^{98}Mo(^{16}O,4nγ) 2005Wo03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	G. Gürdal and F. G. Kondev	NDS 113, 1315 (2012)	1-Aug-2011

Beam: E(^{16}O)=60, 70, 75 and 80 MeV. Target: 3-5.6 mg/cm^2 enriched ^{98}Mo target. The experiment was performed at the Heavy Ion Laboratory cyclotron of the Warsaw University. γ-rays were detected using OSIRIS-II array consisting of 10 Compton-suppressed HPGe detectors combined with a 48-element BGO sum-energy and multiplicity filter. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$, $\gamma\gamma(\theta)$.

Other: 2003Wo15, 2003Wo16, 1988Ha20, 1987HaZE, 1986KaZS, 1986Ka25, 1986KaZY, 1985HaZD.

^{110}Sn Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0[@]	0$^+$		
1211.8[@] *4*	2$^+$		
2057.8 *6*	(0,2)		
2196.8[@] *5*	4$^+$		
2455.4 *6*	(4)		
2458.1[c] *5*	3$^-$		configuration: possible $\nu(h_{11/2},d_{5/2})$ or octupole structure.
2477.3[@] *5*	6$^+$		
2741.9 *9*	(0,1,2,3)		
2752.6 *5*	6$^+$		
2800.1[&] *5*	(6$^+$)		
2821.4 *7*	(3,4)		
2963.5 *5*	5$^{(-)}$		
3210.6 *6*	(3,5)		
3248.9 *9*	6$^{(-)}$		
3320.8[a] *5*	(6$^+$)		
3334.8 *6*	(6$^+$)		
3354.5[c] *5*	(5$^-$)		
3416.5 *5*	6$^{(-)}$		
3686.7[c] *5*	7$^-$		
3764.9[c] *5*	8$^-$	1.16 ns *10*	
3812.4[@] *5*	(8$^+$)		configuration: possible $\nu(g^2_{7/2},d^2_{5/2})$.
3932.3[c] *5*	9$^-$	121 ps *19*	configuration: possible $\nu(h_{11/2},g_{7/2})$.
3991.3[&] *6*	(8$^+$)		Member of $\nu[g^2_{7/2}h^2_{11/2}]$ or $\nu[d^2_{5/2}h^2_{11/2}]$ multiplets.
4002.7 *5*	(7$^+$)		
4137.5[a] *5*	(8$^+$)		
4280.2 *8*	(8$^+$)		configuration: possible member of $\nu(g^2_{7/2},h^2_{11/2})$ or $\nu(d^2_{5/2},h^2_{11/2})$ multiplets.
4314.6 *6*	(8$^+$)		configuration: possible member of $\nu(h^2_{11/2})$ multiplet.
4779.6[c] *5*	9$^-$		
4880.7[a] *5*	(10$^+$)		
4894.3[c] *5*	10$^-$	<21 ps	
5016.5[@] *5*	(10$^+$)		configuration: possible $\nu(g^2_{7/2}d^2_{5/2})$.
5107.0[c] *5*	(11$^-$)	52 ps *16*	
5218.9[&] *6*	(10$^+$)		configuration: possible competition between the $\nu(g^2_{7/2},d^2_{5/2})$ and $\nu(h^2_{11/2})$ multiplets.
5227.9[b] *5*	10$^+$		
5330.1[c] *5*	(11$^-$)		
5730.4[a] *6*	(12$^+$)		
5938.3[d] *6*	(9)		
6036.0[b] *5*	(12$^+$)		
6065.4[d] *6*	(10)		

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^{98}Mo(^{16}O,4nγ) 2005Wo03 (continued)

^{110}Sn Levels (continued)

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
6206.0[d] 5	(11)	6597.9[a] 6	(14+)	7540.7[a] 6	(16+)	10501.5?[b] 6	(22+)
6353.7[d] 6	(12)	6613.2?[d] 8	(13)	7586.8[b] 5	(16+)	11516.0?[b] 6	(24+)
6370.9[c] 11	(12)	6776.9[b] 5	(14+)	8490.8[b] 6	(18+)		
6545.2[c] 5	(13)	6974.4?[d] 13	(14)	9494.1[b] 6	(20+)		

† From least-squares fit to Eγ's.
‡ From 2005Wo03, based on deduced transition multipolarities.
# From recoil-distance method in 1986Ka25.
@ Band(A): g.s. band.
& Band(B): band based on the 2800.1 keV level.
a Band(C): band based on the 3320.8 keV level.
b Band(D): band based on the 5227.9 keV level.
c Band(E): band based on the 2458.1 keV level.
d Band(F): band based on the 5938.3 keV level.

γ(^{110}Sn)

Eγ‡	Iγ‡	Ei(level)	Jiπ	Ef	Jfπ	Mult.#	δ	α†	Comments
78.3 1	13.8 5	3764.9	8−	3686.7	7−	M1+E2		2.5 14	DCO=1.3 3; A2=+0.07 5; A4=+0.06 3 α(K)=1.7 8; α(L)=0.6 5; α(M)=0.12 10; α(N+..)=0.022 17 α(N)=0.021 17; α(O)=0.0009 5
127.0 1	0.3 2	6065.4	(10)	5938.3	(9)				
140.2 2	0.2 1	6206.0	(11)	6065.4	(10)				
147.7 3	0.3 1	6353.7	(12)	6206.0	(11)				
163.9 1	0.9 1	2963.5	5(−)	2800.1	(6+)				
167.5 1	12.7 4	3932.3	9−	3764.9	8−	M1+E2	0.06 3	0.1345 20	DCO=1.13 23 α(K)=0.1163 17; α(L)=0.01472 24; α(M)=0.00289 5; α(N+..)=0.000590 10 α(N)=0.000543 9; α(O)=4.70×10−5 7 B(M1)(W.u.)=0.034 6; B(E2)(W.u.)=4 4 δ: From 1986Ka25.
211.0 2	0.8	5227.9	10+	5016.5	(10+)	M1+E2			DCO=1.07 15; A2=−0.15 1; A4=−0.20 22
259.6[a] 5	0.3 1	6613.2?	(13)	6353.7	(12)				
261.5 2	1.9 2	2458.1	3−	2196.8	4+				
270.8 2	1.8 1	3686.7	7−	3416.5	6(−)				
275.3 4	10.3 3	2752.6	6+	2477.3	6+	M1+E2		0.041 6	DCO=1.18 25; A2=+0.35 9; A4=−0.01 2 α(K)=0.035 5; α(L)=0.0050 12; α(M)=0.00099 25; α(N+..)=0.00020 5 α(N)=0.00018 5; α(O)=1.40×10−5 17
280.2 3	57 2	2477.3	6+	2196.8	4+	E2		0.0444	DCO=1.20 13; A2=+0.11 1; A4=−0.14 9 α(K)=0.0372 6; α(L)=0.00584 9; α(M)=0.001160 17; α(N+..)=0.000227 4 α(N)=0.000213 3; α(O)=1.473×10−5 22 B(E2)(W.u.)=1.79 13
285.4 7	2.0 3	3248.9	6(−)	2963.5	5(−)	M1+E2			DCO=1.03 17; A2=−0.13 19; A4=+0.04 7
311.7 2	1.1 1	4314.6	(8+)	4002.7	(7+)	M1+E2		0.029 3	A2=+0.25 21; A4=+0.02 2

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^{98}Mo(^{16}O,4nγ) 2005Wo03 (continued)

γ(^{110}Sn) (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[†]	Comments
								α(K)=0.0244 *20*; α(L)=0.0034 *7*; α(M)=0.00067 *13*; α(N+..)=0.000134 *23* α(N)=0.000124 *22*; α(O)=9.7×10^{-6} *8*
318.0 *8*	0.1 *1*	6353.7	(12)	6036.0	(12$^+$)			E_γ: 318.0(8.0) in table 2 of 2005Wo03 seems a misprint.
323.1 *1*	2.8 *2*	2800.1	(6$^+$)	2477.3	6$^+$			
332.0[a] *1*	0.2 *1*	3686.7	7$^-$	3354.5	(5$^-$)			
334.5 *3*	0.5 *1*	5227.9	10$^+$	4894.3	10$^-$			
361.2[a] *10*	0.1 *1*	6974.4?	(14)	6613.2?	(13)			
382.7 *4*	0.5 *1*	4314.6	(8$^+$)	3932.3	9$^-$			
437.2[a] *3*	0.7 *1*	3686.7	7$^-$	3248.9	6$^{(-)}$			
447.7 *8*	3.4 *1*	5227.9	10$^+$	4779.6	9$^-$	E1		DCO=0.55 *10*; A_2=−0.35 *16*; A_4=+0.001 *3*
453.4 *1*	1.4 *3*	3416.5	6$^{(-)}$	2963.5	5$^{(-)}$	M1+E2		DCO=1.04 *16*; A_2=+0.36 *20*; A_4=+0.06 *9*
486.0 *1*	1.3 *1*	2963.5	5$^{(-)}$	2477.3	6$^+$	E1	0.00255 *4*	DCO=0.56 *22*; A_2=−0.44 *14*; A_4=+0.01 *2* α=0.00255 *4*; α(K)=0.00222 *4*; α(L)=0.000266 *4*; α(M)=5.18×10^{-5} *8*; α(N+..)=1.053×10^{-5} *15* α(N)=9.71×10^{-6} *14*; α(O)=8.22×10^{-7} *12*
505.8 *2*	1.1 *1*	2963.5	5$^{(-)}$	2458.1	3$^-$			
602.1 *3*	1.5 *1*	3354.5	(5$^-$)	2752.6	6$^+$			
603.4 *1*	5.9 *5*	2800.1	(6$^+$)	2196.8	4$^+$			
604.5 *6*	≤0.1	5938.3	(9)	5330.1	(11$^-$)			
624.0 *9*	0.8 *4*	2821.4	(3,4)	2196.8	4$^+$			
740.9 *1*	9.7 *4*	6776.9	(14$^+$)	6036.0	(12$^+$)	E2	0.00260 *4*	DCO=1.02 *10*; A_2=+0.29 *9*; A_4=−0.06 *7* α=0.00260 *4*; α(K)=0.00224 *4*; α(L)=0.000285 *4*; α(M)=5.58×10^{-5} *8*; α(N+..)=1.131×10^{-5} *16* α(N)=1.044×10^{-5} *15*; α(O)=8.67×10^{-7} *13*
743.2[&] *1*	3.2 *3*	4880.7	(10$^+$)	4137.5	(8$^+$)			
808.2 *1*	9.8 *6*	6036.0	(12$^+$)	5227.9	10$^+$	(E2)	0.00210 *3*	α=0.00210 *3*; α(K)=0.00182 *3*; α(L)=0.000229 *4*; α(M)=4.47×10^{-5} *7*; α(N+..)=9.08×10^{-6} *13* α(N)=8.38×10^{-6} *12*; α(O)=7.02×10^{-7} *10* DCO=1.11 *13*, A_2=+0.43 *11*, A_4=−0.01 *1* for 808+810.
809.9 *1*	10.4 *5*	7586.8	(16$^+$)	6776.9	(14$^+$)	(E2)	0.00209 *3*	α=0.00209 *3*; α(K)=0.00181 *3*; α(L)=0.000227 *4*; α(M)=4.45×10^{-5} *7*; α(N+..)=9.03×10^{-6} *13* α(N)=8.33×10^{-6} *12*; α(O)=6.98×10^{-7} *10* DCO=1.11 *13*, A_2=+0.43 *11*, A_4=−0.01 *1* for 808+810.
816.7[&] *1*	4.4 *3*	4137.5	(8$^+$)	3320.8	(6$^+$)			
816.9 *4*	0.8 *1*	6036.0	(12$^+$)	5218.9	(10$^+$)			
843.5 *1*	4.7 *4*	3320.8	(6$^+$)	2477.3	6$^+$	(M1)		DCO=0.53 *13*
846.0 *4*	4.6 *1*	2057.8	(0,2)	1211.8	2$^+$			
848.5[a] *9*	0.2 *1*	4779.6	9$^-$	3932.3	9$^-$			
849.7[&] *2*	1.4 *2*	5730.4	(12$^+$)	4880.7	(10$^+$)			
857.5 *4*	1.2 *3*	3334.8	(6$^+$)	2477.3	6$^+$			
865.0[&] *5*	1.2 *2*	3320.8	(6$^+$)	2455.4	(4)			
867.5[&] *2*	1.3 *1*	6597.9	(14$^+$)	5730.4	(12$^+$)			
876.0 *4*	0.8 *1*	6206.0	(11)	5330.1	(11$^-$)			
896.2 *3*	2.3 *3*	3354.5	(5$^-$)	2458.1	3$^-$			
903.9 *1*	4.2 *1*	8490.8	(18$^+$)	7586.8	(16$^+$)	E2		Mult.: From γ-ray decay pattern; A_2=+0.17 *17* \$ A_4=−0.10 *16*.
912.8 *7*	0.3	5227.9	10$^+$	4314.6	(8$^+$)			

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^{98}Mo(^{16}O,4nγ) 2005Wo03 (continued)

γ(^{110}Sn) (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[†]	Comments
933.9 *2*	1.7 *1*	3686.7	7^-	2752.6	6^+	(E1)	0.000623 *9*	A_2=−0.22 *9*; A_4=+0.01 *1* α=0.000623 *9*; α(K)=0.000544 *8*; α(L)=6.40×10^{-5} *9*; α(M)=1.244×10^{-5} *18*; α(N+..)=2.54×10^{-6} *4* α(N)=2.34×10^{-6} *4*; α(O)=2.03×10^{-7} *3*
938.3 *3*	1.8 *3*	3416.5	$6^{(-)}$	2477.3	6^+			
942.8[&] *2*	1.6 *1*	7540.7	(16^+)	6597.9	(14^+)			
945.4 *5*	0.8 *2*	4280.2	(8^+)	3334.8	(6^+)			
967.4 *4*	0.3 *1*	4779.6	9^-	3812.4	(8^+)			
978.2 *1*	1.3 *4*	6206.0	(11)	5227.9	10^+			
984.6 *4*	83 *3*	2196.8	4^+	1211.8	2^+	E2	0.001332 *19*	DCO=0.96 *8*; A_2=+0.29 *7*; A_4=−0.01 *1* α=0.001332 *19*; α(K)=0.001156 *17*; α(L)=0.0001422 *20*; α(M)=2.78×10^{-5} *4*; α(N+..)=5.66×10^{-6} α(N)=5.21×10^{-6} *8*; α(O)=4.44×10^{-7} *7*
1003.3 *1*	2.7 *2*	9494.1	(20^+)	8490.8	(18^+)			
1007.6[@a] *2*	1.3 *1*	10501.5?	(22^+)	9494.1	(20^+)			
1012.3 *1*	5.2 *3*	3764.9	8^-	2752.6	6^+	(M2)	0.00370 *6*	DCO=0.90 *15*; A_2=+0.30 *12*; A_4=−0.06 *7* α=0.00370 *6*; α(K)=0.00320 *5*; α(L)=0.000398 *6*; α(M)=7.81×10^{-5} *11*; α(N+..)=1.601×10^{-5} *23* α(N)=1.472×10^{-5} *21*; α(O)=1.292×10^{-6} *18*
1013.8 *3*	4.0 *6*	3210.6	(3,5)	2196.8	4^+			For J=3, A_2=+0.15 *20*, A_4=+0.003 *7*; for J=5 A_2=+0.15 *20*, A4=+0.01 *2*.
1014.5[@a] *2*	1.3 *1*	11516.0?	(24^+)	10501.5?	(22^+)			
1019.1 *9*	0.4 *1*	6036.0	(12^+)	5016.5	(10^+)			
1041.0[a] *10*	0.3 *1*	6370.9	(12)	5330.1	(11^-)			
1092.9 *1*	3.6 *3*	4779.6	9^-	3686.7	7^-	E2		A_2=+0.24 *11*; A_4=−0.09 *5*
1099.0 *1*	2.5 *1*	6206.0	(11)	5107.0	(11^-)	D		DCO=0.90 *15*
1129.5 *1*	6.1 *3*	4894.3	10^-	3764.9	8^-	E2		DCO=0.64 *14*; A_2=+0.26 *11*; A_4=−0.08 *7*
1175.3 *5*	8.9 *3*	5107.0	(11^-)	3932.3	9^-	E2	0.000912 *13*	DCO=0.94 *18*; A_2=+0.33 *8*; A_4=−0.05 *2* α=0.000912 *13*; α(K)=0.000790 *11*; α(L)=9.57×10^{-5} *14*; α(M)=1.87×10^{-5} *3*; α(N+..)=8.05×10^{-6} *12* α(N)=3.51×10^{-6} *5*; α(O)=3.02×10^{-7} *5*; α(IPF)=4.24×10^{-6} *8* B(E2)(W.u.)=0.16 *5*
1191.1 *3*	1.9 *3*	3991.3	(8^+)	2800.1	(6^+)			
1203.7 *2*	2.1 *2*	5016.5	(10^+)	3812.4	(8^+)			
1208.8 *5*	31 *1*	3686.7	7^-	2477.3	6^+	E1	0.000424 *6*	DCO=0.72 *09*; A_2=−0.29 *9*; A_4=+0.01 *1* α=0.000424 *6*; α(K)=0.000337 *5*; α(L)=3.93×10^{-5} *6*; α(M)=7.64×10^{-6} *11*; α(N+..)=4.04×10^{-5} *7* α(N)=1.438×10^{-6} *21*; α(O)=1.252×10^{-7} *18*; α(IPF)=3.89×10^{-5} *6*
1211.8 *4*	100 *8*	1211.8	2^+	0.0	0^+	E2	0.000860 *12*	DCO=1.00 *9*; A_2=+0.20 *7*; A_4=−0.07 *4* α=0.000860 *12*; α(K)=0.000741 *11*; α(L)=8.95×10^{-5} *13*; α(M)=1.747×10^{-5} *25*; α(N+..)=1.200×10^{-5} α(N)=3.28×10^{-6} *5*; α(O)=2.83×10^{-7} *4*; α(IPF)=8.44×10^{-6} *13*
1215.3[a] *1*	1.4 *2*	6545.2	(13)	5330.1	(11^-)			

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^{98}Mo(^{16}O,4nγ) 2005Wo03 (continued)

γ(^{110}Sn) (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[†]	Comments
1219.3 *2*	6.0 *5*	3416.5	$6^{(-)}$	2196.8	4^+			
1227.4 *4*	0.7 *1*	5218.9	(10^+)	3991.3	(8^+)			
1242.5 *8*	1.7 *7*	2455.4	(4)	1211.8	2^+			
1246.4 *2*	4.8 *6*	2458.1	3^-	1211.8	2^+	E1		A_2=−0.16 *5*; A_4=+0.01 *2*
1249.9 *2*	2.1 *2*	4002.7	(7^+)	2752.6	6^+	M1+E2	0.00089 *8*	DCO=0.8 *3*; A_2=+0.5 *4*; A_4=+0.13 *10* α=0.00089 *8*; α(K)=0.00076 *7*; α(L)=9.1×10^{-5} *8*; α(M)=1.78×10^{-5} *15*; α(N+..)=1.69×10^{-5} *6* α(N)=3.4×10^{-6} *3*; α(O)=2.9×10^{-7} *3*; α(IPF)=1.33×10^{-5} *9*
1287.5 *5*	0.9 *1*	3764.9	8^-	2477.3	6^+			
1295.6 *1*	1.9 *1*	5227.9	10^+	3932.3	9^-	E1		DCO=0.60 *18*; A_2=+0.4 *4*; A_4=+0.16 *18*
1335.0 *1*	2.3 *2*	3812.4	(8^+)	2477.3	6^+	(E2)	0.000728 *11*	A_2=+0.36 *15*; A_4=−0.03 *4* α=0.000728 *11*; α(K)=0.000608 *9*; α(L)=7.29×10^{-5} *11*; α(M)=1.422×10^{-5} *20*; α(N+..)=3.37×10^{-5} *5* α(N)=2.68×10^{-6} *4*; α(O)=2.32×10^{-7} *4*; α(IPF)=3.08×10^{-5} *5*
1397.6 *1*	2.7 *1*	5330.1	(11^-)	3932.3	9^-	E2	0.000684 *10*	DCO=0.9 *3*; A_2=+0.19 *8*; A_4=−0.11 *6* α=0.000684 *10*; α(K)=0.000554 *8*; α(L)=6.64×10^{-5} *10*; α(M)=1.293×10^{-5} *19*; α(N+..)=5.03×10^{-5} *7* α(N)=2.43×10^{-6} *4*; α(O)=2.11×10^{-7} *3*; α(IPF)=4.77×10^{-5} *7*
1530.1 *8*	1.7 *5*	2741.9	(0,1,2,3)	1211.8	2^+			
1609.8 *6*	2.3 *6*	2821.4	(3,4)	1211.8	2^+			For J=3 A_2=+0.10 *10*, A_4=+0.01 *1*; for J=4 A_2=+0.06 *6*, A_4=−0.15 *15*.

† Additional information 1.
‡ From 2005Wo03 (Iγ(1211.8)=100).
# Deduced from DCO ratios,$\gamma(\theta)$ and γ-decay pattern. DCO ratio was defined as DCO=I_γ(E_γ; 38°+25°)/I_γ(E_γ; 90°+87°); DCO is around 0.6 for ΔJ=1, dipole transitions and about 1.0 for stretched ΔJ=2, quadrupole or ΔI=0, dipole transitions. Angular distribution data were normalized to transitions with isotropic angular distributions of γ rays from long-lived radioactive nuclide.
@ Ordering of the 1007.6-1014.5 cascade is arbitrary.
& ΔJ=2 favored from the apparent cascade assignment, but direct information concerning the multipolarity is not available, because the γ-ray peak is located on the tail of a closely spaced strong peak.
a Placement of transition in the level scheme is uncertain.

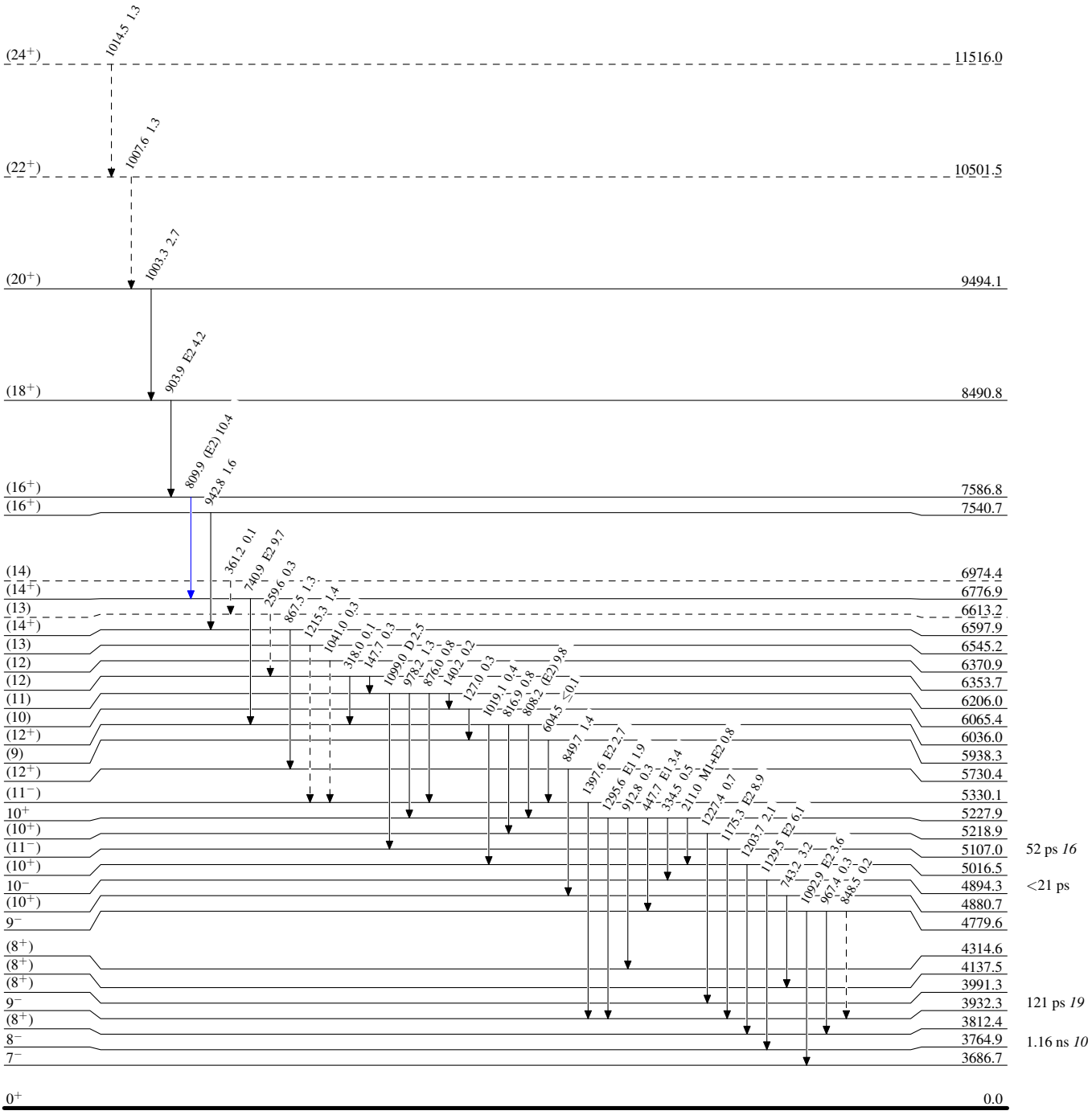
^{98}Mo(^{16}O,4nγ) 2005Wo03

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)



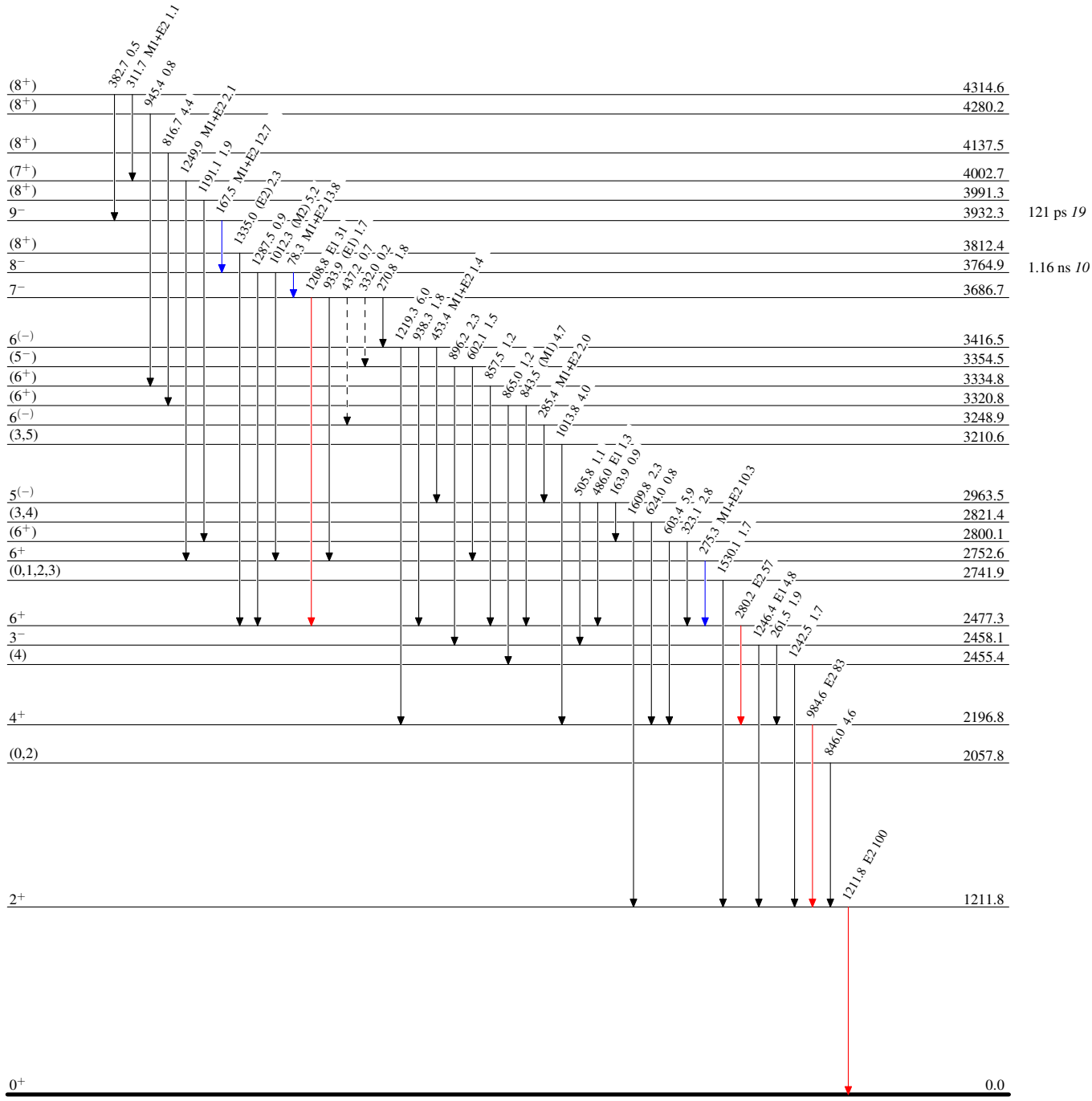
$^{110}_{50}Sn_{60}$

^{98}Mo(^{16}O,4nγ) 2005Wo03

Level Scheme (continued)

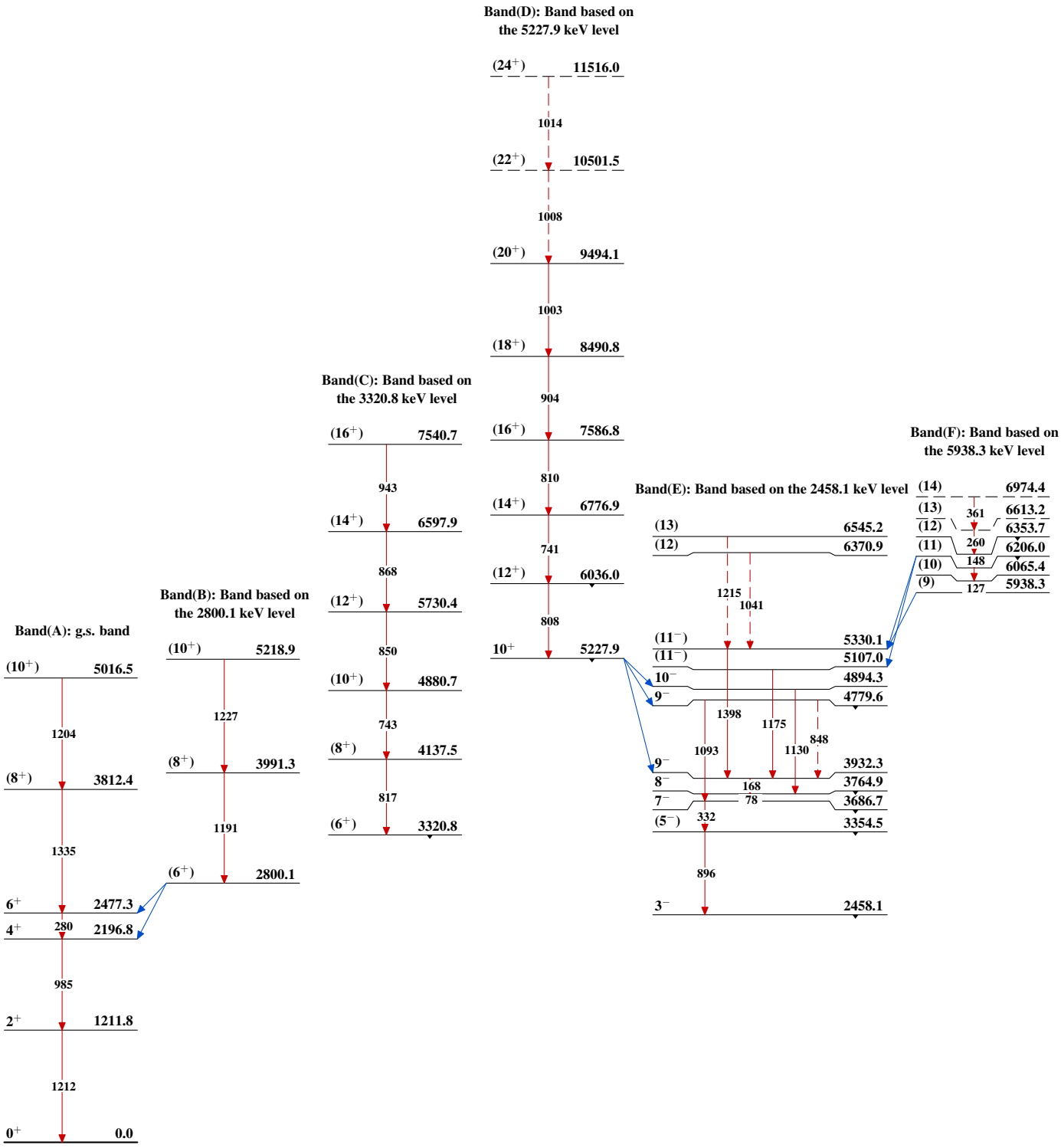
Intensities: Relative I_γ

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



$^{110}_{50}Sn_{60}$

$^{98}Mo(^{16}O,4n\gamma)$ 2005Wo03



$^{110}_{50}Sn_{60}$