^{106}Cd(^{58}Ni,3pγ) 2011La01

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 112,2497 (2011)	1-Jun-2011

Additional information 1.

From considerations of the systematics of the yrast bands in the heavier odd-A Ta isotopes, 2011La01 propose that there is a $9/2^-$ level near to, but below, the $(11/2^-)$ level. This level has not yet been directly observed. For a discussion of the implications of the existence of this level for the data reported for the $(11/2^-)$ level, see the Adopted Levels.

E(^{58}Ni)=270 MeV. Self-supporting ^{106}Cd foil, (96.5% enrichment), thickness 0.9 mg/cm^2. Prompt γ's were recorded in the JUROGAM array consisting of 43 EUROGAM escape-suppressed Ge detectors. The recoil fusion-evaporation products were separated from the primary beam by the RITU gas-filled recoil separator and implanted in the double-sided Si-strip detectors of the GREAT spectrometer. Recoil-decay tagging was used, but was not especially successful, owing to the relatively long half-life and weak α-decay branch of the ^{161}Ta activity. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma\gamma(\theta)$(DCO). Deduced levels, spins, multipolarities, band structures, configurations, alignments, B(M1)/B(E2) ratios. Comparison with cranked shell-model calculations. Total Routhians calculated as a function of the γ-deformation parameter.

^{161}Ta Levels

The quasiparticle orbitals are labeled as follows.

A: $\nu i_{13/2}$, $(\alpha=+1/2)_1$.

B: $\nu i_{13/2}$, $(\alpha=-1/2)_1$.

C: $\nu i_{13/2}$, $(\alpha=+1/2)_2$.

E: $\nu(h_{9/2},f_{7/2})$, $\alpha=-1/2$.

F: $\nu(h_{9/2},f_{7/2})$, $\alpha=+1/2$.

e: $\pi h_{11/2}$, $\alpha=-1/2$.

f: $\pi h_{11/2}$, α-+1/2.

E(level)[†]	J$^\pi$	E(level)[†]	J$^\pi$	E(level)[†]	J$^\pi$	E(level)[†]	J$^\pi$
0+x[‡]	$(11/2^-)$	2494.5+x 11	$(25/2^+)$	3467.2+x[d] 24		4673.6+x[&] 19	$(39/2^-)$
396.0+x[#] 5	$(13/2^-)$	2528.3+x[a] 9	$(25/2^+)$	3573.7+x[c] 12	$(35/2^+)$	4770+x?[d] 4	
482.8+x[‡] 5	$(15/2^-)$	2537.6+x[b] 9	$(25/2^+)$	3689.2+x[@] 22	$(33/2^-)$	4864.4+x[c] 15	$(43/2^+)$
956.2+x[#] 5	$(17/2^-)$	2652.1+x[c] 11	$(27/2^+)$	3762.2+x[‡] 13	$(35/2^-)$	4980.7+x[@] 20	$(41/2^-)$
1083.2+x[‡] 6	$(19/2^-)$	2741.8+x[a] 8	$(27/2^+)$	3872+x?[d] 3		5061+x?[e] 4	
1583.4+x[#] 6	$(21/2^-)$	2760.3+x[#] 10	$(29/2^-)$	3941.7+x[b] 12	$(37/2^+)$	5070.9+x[#] 25	$(41/2^-)$
1677.4+x 11		2817.4+x[b] 10	$(29/2^+)$	4023.5+x[&] 16	$(35/2^-)$	5088.5+x 25	
1763.6+x[‡] 7	$(23/2^-)$	2891.9+x[d] 14	$(29/2^+)$	4058.8+x 16	$(35/2^-)$	5289.6+x[‡] 25	$(43/2^-)$
1794.5+x[a] 9	$(19/2^+)$	3016.7+x[c] 11	$(31/2^+)$	4098+x?[d] 3		5328.4+x[&] 21	$(43/2^-)$
1994.8+x 11	$(21/2^+)$	3089.8+x[‡] 11	$(31/2^-)$	4202.7+x[c] 13	$(39/2^+)$	5653.9+x[@] 25	$(45/2^-)$
2073.2+x[a] 7	$(21/2^+)$	3169+x[@] 4	$(29/2^-)$	4218.1+x[#] 14	$(37/2^-)$	6024+x[&] 3	$(47/2^-)$
2176.4+x[#] 7	$(25/2^-)$	3261.2+x 13	$(31/2^-)$	4313.9+x[@] 19	$(37/2^-)$	6093+x[‡] 4	$(47/2^-)$
2243.6+x[a] 7	$(23/2^+)$	3343.8+x[b] 11	$(33/2^+)$	4445+x?[e] 3		6382+x[@] 3	$(49/2^-)$
2321.2+x 21		3443.5+x[#] 12	$(33/2^-)$	4496.6+x[‡] 15	$(39/2^-)$	6764+x[&] 3	$(51/2^-)$
2467.7+x[‡] 8	$(27/2^-)$	3447+x[&] 3	$(31/2^-)$	4544.3+x[b] 14	$(41/2^+)$		

[†] From a least-squares fit to the listed Eγ values by the evaluator.

[‡] Band(A): $\pi h_{11/2}$ band, $\alpha=-1/2$ branch. Band shows a backbend near $\hbar\omega\approx0.3$ MeV, J^π=29/2, attributed to the alignment of a pair of $i_{13/2}$ neutrons. Conf is eEF or eAB.

[#] Band(a): $\pi h_{11/2}$ band, $\alpha=+1/2$ branch. See the comment on the $\alpha=-1/2$ branch. Conf is fEF or fAB.

[@] Band(B): Band based on $(29/2^-)$, $\alpha=+1/2$. Possible conf is eAB $\rightarrow$ eABEF.

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^{106}Cd(^{58}Ni,3pγ) 2011La01 (continued)

^{161}Ta Levels (continued)

& Band(b): Band based on (29/2$^-$), α=−1/2. Possible conf is fAB → fABEF.
[a] Band(C): Band based on (19/2$^+$). Possible $\pi h_{11/2}$ coupled to a 3$^-$ octupole excitation.
[b] Band(D): Band based on (25/2$^+$), α=+1/2 branch. Possible conf is eAF.
[c] Band(d): Band based on (25/2$^+$), α=−1/2 branch. Possible conf is fAF.
[d] Band(E): Tentative band based on (29/2$^+$), α=+1/2 branch. Possible conf is eAE.
[e] Band(e): Tentative band based on (29/2$^+$), α=−1/2 branch. Possible conf is fAE.

γ(^{161}Ta)

The DCO ratio was defined as [Iγ(backward) gated perpendicular]/[Iγ(perpendicular) gated backward]. The backward angle was 158°; and the perpendicular angles were 86° or 94°.

E_γ[†]	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	Comments
(44)		2537.6+x	(25/2$^+$)	2494.5+x	(25/2$^+$)		E_γ: value from the level scheme of 2011La01, but not listed in their table of measured γ properties (their Table 1).
75.8 *20*	1.0 *1*	2817.4+x	(29/2$^+$)	2741.8+x	(27/2$^+$)		
86.9 *20*	1.0 *1*	482.8+x	(15/2$^-$)	396.0+x	(13/2$^-$)	M1+E2	DCO=0.5 *4*.
114.9 *10*	2.6 *1*	2652.1+x	(27/2$^+$)	2537.6+x	(25/2$^+$)	M1+E2	DCO=0.9 *1*.
125.6 *20*	0.2 *1*	3016.7+x	(31/2$^+$)	2891.9+x	(29/2$^+$)		
127.5 *20*	1.7 *10*	1083.2+x	(19/2$^-$)	956.2+x	(17/2$^-$)	M1+E2	DCO=0.6 *2*.
165.6 *10*	2.4 *1*	2817.4+x	(29/2$^+$)	2652.1+x	(27/2$^+$)	E2	DCO=0.9 *1*.
170.7 *20*	0.9 *1*	2243.6+x	(23/2$^+$)	2073.2+x	(21/2$^+$)	M1+E2	DCO=0.5 *3*.
180.0 *10*	3.7 *17*	1763.6+x	(23/2$^-$)	1583.4+x	(21/2$^-$)	M1+E2	DCO=0.8 *2*.
199.3 *5*	12.3 *5*	3016.7+x	(31/2$^+$)	2817.4+x	(29/2$^+$)	M1+E2	DCO=0.9 *1*.
213.4 *10*	4.2 *2*	2741.8+x	(27/2$^+$)	2528.3+x	(25/2$^+$)	M1+E2	DCO=0.6 *1*.
227.1 *20*	0.6 *1*	4098+x?		3872+x?			
229.9 *10*	8.6 *4*	3573.7+x	(35/2$^+$)	3343.8+x	(33/2$^+$)	M1+E2	DCO=0.9 *1*.
240.0 *10*	4.4 *3*	2891.9+x	(29/2$^+$)	2652.1+x	(27/2$^+$)		
241.8 *20*	0.9 *1*	3689.2+x	(33/2$^-$)	3447+x	(31/2$^-$)		
251.7 *10*	2.3 *2*	2494.5+x	(25/2$^+$)	2243.6+x	(23/2$^+$)	M1+E2	DCO=1.0 *1*.
256.7 *20*	0.6 *1*	4313.9+x	(37/2$^-$)	4058.8+x	(35/2$^-$)		
261.4 *10*	6.5 *3*	4202.7+x	(39/2$^+$)	3941.7+x	(37/2$^+$)	M1+E2	DCO=0.7 *1*.
278.6 *10*	2.0 *1*	4496.6+x	(39/2$^-$)	4218.1+x	(37/2$^-$)		
278.7[#] *20*	1.4[#] *2*	2073.2+x	(21/2$^+$)	1794.5+x	(19/2$^+$)	M1+E2	DCO=1.1 *1*.
278.7[#] *20*	0.8[#] *1*	3447+x	(31/2$^-$)	3169+x	(29/2$^-$)		
285.4 *20*	1.7 *1*	2528.3+x	(25/2$^+$)	2243.6+x	(23/2$^+$)	M1+E2	DCO=0.7 *2*.
288.8 *20*	1.9 *1*	2817.4+x	(29/2$^+$)	2528.3+x	(25/2$^+$)	E2	DCO=1.2 *4*.
289.6 *20*	1.9 *1*	4313.9+x	(37/2$^-$)	4023.5+x	(35/2$^-$)	M1+E2	DCO=0.6 *2*.
291.1 *10*	3.2 *2*	2467.7+x	(27/2$^-$)	2176.4+x	(25/2$^-$)		
293.0 *10*	2.9 *2*	2760.3+x	(29/2$^-$)	2467.7+x	(27/2$^-$)	M1+E2	DCO=0.8 *2*.
293.7 *10*	6.5 *3*	2537.6+x	(25/2$^+$)	2243.6+x	(23/2$^+$)	M1+E2	DCO=0.7 *1*.
307.2 *10*	2.4 *2*	4980.7+x	(41/2$^-$)	4673.6+x	(39/2$^-$)	M1+E2	DCO=0.5 *2*.
318.4 *20*	1.7 *1*	3762.2+x	(35/2$^-$)	3443.5+x	(33/2$^-$)		
320.1 *10*	5.5 *2*	4864.4+x	(43/2$^+$)	4544.3+x	(41/2$^+$)	M1+E2	DCO=0.8 *1*.
325.5 *20*	1.6 *2*	5653.9+x	(45/2$^-$)	5328.4+x	(43/2$^-$)	M1+E2	DCO=0.8 *2*.
327.1 *5*	12.2 *6*	3343.8+x	(33/2$^+$)	3016.7+x	(31/2$^+$)	M1+E2	DCO=0.8 *1*.
329.6 *10*	3.7 *3*	3089.8+x	(31/2$^-$)	2760.3+x	(29/2$^-$)	M1+E2	DCO=0.7 *1*.
334.5 *20*	1.7 *1*	4023.5+x	(35/2$^-$)	3689.2+x	(33/2$^-$)		
341.9 *10*	7.3 *4*	4544.3+x	(41/2$^+$)	4202.7+x	(39/2$^+$)	M1+E2	DCO=0.7 *1*.
346.4 *20*	1.2 *1*	4445+x?		4098+x?			
347.7 *10*	2.9 *2*	5328.4+x	(43/2$^-$)	4980.7+x	(41/2$^-$)	M1+E2	DCO=0.4 *1*.
349.2 *10*	2.0 *1*	2817.4+x	(29/2$^+$)	2467.7+x	(27/2$^-$)	E1	DCO=0.7 *3*.

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^{106}Cd(^{58}Ni,3pγ) 2011La01 (continued)

γ(^{161}Ta) (continued)

E_γ †	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult. ‡	Comments
354.2 *20*	1.2 *1*	3443.5+x	(33/2⁻)	3089.8+x	(31/2⁻)		
358.2 *10*	2.2 *2*	6382+x	(49/2⁻)	6024+x	(47/2⁻)		
359.8 *10*	3.0 *2*	4673.6+x	(39/2⁻)	4313.9+x	(37/2⁻)	M1+E2	DCO=0.5 *1*.
368.0 *5*	12.0 *5*	3941.7+x	(37/2⁺)	3573.7+x	(35/2⁺)	M1+E2	DCO=0.7 *1*.
370.3 *10*	2.5 *2*	6024+x	(47/2⁻)	5653.9+x	(45/2⁻)		
382.1 *20*	1.2 *1*	6764+x	(51/2⁻)	6382+x	(49/2⁻)		
396.1 *5*	19.2 *9*	396.0+x	(13/2⁻)	0+x	(11/2⁻)	M1+E2	DCO=0.9 *1*.
405.3 *20*	1.0 *1*	3872+x?		3467.2+x			
412.4 *5*	12.3 *6*	2176.4+x	(25/2⁻)	1763.6+x	(23/2⁻)	M1+E2	DCO=0.7 *1*.
422.0 *20*	1.7 *2*	2494.5+x	(25/2⁺)	2073.2+x	(21/2⁺)		
449.2 *10*	6.5 *4*	2243.6+x	(23/2⁺)	1794.5+x	(19/2⁺)	E2	DCO=1.0 *1*.
454.7 *20*	1.9 *2*	2528.3+x	(25/2⁺)	2073.2+x	(21/2⁺)	E2	DCO=1.3 *4*.
455.8 *20*	0.7 *2*	4218.1+x	(37/2⁻)	3762.2+x	(35/2⁻)		
473.3 *5*	18.6 *10*	956.2+x	(17/2⁻)	482.8+x	(15/2⁻)	M1+E2	DCO=1.0 *2*.
482.7 *5*	100.0 *3*	482.8+x	(15/2⁻)	0+x	(11/2⁻)	E2	DCO=0.9 *1*.
498.7 *10*	6.3 *3*	2741.8+x	(27/2⁺)	2243.6+x	(23/2⁺)	E2	DCO=0.9 *1*.
499.7 *20*	1.3 *3*	2494.5+x	(25/2⁺)	1994.8+x	(21/2⁺)		
500.4 *5*	21.1 *1*	1583.4+x	(21/2⁻)	1083.2+x	(19/2⁻)	M1+E2	DCO=0.9 *1*.
526.3 *10*	4.1 *3*	3343.8+x	(33/2⁺)	2817.4+x	(29/2⁺)		
557.0 *5*	10.2 *5*	3573.7+x	(35/2⁺)	3016.7+x	(31/2⁺)		
560.4 *5*	15.5 *8*	956.2+x	(17/2⁻)	396.0+x	(13/2⁻)	E2	DCO=1.1 *1*.
565.4 *5*	10.2 *5*	2741.8+x	(27/2⁺)	2176.4+x	(25/2⁻)	E1	DCO=0.6 *1*.
572.8 *20*	0.9 *2*	4445+x?		3872+x?			
575.3 *20*	1.7 *2*	3467.2+x		2891.9+x	(29/2⁺)		
583.6 *10*	8.9 *5*	2760.3+x	(29/2⁻)	2176.4+x	(25/2⁻)	E2	DCO=1.2 *1*.
593.0 *5*	20.4 *10*	2176.4+x	(25/2⁻)	1583.4+x	(21/2⁻)	E2	DCO=1.0 *1*.
598.0 *10*	5.5 *4*	3941.7+x	(37/2⁺)	3343.8+x	(33/2⁺)		
600.4 *5*	79 *4*	1083.2+x	(19/2⁻)	482.8+x	(15/2⁻)	E2	DCO=1.1 *1*.
602.3 *10*	6.6 *4*	4544.3+x	(41/2⁺)	3941.7+x	(37/2⁺)		
616.0 *20*	0.8 *2*	5061+x?		4445+x?			
622.0 *10*	8.5 *6*	3089.8+x	(31/2⁻)	2467.7+x	(27/2⁻)		
624.6 *20*	1.6 *2*	4313.9+x	(37/2⁻)	3689.2+x	(33/2⁻)		
627.1 *5*	25.9 *12*	1583.4+x	(21/2⁻)	956.2+x	(17/2⁻)		
629.0 *5*	11.4 *6*	4202.7+x	(39/2⁺)	3573.7+x	(35/2⁺)		
631.2 *10*	2.2 *2*	4098+x?		3467.2+x			
649.4 *20*	1.6 *2*	4673.6+x	(39/2⁻)	4023.5+x	(35/2⁻)		
654.7 *20*	0.6 *2*	5328.4+x	(43/2⁻)	4673.6+x	(39/2⁻)		
660.4 *5*	10.7 *6*	2243.6+x	(23/2⁺)	1583.4+x	(21/2⁻)		
661.6 *10*	3.2 *3*	4864.4+x	(43/2⁺)	4202.7+x	(39/2⁺)		
666.7 *10*	2.2 *2*	4980.7+x	(41/2⁻)	4313.9+x	(37/2⁻)		
671.5 *20*	0.8 *2*	4770+x?		4098+x?			
672.5 *10*	4.3 *3*	3762.2+x	(35/2⁻)	3089.8+x	(31/2⁻)		
673.2 *20*	1.8 *2*	5653.9+x	(45/2⁻)	4980.7+x	(41/2⁻)		
680.2 *5*	47.1 *20*	1763.6+x	(23/2⁻)	1083.2+x	(19/2⁻)	E2	DCO=1.1 *1*.
683.0 *10*	6.6 *4*	3443.5+x	(33/2⁻)	2760.3+x	(29/2⁻)	E2	DCO=1.0 *1*.
704.1 *5*	12.9 *7*	2467.7+x	(27/2⁻)	1763.6+x	(23/2⁻)	E2	DCO=1.1 *1*.
728.0 *20*	1.9 *4*	6382+x	(49/2⁻)	5653.9+x	(45/2⁻)		
734.4 *10*	2.6 *2*	4496.6+x	(39/2⁻)	3762.2+x	(35/2⁻)		
739.0 *20*	1.0 *2*	6764+x	(51/2⁻)	6024+x	(47/2⁻)		
761.9 *10*	2.7 *2*	4023.5+x	(35/2⁻)	3261.2+x	(31/2⁻)	E2	DCO=1.1 *4*.
764.4 *10*	8.1 *6*	2528.3+x	(25/2⁺)	1763.6+x	(23/2⁻)	E1	DCO=0.7 *1*.
773.9 *10*	8.8 *5*	2537.6+x	(25/2⁺)	1763.6+x	(23/2⁻)		
774.6 *10*	5.5 *3*	4218.1+x	(37/2⁻)	3443.5+x	(33/2⁻)	E2	DCO=1.1 *3*.
793 *2*		5289.6+x	(43/2⁻)	4496.6+x	(39/2⁻)		E_γ: from the level scheme drawing of 2011La01. In their table of measured γ properties (their

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^{106}Cd(^{58}Ni,3pγ) 2011La01 (continued)

γ(^{161}Ta) (continued)

Eγ†	Iγ	Ei(level)	J^π_i	Ef	J^π_f	Mult.‡	Comments
							Table 1), they list only one 793.5 γ, which they place from the 3261.2+x, (31/2⁻), level.
793.5 *10*	8.0 *12*	3261.2+x	(31/2⁻)	2467.7+x	(27/2⁻)		
798.0 *10*	2.8 *3*	4058.8+x	(35/2⁻)	3261.2+x	(31/2⁻)		
803.2 *20*	0.9 *2*	6093+x	(47/2⁻)	5289.6+x	(43/2⁻)		
838.3 *10*	8.2 *6*	1794.5+x	(19/2⁺)	956.2+x	(17/2⁻)	E1	DCO=0.4 *1*.
852.8 *20*	1.6 *2*	5070.9+x	(41/2⁻)	4218.1+x	(37/2⁻)		
870.4 *20*	1.3 *1*	5088.5+x		4218.1+x	(37/2⁻)		
911.5 *10*	3.7 *6*	1994.8+x	(21/2⁺)	1083.2+x	(19/2⁻)	E1	DCO=0.4 *2*.
990.0 *5*	11.5 *5*	2073.2+x	(21/2⁺)	1083.2+x	(19/2⁻)	E1	DCO=0.6 *1*.
1194.6 *10*	2.5 *2*	1677.4+x		482.8+x	(15/2⁻)		
1238.0 *20*	0.8 *1*	2321.2+x		1083.2+x	(19/2⁻)		

† 2011La01 state that the uncertainties are 0.5 keV for transitions with Iγ>>10 and 2 keV for weaker transitions. The evaluator has assigned uncertainties as follows: for γ′s with Iγ>10, 0.5 keV; for γ′s with 2<Iγ<10, 1.0 keV; and for γ′s with Iγ<2, 2.0 keV.

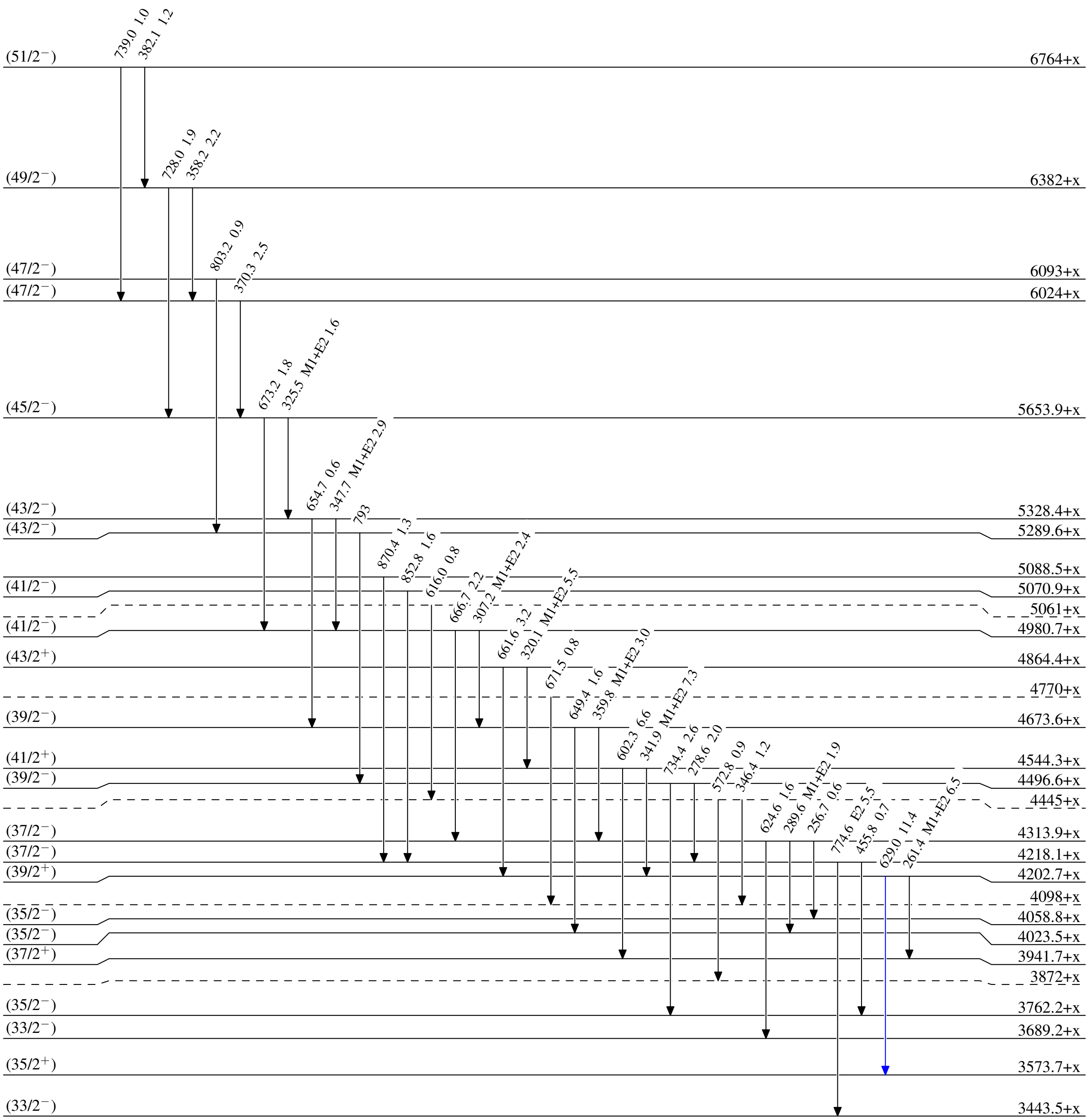
‡ As assigned by 2011La01, from DCO ratios and band assignments.

Multiply placed with intensity suitably divided.

^{106}Cd(^{58}Ni,3pγ) 2011La01

Level Scheme

Intensities: Relative I_γ



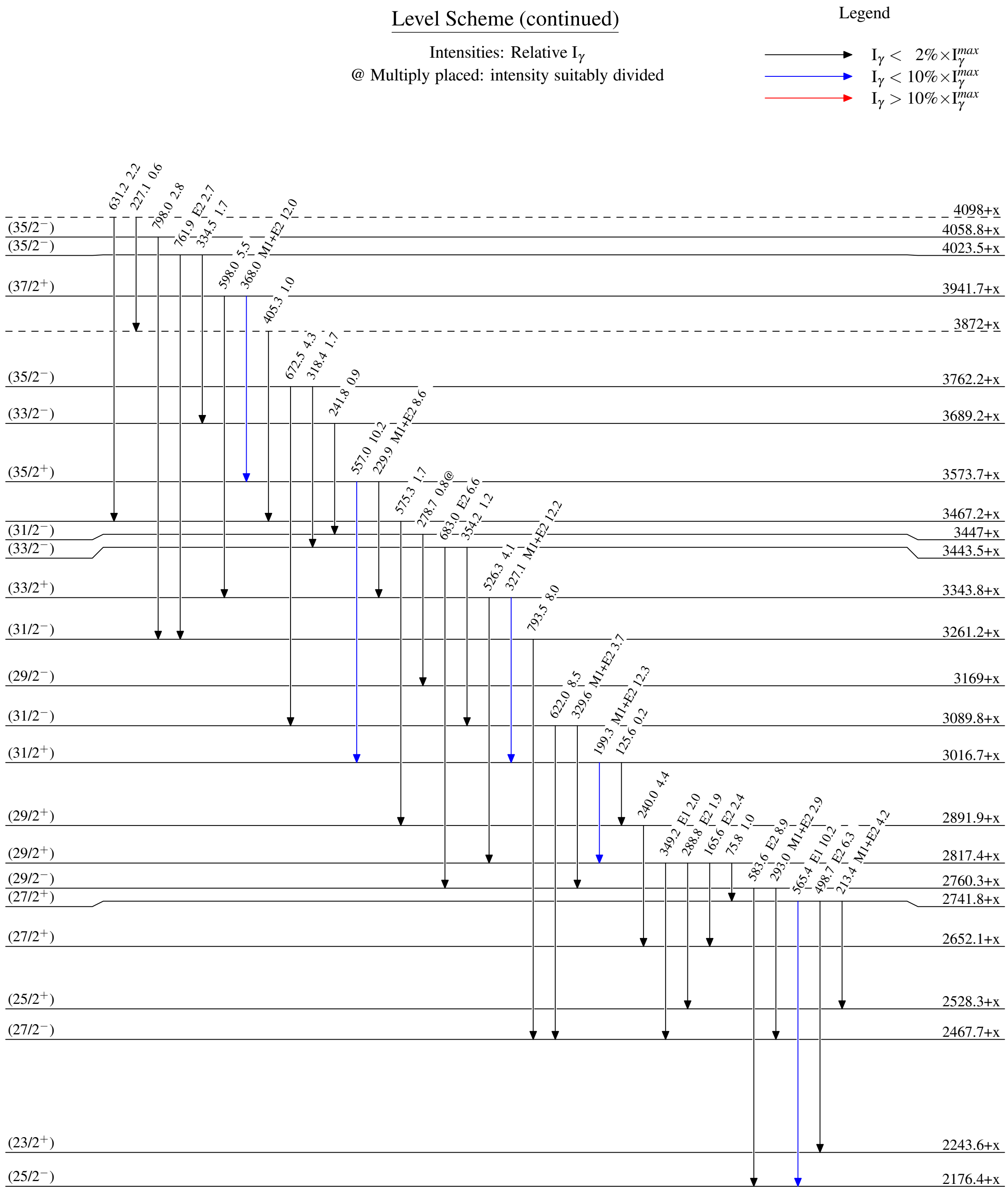
$^{161}_{73}Ta_{88}$

^{106}Cd(^{58}Ni,3pγ) 2011La01

Level Scheme (continued)

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided



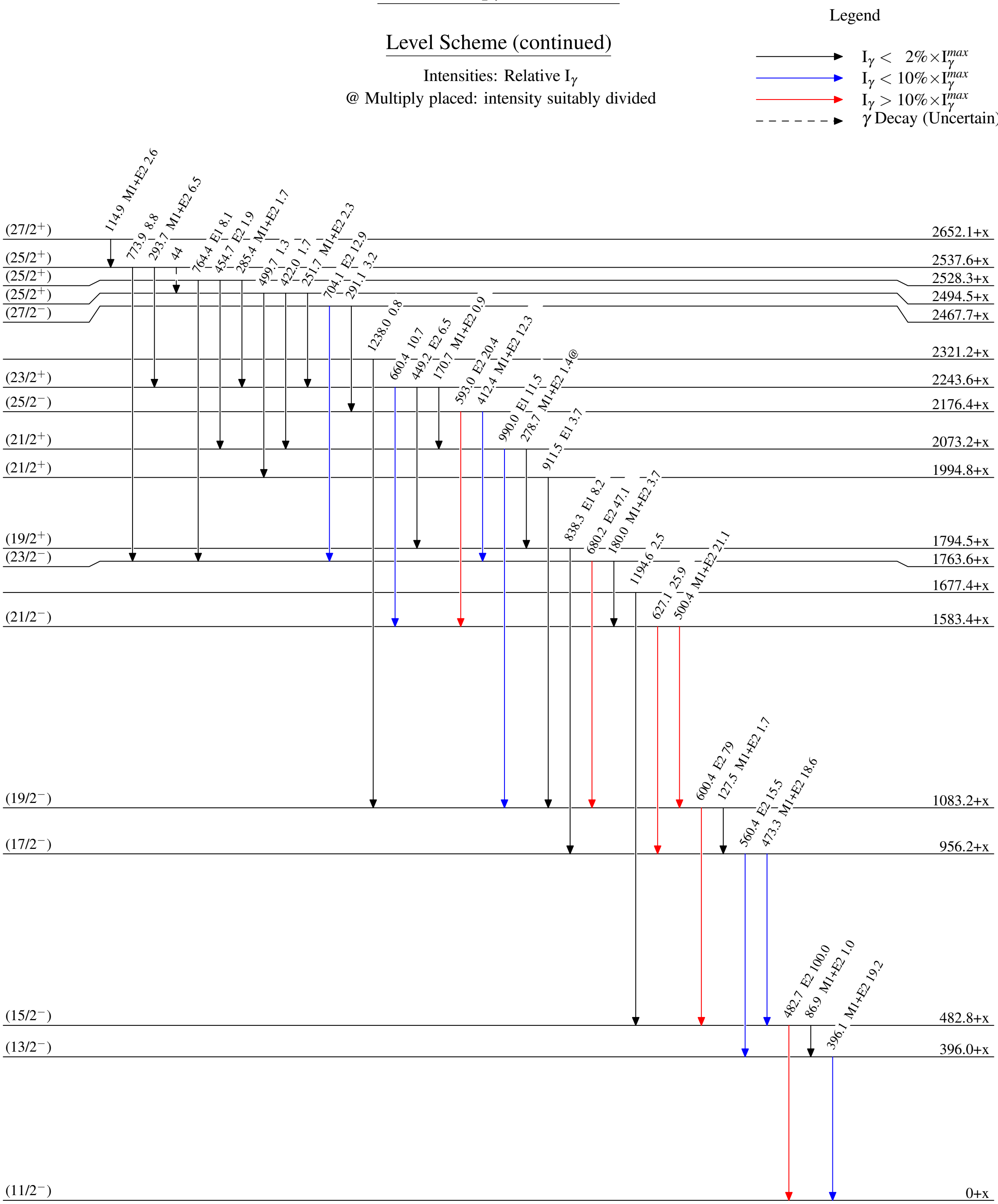
$^{161}_{73}Ta_{88}$

$^{106}Cd(^{58}Ni,3p\gamma)$ 2011La01

Level Scheme (continued)

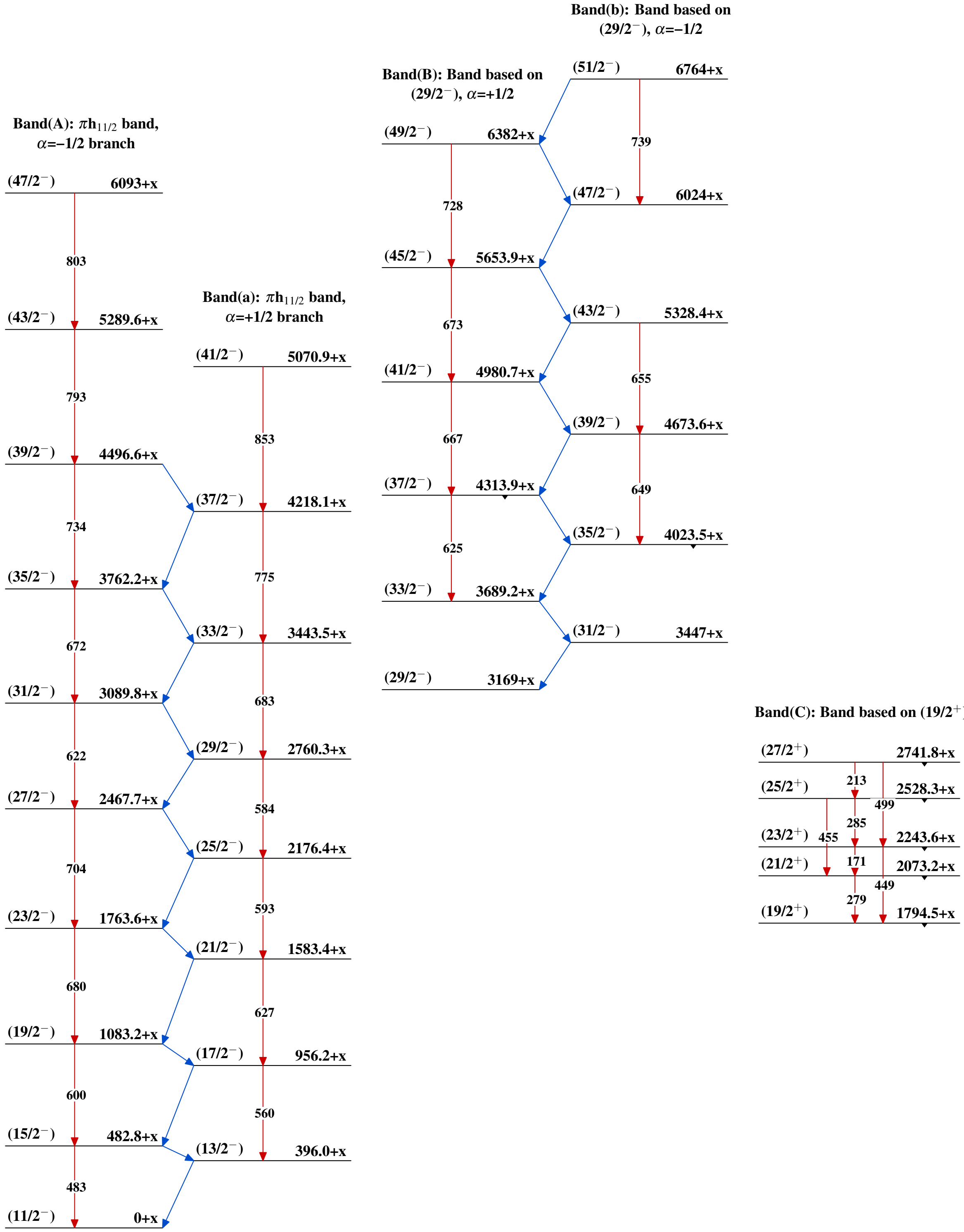
Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

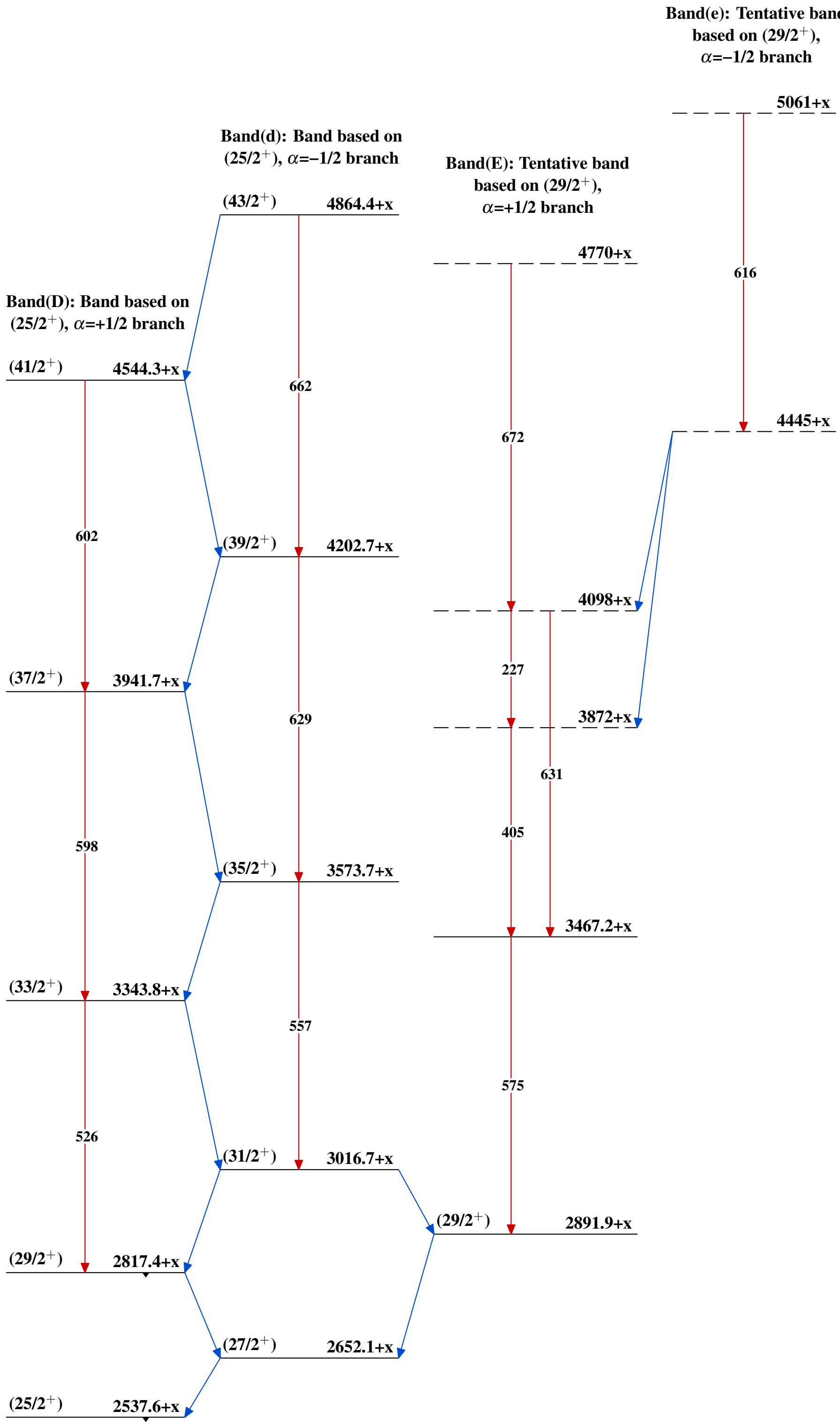


$^{161}_{73}Ta_{88}$

$^{106}Cd(^{58}Ni,3p\gamma)$ 2011La01



$^{106}Cd(^{58}Ni,3p\gamma)$ 2011La01 (continued)



$^{161}_{73}Ta_{88}$