(HI,xnγ) 1989Pa01

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 154, 1 (2018)	20-Nov-2018

^{94}Mo(^{50}Cr,2p2nγ) E=230 MeV (1985Li13); ^{92}Mo(^{54}Fe,αp2pγ) E=260 MeV (1988Bi03); ^{92}Mo(^{50}Cr,2pγ) E=210, 230 MeV (1989Pa01).

Measured: γ, γγ, yield (1989Pa01,1988Bi03,1985Li13), DCO (1989Pa01).

^{140}Gd Levels

E(level)	Jπ†	Comments
0.0‡	0+	
328.6‡ 3	2+	
713.3# 4	(2+)	
836.2‡ 5	4+	
1068.2# 4	(3+)	
1281.4# 5	(4+)	
1464.0‡ 6	6+	
1693.4# 5	(5+)	
1881.4# 11	(6+)	
2139.7‡ 6	8+	
2411.4# 11	(7+)	
2632?#	(8+)	
2796.8‡ 7	10+	
2926.8& 7	10+	Jπ: intermediary level in between 12+ and 8+; 10+ and E2′s to this and from this level is best supported by measured DCO′s of the two γ′s.
3033.7@ 7	9(−)	
3267.5‡ 7	12+	
3617?&	(12+)	
3624.7@ 8	11(−)	
3849.3‡ 8	14+	
4025.5 8	(12,13)	
4319.9@ 8	(13−)	
4592.8‡ 8	16+	
5460.9‡ 9	(18+)	
6422.9‡ 13	(20+)	

† 1989Pa01 J^π values are based on measured DCO, deformation (g.s. quoted values: β=0.236, γ=−20°, Lund convention), and in-band Iγ′s. For the g.s. band the assignments are definite (unambiguous 0+ of g.s., E2 329γ and measured stretched Q′s for other in-band γ′s). The π assignments are tentative for the other bands (based on systematics).

‡ Band(A): yrast g.s. band.

Band(B): K=2+ γ-vibrational band.

@ Band(C): negative parity band.

& Band(D): positive parity band.

(HI,xnγ) 1989Pa01 (continued)

γ(^{140}Gd)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	Comments
328.6 *3*	100	328.6	2^+	0.0	0^+	E2	0.0457	α(K)=0.0354 *5*; α(L)=0.00798 *12*; α(M)=0.00180 *3*; α(N+..)=0.000468 *7* α(N)=0.000408 *6*; α(O)=5.83×10^{-5} *9*; α(P)=2.25×10^{-6} *4* DCO=1.0 *1*, typical for stretched Q; M2 excluded by RUL, based on $T_{1/2}$≤50 ns for 329 level from time gate for coincidences (1989Pa01).
340.8 *3*	4 *1*	3267.5	12^+	2926.8	10^+	(E2)	0.0409	α(K)=0.0319 *5*; α(L)=0.00702 *10*; α(M)=0.001582 *23*; α(N+..)=0.000412 *6* α(N)=0.000359 *6*; α(O)=5.15×10^{-5} *8*; α(P)=2.04×10^{-6} *3* DCO=0.8 *3*, stretched D or stretched Q; if stretched D then 787.1γ should be ΔJ=3, overruled by its DCO; E2 linking g.s. and positive parity bands.
355.0 *3*	2 *1*	1068.2	(3^+)	713.3	(2^+)	(M1+E2)	0.049 *13*	α(K)=0.040 *12*; α(L)=0.0067 *6*; α(M)=0.00148 *11*; α(N+..)=0.00039 *4* α(N)=0.00034 *3*; α(O)=5.1×10^{-5} *6*; α(P)=2.8×10^{-6} *10* DCO=1.1 *3*, typical for stretched Q, considered ΔJ=1, Δπ=no by 1989Pa01 as in between signature partners of γ band.
384.8 *3*	7 *1*	713.3	(2^+)	328.6	2^+	(M1+E2)	0.039 *11*	α(K)=0.032 *10*; α(L)=0.0053 *7*; α(M)=0.00116 *12*; α(N+..)=0.00031 *4* α(N)=0.00027 *3*; α(O)=4.0×10^{-5} *6*; α(P)=2.3×10^{-6} *8* DCO=1.0 *1*, typical for stretched Q, considered ΔJ=0, Δπ=no by 1989Pa01 as linking γ and g.s. bands.
470.7 *3*	16 *1*	3267.5	12^+	2796.8	10^+	(E2)	0.01638	α(K)=0.01325 *19*; α(L)=0.00244 *4*; α(M)=0.000543 *8*; α(N+..)=0.0001427 *21* α(N)=0.0001237 *18*; α(O)=1.82×10^{-5} *3*; α(P)=8.84×10^{-7} *13* DCO=1.0 *1*, typical for stretched Q, E2 as g.s.-band transition.
507.6 *3*	68 *3*	836.2	4^+	328.6	2^+	(E2)	0.01341	α(K)=0.01092 *16*; α(L)=0.00195 *3*; α(M)=0.000431 *6*; α(N+..)=0.0001135 *16* α(N)=9.83×10^{-5} *14*; α(O)=1.454×10^{-5} *21*; α(P)=7.33×10^{-7} *11* DCO=1.0 *1*, typical for stretched Q; E2 as g.s.-band transition.
568.1 *3*	5 *1*	1281.4	(4^+)	713.3	(2^+)	(E2)	0.01004	α(K)=0.00825 *12*; α(L)=0.001403 *20*; α(M)=0.000310 *5*; α(N+..)=8.18×10^{-5} *12* α(N)=7.07×10^{-5} *10*; α(O)=1.054×10^{-5} *15*; α(P)=5.59×10^{-7} *8* DCO=1.0 *2*, typical for stretched Q; E2 as γ-band transition.
581.8 *3*	14 *1*	3849.3	14^+	3267.5	12^+	(E2)	0.00946	α(K)=0.00778 *11*; α(L)=0.001312 *19*; α(M)=0.000289 *4*; α(N+..)=7.64×10^{-5} *11* α(N)=6.60×10^{-5} *10*; α(O)=9.86×10^{-6} *14*; α(P)=5.28×10^{-7} *8* DCO=1.0 *1*, typical for stretched Q; E2 as g.s.-band transition.
591.0 *3*	6 *1*	3624.7	$11^{(-)}$	3033.7	$9^{(-)}$	(E2)	0.00910	α(K)=0.00749 *11*; α(L)=0.001255 *18*; α(M)=0.000277 *4*; α(N+..)=7.31×10^{-5} *11*

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(HI,xnγ) 1989Pa01 (continued)

γ(^{140}Gd) (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	Comments
								α(N)=6.32×10^{-5} *9*; α(O)=9.44×10^{-6} *14*; α(P)=5.09×10^{-7} *8* DCO=1.0 *1*, typical for stretched Q; E2 as negative parity band transition.
600 *1*	4 *1*	1881.4	(6$^+$)	1281.4	(4$^+$)	(E2)	0.00876	α(K)=0.00722 *11*; α(L)=0.001204 *18*; α(M)=0.000265 *4*; α(N+..)=7.01×10^{-5} *11* α(N)=6.06×10^{-5} *9*; α(O)=9.06×10^{-6} *14*; α(P)=4.91×10^{-7} *8* DCO=0.9 *3*, typical for stretched Q; E2 as γ-band transition.
625.2 *3*	<4	1693.4	(5$^+$)	1068.2	(3$^+$)	(E2)	0.00792	α(K)=0.00655 *10*; α(L)=0.001075 *16*; α(M)=0.000237 *4*; α(N+..)=6.26×10^{-5} *9* α(N)=5.41×10^{-5} *8*; α(O)=8.11×10^{-6} *12*; α(P)=4.47×10^{-7} *7* DCO=0.9 *3*, typical for stretched Q; E2 as γ-band transition.
627.8 *3*	55 *2*	1464.0	6$^+$	836.2	4$^+$	(E2)	0.00784	α(K)=0.00648 *10*; α(L)=0.001063 *15*; α(M)=0.000234 *4*; α(N+..)=6.19×10^{-5} *9* α(N)=5.34×10^{-5} *8*; α(O)=8.02×10^{-6} *12*; α(P)=4.42×10^{-7} *7* DCO=1.0 *1*, typical for stretched Q; E2 as g.s.-band transition.
657.1 *3*	25 *2*	2796.8	10$^+$	2139.7	8$^+$	(E2)	0.00703	α(K)=0.00583 *9*; α(L)=0.000940 *14*; α(M)=0.000207 *3*; α(N+..)=5.47×10^{-5} *8* α(N)=4.72×10^{-5} *7*; α(O)=7.10×10^{-6} *10*; α(P)=3.98×10^{-7} *6* DCO=1.1 *1*, typical for stretched Q; E2 as g.s.-band transition.
675.7 *3*	44 *2*	2139.7	8$^+$	1464.0	6$^+$	(E2)	0.00658	α(K)=0.00546 *8*; α(L)=0.000873 *13*; α(M)=0.000192 *3*; α(N+..)=5.08×10^{-5} *8* α(N)=4.38×10^{-5} *7*; α(O)=6.60×10^{-6} *10*; α(P)=3.74×10^{-7} *6* DCO=1.1 *1*, typical for stretched Q; E2 as g.s.-band transition.
690[@] *1*	<5	3617?	(12$^+$)	2926.8	10$^+$			
695.2 *3*	<5	4319.9	(13$^-$)	3624.7	11$^{(-)}$			
713 *1*	<5	713.3	(2$^+$)	0.0	0$^+$			
718 *1*	<4	2411.4	(7$^+$)	1693.4	(5$^+$)	(E2)	0.00570	α(K)=0.00475 *7*; α(L)=0.000746 *11*; α(M)=0.0001635 *24*; α(N+..)=4.34×10^{-5} *7* α(N)=3.74×10^{-5} *6*; α(O)=5.65×10^{-6} *9*; α(P)=3.26×10^{-7} *5* DCO=1.0 *2*, typical for stretched Q; E2 as γ-band transition.
739.6 *3*	5 *1*	1068.2	(3$^+$)	328.6	2$^+$	(M1+E2)	0.0074 *21*	α(K)=0.0063 *19*; α(L)=0.00090 *21*; α(M)=0.00020 *5*; α(N+..)=5.2×10^{-5} *12* α(N)=4.5×10^{-5} *11*; α(O)=6.9×10^{-6} *17*; α(P)=4.5×10^{-7} *15* DCO=1.4 *3*, typical for non-stretched Q or D+Q, ΔJ=1, Δπ=no by 1989Pa01 as linking γ to g.s. bands.
743.5 *3*	9 *1*	4592.8	16$^+$	3849.3	14$^+$	(E2)	0.00526	α(K)=0.00439 *7*; α(L)=0.000682 *10*; α(M)=0.0001494 *21*; α(N+..)=3.97×10^{-5} *6* α(N)=3.42×10^{-5} *5*; α(O)=5.17×10^{-6} *8*;

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(HI,xnγ) 1989Pa01 (continued)

γ(^{140}Gd) (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	Comments
								α(P)=3.02×10^{-7} *5* DCO=0.9 *2*, typical for stretched Q; E2 as g.s.-band transition.
750[@] *1*	<4	2632?	(8$^+$)	1881.4	(6$^+$)			
758.0 *3*	5 *1*	4025.5	(12,13)	3267.5	12$^+$	D		DCO=0.8 *1*, D or mixed D+Q.
787.1 *3*	5 *1*	2926.8	10$^+$	2139.7	8$^+$	(E2)	0.00462	α(K)=0.00387 *6*; α(L)=0.000592 *9*; α(M)=0.0001294 *19*; α(N+..)=3.44×10^{-5} *5* α(N)=2.96×10^{-5} *5*; α(O)=4.49×10^{-6} *7*; α(P)=2.67×10^{-7} *4* DCO=1.0 *2*, typical for stretched Q, E2 linking positive parity and g.s. bands.
828 *1*	<5	3624.7	11$^{(-)}$	2796.8	10$^+$			
868.1 *3*	6 *1*	5460.9	(18$^+$)	4592.8	16$^+$			
894.0 *3*	5 *1*	3033.7	9$^{(-)}$	2139.7	8$^+$	D		DCO=0.5 *1*, typical for stretched D, considered ΔJ=1, Δπ=(yes) by 1989Pa01 as linking negative parity and g.s. bands.
962 *1*	<5	6422.9	(20$^+$)	5460.9	(18$^+$)			

[†] Based on measured DCO values (intensity asymmetries) from gates on Q transitions of g.s. band by 1989Pa01. Values ≥1.0 are quoted as typical for stretched-Q transitions and ≤0.7 for stretched-D transitions. No mult are explicitly assigned, but from J^π assignments only the E1, E2, and M1+E2 possibilities are considered by 1989Pa01. No criteria are given for non-stretched and/or mixed transitions, although definite assignments are done by 1989Pa01 for such transitions based on the typical values for stretched transitions.

[‡] From 1989Pa01 at E(^{50}Cr)=210 MeV.

[#] 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.

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

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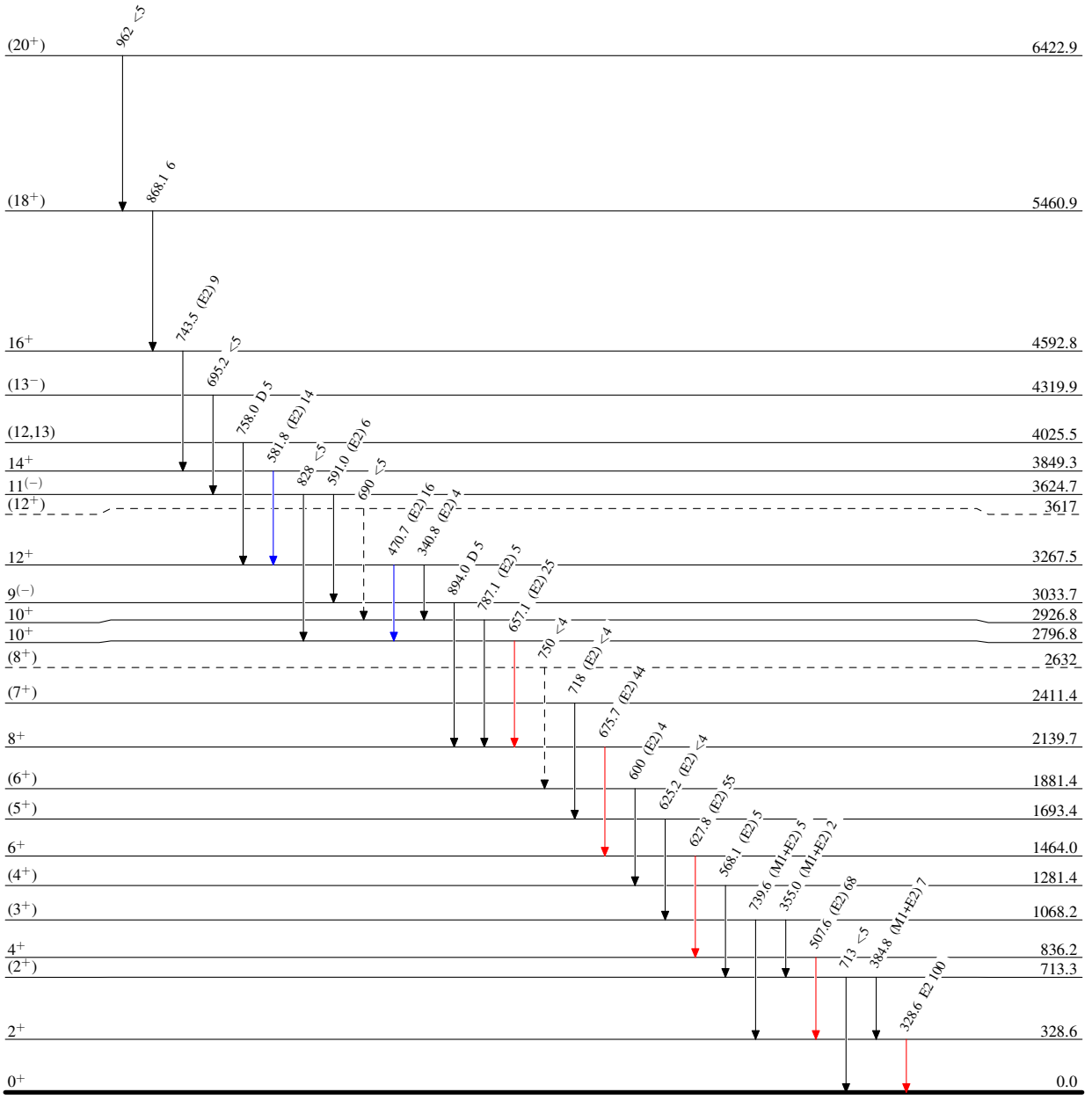
Level Scheme

Intensities: Relative I_γ

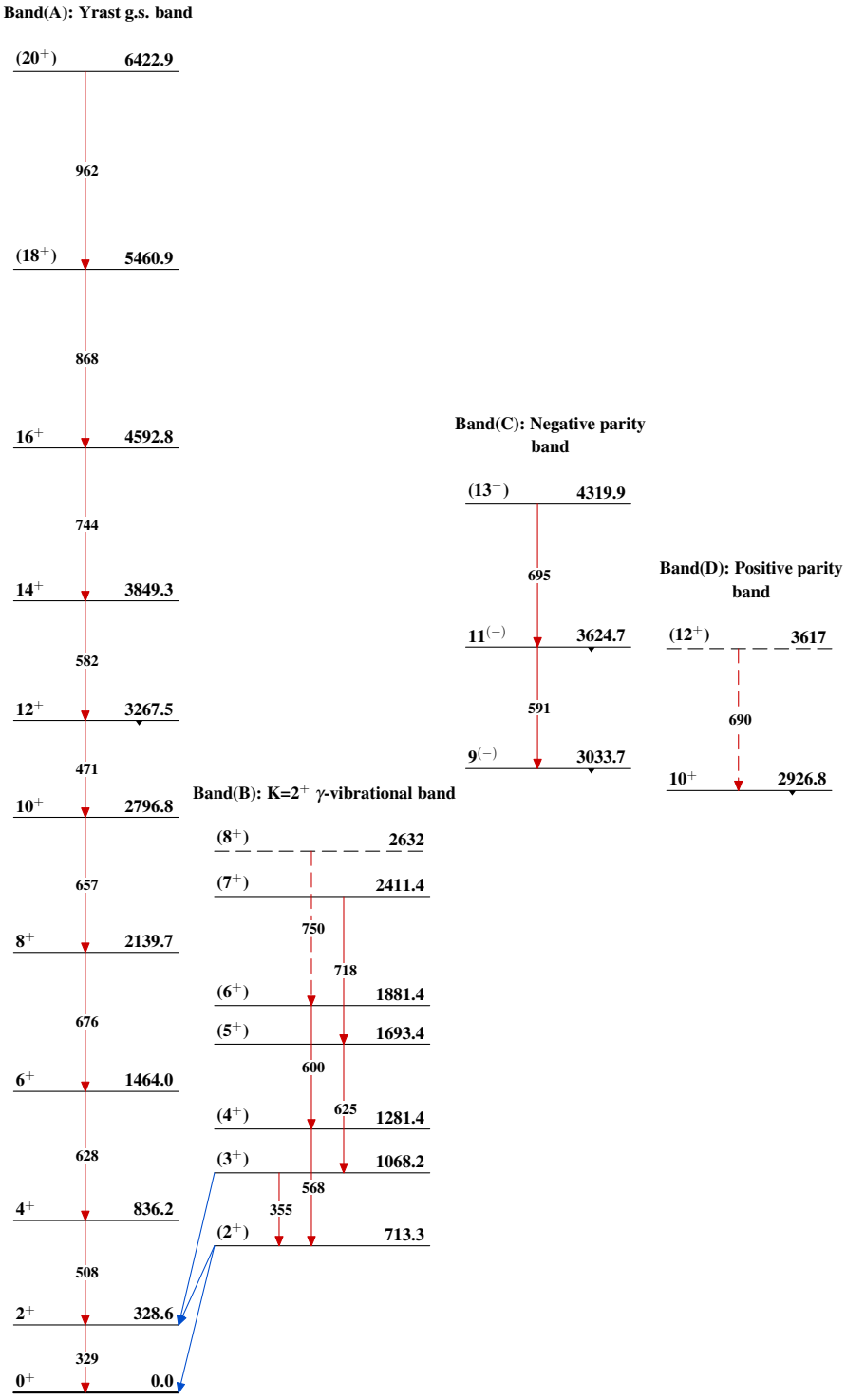
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



$^{140}_{64}Gd_{76}$

(HI,xnγ) 1989Pa01



$^{140}_{64}Gd_{76}$