^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	P. K. Joshi, B. Singh, S. Singh, A. K. Jain	NDS 138, 1 (2016)	15-Oct-2016

E=210-230 MeV.

1989Ma03: E=200-230 MeV. Measured Eγ, Iγ, $\gamma\gamma$, excitation functions, $\gamma\gamma(\theta)$ using five BGO-shielded Ge detectors and a multiplicity filter of 14 BGO detectors. Main experiment at 210 MeV beam energy. Deduced average directional correlation (DCO) ratios. A negative-parity band established from $9/2^-$ to $35/2^-$ and ascribed to $\nu h_{11/2}$ 9/2[514] configuration, crossed at higher spins by a pair of $h_{11/2}$ protons.

1990Ma53 (same group as 1989Ma03): E=220 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO) using TESSA3 array of 16 Ge detectors and 50 BGO inner ball detectors. An $i_{13/2}$ intruder highly-deformed band and several other sequences were found in this study, but no data details were provided.

1991Pa04 (same group as 1990Ma53 and same experimental arrangement used): measured $\gamma(\theta)$ and deduced mixing ratios for nine transitions in the 9/2[514] band.

1992Pa04 (same group as 1990Ma53 and same experimental arrangement used): measured Doppler-shift attenuations for γ rays in the highly-deformed (decoupled) band; deduced intrinsic quadrupole moment for the band and quadrupole deformation from lifetime measurements for seven transitions in the band.

1997Ro13 (also 1995Ro15): E=220 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO) using GASP array of 40 Ge detectors and 80 BGO inner-ball detectors. Details of data on highly-deformed band and negative parity based on the ground state.

Main level scheme is from 1990Ma53, except that the 1/2[660] band linkage to lower section of the level scheme is from 1997Ro13.

^{139}Gd Levels

E(level)[†]	J$^\pi$[#]	Comments
0.0[&]	$9/2^-$	
211.95[a] 24	$11/2^-$	
427.0[b] 7	$(7/2^-)$	
530.06[&] 24	$13/2^-$	
753.0[b] 8	$11/2^{(-)}$	
755.2[a] 3	$15/2^-$	
1171.2[&] 3	$17/2^-$	
1255.0[b] 12	$15/2^{(-)}$	
1415.7[a] 4	$19/2^-$	
1626.0[c] 12	$13/2^+$	
1871.0[c] 13	$17/2^+$	
1882.0[b] 14	$19/2^{(-)}$	
1910.9[&] 4	$21/2^-$	
2174.7[a] 4	$23/2^-$	
2174.7+y[‡][f]		Additional information 1.
2238.0[@c] 15	$21/2^+$	
2318.7+y[f] 10		
2490.3[d] 8		
2576.7[&] 4	$25/2^-$	
2590.0[b] 18	$23/2^{(-)}$	
2607.7+y[f] 15		
2691.3[d] 13		
2697.0[@c] 18	$25/2^+$	
2766.8[a] 5	$27/2^-$	
2919.3[d] 17		
2944.7+y[f] 18		

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^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13 (continued)

^{139}Gd Levels (continued)

E(level)†	Jπ#	E(level)†	Jπ#	E(level)†	Jπ#	E(level)†	Jπ#
3031.4& 5	29/2−	3558.3d 22		4108.7+yf 25		5401@c 3	(41/2+)
3093.7e 11		3627.7& 6	33/2−	4370.6& 9	37/2−	5700.3?a 14	(43/2−)
3235.3d 19		3683.8e 17		4374.2e 18		6280@c 3	(45/2+)
3245.0c 20	29/2+	3705.7+yf 23		4417.0b 25	(35/2−)	7231@c 3	(49/2+)
3257.0b 20	27/2(−)	3777.0b 23	31/2(−)	4600.0@c 25	(37/2+)	8251@c 4	(53/2+)
3288.2a 5	31/2−	3880.0c 23	33/2+	4768.3a 11	39/2−	9340c 4	(57/2+)
3312.7+yf 20		3960.0a 8	35/2−	4788.2e 21		10498?c 4	(61/2+)
3390.7e 15		4011.6e 17		5247.3& 14	41/2−		

† From least-squares fit to Eγ data, ΔE(γ)=1 keV assumed when not given.

‡ This level decays to 2174.7 level, but connecting Eγ is not known.

As proposed in 1989Ma03, 1990Ma53 and 1997Ro13 based on DCO ratios, band structures, systematics of N=75 isotones and decay patterns. The assignments are the same in Adopted Levels, except that all are given in parentheses there due to lack of strong supporting arguments.

@ Lifetime measured in 1992Pa04 (see F(τ) curve in figure 2 of 1992Pa04).

& Band(A): ν9/2[514] α=−1/2. At low spins, this band is from νh$_{11/2}$ 9/2[514] orbital. At ħω≈0.3 MeV and J^{π}=23/2−, this band is crossed by a pair of h$_{11/2}$ protons, thus evolves into a 3-qp configuration=ν9/2[514]⊗ πh$^2_{11/2}$. This band was first proposed in 1989Ma03, later confirmed in 1990Ma53, 1991Pa04 and 1997Ro13.

a Band(a): ν9/2[514],α=+1/2. See comment for the α=−1/2 partner.

b Band(B): ν1/2[530] band. Band from νh$_{9/2}$ orbital (1997Ro13).

c Band(C): ν1/2[660], Highly deformed band. Q(intrinsic)≈7.0 (1992Pa04) from lifetime measurements of seven transitions in the band. Band from νi$_{13/2}$ orbital (1997Ro13,1990Ma53).

d Band(D): ΔJ=(1) band. Band from 1990Ma53 only.

e Band(E): ΔJ=1 band. Band from 1990Ma53 only.

f Band(F): ΔJ=(1) band. Band from 1990Ma53 only.

γ(^{139}Gd)

DCO values correspond to gates on ΔJ=2, quadrupole transitions. Expected values are: ≈1 for ΔJ=2, Q and ≈0.5 for ΔJ=1, dipole transitions (1997Ro13); ≥1.0 for ΔJ=2, Q and ≤0.7 for ΔJ=1, transitions (1989Ma03).

Eγ†	Iγ‡	Ei(level)	J^{π}_i	E_f	J^{π}_f	Mult.#	δ@	Comments
y		2174.7+y		2174.7	23/2−			
144		2318.7+y		2174.7+y				
190.0 3	79 8	2766.8	27/2−	2576.7	25/2−	M1+E2	−0.17 6	DCO=0.7 1 (1989Ma03) Additional information 27.
201		2691.3		2490.3				
212.0 3	190 19	211.95	11/2−	0.0	9/2−	D		DCO=0.3 1 (1989Ma03) Additional information 2.
215&	3.0a 4	427.0	(7/2−)	211.95	11/2−			Additional information 3.
225.3 3	86 9	755.2	15/2−	530.06	13/2−	M1+E2	−0.27 4	DCO=0.4 1 (1989Ma03) Additional information 9.
228		2919.3		2691.3				
244.3 3	33 4	1415.7	19/2−	1171.2	17/2−	M1+E2	−0.26 7	DCO=0.5 1 (1989Ma03) Additional information 14.
245&	5b 1	1871.0	17/2+	1626.0	13/2+	Q		DCO=0.97 5 (1997Ro13)

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^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13 (continued)

$\gamma(^{139}Gd)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[@]	Comments
256.9 *3*	48 *5*	3288.2	31/2$^-$	3031.4	29/2$^-$	M1+E2	−0.27 *4*	DCO=0.7 *1* (1989Ma03) Additional information 33.
264.0 *3*	19 *2*	2174.7	23/2$^-$	1910.9	21/2$^-$	D		DCO=0.7 *1* (1989Ma03) Additional information 20.
264.8 *3*	58 *6*	3031.4	29/2$^-$	2766.8	27/2$^-$			Additional information 29.
289		2607.7+y		2318.7+y				
293		3683.8		3390.7				
297		3390.7		3093.7				
316		3235.3		2919.3				
318.2 *3*	81 *8*	530.06	13/2$^-$	211.95	11/2$^-$	D		DCO=0.3 *1* (1989Ma03) Additional information 5.
323		3558.3		3235.3				
326	57[a] *6*	753.0	11/2$^{(-)}$	427.0	(7/2$^-$)	(Q)		DCO=1.21 *25* (1997Ro13) Additional information 7. Mult.: D+Q also possible from DCO ratio.
328		4011.6		3683.8				
332 *1*	<10	3960.0	35/2$^-$	3627.7	33/2$^-$	M1+E2	−0.34 *8*	Additional information 39.
337		2944.7+y		2607.7+y				
339.3 *3*	25 *3*	3627.7	33/2$^-$	3288.2	31/2$^-$	M1+E2	−0.20 *7*	DCO=0.5 *1* (1989Ma03) Additional information 35.
356[&]	10[b] *2*	2238.0	21/2$^+$	1882.0	19/2$^{(-)}$			
363		4374.2		4011.6				
367[c]	82[b] *3*	2238.0	21/2$^+$	1871.0	17/2$^+$	E2		DCO=1.05 *6* (1997Ro13) Additional information 22.
368		3312.7+y		2944.7+y				
393		3705.7+y		3312.7+y				
398		4768.3	39/2$^-$	4370.6	37/2$^-$			
402.1 *3*	41 *4*	2576.7	25/2$^-$	2174.7	23/2$^-$	M1+E2	−0.17 *4*	DCO=0.3 *1* (1989Ma03) Additional information 23.
403		4108.7+y		3705.7+y				
411		4370.6	37/2$^-$	3960.0	35/2$^-$			
414		4788.2		4374.2				
416.2 *3*	46 *5*	1171.2	17/2$^-$	755.2	15/2$^-$	M1+E2	−0.48 *4*	DCO=0.4 *1* (1989Ma03) Additional information 11.
427[&]	27[a] *5*	427.0	(7/2$^-$)	0.0	9/2$^-$	D		DCO=0.51 *7* (1997Ro13) Additional information 4.
453[e]		5700.3?	(43/2$^-$)	5247.3	41/2$^-$			
455 *1*	<10	3031.4	29/2$^-$	2576.7	25/2$^-$	Q		DCO=1.5 *3* (1989Ma03) Additional information 30.
459[c]	100[b]	2697.0	25/2$^+$	2238.0	21/2$^+$	E2		DCO=1.03 *6* (1997Ro13) Additional information 26.
479		5247.3	41/2$^-$	4768.3	39/2$^-$			
495.1 *3*	25 *3*	1910.9	21/2$^-$	1415.7	19/2$^-$	M1+E2	−0.34 *6*	DCO=0.4 *1* (1989Ma03) Additional information 18.
502	57[a] *12*	1255.0	15/2$^{(-)}$	753.0	11/2$^{(-)}$	Q		DCO=0.92 *10* (1997Ro13) Additional information 13.

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^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13 (continued)

γ(^{139}Gd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
520[&]	6.8[a] *23*	3777.0	31/2$^{(-)}$	3257.0	27/2$^{(-)}$	Q	DCO=1.03 *10* (1997Ro13) Additional information 37.
521.2 *3*	18 *2*	3288.2	31/2$^-$	2766.8	27/2$^-$	Q	DCO=1.5 *3* (1989Ma03) Additional information 34.
530.0 *3*	37 *4*	530.06	13/2$^-$	0.0	9/2$^-$	Q	DCO=1.1 *2* (1989Ma03) Additional information 6.
543.2 *3*	100	755.2	15/2$^-$	211.95	11/2$^-$	Q	DCO=1.1 *2* (1989Ma03) Additional information 10.
548	90[b] *2*	3245.0	29/2$^+$	2697.0	25/2$^+$	Q	DCO=1.05 *10* (1997Ro13) Additional information 31.
579		2490.3		1910.9	21/2$^-$		
590[e]		3683.8		3093.7			
592.2 *3*	27 *3*	2766.8	27/2$^-$	2174.7	23/2$^-$	Q	DCO=1.3 *3* (1989Ma03) Additional information 28.
596.4 *3*	<10	3627.7	33/2$^-$	3031.4	29/2$^-$		Additional information 36.
616	82[b] *3*	1871.0	17/2$^+$	1255.0	15/2$^{(-)}$	D	DCO=0.50 *5* (1997Ro13) Additional information 16.
621		4011.6		3390.7			
627[&]	27[a] *3*	1882.0	19/2$^{(-)}$	1255.0	15/2$^{(-)}$	Q	DCO=1.08 *10* (1997Ro13) Additional information 17.
635	55[b] *5*	3880.0	33/2$^+$	3245.0	29/2$^+$	Q	DCO=0.90 *10* (1997Ro13) Additional information 38.
640[&]	4.5[a] *23*	4417.0	(35/2$^-$)	3777.0	31/2$^{(-)}$		Additional information 40.
641.0 *3*	38 *4*	1171.2	17/2$^-$	530.06	13/2$^-$	Q	DCO=1.0 *2* (1989Ma03) Additional information 12.
660.4 *3*	87 *9*	1415.7	19/2$^-$	755.2	15/2$^-$	Q	DCO=1.0 *1* (1989Ma03) Additional information 15.
665.6 *3*	21 *2*	2576.7	25/2$^-$	1910.9	21/2$^-$	(Q)	DCO>1.0 (1989Ma03) Additional information 24.
667[&]	9[a] *3*	3257.0	27/2$^{(-)}$	2590.0	23/2$^{(-)}$	Q	DCO=1.02 *20* (1997Ro13) Additional information 32.
672		3960.0	35/2$^-$	3288.2	31/2$^-$		
690		4374.2		3683.8			
708[&]	23[a] *3*	2590.0	23/2$^{(-)}$	1882.0	19/2$^{(-)}$	Q	DCO=1.08 *10* (1997Ro13) Additional information 25.
720[c]		4600.0	(37/2$^+$)	3880.0	33/2$^+$		
740.0[d] *3*	35 *4*	1910.9	21/2$^-$	1171.2	17/2$^-$	Q	DCO=1.0 *2* (1989Ma03) Additional information 19.
743		4370.6	37/2$^-$	3627.7	33/2$^-$		
753[&]	11[a] *5*	753.0	11/2$^{(-)}$	0.0	9/2$^-$	D	DCO=0.57 *10* (1997Ro13) Additional information 8.
758.9[d] *3*	71 *7*	2174.7	23/2$^-$	1415.7	19/2$^-$	Q	DCO=1.0 *2* (1989Ma03) Additional information 21.
801[c]		5401	(41/2$^+$)	4600.0	(37/2$^+$)		
808		4768.3	39/2$^-$	3960.0	35/2$^-$		
873[&]	5[b] *2*	1626.0	13/2$^+$	753.0	11/2$^{(-)}$		
877[e]		5247.3	41/2$^-$	4370.6	37/2$^-$		
879[c]		6280	(45/2$^+$)	5401	(41/2$^+$)		
919[e]		3093.7		2174.7	23/2$^-$		
932[e]		5700.3?	(43/2$^-$)	4768.3	39/2$^-$		
951[c]		7231	(49/2$^+$)	6280	(45/2$^+$)		
1020[c]		8251	(53/2$^+$)	7231	(49/2$^+$)		

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^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13 (continued)

$\gamma(^{139}Gd)$ (continued)

E_γ [†]	E_i(level)	J_i^π	E_f	J_f^π
1075	2490.3		1415.7	$19/2^-$
1089	9340	$(57/2^+)$	8251	$(53/2^+)$
1158[e]	10498?	$(61/2^+)$	9340	$(57/2^+)$

† Values given with uncertainties are from 1989Ma03. Values with no uncertainties are from 1990Ma53, unless otherwise noted.

‡ From 1989Ma03, normalized to Iγ(543γ)=100 with typical uncertainty quoted as <10%, except as noted. The evaluators assign 10% uncertainty. Values listed are relative intensities, but for 1/2[660] band, values are relative within the band.

Mult=Q indicates stretched quadrupole (most likely E2), mult=D indicates stretched dipole (most likely M1 or M1+E2, except E1 for 616γ from $17/2^+$ level) from DCO ratios. Mult=M1+E2 is from measured DCO ratio, significantly large δ value and implied RUL. Mult=E2 is from DCO ratio and RUL; level lifetimes are not listed but are implied as short (in ps region) from transition quadrupole moment deduced from these measurements in 1992Pa04.

@ Read by the evaluators from figure 1 of 1991Pa04.

& From 1997Ro13.

a From 1997Ro13. Values in 1997Ro13 are normalized to 100 for Iγ(212γ+530γ); these have been renormalized by the evaluators to Iγ(212γ+530γ)=227 *19* to match the intensity scale in 1989Ma03, from which other Iγ values are taken.

b From 1997Ro13, relative intensity within the band, normalized to 100 for the 459 transition.

c Doppler-shift attenuation measurement for this γ transition in the highly-deformed band (1992Pa04).

d Doublet with a transition in ^{140}Gd.

e Placement of transition in the level scheme is uncertain.

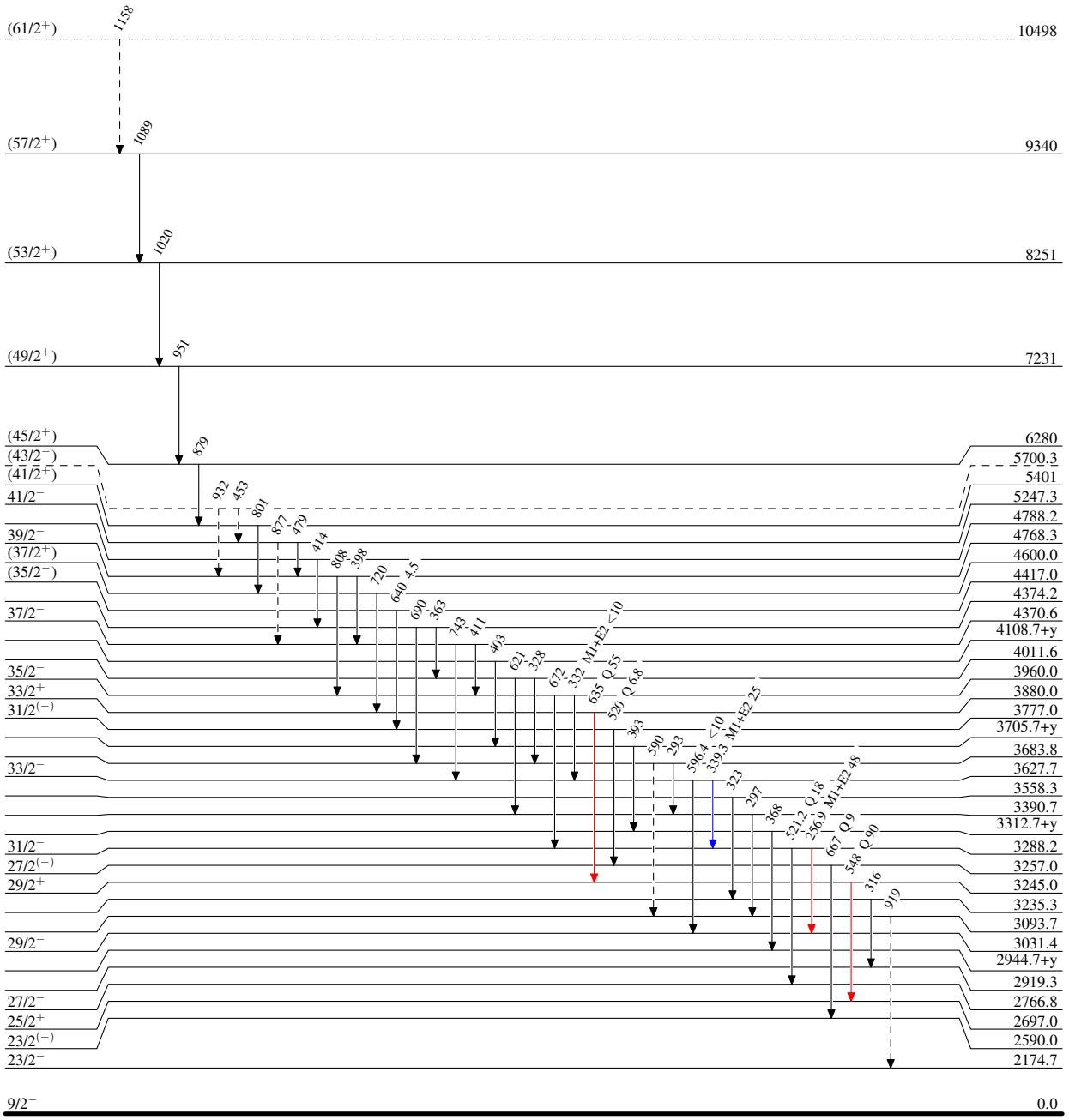
^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13

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)

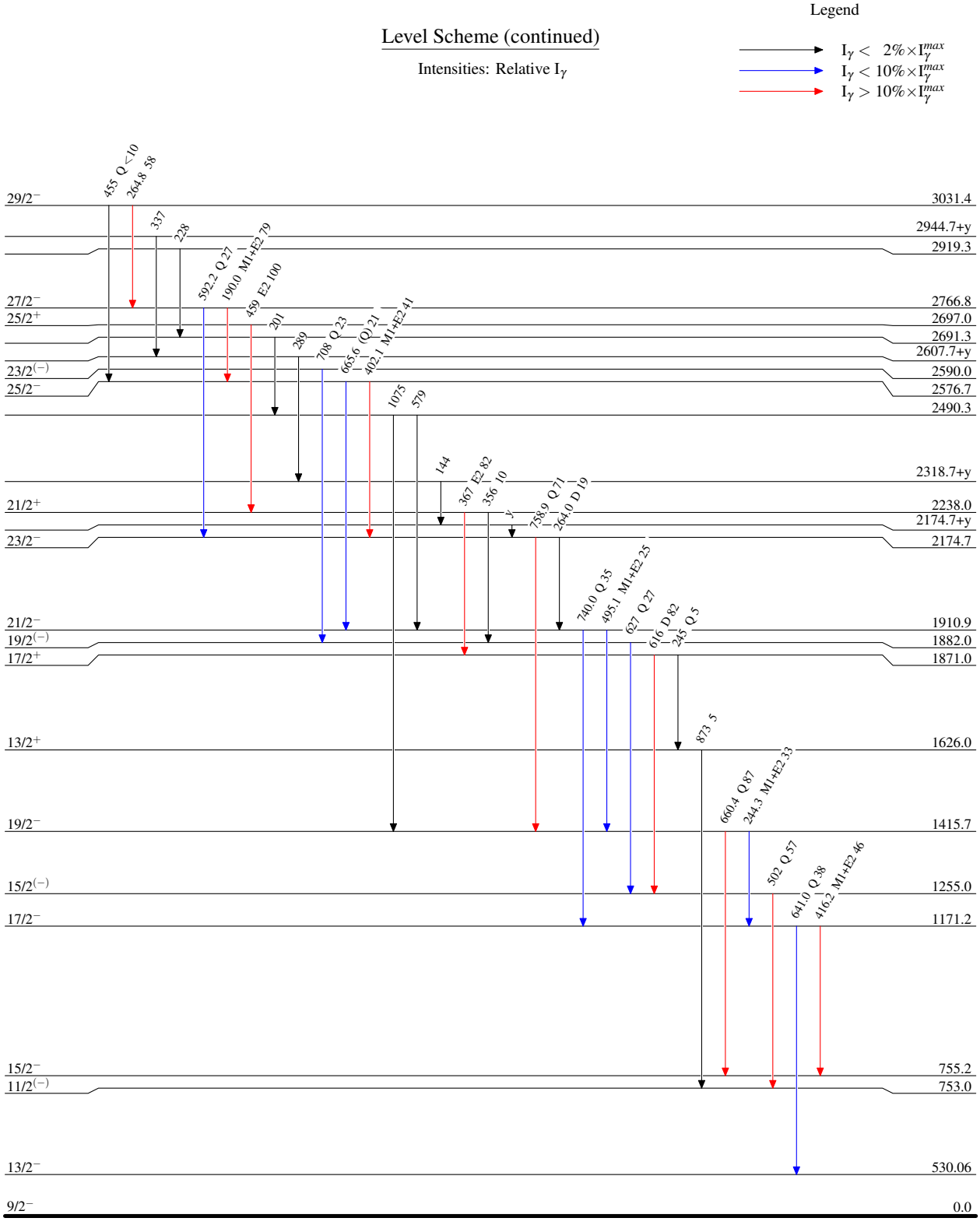


$^{139}_{64}Gd_{75}$

^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13

Level Scheme (continued)

Intensities: Relative I_γ

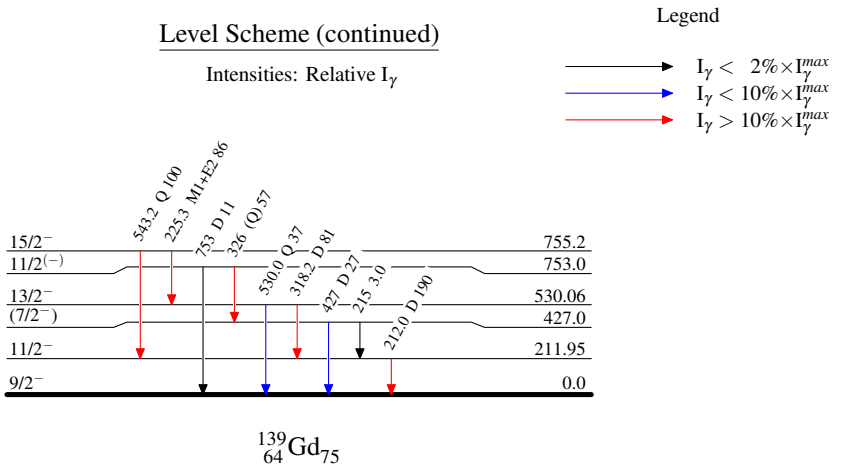


$^{139}_{64}Gd_{75}$

^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13

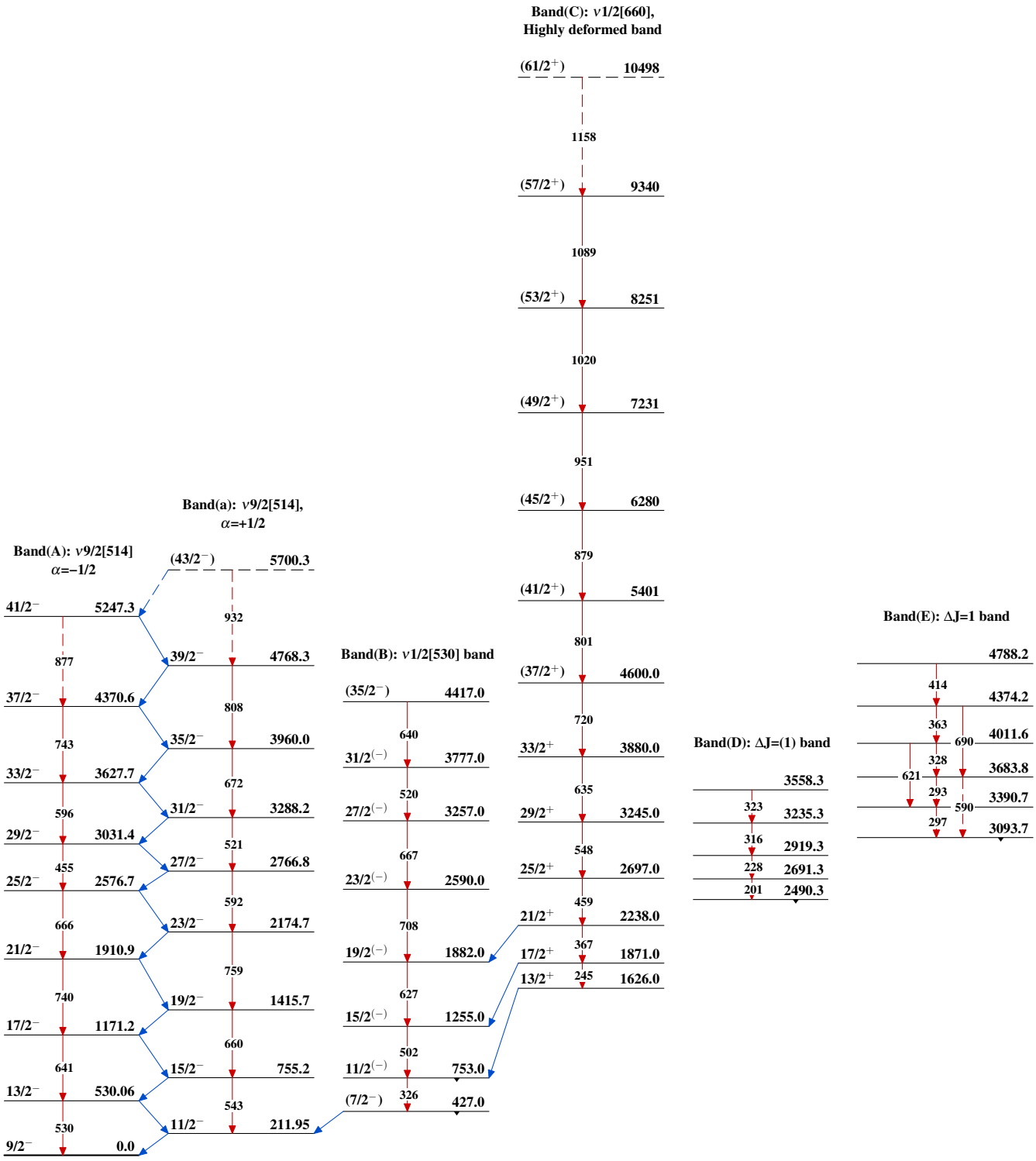
Level Scheme (continued)

Intensities: Relative I_γ

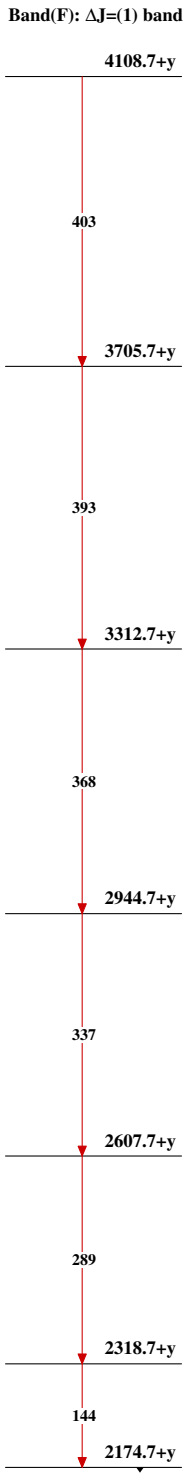


$^{139}_{64}Gd_{75}$

^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13



^{92}Mo(^{50}Cr,n2pγ) 1989Ma03,1990Ma53,1997Ro13 (continued)



$^{139}_{64}Gd_{75}$