^{106}Cd(α,nγ) 1999Da05,1976Ma09

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	S. Kumar(a), J. Chen(b) and F. G. Kondev	NDS 137, 1 (2016)	31-May-2016

1999Da05: E(α)=15, 16, 17, 18, 19, 20 MeV, 20 MeV for $\gamma\gamma$ data, beam from the Debrecen cyclotron. Targets: 0.4-2.5 mg/cm^2-thick self-supporting one and 5 mg/cm^2-thick (rolled) metal one isotopically enriched to 77.3% in ^{106}Cd. Detectors: a superconducting magnetic lens plus Si(Li) electron spectrometer, two HPGe detectors (20 % and 25%) Measured :Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$, α(K)exp (normalized to 1293.558 keV E2 in ^{116}Sn). Deduced levels, J^π, γ-ray multipolarities, branching ratios, conversion coefficients. Comparisons with shell model calculations.

1976Ma09: E(α)=15-18 MeV. Measured: Eγ, Iγ, $\gamma\gamma$ at 18 MeV, excitation functions, and α(K)exp (normalized to 632.66γ, E2 in ^{106}Cd).

1981JoZX: E(α)=12.5-18.0 MeV. Measured: Eγ, n-γ, γ-γ, $\gamma(\theta)$.

1995Ka09: E(α)=23 MeV. Measured Eγ, $\gamma\gamma$, γ(t).

1984Ka16: E(α)=20 MeV,$T_{1/2}$ using γ(t) method.

1996ViZZ: E(α)=27 MeV, Eγ, Iγ, $\gamma\gamma$.

1986En06: E(α)=20-27 meV. Measured $T_{1/2}$ using the γ(t) method.

The level scheme is from 1999Da05, unless otherwise stated.

^{109}Sn Levels

E(level)[†]	J^{π}[‡]	$T_{1/2}$	Comments
0.0	5/2$^+$		
14.0 *10*	7/2$^+$		Additional information 1. E(level): the existence of this level is confirmed by 1999Da05, based on $\gamma\gamma$-coincidences.
544.86 *15*	(3/2)$^+$		
678.60 *10*	5/2$^+$		
925.6 *5*	3/2$^+$		
991.1 *3*	≤5/2$^+$		
1061.7 *3*	(3/2)$^+$		
1078.05 *10*	7/2$^+$		
1239.77 *12*	9/2$^+$	≤0.2[#] ns	
1257.84 *9*	11/2$^+$		
1269.85 *11*	11/2$^-$		
1343.56 *25*	7/2$^+$		
1495.8 *5*	3/2,5/2$^{(+)}$		
1614.4 *4*	≤5/2$^{(+)}$		
1649.5 *5*	(5/2,7/2$^+$)		
1677.1 *5*	9/2,11/2$^{(+)}$		
1715.1 *4*	7/2,9/2$^{(+)}$		
1883.57 *23*	11/2$^+$		
1930.25 *10*	13/2$^+$		
1992.2 *4*	9/2$^{(+)}$		
2050.0 *4*	11/2$^{(+)}$		
2071.34 *15*	13/2$^+$		
2090.65 *15*	15/2$^+$	7 ns *1*	$T_{1/2}$: from γ(t) in 1986En06. The same value is also reported in 1984Ka16, 1995Ka09 using 833γ(t) and 1244γ(t), as well as the 185.6γ(t). However, the latter γ rays is not in coincidence with the 883 and 1244γ.
2116.1 *3*	17/2$^{(+)}$		
2218.40 *13*	15/2$^+$		
2244.41 *23*	7/2$^{(+)}$		
2350.90 *23*	15/2$^-$	≤0.2[#] ns	
2380.1 *4*	13/2$^{(+)}$		
2397.5 *3*	13/2$^{(+)}$		
2442.91 *17*	13/2		

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^{106}Cd(α,nγ) 1999Da05,1976Ma09 (continued)

^{109}Sn Levels (continued)

E(level)†	Jπ‡	E(level)†	Jπ‡	$T_{1/2}$	E(level)†	Jπ‡	$T_{1/2}$
2512.0 *3*	9/2,11/2$^{(+)}$	2821.6 *5*	9/2$^{(+)}$		3316.2 *4*	19/2$^{(-)}$	≤0.2# ns
2532.14 *22*		2921.7 *6*			3346.5 *4*	21/2$^{(+)}$	≤0.2# ns
2571.2 *3*	7/2,(9/2$^+$)	3266.1 *4*	(19/2$^+$)		3474.6 *4*	21/2$^{(+)}$	≤0.2# ns
2645.3 *3*		3301.1 *3*	19/2$^{(-)}$	≤0.2# ns	3527.7 *6*	(19/2$^-$)	

† From a least-squares fit to Eγ.
‡ From 1999Da05, based on deduced γ-ray multipolarities using ce data, γ(θ), and side-feeding excitation functions of populated states.
# From 1995Ka09, using γ(t) method (see also 1984Ka16).

γ(^{109}Sn)

Eγ†	Iγ†	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	Comments
12.8	>69	14.0	7/2$^+$	0.0	5/2$^+$		Eγ: seen in γγ coinc in 1995Ka09. Iγ: From the intensity balance using a α=26.23 (1999Da05).
25.5 *5*	14 *5*	2116.1	17/2$^{(+)}$	2090.65	15/2$^+$		Iγ: from the relative intensity of the 185γ and 832γ in the 1150 +1230 gates.
146.95 *20*	17 *2*	2218.40	15/2$^+$	2071.34	13/2$^+$		
158.4 *3*	6 *2*	3474.6	21/2$^{(+)}$	3316.2	19/2$^{(-)}$		
160.45 *15*	30 *3*	2090.65	15/2$^+$	1930.25	13/2$^+$		Eγ: Others: 161.1 (1996ViZZ). Iγ: Others: 6.1 (1996ViZZ).
173.48 *20*	9 *1*	3474.6	21/2$^{(+)}$	3301.1	19/2$^{(-)}$		Eγ: Other: 174.2 (1996ViZZ). Iγ: Other: 7.4 (1996ViZZ).
185.8 *3*	18 *2*	2116.1	17/2$^{(+)}$	1930.25	13/2$^+$		
^{x}246.5	2.5						Eγ,Iγ: from 1996ViZZ.
^{x}261.6	4.9						Eγ,Iγ: from 1996ViZZ.
288.17 *10*	55 *6*	2218.40	15/2$^+$	1930.25	13/2$^+$	M1,E2	Mult.: α(K)exp=0.037 *12* (1999Da05).
^{x}389.8	6.5						Eγ,Iγ: from 1996ViZZ.
^{x}407.2 *4*	7.8 *12*						Eγ,Iγ: from 1976Ma09.
^{x}416.9 *6*	4 *1*						Eγ,Iγ: from 1976Ma09.
437.3 *4*	9 *4*	1677.1	9/2,11/2$^{(+)}$	1239.77	9/2$^+$		
446.3 *5*	7 *2*	991.1	≤5/2$^+$	544.86	(3/2)$^+$		
^{x}452.0	3.8						Eγ,Iγ: from 1996ViZZ.
544.86# *15*	86 *4*	544.86	(3/2)$^+$	0.0	5/2$^+$	M1,E2	Eγ: Others: 544.9 *2* (1976Ma09), 543.0 (1996ViZZ). Iγ: Others: 32 *3* (1976Ma09), 32.8 (1996ViZZ). Mult.: A_2/A_0=−0.17 *2*, A_4/A_0=0.032 (1981JoZX); A_2/A_0=−0.37 *16*, α(K)exp=0.0043 *14* (1999Da05); α(K)exp=0.0048 *9* (1976Ma09).
554.67 *25*	16 *2*	2645.3		2090.65	15/2$^+$		
660.43 *10*	46 *6*	1930.25	13/2$^+$	1269.85	11/2$^-$		
664.58 *10*	313 *15*	678.60	5/2$^+$	14.0	7/2$^+$	M1,E2	Eγ: Others: 664.5 *4* (1976Ma09), 664.1 (1996ViZZ). Iγ: Others: 152 *15* (1976Ma09), 32.8 (1996ViZZ). Mult.: A_2/A_0=−0.33 *2*, A_4/A_0=0.05 *2* (1981JoZX); A_2/A_0=−0.50 *12*, α(K)exp=0.0025 *8* (1999Da05); α(K)exp=0.0030 *6* (1976Ma09).
672.45 *10*	80 *6*	1930.25	13/2$^+$	1257.84	11/2$^+$	M1,E2	Eγ: Others: 673.0 *4* (1976Ma09), 672.9

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^{106}Cd(α,nγ) 1999Da05,1976Ma09 (continued)

γ(^{109}Sn) (continued)

E_γ [†]	I_γ [†]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	Comments
							(1996ViZZ). I_γ: Others: 38 *4* (1976Ma09), 31.9 (1996ViZZ). Mult.: α(K)exp=0.0040 *16* (1999Da05).
678.73 *25*	85 *9*	678.60	5/2+	0.0	5/2+		E_γ: Others: 678.7 *2* (1976Ma09), 678.7 (1996ViZZ). I_γ: Others: 34 *3* (1976Ma09), 8.2 (1996ViZZ). Mult.: A_2/A_0=0.05 *3*, A_4/A_0=0.01*3* (1981JoZX).
690.42 *20*	101 *6*	1930.25	13/2+	1239.77	9/2+	(E2)	E_γ: Others 690.1 (1996ViZZ). I_γ: Other: 7.4 (1996ViZZ). Mult.: α(K)exp=0.0040 *14* (1999Da05).
734.2 *4*	42 *4*	1992.2	9/2(+)	1257.84	11/2+		
752.6 *5*	9 *3*	1992.2	9/2(+)	1239.77	9/2+		
805.52 *20*	91 *6*	1883.57	11/2+	1078.05	7/2+	(E2)	E_γ: Others: 805.1 (1976Ma09), 804.8 (1996ViZZ). I_γ: Others: 26 (1976Ma09), 35 (1996ViZZ). Mult.: α(K)exp=0.0018 *6* (1999Da05), α(K)exp=0.0022 *4* (1976Ma09).
813.44 *15*	93 *6*	2071.34	13/2+	1257.84	11/2+	M1,E2	E_γ: Others: 813.4 *2* (1976Ma09), 812.9 (1996ViZZ). I_γ: Others: 25 *3* (1976Ma09), 19.5 (1996ViZZ). Mult.: α(K)exp=0.0026 *8*.
831.1 *5*	22 *8*	2921.7		2090.65	15/2+		
832.71 *20*	298 *21*	2090.65	15/2+	1257.84	11/2+	E2	E_γ: Others: 832.7 (1976Ma09), 832.2 (1996ViZZ) ; composite γ. I_γ: Others: 63 (1976Ma09), 57.0 (1996ViZZ). Mult.: α(K)exp=0.0018 *6* (1999Da05), α(K)exp=0.0017 *3* (1976Ma09).
[x]887.7	18 *3*						E_γ,I_γ: from 1976Ma09, also seen in 1996ViZZ.
[x]891.3	4.6						E_γ,I_γ: from 1996ViZZ.
925.6[#] *5*	70 *8*	925.6	3/2+	0.0	5/2+	M1,E2	E_γ: Others: 925.6 (1976Ma09), 925.3 (1996ViZZ). I_γ: Others: 33 (1976Ma09), 13.1 (1996ViZZ). Mult.: A_2/A_0=−0.03 *1*, A_4/A_0=0.01 *1* (1981JoZX) α(K)exp=0.0016 *6* (1999Da05).
935.8 *3*	14 *3*	1614.4	≤5/2(+)	678.60	5/2+		
[x]945.9	3.3						E_γ,I_γ: from 1996ViZZ.
950.25 *15*	19 *4*	3301.1	19/2(−)	2350.90	15/2−		E_γ: Other: 949.8 (1996ViZZ). I_γ: Other: 31.8 (1996ViZZ).
960.5 *4*	32 *3*	2218.40	15/2+	1257.84	11/2+	(E2)	E_γ: Other: 961.0 (1996ViZZ). I_γ: Other: 5.6 (1996ViZZ). Mult.: α(K)exp=0.0013 *5* (1999Da05).
965.2 *3*	16 *3*	3316.2	19/2(−)	2350.90	15/2−		E_γ: Other: 964.8 (1996ViZZ). I_γ: Other: 5.4 (1996ViZZ).
971.9 *3*	27 *6*	2050.0	11/2(+)	1078.05	7/2+		
986.8 *3*	18 *5*	2244.41	7/2(+)	1257.84	11/2+		
991.1[#] *3*	37 *5*	991.1	≤5/2+	0.0	5/2+	M1,E2	Mult.: A_2/A_0=−0.20 *2*, A_4/A_0=0.02 *1* (1981JoZX), α(K)exp=0.0010 *4* (1999Da05).
1004.4 *3*	26 *5*	2244.41	7/2(+)	1239.77	9/2+		
1036.5 *3*	48 *4*	1715.1	7/2,9/2(+)	678.60	5/2+		
1061.7[#] *3*	53 *4*	1061.7	(3/2)+	0.0	5/2+	M1,E2	E_γ: Others: 1062.8 (1976Ma09), 1062.8 (1996ViZZ); composite γ. I_γ: Others: 20 (1976Ma09), 13 (1996ViZZ). Mult.: A_2/A_0=−0.36 *3*, A_4/A_0=0.10 *3* (1981JoZX); A_2/A_0=−0.22 *20*, α(K)exp=0.0011 *4* (1999Da05).
1064.0 *3*	58 *4*	1078.05	7/2+	14.0	7/2+	M1,E2	Mult.: α(K)exp=0.0009 *3* (1999Da05).
1078.05 *10*	258 *16*	1078.05	7/2+	0.0	5/2+	M1,E2	E_γ: Others: 1078.7 *10* (1976Ma09), 1080.7 (1996ViZZ); composite γ. I_γ: Others: 62 (1976Ma09), 63.9 (1996ViZZ). Mult.: A_2/A_0=−0.82 *5*, A_4/A_0=0.22 *5* (1981JoZX), α(K)exp=0.0010 *3* (1999Da05).

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^{106}Cd(α,nγ) 1999Da05,1976Ma09 (continued)

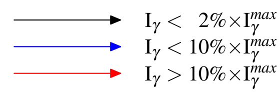
γ(^{109}Sn) (continued)

E_γ †	I_γ †	E_i(level)	J^π_i	E_f	J^π_f	Mult. ‡	Comments
1081.04 *20*	166 *12*	2350.90	15/2⁻	1269.85	11/2⁻	(E2)	E_γ: Others: 1081.4 *15* (1976Ma09), 1080.7 (1996ViZZ) ; composite γ. I_γ: Others: 62 (1976Ma09), 63.9 (1996ViZZ). Mult.: α(K)exp=0.0009 *3*.
1104.6 *4*	20 *6*	1649.5	(5/2,7/2⁺)	544.86	(3/2)⁺		
1122.3 *3*	74 *4*	2380.1	13/2$^{(+)}$	1257.84	11/2⁺		
ˣ1135.1	3.7						E_γ,I_γ: from 1996ViZZ.
1150.0 *3*	6 *2*	3266.1	(19/2⁺)	2116.1	17/2$^{(+)}$		
1157.72 *25*	34 *7*	2397.5	13/2$^{(+)}$	1239.77	9/2⁺		
1173.08 *20*	20 *3*	2442.91	13/2	1269.85	11/2⁻		
1176.8 *5*	8 *3*	3527.7	(19/2⁻)	2350.90	15/2⁻		E_γ: Other: 1176.3 (1996ViZZ). I_γ: Other: 1.6 (1996ViZZ).
1185.03 *20*	26 *3*	2442.91	13/2	1257.84	11/2⁺		E_γ: Other: 1184.8 (1996ViZZ). I_γ: Other: 11.0 (1996ViZZ).
1225.8 *3*	39 *4*	1239.77	9/2⁺	14.0	7/2⁺		
1230.4 *3*	27 *14*	3346.5	21/2$^{(+)}$	2116.1	17/2$^{(+)}$		E_γ: Others: 1230 (1976Ma09), 1229.8 (1996ViZZ). I_γ: Other: 14.8 (1996ViZZ).
1239.67 *15*	409 *18*	1239.77	9/2⁺	0.0	5/2⁺	E2	E_γ: Other: 1239.5 (1996ViZZ). I_γ: Other: 55.8 (1996ViZZ). Mult.: A_2/A_0=0.24 *3*, A_4/A_0=−0.19 *3* (1981JoZX), α(K)exp=0.0009 *3* (1999Da05).
1243.83 *10*	1000 *34*	1257.84	11/2⁺	14.0	7/2⁺	(E2)	E_γ: Others: 1243.80 *15* (1976Ma09), 1243.5 (1996ViZZ). I_γ: Others: 237 *60* (1976Ma09), 185 (1996ViZZ). Mult.: A_2/A_0=0.25 *3*, A_4/A_0=−0.18 *3* (1981JoZX), α(K)exp=0.0007 *2* (1999Da05),α(K)exp=0.0006 *2* (1976Ma09).
1255.93 *15*	398 *17*	1269.85	11/2⁻	14.0	7/2⁺	M2(+E3)	E_γ: Others: 1255.8 *2* (1976Ma09), 1255.8 (1996ViZZ). I_γ: Others: 100 (1976Ma09), 100 (1996ViZZ). Mult.: A_2/A_0=0.15 *3*, A_4/A_0=−0.20 *3* (1981JoZX), α(K)exp=0.0019 *6* (1999Da05), α(K)exp=0.0016 *3* (1976Ma09).
1272.19 *25*	34 *6*	2512.0	9/2,11/2$^{(+)}$	1239.77	9/2⁺		
1274.29 *20*	49 *12*	2532.14		1257.84	11/2⁺		
1313.32 *25*	31 *8*	2571.2	7/2,(9/2⁺)	1257.84	11/2⁺		
1343.55 *25*	93 *5*	1343.56	7/2⁺	0.0	5/2⁺	M1,E2	E_γ: Others: 1343.7 *2* (1976Ma09), 1343.7 (1996ViZZ). I_γ: Others: 31 *5* (1976Ma09), 10.7 (1996ViZZ). Mult.: A_2/A_0=−0.23 *3*, A_4/A_0=−0.02 *3* (1981JoZX), α(K)exp=0.0007 *2* (1999Da05), α(K)exp=0.00060 *13*(1976Ma09).
1495.8# *5*	16 *4*	1495.8	3/2,5/2$^{(+)}$	0.0	5/2⁺		
1563.7 *5*	14 *3*	2821.6	9/2$^{(+)}$	1257.84	11/2⁺		

† From 1999Da05, unless otherwise stated.
‡ From γ(θ) and conversion coefficients.
# Feeds the ground state or the 14.0 level (1999Da05).
ˣ γ ray not placed in level scheme.

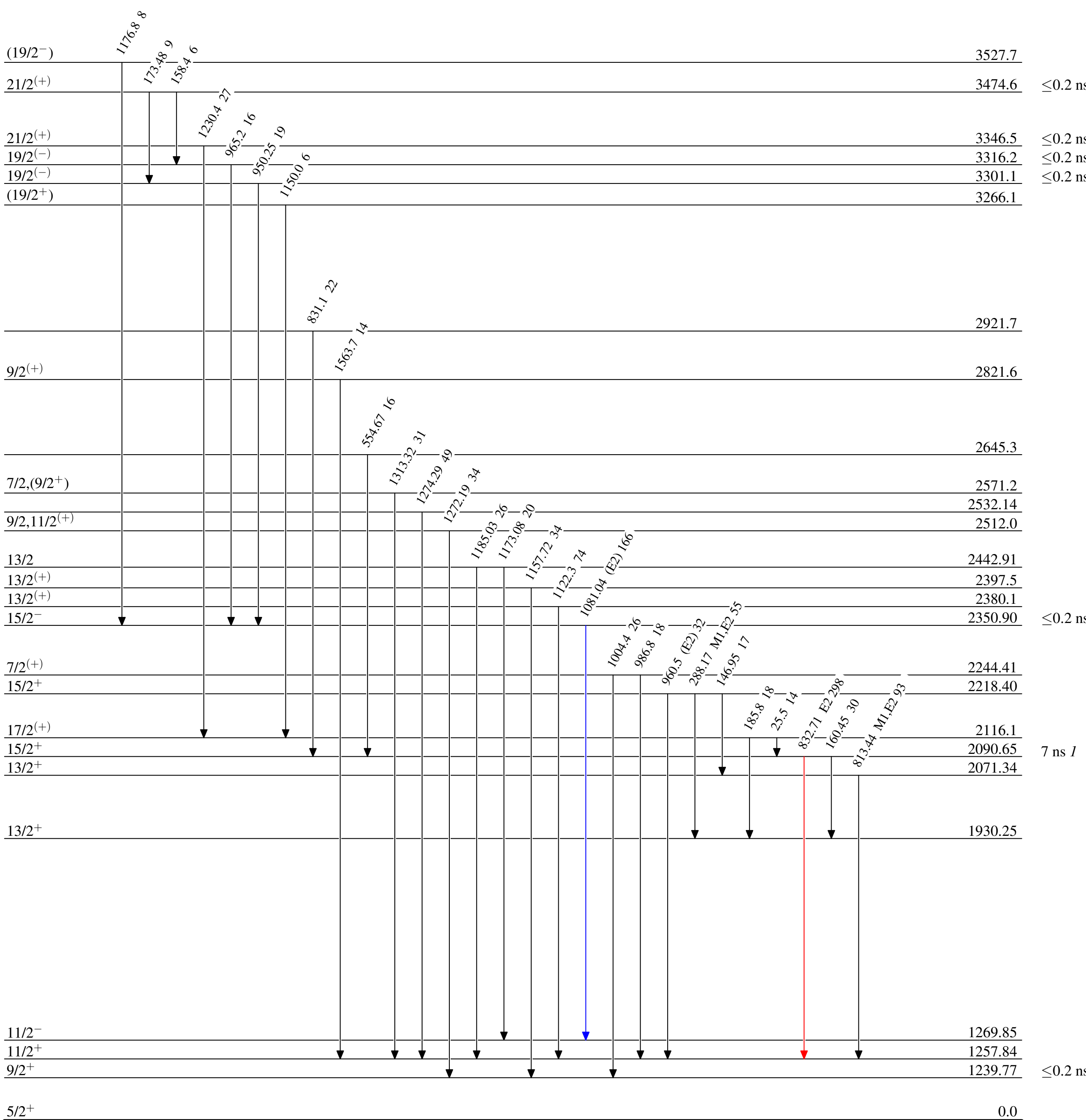
^{106}Cd(α,nγ) 1999Da05,1976Ma09

Legend



Level Scheme

Intensities: Relative I_γ



$^{109}_{50}Sn_{59}$

$^{106}Cd(\alpha,n\gamma)$ 1999Da05,1976Ma09

Level Scheme (continued)

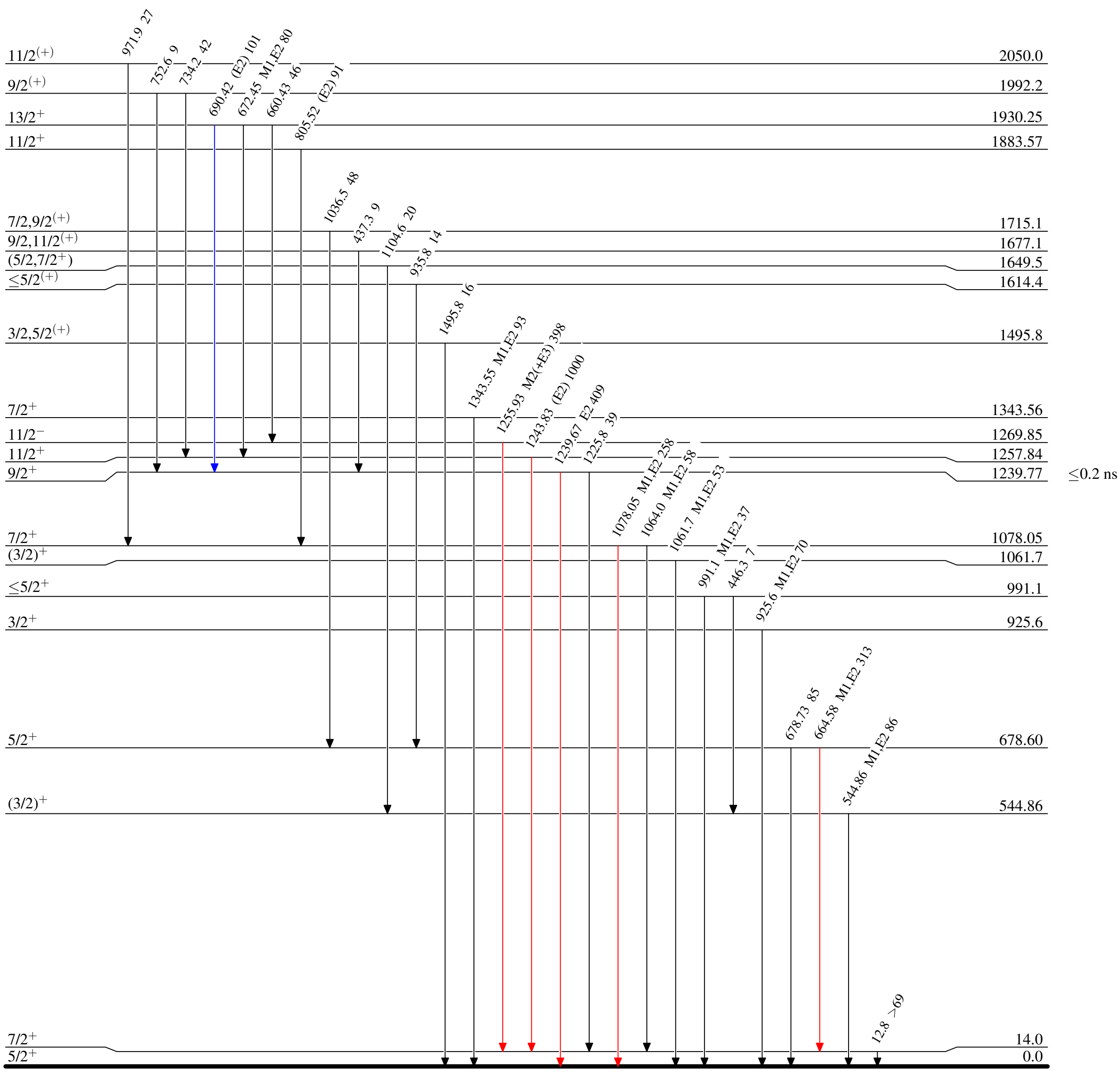
Intensities: Relative I_γ

Legend

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

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

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



$^{109}_{50}Sn_{59}$