^{99}Nb β^- decay (15.0 s) 1997Lh01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 145, 25 (2017)	1-Jul-2017

Parent: ^{99}Nb: E=0.0; J$^\pi$=9/2$^+$; $T_{1/2}$=15.0 s *2*; Q(β^-)=3635 *12*; %β^- decay=100.0

^{99}Nb was produced by fission of a natural uranium target induced by 25-MeV protons. ^{99}Nb was mass separated on-line using the IGISOL separator. Measured Eγ, Iγ, in singles, $\gamma\gamma$ coin, $\beta\gamma$ coin. Detectors: germanium for γ rays, plastic scintillator for beta particles. Others:1970Ei02, 1982Ba36, 1967Hu09.

^{99}Mo Levels

E(level)†	J$^\pi$‡	$T_{1/2}$	Comments
0.0	1/2$^+$	65.924 h *6*	$T_{1/2}$: From Adopted Levels.
97.79 *10*	5/2$^+$	15.5 μs *2*	$T_{1/2}$: From Adopted Levels.
235.52 *12*	7/2$^+$	0.87 ns *15*	$T_{1/2}$: From 1982Ba36. Other value: 0.97 ns *19* (1997Lh01).
351.23 *13*	3/2$^+$	0.23 ns *17*	$T_{1/2}$: From 1997Lh01.
548.70 *17*	3/2$^+$	0.030 ns *25*	$T_{1/2}$: From 1997Lh01.
615.11 *15*	5/2$^+$		
684.13 *22*	11/2$^-$		
698.14 *18*	(7/2$^+$)#		
754.3 *3*	(7/2$^-$)		
865.88 *16*	7/2$^+$#		
906.13 *23*	9/2$^+$		
1048.14 *19*	(5/2$^-$,7/2$^+$)		
1142.81 *17*	7/2$^+$#		
1272.4 *8*			
1314.1 *3*	11/2$^+$		
1342.78 *19*	(7/2$^+$)#		
1401.23 *23*	(5/2$^-$,7/2$^+$)#		
1464.2 *3*	(9/2$^+$)		
1535.7 *5*	(7/2)		
1639.4 *3*			
1813.4 *3*			
1857.92 *19*	(9/2,11/2)#		
1987.4			
2059.7			
2174.8			

† Deduced by evaluators from least-squares fit to γ rays.
‡ Listed in 1997Lh01 from literature, except otherwise noted.
\# Proposed in 1997Lh01, based on β^- feedings.

β^- radiations

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(1460 *12*)	2174.8	0.28 *6*	5.67 *10*	av Eβ=551.0 *54*
(1575 *12*)	2059.7	0.38 *8*	5.66 *10*	av Eβ=602.2 *54*
(1648 *12*)	1987.4	0.17 *5*	6.09 *13*	av Eβ=634.6 *54*
(1777 *12*)	1857.92	2.4 *4*	5.07 *8*	av Eβ=693.0 *55*
(1822 *12*)	1813.4	0.15 *4*	6.32 *12*	av Eβ=713.2 *55*
(1996 *12*)	1639.4	0.37 *8*	6.09 *10*	av Eβ=792.6 *55*
(2099 *12*)	1535.7	0.11 *5*	6.70 *20*	av Eβ=840.2 *56*
(2171 *12*)	1464.2	0.16 *5*	6.60 *14*	av Eβ=873.2 *56*

Continued on next page (footnotes at end of table)

^{99}Nb β^- decay (15.0 s) 1997Lh01 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^- †‡	Log *ft*	Comments
(2234 *12*)	1401.23	1.3 *2*	5.74 *7*	av Eβ=902.4 *56*
(2292 *12*)	1342.78	1.3 *3*	5.79 *10*	av Eβ=929.4 *56*
(2321 *12*)	1314.1	0.30 *7*	6.45 *11*	av Eβ=942.8 *56*
(2492 *12*)	1142.81	1.4 *3*	5.91 *10*	av Eβ=1022.5 *56*
(2587 *12*)	1048.14	≤0.1	≥7.1	av Eβ=1066.8 *57*
(2729 *12*)	906.13	0.34 *13*	6.69 *17*	av Eβ=1133.4 *57*
(2769 *12*)	865.88	1.3 *3*	6.13 *10*	av Eβ=1152.3 *57*
(2881 *12*)	754.3	≤0.1	≥7.3	av Eβ=1204.8 *57*
(2937 *12*)	698.14	1.3 *3*	6.24 *10*	av Eβ=1231.3 *57*
(2951 *12*)	684.13	0.21 *7*	7.04 *15*	av Eβ=1237.9 *57*
(3020 *12*)	615.11	0.19 *14*	7.1 *4*	av Eβ=1270.5 *57*
(3086 *12*)	548.70	1.1 *2*	6.41 *8*	av Eβ=1301.9 *57*
(3399 *12*)	235.52	82 *11*	4.71 *6*	av Eβ=1450.3 *57*
(3537 *12*)	97.79	≈5	≈6.0	av Eβ=1515.8 *57*

† Deduced by evaluators from a γ-ray transition intensity balance at each level.
‡ Absolute intensity per 100 decays.

$\gamma(^{99}$Mo)

Iγ normalization: Deduced by evaluators from decay scheme assuming no direct β^- feeding to the ground state of ^{99}Mo and Σ I(γ+ce) to g.s. equal 100%.

E_γ	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	α[‡]	Comments
97.8 *1*	53 *5*	97.79	5/2+	0.0	1/2+	E2	1.307	α(K)=1.055 *16*; α(L)=0.209 *3*; α(M)=0.0379 *6* α(N)=0.00533 *8*; α(O)=0.0001502 *22* %Iγ=43.1 *4*.
137.7 *1*	100 *7*	235.52	7/2+	97.79	5/2+	(M1)	0.1040	α(K)=0.0911 *13*; α(L)=0.01073 *16*; α(M)=0.00192 *3* α(N)=0.000292 *5*; α(O)=1.619×10^{-5} *23* %Iγ=81 *6*. I_γ: ΔIγ assumed by evaluators.
197.4 *3*	0.12 *3*	548.70	3/2+	351.23	3/2+	[M1+E2]	0.072 *33*	α(K)=0.062 *27*; α(L)=0.0083 *43*; α(M)=0.00149 *77* α(N)=2.2×10^{-4} *11*; α(O)=1.00×10^{-5} *39* %Iγ=0.10 *3*.
208.0 *4*	0.05 *2*	906.13	9/2+	698.14	(7/2+)	[M1+E2]	0.060 *26*	α(K)=0.052 *22*; α(L)=0.0069 *34*; α(M)=0.00124 *62* α(N)=1.84×10^{-4} *88*; α(O)=8.5×10^{-6} *31* %Iγ=0.041 *17*.
250.8 *4*	0.16 *7*	865.88	7/2+	615.11	5/2+	[M1+E2]	0.033 *12*	α(K)=0.029 *10*; α(L)=0.0036 *15*; α(M)=6.5×10^{-4} *27* α(N)=9.7×10^{-5} *39*; α(O)=4.7×10^{-6} *15* %Iγ=0.13 *6*.
253.4 *2*	0.41 *13*	351.23	3/2+	97.79	5/2+	[M1+E2]	0.0216 *23*	α(K)=0.0189 *19*; α(L)=0.0022 *3*; α(M)=0.00040 *6* α(N)=6.0×10^{-5} *8*; α(O)=3.3×10^{-6} *3* %Iγ=0.33 *11*.
263.8 *2*	0.48 *11*	615.11	5/2+	351.23	3/2+	M1	0.0187	α(K)=0.01640 *24*; α(L)=0.00189 *3*; α(M)=0.000339 *5* α(N)=5.15×10^{-5} *8*; α(O)=2.90×10^{-6} *4* %Iγ=0.39 *10*.
277.1 *2*	0.05 *2*	1142.81	7/2+	865.88	7/2+	[M1+E2]	0.0241 *76*	α(K)=0.0209 *65*; α(L)=0.00262 *96*; α(M)=4.7×10^{-4} *18* α(N)=7.0×10^{-5} *25*; α(O)=3.49×10^{-6} *94* %Iγ=0.041 *17*.
294.3 *6*	0.05 *2*	1342.78	(7/2+)	1048.14	(5/2−,7/2+)			%Iγ=0.041 *17*.
316.8 *5*	0.03 *1*	2174.8		1857.92	(9/2,11/2)			%Iγ=0.024 *9*.
351.2 *2*	0.32 *15*	351.23	3/2+	0.0	1/2+			%Iγ=0.26 *13*.
379.6 *2*	0.12 *5*	615.11	5/2+	235.52	7/2+	E2	0.01112	α(K)=0.00968 *14*; α(L)=0.001200 *17*; α(M)=0.000215 *3* α(N)=3.21×10^{-5} *5*; α(O)=1.600×10^{-6} *23* %Iγ=0.10 *5*.
408.1 *3*	0.05 *2*	1314.1	11/2+	906.13	9/2+	[M1+E2]	0.0076 *13*	α(K)=0.0066 *11*; α(L)=0.00079 *16*; α(M)=0.00014 *3* α(N)=2.1×10^{-5} *4*; α(O)=1.13×10^{-6} *16* %Iγ=0.041 *17*.
432.8 *3*	0.08 *2*	1048.14	(5/2−,7/2+)	615.11	5/2+			%Iγ=0.065 *18*.
448.6 *2*	0.35 *7*	684.13	11/2−	235.52	7/2+			%Iγ=0.28 *7*.
450.9 *2*	0.94 *24*	548.70	3/2+	97.79	5/2+	M1	0.00495	α(K)=0.00435 *7*; α(L)=0.000494 *7*; α(M)=8.83×10^{-5} *13*

$^{99}_{42}$Mo$_{57}$-3

γ(^{99}Mo) (continued)

E_γ	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	α[‡]	Comments
								α(N)=1.345×10^{-5} *19*; α(O)=7.64×10^{-7} *11* %Iγ=0.77 *21*.
459.4[@] *7*	0.03 *1*	1142.81	7/2$^+$	684.13	11/2$^-$	[M2]	0.01617	α(K)=0.01410 *21*; α(L)=0.00171 *3*; α(M)=0.000308 *5* α(N)=4.68×10^{-5} *7*; α(O)=2.59×10^{-6} *4* %Iγ=0.024 *9*.
462.4 *3*	0.30 *7*	698.14	(7/2$^+$)	235.52	7/2$^+$	[M1+E2]	0.0053 *7*	α(K)=0.0047 *6*; α(L)=0.00055 *9*; α(M)=9.8×10^{-5} *16* α(N)=1.48×10^{-5} *22*; α(O)=8.0×10^{-7} *8* %Iγ=0.24 *7*.
499.3 *3*	0.03 *1*	1048.14	(5/2$^-$,7/2$^+$)	548.70	3/2$^+$			%Iγ=0.024 *9*.
514.7 *3*	0.17 *8*	865.88	7/2$^+$	351.23	3/2$^+$	[E2]	0.00436	α(K)=0.00381 *6*; α(L)=0.000455 *7*; α(M)=8.13×10^{-5} *12* α(N)=1.223×10^{-5} *18*; α(O)=6.41×10^{-7} *9* %Iγ=0.14 *7*.
515.4 *3*	0.05 *2*	1857.92	(9/2,11/2)	1342.78	(7/2$^+$)			%Iγ=0.041 *17*.
518.1 *6*	0.11 *8*	615.11	5/2$^+$	97.79	5/2$^+$	[M1+E2]	0.0039 *4*	α(K)=0.0034 *3*; α(L)=0.00040 *5*; α(M)=7.1×10^{-5} *9* α(N)=1.08×10^{-5} *12*; α(O)=5.9×10^{-7} *5* %Iγ=0.09 *7*.
518.8 *5*	0.03 *2*	754.3	(7/2$^-$)	235.52	7/2$^+$	[E1]	1.36×10^{-3}	α(K)=0.001194 *17*; α(L)=0.0001335 *19*; α(M)=2.38×10^{-5} *4* α(N)=3.61×10^{-6} *6*; α(O)=2.02×10^{-7} *3* %Iγ=0.024 *17*.
527.9 *3*	0.08 *2*	1142.81	7/2$^+$	615.11	5/2$^+$	[M1+E2]	0.0037 *4*	α(K)=0.0033 *3*; α(L)=0.00038 *5*; α(M)=6.8×10^{-5} *8* α(N)=1.03×10^{-5} *11*; α(O)=5.6×10^{-7} *4* %Iγ=0.065 *18*.
548.5 *6*	0.27 *10*	548.70	3/2$^+$	0.0	1/2$^+$	M1+E2	0.0034 *3*	α(K)=0.00295 *23*; α(L)=0.00034 *4*; α(M)=6.1×10^{-5} *6* α(N)=9.3×10^{-6} *9*; α(O)=5.1×10^{-7} *3* %Iγ=0.22 *9*.
586.5 *6*	0.04 *2*	1987.4		1401.23	(5/2$^-$,7/2$^+$)			%Iγ=0.033 *17*.
600.4 *2*	1.42 *28*	698.14	(7/2$^+$)	97.79	5/2$^+$	[M1+E2]	0.00266 *15*	α(K)=0.00233 *13*; α(L)=0.000269 *20*; α(M)=4.8×10^{-5} *4* α(N)=7.3×10^{-6} *5*; α(O)=4.02×10^{-7} *16* %Iγ=1.2 *3*.
631.6 *7*	0.05 *3*	865.88	7/2$^+$	235.52	7/2$^+$	[M1+E2]	0.00234 *11*	α(K)=0.00205 *9*; α(L)=0.000236 *15*; α(M)=4.2×10^{-5} *3* α(N)=6.4×10^{-6} *4*; α(O)=3.54×10^{-7} *11* %Iγ=0.041 *24*.
656.5 *3*	0.13 *5*	754.3	(7/2$^-$)	97.79	5/2$^+$	E1	7.89×10^{-4}	α(K)=0.000695 *10*; α(L)=7.74×10^{-5} *11*; α(M)=1.377×10^{-5} *20* α(N)=2.09×10^{-6} *3*; α(O)=1.179×10^{-7} *17* %Iγ=0.11 *5*.
657.3 *7*	0.04 *2*	1272.4		615.11	5/2$^+$			%Iγ=0.033 *17*.
657.9 *6*	0.03 *1*	2059.7		1401.23	(5/2$^-$,7/2$^+$)			%Iγ=0.024 *9*.
671.0 *4*	0.04 *2*	1813.4		1142.81	7/2$^+$			%Iγ=0.033 *17*.
671.3 *8*	0.05 *2*	906.13	9/2$^+$	235.52	7/2$^+$	[M1+E2]	0.00201 *7*	α(K)=0.00176 *6*; α(L)=0.000202 *10*; α(M)=3.61×10^{-5} *18* α(N)=5.48×10^{-6} *25*; α(O)=3.04×10^{-7} *7* %Iγ=0.041 *17*.

$^{99}_{42}$Mo$_{57}$-4

γ(^{99}Mo) (continued)

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[‡]	Comments
673.2 *6*	0.03 *2*	1987.4		1314.1	11/2+			%Iγ=0.024 *17*.
696.9 *4*	0.12 *3*	1048.14	(5/2−,7/2+)	351.23	3/2+			%Iγ=0.10 *3*.
715.2 *3*	0.11 *3*	1857.92	(9/2,11/2)	1142.81	7/2+			%Iγ=0.09 *3*.
716.8 *4*	0.05 *2*	2059.7		1342.78	(7/2+)			%Iγ=0.041 *17*.
727.7 *3*	0.12 *4*	1342.78	(7/2+)	615.11	5/2+	[M1+E2]	0.00165 *4*	α(K)=0.00145 *3*; α(L)=0.000165 *6*; α(M)=2.95×10^{-5} *10* α(N)=4.48×10^{-6} *14*; α(O)=2.50×10^{-7} *4* %Iγ=0.10 *4*.
733.3 *9*	0.04 *2*	1639.4		906.13	9/2+			%Iγ=0.033 *17*.
765.7 *5*	0.05 *2*	1464.2	(9/2+)	698.14	(7/2+)	[M1+E2]	1.46×10^{-3} *2*	α(K)=0.001281 *20*; α(L)=0.000146 *4*; α(M)=2.60×10^{-5} *7* α(N)=3.95×10^{-6} *9*; α(O)=2.21×10^{-7} *4* %Iγ=0.041 *17*.
768.1 *2*	1.6 *3*	865.88	7/2+	97.79	5/2+	[M1+E2]	1.45×10^{-3} *2*	α(K)=0.001272 *20*; α(L)=0.000145 *4*; α(M)=2.58×10^{-5} *7* α(N)=3.92×10^{-6} *9*; α(O)=2.20×10^{-7} *4* %Iγ=1.3 *3*.
773.0 *4*	0.06 *2*	2174.8		1401.23	(5/2−,7/2+)			%Iγ=0.049 *17*.
773.6 *3*	0.07 *2*	1639.4		865.88	7/2+			%Iγ=0.057 *18*.
780.1 *9*	0.02 *1*	1464.2	(9/2+)	684.13	11/2−	[E1]	5.44×10^{-4}	α(K)=0.000480 *7*; α(L)=5.32×10^{-5} *8*; α(M)=9.48×10^{-6} *14* α(N)=1.442×10^{-6} *21*; α(O)=8.16×10^{-8} *12* %Iγ=0.016 *9*.
781.4 *4*	0.13 *5*	1535.7	(7/2)	754.3	(7/2−)			%Iγ=0.11 *5*.
808.4 *3*	0.41 *15*	906.13	9/2+	97.79	5/2+	E2	1.28×10^{-3}	α(K)=0.001126 *16*; α(L)=0.0001294 *19*; α(M)=2.31×10^{-5} *4* α(N)=3.50×10^{-6} *5*; α(O)=1.92×10^{-7} *3* %Iγ=0.33 *13*.
812.9 *3*	0.08 *2*	1048.14	(5/2−,7/2+)	235.52	7/2+			%Iγ=0.065 *18*.
844.4 *5*	0.04 *2*	1987.4		1142.81	7/2+			%Iγ=0.033 *17*.
907.2 *2*	1.37 *21*	1142.81	7/2+	235.52	7/2+	[M1+E2]	9.81×10^{-4} *18*	α(K)=0.000863 *17*; α(L)=9.74×10^{-5} *14*; α(M)=1.738×10^{-5} *25* α(N)=2.64×10^{-6} *4*; α(O)=1.49×10^{-7} *4* %Iγ=1.12 *20*.
991.9 *3*	0.23 *6*	1857.92	(9/2,11/2)	865.88	7/2+			%Iγ=0.19 *6*.
1012.2 *4*	0.14 *6*	2059.7		1048.14	(5/2−,7/2+)			%Iγ=0.11 *5*.
1031.7 *4*	0.08 *3*	2174.8		1142.81	7/2+			%Iγ=0.07 *3*.
1044.8 *5*	0.39 *16*	1142.81	7/2+	97.79	5/2+	[M1+E2]	7.15×10^{-4} *19*	α(K)=0.000630 *17*; α(L)=7.07×10^{-5} *15*; α(M)=1.26×10^{-5} *3* α(N)=1.92×10^{-6} *5*; α(O)=1.09×10^{-7} *4* %Iγ=0.32 *14*.
1078.4 *3*	0.35 *7*	1314.1	11/2+	235.52	7/2+	[E2]	6.52×10^{-4}	α(K)=0.000573 *8*; α(L)=6.47×10^{-5} *9*; α(M)=1.155×10^{-5} *17* α(N)=1.755×10^{-6} *25*; α(O)=9.84×10^{-8} *14* %Iγ=0.28 *7*.
1107.4 *2*	1.5 *3*	1342.78	(7/2+)	235.52	7/2+	[M1+E2]	6.31×10^{-4} *18*	α(K)=0.000555 *16*; α(L)=6.21×10^{-5} *15*; α(M)=1.11×10^{-5} *3* α(N)=1.69×10^{-6} *5*; α(O)=9.6×10^{-8} *4*; α(IPF)=6.9×10^{-7} *9* %Iγ=1.2 *3*.
1165.6 *2*	1.34 *21*	1401.23	(5/2−,7/2+)	235.52	7/2+			%Iγ=1.09 *20*.
1173.7 *6*	0.04 *2*	1857.92	(9/2,11/2)	684.13	11/2−			%Iγ=0.033 *17*.
1193.7 *7*	0.05 *2*	2059.7		865.88	7/2+			%Iγ=0.041 *17*.

$\gamma(^{99}$Mo) (continued)

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[‡]	Comments
1228.9 *4*	0.07 *2*	1464.2	(9/2$^+$)	235.52	7/2$^+$	[M1+E2]	5.15×10^{-4} *15*	α(K)=0.000445 *14*; α(L)=4.96×10^{-5} *14*; α(M)=8.85×10^{-6} *24* α(N)=1.35×10^{-6} *4*; α(O)=7.7×10^{-8} *3*; α(IPF)=1.09×10^{-5} *12* %Iγ=0.057 *18*.
1269.5 *5*	0.08 *3*	2174.8		906.13	9/2$^+$			%Iγ=0.07 *3*.
1303.7 *9*	0.03 *1*	1987.4		684.13	11/2$^-$			%Iγ=0.024 *9*.
1304.4 *6*	0.29 *10*	1401.23	(5/2$^-$,7/2$^+$)	97.79	5/2$^+$			%Iγ=0.24 *9*.
1366.4 *7*	0.06 *4*	1464.2	(9/2$^+$)	97.79	5/2$^+$			%Iγ=0.05 *4*.
1403.7 *4*	0.35 *7*	1639.4		235.52	7/2$^+$			%Iγ=0.28 *7*.
1577.5 *4*	0.15 *4*	1813.4		235.52	7/2$^+$			%Iγ=0.12 *4*.
1622.2 *3*	2.5 *4*	1857.92	(9/2,11/2)	235.52	7/2$^+$			%Iγ=2.0 *4*.
1751.8 *6*	0.07 *3*	1987.4		235.52	7/2$^+$			%Iγ=0.06 *3*.
1823.7 *6*	0.20 *4*	2059.7		235.52	7/2$^+$			%Iγ=0.16 *4*.
1939.0 *7*	0.09 *3*	2174.8		235.52	7/2$^+$			%Iγ=0.07 *3*.

† From Adopted Gammas.

‡ Additional information 1.

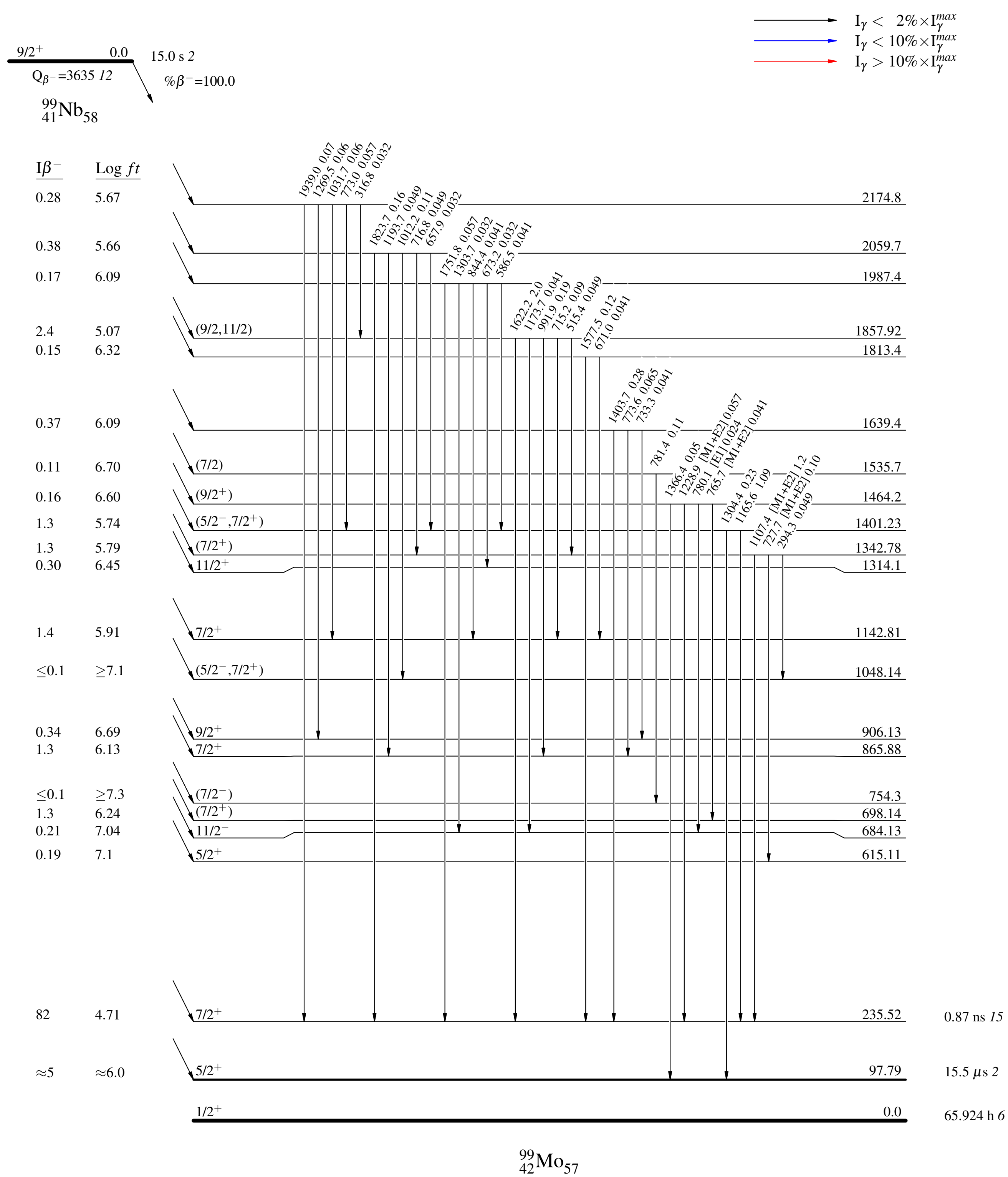
\# For absolute intensity per 100 decays, multiply by 0.81 *8*.

@ Placement of transition in the level scheme is uncertain.

^{99}Nb β^- decay (15.0 s) 1997Lh01

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



^{99}Nb β^- decay (15.0 s) 1997Lh01

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays