^{116}Cd(^{24}Mg,4nγ) 1987Pa17

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 152, 331 (2018)	1-Apr-2018

Includes ^{114}Cd(^{27}Al,p4nγ).

1987Pa17: E(^{24}Mg)=106, 111 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coincidences and excitation functions using four Compton-suppressed HPGe detectors. E(^{27}Al)=129 MeV. Measured $\gamma(\theta)$ using one Compton-suppressed HPGe and a Ge(Li) detector as a monitor.

^{136}Nd Levels

E(level)	J$^{\pi}$[†]	Comments
0.0[&]	0$^+$	
373.6[&] 3	2$^+$	
862.1[a] 3	2$^+$[@]	
976.3[&] 4	4$^+$	
1230.8[a] 4	(3)$^+$[@]	
1541?[a]	(4$^+$)[@]	
1746.8[&] 5	6$^+$	
2035.9[b] 5	5$^-$	
2045.9[a] 5	(5$^+$)[@]	
2439.9[b] 5	7$^-$	
2483.9[c] 5	6$^-$	
2632.9[&] 5	8$^+$	
2757.8[c] 5	8$^-$	
2941.1[b] 5	9$^-$	
3244.4[c] 6	10$^-$	
3278.7[d] 6	10$^+$	
3296.5[e] 6	10$^+$	
3552.6[&] 6	10$^+$	
3602.3[b] 6	11$^-$	
3686.5[e] 6	12$^+$	
3768.2[f] 7	(10$^+$)[‡]	J$^{\pi}$: 9$^{(-)}$ in 1987Pa17.
3997.3[d] 7	12$^+$	
4016.8[c] 8	12$^-$	
4320.0[f] 6	(12$^+$)[‡]	J$^{\pi}$: 11$^{(-)}$ in 1987Pa17.
4347.5[e] 6	14$^+$	
4426.6[b] 6	13$^-$	
4455.7[h] 7	(13$^+$)[‡]	J$^{\pi}$: 12 in 1987Pa17.
4849.1[d] 8	14$^+$	
4855.9[i] 7	(14$^+$)[‡]	J$^{\pi}$: 13 in 1987Pa17.
5022.5[g] 7	(14$^+$)[‡]	J$^{\pi}$: 12$^{(-)}$ in 1987Pa17.
5022.7[c] 8	14$^-$	
5032.0[f] 7	(14$^+$)[‡]	J$^{\pi}$: 13$^{(-)}$ in 1987Pa17.
5132.7[h] 8	(15$^+$)[‡]	J$^{\pi}$: 14 in 1987Pa17.
5192.2[e] 7	16$^+$	
5415.8[b] 7	15$^-$	
5570.2[i] 7	(16$^+$)[‡]	J$^{\pi}$: 15 in 1987Pa17.
5695.6[g] 7	(16$^+$)[‡]	J$^{\pi}$: 14$^{(-)}$ in 1987Pa17.
5844.1[d] 8	16$^+$	

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^{116}Cd(^{24}Mg,4nγ) 1987Pa17 (continued)

^{136}Nd Levels (continued)

E(level)	J$^\pi$[†]	Comments
5876.0?[f] 9	(16$^+$)[‡]	J$^\pi$: 15$^{(-)}$ in 1987Pa17.
5942.2[h] 9	(17$^+$)[‡]	J$^\pi$: (16) in 1987Pa17.
6040.4[c] 9	16$^-$	
6191.7[e] 7	18$^+$	
6360.6[b] 7	17$^-$	
6472.1?[i] 9	(18$^+$)[‡]	J$^\pi$: (17) in 1987Pa17.
6522.7[g] 8	(18$^+$)[‡]	J$^\pi$: 16$^{(-)}$ in 1987Pa17.
6675.9[c] 9	(18$^-$)	
6756.3[d] 9	18$^+$	
6771.0?[f] 14	(18$^+$)[‡]	J$^\pi$: (17$^-$) in 1987Pa17.
6930.8[h] 10	(19$^+$)[‡]	J$^\pi$: (18) in 1987Pa17.
7142.1[b] 8	19$^-$	
7238.1[#e] 9	20$^+$	E(level): the 20$^+$ member of Band (F) placed at 7355.4-keV in ^{110}Pd(^{30}Si,4nγ).
7374.4?[#g] 9		J$^\pi$: (18$^-$) in 1987Pa17.
7491?[#d]	(20$^+$)	E(level): the 20$^+$ member of Band (E) placed at 7732.4-keV in ^{110}Pd(^{30}Si,4nγ).
7497.1?[#i] 14		J$^\pi$: (19) in 1987Pa17.
7533.4[c] 10	(20$^-$)	
8025.8?[#h] 14		J$^\pi$: (20) in 1987Pa17.
8050.1[b] 9	21$^-$	
8329.1?[#e] 14	(22$^+$)	E(level): the 22$^+$ member of Band (F) placed at 8622.6-keV in ^{110}Pd(^{30}Si,4nγ).
8566.4?[#c] 14	(22$^-$)	E(level): the 22$^-$ member of Band (D) placed at 8556.1-keV in ^{110}Pd(^{30}Si,4nγ).
9072.7?[#b] 11	(23$^-$)	E(level): the 23$^-$ member of Band (C) placed at 9048.6-keV in ^{110}Pd(^{30}Si,4nγ).
9728.4?[#c] 18	(24$^-$)	E(level): the 24$^-$ member of Band (D) placed at 9558.1-keV in ^{110}Pd(^{30}Si,4nγ).
10175.7?[#b] 15	(25$^-$)	E(level): the 25$^-$ member of Band (C) placed at 9893.9-keV in ^{110}Pd(^{30}Si,4nγ).

[†] From 1987Pa17,except where noted. For the possible γ-vibrational band, see Adopted Levels.

[‡] From the Adopted Levels. The assignment given by 1987Pa17 is given under comments.

[#] This level is not reported in the more recent high-spin studies with large detector arrays (1996Pe06,1996Pe08), thus it is not listed in the Adopted Levels.

[@] From the Adopted Levels.

[&] Band(A): K$^\pi$=0$^+$, g.s. band.

[a] Band(B): possible K$^\pi$=2$^+$ γ band.

[b] Band(C): $\pi h_{11/2}\pi g_{7/2}$. α=1. Shape change from $\gamma\approx-10°$ to γ=0°.

[c] Band(D): $\pi h_{11/2}\pi g_{7/2}$. α=0. Shape change from γ=0° to 10°.

[d] Band(E): aligned $\nu h^2_{11/2}$.

[e] Band(F): aligned $\pi h^2_{11/2}$. (1987Pa17).

[f] Band(G): band based on (10$^+$). The assignment is from Adopted Levels. In 1987Pa17, this band was based on 9$^{(-)}$ with configuration= $\nu h_{11/2}\nu g_{7/2}$ (?), α=1. $\gamma\approx-60°$.

[g] Band(H): band based on (14$^+$). The assignment is from Adopted Levels. In 1987Pa17, this band was based on 12$^{(-)}$ with configuration= $\nu h_{11/2}\nu g_{7/2}$ (?), α=0. $\gamma\approx-60°$.

[h] Band(I): band based on (13$^+$). The assignment is from Adopted Levels. In 1987Pa17, this band was based on (12) with configuration= $\pi h_{11/2}\pi g_{7/2}$, α=1; $\nu h_{11/2}\nu g_{7/2}$, α=1 (?).

[i] Band(J): band based on (15$^+$). The assignment is from Adopted Levels. In 1987Pa17, this band was based on (14) with configuration= $\pi h_{11/2}\pi g_{7/2}$, α=0; $\nu h_{11/2}\nu g_{7/2}$, α=0 (?).

^{116}Cd(^{24}Mg,4nγ) 1987Pa17 (continued)

$\gamma(^{136}Nd)$

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[@]	Comments
273.9 *3*	3.8 *2*	2757.8	8^-	2483.9	6^-	(Q)		Iγ(132°)/Iγ(57°)=1.16 *10*.
303.3 *3*	2.2 *2*	3244.4	10^-	2941.1	9^-			Iγ(132°)/Iγ(57°)=0.82 *13*.
317.9 *3*	5.8 *2*	2757.8	8^-	2439.9	7^-			A_2=+0.05 *13*, A_4=+0.10 *17*. Iγ(132°)/Iγ(57°)=1.00 *8*.
355.4 *3*	8.5 *2*	3296.5	10^+	2941.1	9^-	D		A_2=−0.34 *14*, A_4=−0.19 *20*. Iγ(132°)/Iγ(57°)=0.93 *4*.
368.8 *5*	1.1 *2*	1230.8	$(3)^+$	862.1	2^+			
373.5 *3*		373.6	2^+	0.0	0^+	(E2)	0.0270	α(K)=0.0219; α(L)=0.00403; α(M)=0.00087; α(N+..)=0.00023 Iγ(132°)/Iγ(57°)=1.07 *2*. A_2=+0.170 *11*, A_4=+0.027 *18*.
390.1 *3*	40.8 *3*	3686.5	12^+	3296.5	10^+	(E2)	0.0238	α(K)=0.0193; α(L)=0.00349; α(M)=0.00075; α(N+..)=0.00020 A_2=+0.24 *9*, A_4=+0.05 *10*. Iγ(132°)/Iγ(57°)=1.05 *2*.
404.1 *3*	6.4 *2*	2439.9	7^-	2035.9	5^-	E2	0.0214	α(K)=0.0175; α(L)=0.00311; α(M)=0.00067; α(N+..)=0.00018 A_2=+0.39 *8*, A_4=+0.00 *12*. Iγ(132°)/Iγ(57°)=1.18 *7*.
438.1 *4*	1.3 *2*	2483.9	6^-	2045.9	(5^+)			
448.0 *5*	1.7 *2*	2483.9	6^-	2035.9	5^-			Iγ(132°)/Iγ(57°)=0.84 *25*.
486.5 *3*	7.1 *3*	3244.4	10^-	2757.8	8^-	(Q)		Iγ(132°)/Iγ(57°)=1.10 *7*.
488.4 *5*	2.1 *3*	862.1	2^+	373.6	2^+			
501.2 *3*	24.3 *3*	2941.1	9^-	2439.9	7^-	(E2)	0.0118	α(K)=0.0097; α(L)=0.00158 A_2=+0.29 *8*, A_4=−0.01 *10*. Iγ(132°)/Iγ(57°)=1.14 *3*.
551.8 *3*	2.0 *2*	4320.0	(12^+)	3768.2	(10^+)			Iγ(132°)/Iγ(57°)=1.13 *27*.
602.7 *3*	100	976.3	4^+	373.6	2^+	(E2)	0.00729	α(K)=0.00605; α(L)=0.00093 A_2=+0.215 *15*, A_4=+0.002 *21*. Iγ(132°)/Iγ(57°)=1.13 *1*.
635.5 *3*	1.2 *2*	6675.9	(18^-)	6040.4	16^-			
645.8 *3*	8.4 *2*	3278.7	10^+	2632.9	8^+	(Q)		Iγ(132°)/Iγ(57°)=1.14 *6*. A_2=+0.31 *11*, A_4=+0.20 *14*.
661.0 *3*	23.6[#] *5*	4347.5	14^+	3686.5	12^+	(E2)	0.00580	α(K)=0.00483; α(L)=0.00073 A_2=+0.36 *9*, A_4=−0.12 *13* for 661.2+661.0. Iγ(132°)/Iγ(57°)=1.22 *4* for doublet.
661.2 *3*	13.6[#] *6*	3602.3	11^-	2941.1	9^-	(Q)		A_2=+0.36 *9*, A_4=−0.12 *13* for 661.2+661.0. Iγ(132°)/Iγ(57°)=1.22 *4* for doublet.
663.3 *5*	2.1[#] *6*	5695.6	(16^+)	5032.0	(14^+)			A_2=+0.42 *7*, A_4=−0.04 *8* for 663.3+663.5. Iγ(132°)/Iγ(57°)=1.11 *2* for doublet.
663.5 *3*	23.7[#] *5*	3296.5	10^+	2632.9	8^+	E2	0.00574	α(K)=0.00479; α(L)=0.00072 A_2=+0.42 *7*, A_4=−0.04 *8* for 663.5+663.3. Iγ(132°)/Iγ(57°)=1.11 *2* for doublet.
673.1 *3*	2.9 *2*	5695.6	(16^+)	5022.5	(14^+)			Iγ(132°)/Iγ(57°)=0.95 *11*.
677.0 *5*	2.6 *4*	5132.7	(15^+)	4455.7	(13^+)	(Q)		Iγ(132°)/Iγ(57°)=1.20 *19*.
679[&]	<1	1541?	(4^+)	862.1	2^+			
693.1 *3*	21.8 *3*	2439.9	7^-	1746.8	6^+	(D)		Iγ(132°)/Iγ(57°)=0.84 *3*.
702.5 *3*	3.9 *2*	5022.5	(14^+)	4320.0	(12^+)			Iγ(132°)/Iγ(57°)=0.97 *7*.
711.9 *5*	2.1 *3*	5032.0	(14^+)	4320.0	(12^+)	(Q)		Iγ(132°)/Iγ(57°)=1.25 *15*.
714.3 *3*	1.3 *3*	5570.2	(16^+)	4855.9	(14^+)			Iγ(132°)/Iγ(57°)=1.0 *5*.
718.6 *3*	3.8 *2*	3997.3	12^+	3278.7	10^+	(Q)		Iγ(132°)/Iγ(57°)=1.11 *10*.
735[‡&]		7491?	(20^+)	6756.3	18^+			E_γ: energy and placement from figure 1 of 1987Pa17.
737.1 *5*	2.2 *4*	2483.9	6^-	1746.8	6^+	D		Iγ(132°)/Iγ(57°)=0.71 *14*.

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^{116}Cd(^{24}Mg,4nγ) 1987Pa17 (continued)

$\gamma(^{136}Nd)$ (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[@]	Comments
767.5 *3*	7.0 *2*	4320.0	(12^+)	3552.6	10^+			$I\gamma(132°)/I\gamma(57°)=0.77$ *7*.
769.2 *5*	15.7[#] *9*	4455.7	(13^+)	3686.5	12^+			$A_2=+0.284$ *19*, $A_4=+0.05$ *3* for 769.2+770.5. $I\gamma(132°)/I\gamma(57°)=1.13$ *1* for doublet.
770.5 *3*	71.4[#] *8*	1746.8	6^+	976.3	4^+	(E2)	0.00402	α(K)=0.00337; α(L)=0.00049 $A_2=+0.284$ *19*, $A_4=+0.05$ *3* for 769.2+770.5. $I\gamma(132°)/I\gamma(57°)=1.13$ *1* for doublet.
772.4 *5*	2.6 *3*	4016.8	12^-	3244.4	10^-			
781.5 *4*	1.5 *2*	7142.1	19^-	6360.6	17^-			$I\gamma(132°)/I\gamma(57°)=1.21$ *21*.
785.2 *5*	3.5 *2*	5132.7	(15^+)	4347.5	14^+	D		$I\gamma(132°)/I\gamma(57°)=0.67$ *7*.
809.5 *5*	3.0 *2*	5942.2	(17^+)	5132.7	(15^+)			
815.1 *3*	4.1 *2*	2045.9	(5^+)	1230.8	$(3)^+$			$I\gamma(132°)/I\gamma(57°)=0.93$ *20*.
824.3 *3*	4.7 *3*	4426.6	13^-	3602.3	11^-			$I\gamma(132°)/I\gamma(57°)=1.06$ *10*.
827.1 *3*	2.6 *2*	6522.7	(18^+)	5695.6	(16^+)			
844.0[&] *5*	<1	5876.0?	(16^+)	5032.0	(14^+)			
844.7 *3*	14.6 *3*	5192.2	16^+	4347.5	14^+	(Q)		$I\gamma(132°)/I\gamma(57°)=1.11$ *4*.
851.7[&] *3*	<1	7374.4?		6522.7	(18^+)			
851.8 *3*	4.1 *3*	4849.1	14^+	3997.3	12^+	(Q)		$I\gamma(132°)/I\gamma(57°)=1.18$ *8*.
857.1 *5*	4.4[#] *3*	1230.8	$(3)^+$	373.6	2^+			
857.5 *4*	1.2[#] *4*	7533.4	(20^-)	6675.9	(18^-)			
862.2 *3*		862.1	2^+	0.0	0^+			
886.1 *3*	49.0 *4*	2632.9	8^+	1746.8	6^+	(E2)	0.00293	α(K)=0.00247; α(L)=0.00035 $I\gamma(132°)/I\gamma(57°)=1.23$ *2*.
895[&] *1*	<1	6771.0?	(18^+)	5876.0?	(16^+)			
901.9[&] *5*	<1	6472.1?	(18^+)	5570.2	(16^+)			
908.0 *5*	1.0 *2*	8050.1	21^-	7142.1	19^-			$I\gamma(132°)/I\gamma(57°)=1.06$ *23*.
912.2 *3*	1.1 *2*	6756.3	18^+	5844.1	16^+			$I\gamma(132°)/I\gamma(57°)=1.0$ *3*.
919.7 *3*	9.8 *3*	3552.6	10^+	2632.9	8^+	(Q)		$I\gamma(132°)/I\gamma(57°)=1.17$ *6*.
944.8 *3*	2.1 *2*	6360.6	17^-	5415.8	15^-	(Q)		$I\gamma(132°)/I\gamma(57°)=1.39$ *19*.
988.6 *5*	3.0[#] *4*	6930.8	(19^+)	5942.2	(17^+)			$I\gamma(132°)/I\gamma(57°)=1.16$ *10* for doublet.
989.1 *3*	1.9[#] *3*	5415.8	15^-	4426.6	13^-			$I\gamma(132°)/I\gamma(57°)=1.16$ *10* for doublet.
994.9 *3*	1.6 *2*	5844.1	16^+	4849.1	14^+	(Q)		$I\gamma(132°)/I\gamma(57°)=1.63$ *23*.
999.5 *3*	3.8 *2*	6191.7	18^+	5192.2	16^+	(Q)		$I\gamma(132°)/I\gamma(57°)=1.09$ *9*.
1005.9 *3*	3.2 *2*	5022.7	14^-	4016.8	12^-			$I\gamma(132°)/I\gamma(57°)=1.01$ *13*.
1017.7 *3*	1.3 *2*	6040.4	16^-	5022.7	14^-	(Q)		$I\gamma(132°)/I\gamma(57°)=1.4$ *4*.
1022.6[&] *5*	<1	9072.7?	(23^-)	8050.1	21^-			
1025[&] *1*	<1	7497.1?		6472.1?	(18^+)			
1033[&] *1*	<1	8566.4?	(22^-)	7533.4	(20^-)			
1046.4 *5*	1.0 *1*	7238.1	20^+	6191.7	18^+			$I\gamma(132°)/I\gamma(57°)=1.2$ *3*.
1059.5 *3*	7.7 *3*	2035.9	5^-	976.3	4^+	D		$A_2=-0.17$ *6*, $A_4=0.00$ *8*. $I\gamma(132°)/I\gamma(57°)=0.83$ *10*.
1070 *1*	1.1 *1*	2045.9	(5^+)	976.3	4^+			
1091[&] *1*	<1	8329.1?	(22^+)	7238.1	20^+			
1095[&] *1*	<1	8025.8?		6930.8	(19^+)			
1103[&] *1*	<1	10175.7?	(25^-)	9072.7?	(23^-)			
1135.1 *5*	1.1 *1*	3768.2	(10^+)	2632.9	8^+			$I\gamma(132°)/I\gamma(57°)=0.98$ *20*.
1162[&] *1*	<1	9728.4?	(24^-)	8566.4?	(22^-)			
1168.4 *3*	2.5 *2*	6360.6	17^-	5192.2	16^+			I_γ: for 1169.3+1168.4. $I\gamma(132°)/I\gamma(57°)=0.86$ *18* for doublet.
1169.3 *5*	2.5 *2*	4855.9	(14^+)	3686.5	12^+			I_γ: for 1169.3+1168.4. $I\gamma(132°)/I\gamma(57°)=0.86$ *16* for doublet.
1222.7 *4*	1.4 *5*	5570.2	(16^+)	4347.5	14^+			Mult.: dipole suggested by data of 1987Pa17, but $\Delta J=2$ suggested from $\gamma\gamma(\theta)$(DCO) data of

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^{116}Cd(^{24}Mg,4nγ) 1987Pa17 (continued)

$\gamma(^{136}Nd)$ (continued)

E_γ	E_i(level)	Comments
		1996Pe06. Iγ(132°)/Iγ(57°)=0.79 *12*.

† From asymmetry ratio data at 132° and 57°; and $\gamma(\theta)$ data for selected transitions. RUL is used to rule out M2 when ΔJ=2 transition is suggested by $\gamma(\theta)$ data and level lifetime is known. Not all mult assignments quoted by 1987Pa17 are reproduced here, due to ambiguities in the interpretation of $\gamma(\theta)$ data. Only for a very few transitions, the assignments seem secure. See adopted gammas also.

‡ See footnote on associated level.

Iγ(661.0+661.2)=37.2 *3*, Iγ(663.3+663.5)=25.8 *3*, Iγ(769.2+770.5)=87.1 *4*, Iγ(857.1+857.5)=5.6 *2*, and Iγ(988.6+989.1)=4.9 *2* divided by intensity imbalance at 2941, 5032, 3686, 6676, and 5942 levels, respectively (evaluator).

@ 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.

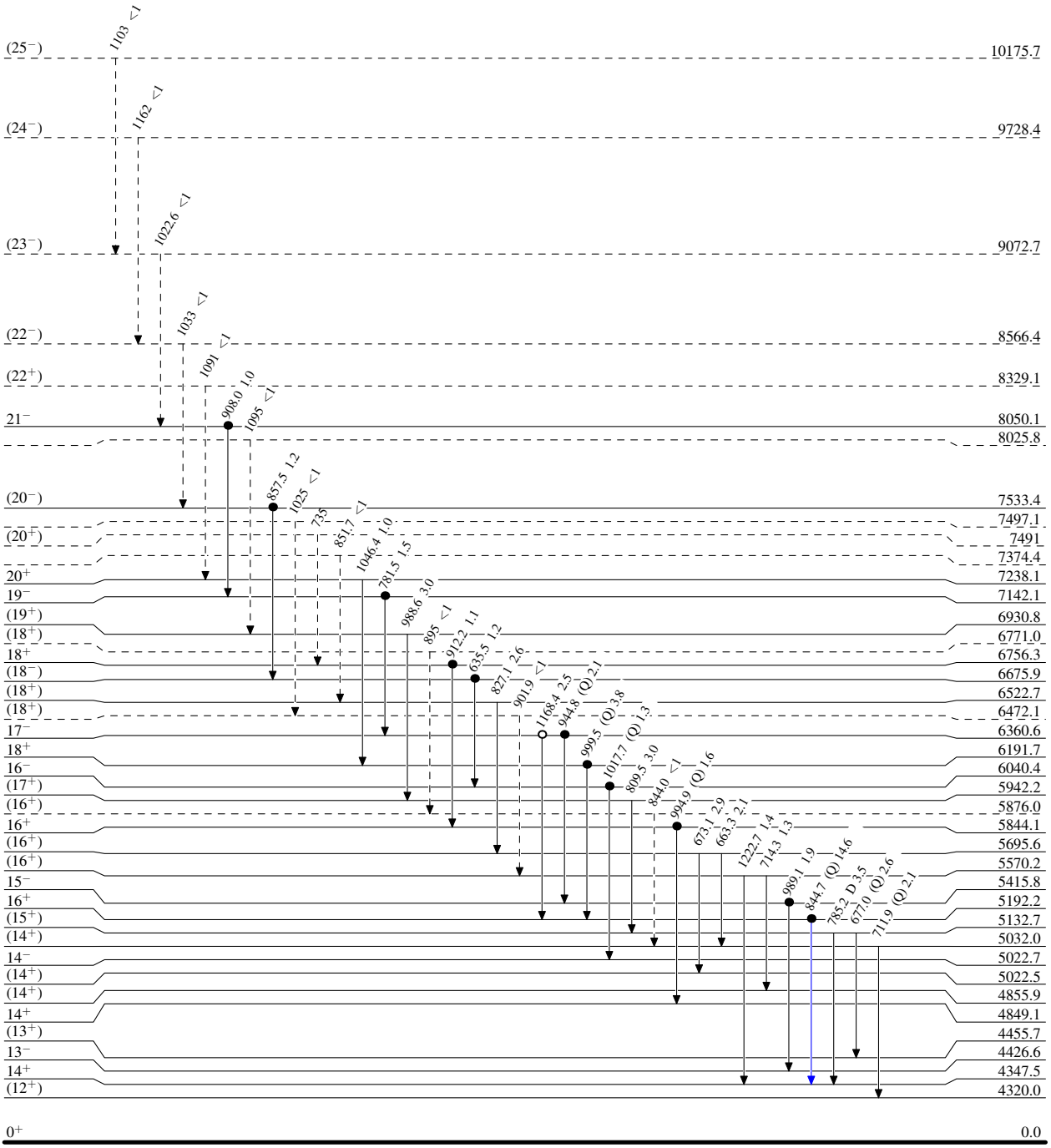
^{116}Cd(^{24}Mg,4nγ) **1987Pa17**

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)
- Coincidence
- Coincidence (Uncertain)

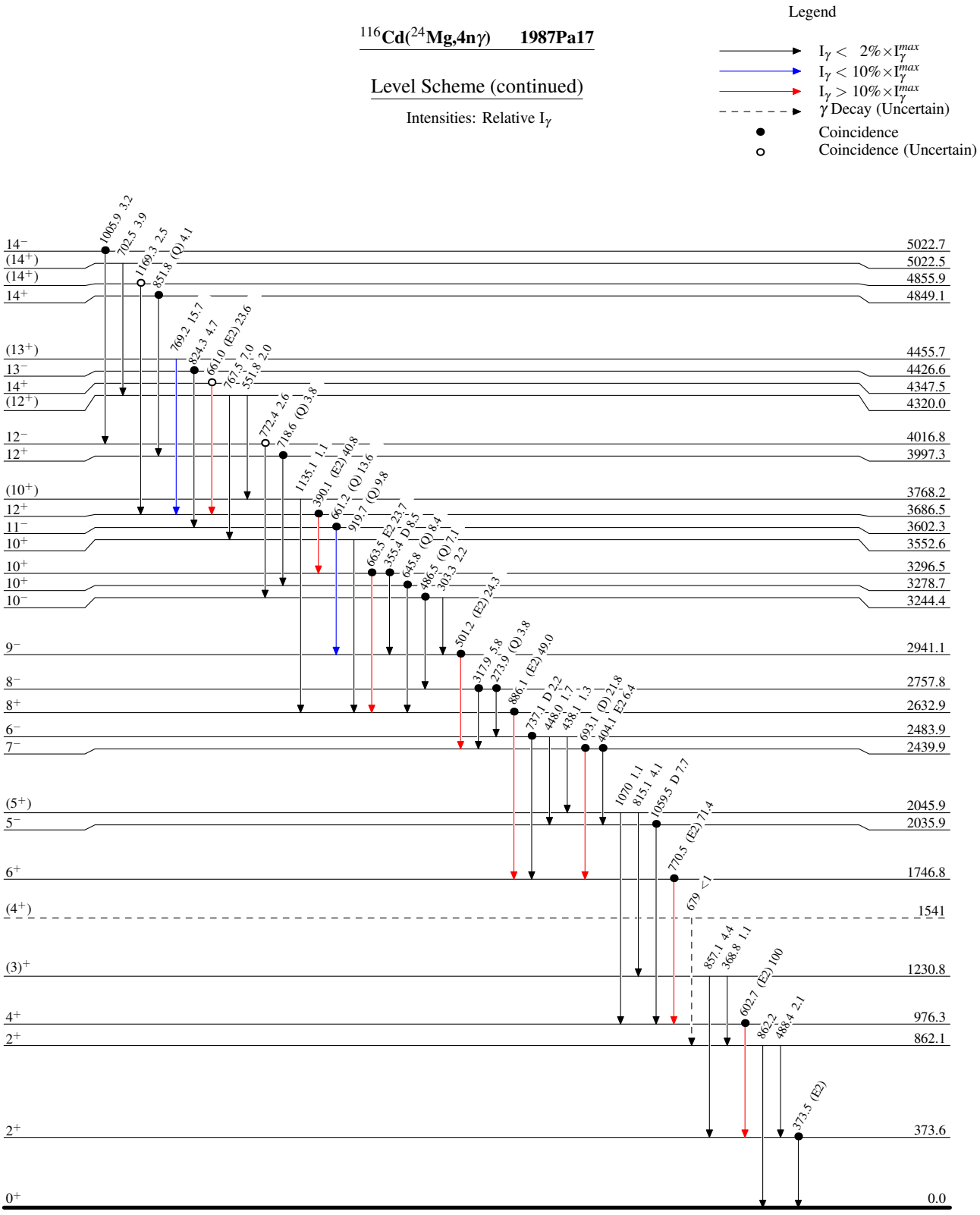


$^{136}_{60}Nd_{76}$

^{116}Cd(^{24}Mg,4nγ) **1987Pa17**

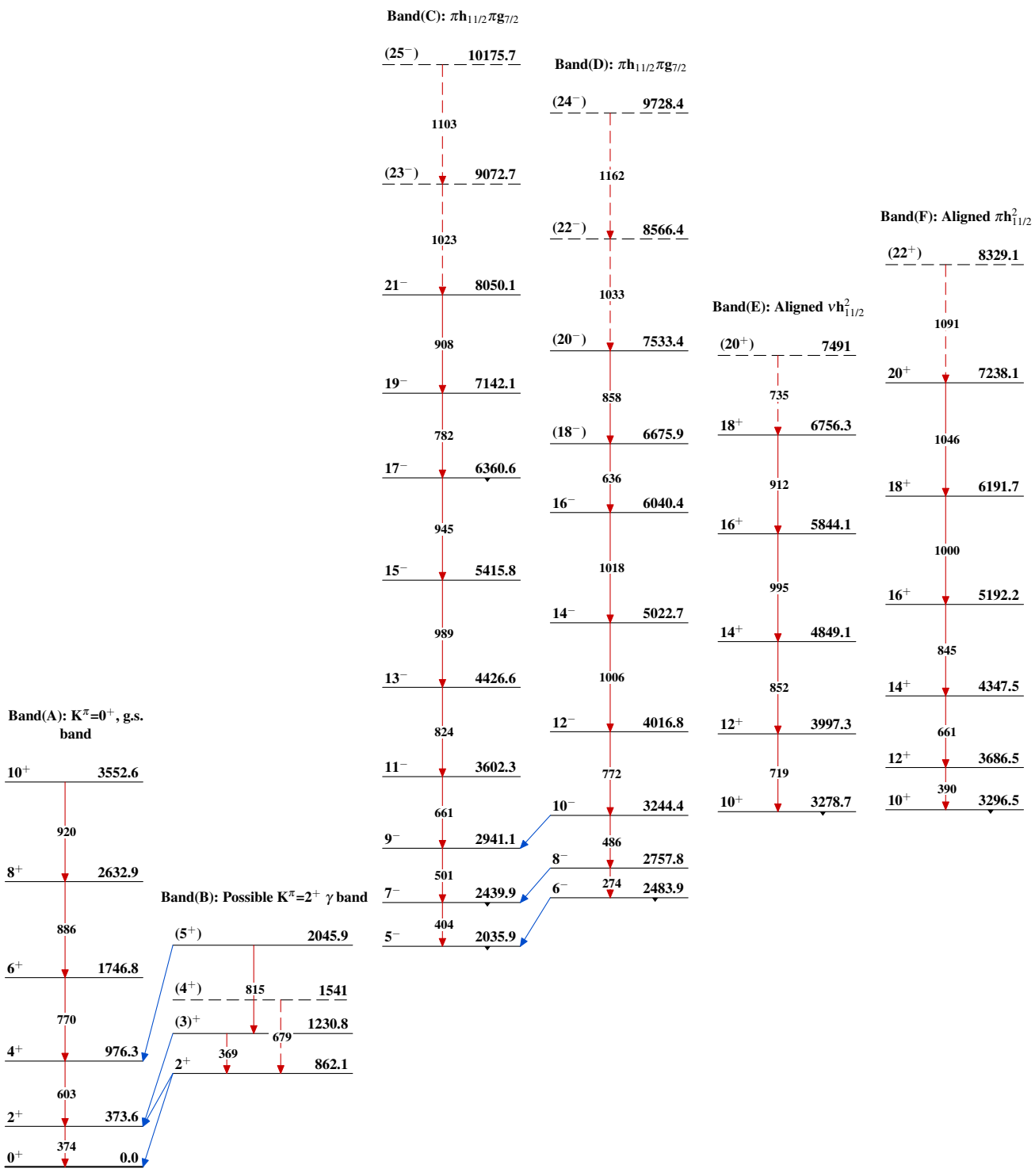
Level Scheme (continued)

Intensities: Relative I_γ



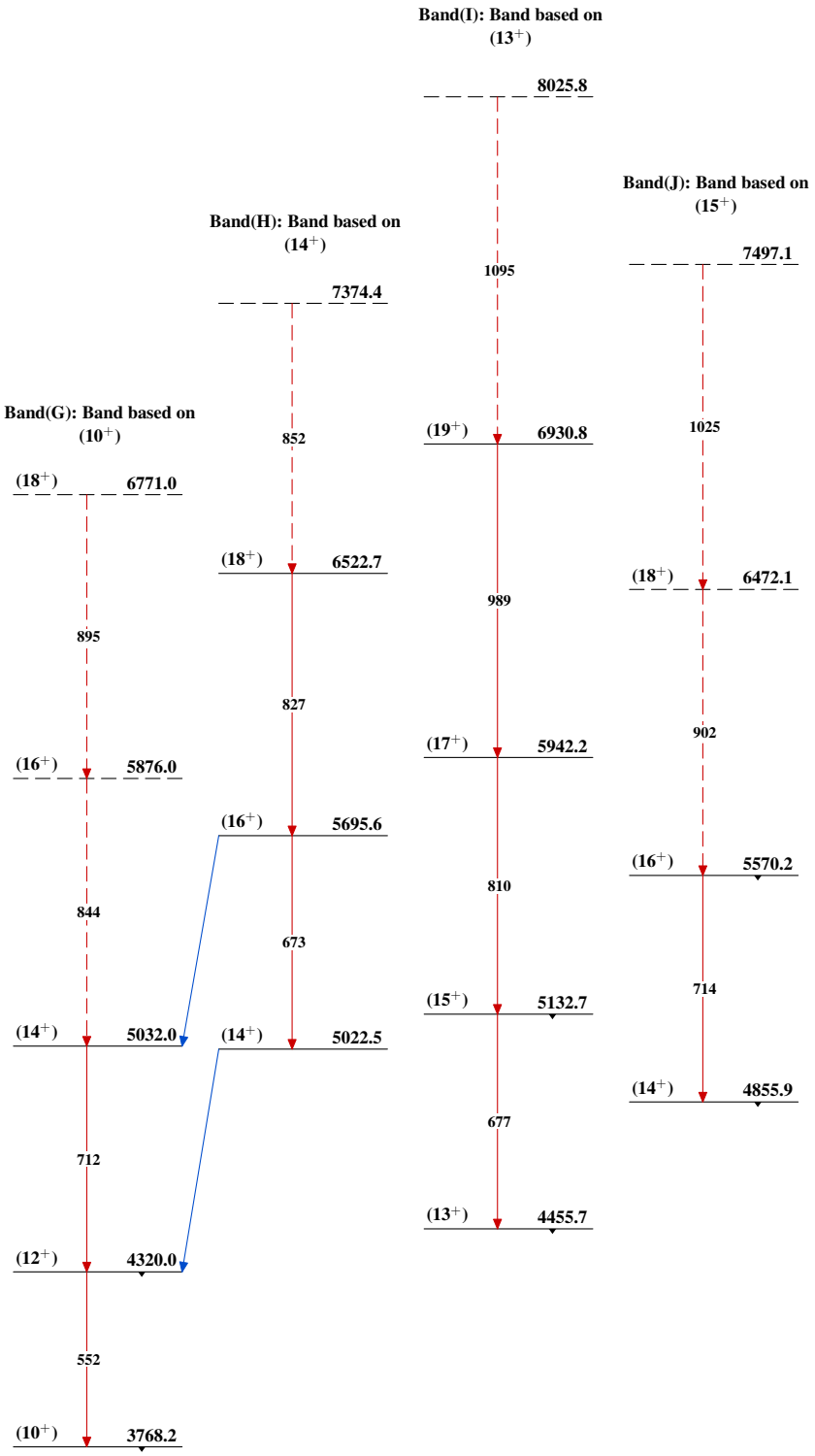
$^{136}_{60}Nd_{76}$

$^{116}Cd(^{24}Mg,4n\gamma)$ 1987Pa17



$^{136}_{60}Nd_{76}$

^{116}Cd(^{24}Mg,4nγ) 1987Pa17 (continued)



$^{136}_{60}Nd_{76}$