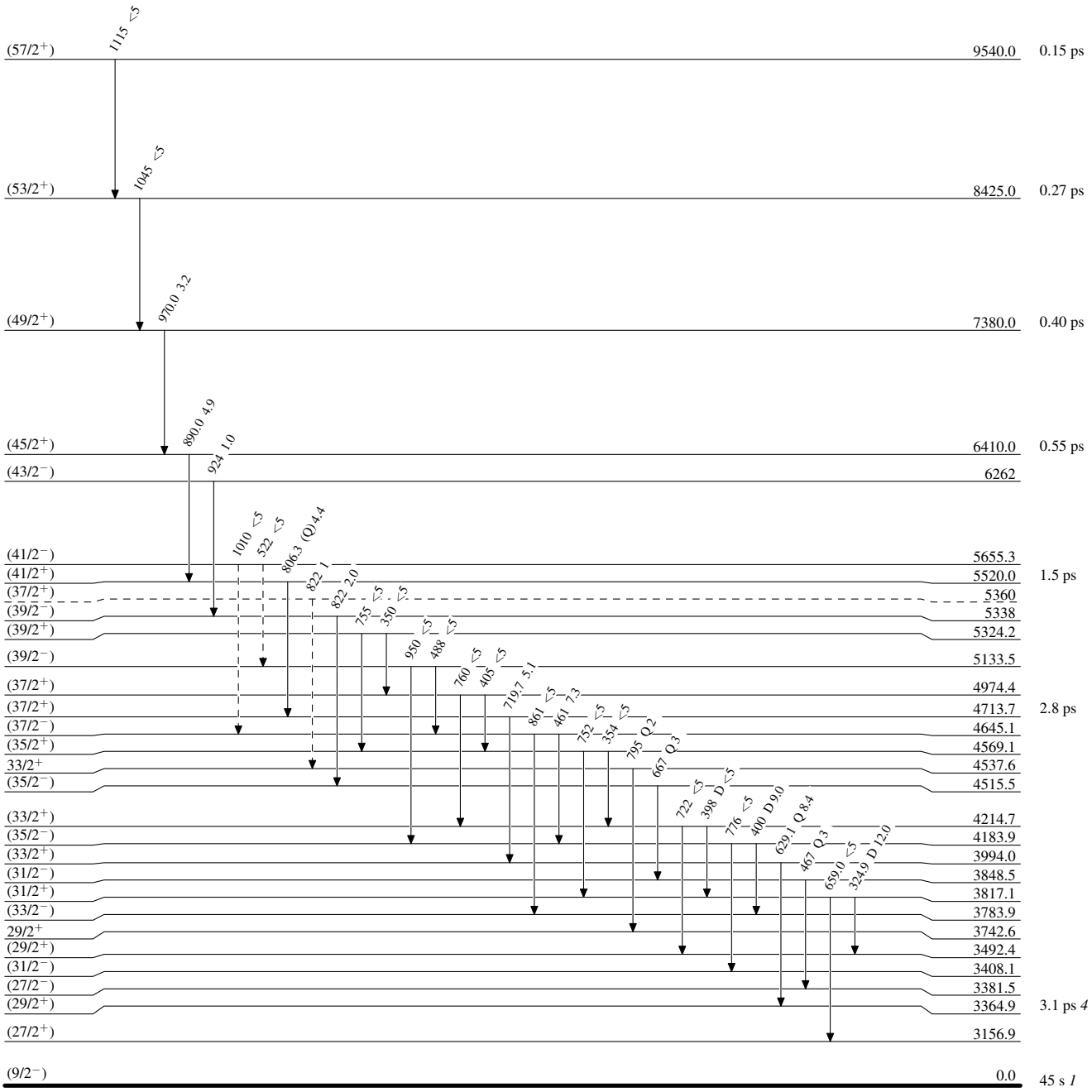
^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13

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)



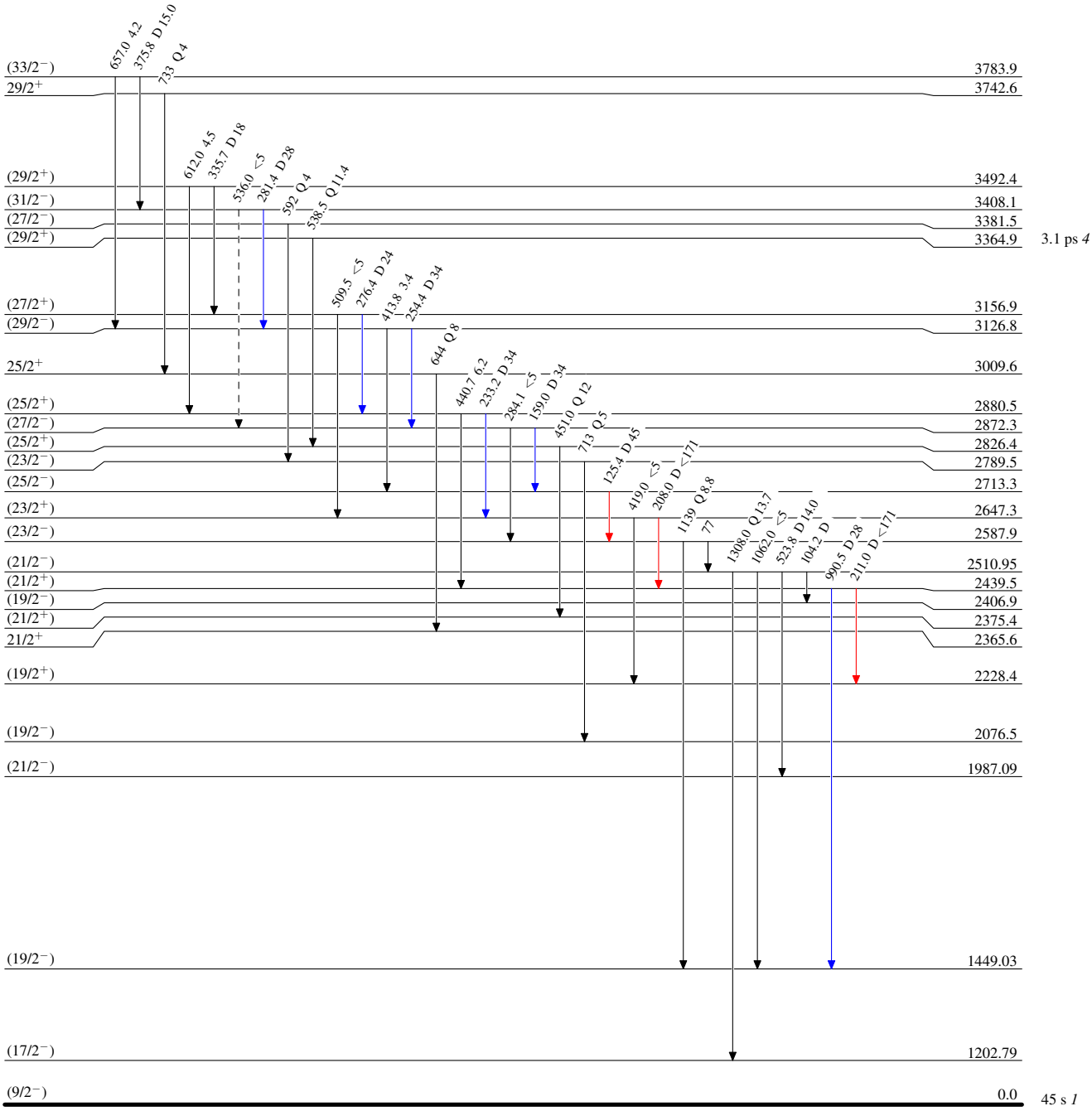
$^{137}_{62}Sm_{75}$

^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13

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)



$^{137}_{62}Sm_{75}$

^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13

Level Scheme (continued)

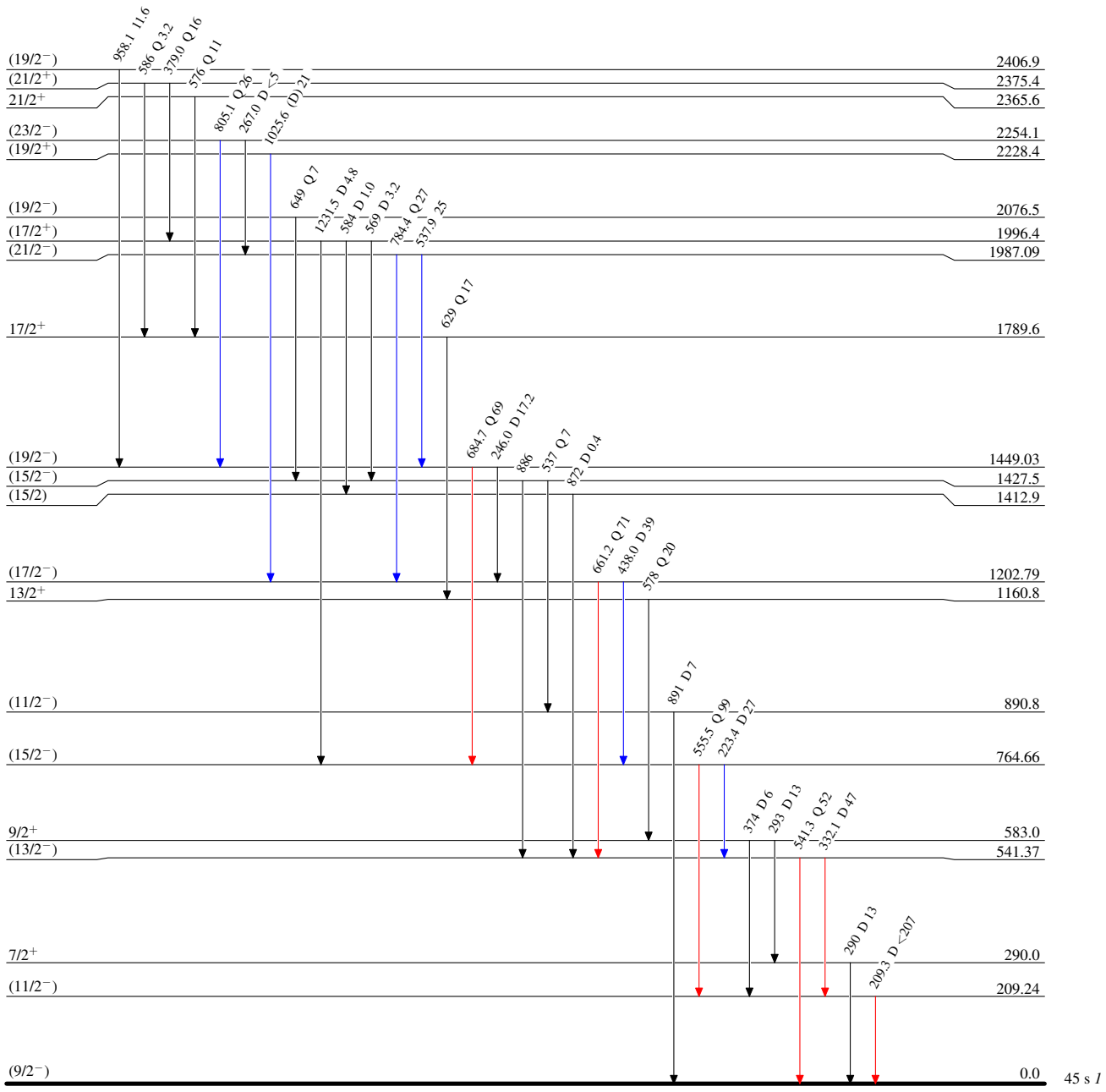
Intensities: Relative I_γ

Legend

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

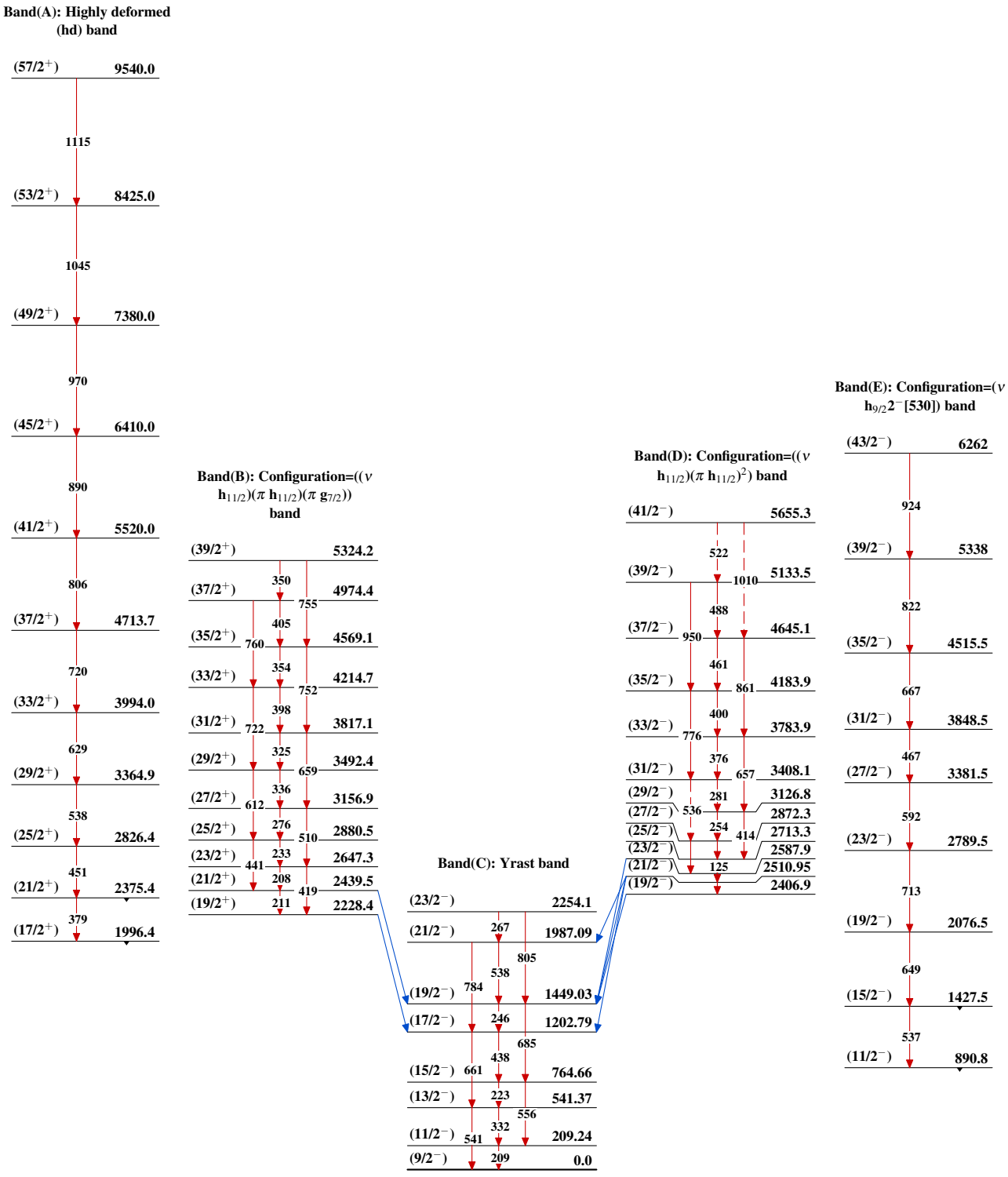
$I_\gamma < 10\% \times I_\gamma^{max}$

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



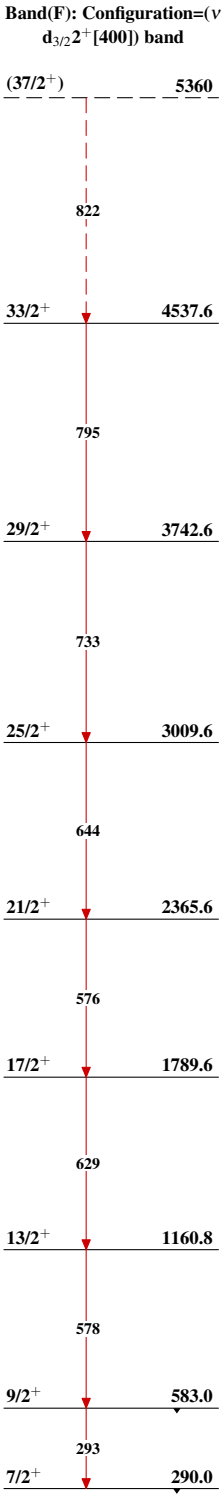
$^{137}_{62}Sm_{75}$

^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13



$^{137}_{62}Sm_{75}$

^{104}Pd(^{37}Cl,p3nγ) E≈170 MeV 1989Ma32,1997Ro13 (continued)



$^{137}_{62}Sm_{75}$