^{96}Mo(n,n′γ) 2007Le05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	D. Abriola(a), A. A. Sonzogni	NDS 109,2501 (2008)	1-Apr-2008

E=2.0-4.0 MeV beam from University of Kentucky Accelerator facility. Measured Eγ, Iγ, γ(θ), excitation functions and lifetimes by DSAM using a BGO-Compton suppressed HPGe detector gated by neutron time-of-flight for background suppression. The γ(θ) data were obtained from 40° to 150° at neutron energies of 2.5, 3.0, 3.5 and 4.0 MeV.

Others measurement: 1973RoXB, which deduced levels up to 2735 keV. This measurement agrees well with 2007Le05.

^{96}Mo Levels

No evidence was found by 2007Le05 for a 1330, 0^+ level reported earlier in a ^{94}Zr(^{3}He,nγ) study.

E(level)‡	Jπ#	$T_{1/2}$†	Comments
0.0	0^+		
778.18 *3*	2^+		
1148.09 *7*	0^+		
1497.66 *4*	2^+	0.74 ps *+63−25*	
1625.79 *4*	2^+	>0.90 ps	
1628.12 *5*	4^+		
1869.41 *5*	4^+		
1978.42 *5*	3^+	>2.29 ps	
2095.73 *5*	2^+	97 fs *11*	E(level): this level is interpreted by 2007Le05 as a mixed-symmetry, one- phonon 2^+ state based on high value of B(M1)=0.17 *2* for transition to the first 2^+ state.
2219.32 *7*	4^+	>0.38 ps	
2234.55 *5*	3^-	>0.277 ps	
2426.06 *5*	2^+	0.19 ps *+4−3*	
2438.40 *7*	5^+	>0.139 ps	
2440.31 *11*	6^+	>0.208 ps	
2480.99 *8*	4^+	>1.01 ps	
2501.52 *5*	1	97 fs *13*	
2540.29 *7*	$(2^+,3^+)$	69 fs *10*	
2594.22 *6*	3^+	0.8 ps *+43−4*	
2611.44 *11*		>0.194 ps	
2622.45 *11*	0^+	0.6 ps *+6−2*	
2625.23 *8*	4^+	0.5 ps *+8−2*	
2700.18 *7*	2^+	104 fs *14*	E(level): this level is interpreted by 2007Le05 as a mixed-symmetry, two- phonon 2^+ state based on high value of B(M1)=0.10 *2* for transition to the second 2^+ state.
2734.50 *8*	4^+	>0.25 ps	
2735.91 *8*	3^+	121 fs *+18−17*	E(level): this level is interpreted by 2007Le05 as a mixed-symmetry, two- phonon 3^+ state based on B(M1)=0.06 *1* for transition to the second 2^+ state.
2748.56 *8*	0^+	0.17 ps *+4−3*	
2755.03 *11*	6^+	>0.194 ps	
2787.04 *7*	2^+	0.15 ps *+4−3*	
2790.12 *8*	(2,4)	>0.68 ps	
2794.44 *6*	1^+	31 fs *3*	E(level): this level is interpreted by 2007Le05 as a mixed-symmetry, two- phonon 1^+ state based on high value of B(M1)=0.11 *2* for transition to the second 2^+ state.
2806.16 *7*	1	114 fs *+21−18*	
2818.44 *11*	4^+	59 fs *+16−12*	
2975.27 *8*	4	>0.347 ps	
2986.76 *5*	2^+	104 fs *+15−14*	E(level): this level is interpreted by 2007Le05 as a possible mixed-symmetry, two-phonon 2^+ state based on strong decay to the main mixed-symmetry 2^+ state at 2096 and a weak E2 transition to the g.s.
3006.32 *11*	0^+	90 fs *+19−15*	

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^{96}Mo(n,n′γ) 2007Le05 (continued)

^{96}Mo Levels (continued)

E(level)‡	Jπ#	$T_{1/2}$†	Comments
3024.46 *6*	2^+	83 fs *+13−12*	
3053.12 *11*	(4^+)	69 fs *+14−11*	
3087.62 *7*	3^+	0.33 ps *+53−14*	
3089.53 *8*	2,3	66 fs *+10−8*	
3134.51 *7*	2^+	76 fs *10*	
3154.10 *12*	1	73 fs *+10−9*	
3178.63 *6*	3^-	142 fs *+24−21*	
3211.31 *6*	3^+	104 fs *+22−18*	
3232.48 *8*	3	236 fs *+10−62*	
3255.54 *8*		0.4 ps *+9−2*	
3284.86 *11*	2^+	0.13 ps *+4−3*	
3300.31 *7*	1^+	8.3 fs *14*	E(level): this level is interpreted by 2007Le05 as a mixed-symmetry, two- phonon 1^+ state based on high value of B(M1)=0.11 *4* for transition to the g.s.
3327.85 *7*	1	49 fs *+12−10*	
3335.22 *7*	(3^+)	0.13 ps *+4−3*	
3351.61 *7*	2^+	36 fs *+10−8*	
3363.9 *3*		0.12 ps *+5−3*	
3373.82 *7*	2^+	23 fs *3*	
3416.78 *7*	4^+	>0.61 ps	
3421.18 *7*	1	52 fs *+9−8*	
3424.89 *8*	1^+	8.3 fs *+28−21*	E(level): it was assigned by 2004Fr30 as a mixed-symmetry 1^+ state, but 2007Le05 reject this assignment based on their lifetime measurements and deduced transition probabilities.
3433.54 *11*	4^+	97 fs *+21−17*	
3441.93 *11*	4^+	0.17 ps *+6−4*	
3464.51 *8*	3	44 fs *+7−6*	
3472.14 *11*	2^+	66 fs *+19−14*	
3530.87 *8*	1,2,3	43 fs *6*	
3540.76 *8*	3	83 fs *+22−17*	
3573.23 *7*	(1)	87 fs *+24−18*	
3599.53 *10*	1^-	10.4 fs *21*	
3610.39 *8*	2,3	104 fs *+21−17*	
3623.14 *11*	(3^+)	>0.236 ps	
3668.77 *9*	3^+	44 fs *+9−8*	

† From DSAM (2007Le05) unless otherwise stated.
‡ From least-squares fit to Eγ′s.
# Author′s values, from Mγ, gamma intensity patterns.

γ(^{96}Mo)

ΔE: 2007Le05 states that ΔEγ=0.05 keV unless otherwise indicated. This value gave a poor fit to level energies, so the default ΔEγ was increased to 0.10 keV.

E_i(level)	J_i^π	E_γ	I_γ&	E_f	J_f^π	Mult.	Comments
778.18	2^+	778.28 *10*	100	0.0	0^+	E2	
1148.09	0^+	369.89 *10*	100	778.18	2^+	E2	
1497.66	2^+	719.55 *10*	71.2 *4*	778.18	2^+	M1+E2	δ: +1.1 *1* or +0.34 *+9−7*.
		1497.76 *10*	28.8 *4*	0.0	0^+	E2	
1625.79	2^+	847.67 *10*	91.7 *2*	778.18	2^+	M1+E2	δ: −6.9 *+12−21* or −0.6 *5*.
		1625.88 *10*	8.3 *2*	0.0	0^+	E2	
1628.12	4^+	849.97 *10*	100	778.18	2^+	E2	

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^{96}Mo(n,n′γ) 2007Le05 (continued)

γ(^{96}Mo) (continued)

E_i(level)	J_i^π	E_γ	I_γ[&]	E_f	J_f^π	Mult.	δ	Comments
1869.41	4^+	241.36 *10*	7.6 *2*	1628.12	4^+	M1+E2		δ: −0.16 *6* or +1.5 *2*. E_γ: second placement of 241γ from a 2219 level proposed earlier is not supported in this experiment.
		1091.38 *10*	92.4 *2*	778.18	2^+	E2		
1978.42	3^+	350.05 *10*	8.52 *2*	1628.12	4^+	M1+E2		δ: −0.04 *3* or −6.1 *9*. I_γ: 8.52 *2* listed in 2007Le05. Since the quoted uncertainty seems unrealistic, we took Iγ=8.5.
		352.61 *10*	3.1 *1*	1625.79	2^+	M1+E2		δ: +0.47 *6* or +4.0 *+12−8*.
		480.42 *10*	26.3 *5*	1497.66	2^+	M1+E2	+0.12 *4*	
		1200.20 *10*	62.4 *6*	778.18	2^+	M1+E2	+0.89 *10*	
2095.73	2^+	1317.50 *10*	98.5 *1*	778.18	2^+	M1+E2	−0.09 *2*	
		2095.59[#] *10*	1.5 *1*	0.0	0^+	E2		
2219.32	4^+	721.77 *10*	78.1 *7*	1497.66	2^+	E2		
		1441.05 *10*	21.9 *7*	778.18	2^+	E2		
2234.55	3^-	365.13 *10*	4.3 *2*	1869.41	4^+	E1		
		608.70 *10*	46.3 *6*	1625.79	2^+	E1		
		736.89 *10*	44.9 *6*	1497.66	2^+	E1		
		1456.26 *10*	4.5 *1*	778.18	2^+	E1		
2426.06	2^+	447.62 *10*	2.5 *1*	1978.42	3^+	M1+E2	*−2.6 +8−16*	
		800.22 *10*	35.8 *5*	1625.79	2^+	M1+E2	−0.18 *17*	
		928.24 *10*	3.9 *1*	1497.66	2^+	M1+E2	*+3.9 +18−10*	
		1647.82 *10*	53.1 *5*	778.18	2^+	M1+E2	+1.2 *3*	
		2426.28 *10*	4.8 *2*	0.0	0^+	E2		
2438.40	5^+	459.98 *10*	28.4 *8*	1978.42	3^+	E2		
		568.79 *10*	58.0 *9*	1869.41	4^+	M1+E2	−0.24 *3*	
		810.49 *10*	13.6 *6*	1628.12	4^+	M1+E2		δ: +2.4 *7* or +0.52 *10*.
2440.31	6^+	812.19 *10*	100	1628.12	4^+	E2		
2480.99	4^+	852.86 *10*	75.0 *6*	1628.12	4^+	M1+E2	−0.20 *7*	
		1702.79 *10*	25.0 *6*	778.18	2^+	E2		
2501.52	1	875.61 *10*	7.4 *2*	1625.79	2^+			
		1003.69 *10*	15.2 *3*	1497.66	2^+			
		1353.35 *10*	43.0 *5*	1148.09	0^+			
		1723.29 *10*	28.7 *4*	778.18	2^+			
		2501.84[#] *10*	5.7 *2*	0.0	0^+			
2540.29	$(2^+,3^+)$	914.52 *10*	8.2 *2*	1625.79	2^+			
		1042.60 *10*	20.0 *4*	1497.66	2^+			
		1762.09 *10*	71.8 *5*	778.18	2^+			
2594.22	3^+	615.35 *10*	31.3 *6*	1978.42	3^+	M1+E2		δ: +0.12 *7* or +1.1 *2*. E_γ: poor fit. Energy-level difference=615.80.
		966.29 *10*	19.5 *6*	1628.12	4^+	M1+E2	−0.9 *3*	
		968.54 *10*	30.9 *6*	1625.79	2^+	M1+E2	−0.86 *23*	
		1096.62	[†]	1497.66	2^+			
		1816.14 *10*	18.3 *3*	778.18	2^+	M1+E2	+1.9 *3*	
2611.44		983.32 *10*	100	1628.12	4^+			
2622.45	0^+	1844.25 *10*	100	778.18	2^+	E2		
2625.23	4^+	405.95 *10*	16.0 *7*	2219.32	4^+	M1+E2		δ: −0.37 *16* or +2.4 *+15−8*.
		1846.98 *10*	84.0 *7*	778.18	2^+	E2		
2700.18	2^+	1074.05	[‡]	1625.79	2^+	M1+E2		
		1202.43 *10*	47.0 *7*	1497.66	2^+	M1+E2	−0.11 *5*	δ: +3.3 *6* is another solution but rejected.
		1921.78 *10*	37.9 *6*	778.18	2^+	M1+E2		δ: +0.23 *6* or +1.4 *2*.

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^{96}Mo(n,n′γ) 2007Le05 (continued)

γ(^{96}Mo) (continued)

E_i(level)	J_i^π	E_γ	I_γ &	E_f	J_f^π	Mult.	δ	Comments
2700.18	2^+	2700.88 *16*	15.2 *8*	0.0	0^+	E2		
2734.50	4^+	865.00 *10*	36.1 *14*	1869.41	4^+			
		1106.47 *10*	63.9 *14*	1628.12	4^+			
2735.91	3^+	1238.17 *10*	36.2 *6*	1497.66	2^+	M1+E2	−0.34 *4*	
		1957.78 *10*	63.8 *6*	778.18	2^+	M1+E2	+0.02 *4*	
2748.56	0^+	1250.78[b] *10*	24.5 *7*	1497.66	2^+			
		1970.47 *10*	75.5 *7*	778.18	2^+			
2755.03	6^+	1126.91 *10*	100	1628.12	4^+	E2		
2787.04	2^+	1161.29 *10*	4.5 *4*	1625.79	2^+	M1+E2	−0.4 *+3−6*	
		1289.32 *10*	7.8 *4*	1497.66	2^+	M1+E2	+1.1 *10*	
		2008.82 *10*	87.7 *6*	778.18	2^+	M1+E2		δ: −0.24 *5* or +5.8 *+21−13*.
2790.12	(2,4)	555.48 *10*	6.7 *5*	2234.55	3^-			
		1164.4 *3*	34.9 *7*	1625.79	2^+			
		1292.99	†	1497.66	2^+			
		2011.98 *10*	58.5 *8*	778.18	2^+			
2794.44	1^+	1296.63 *10*	19.2 *11*	1497.66	2^+	M1+E2		
		2016.54 *10*	11.4 *7*	778.18	2^+	M1+E2		
		2794.24 *10*	69.4 *16*	0.0	0^+	M1		
2806.16	1	1180.42 *10*	8.6 *3*	1625.79	2^+			
		1308.39 *10*	14.5 *5*	1497.66	2^+			
		1658.10 *10*	76.9 *6*	1148.09	0^+			
2818.44	4^+	1190.32 *10*	100	1628.12	4^+	M1+E2	−0.14 *6*	
2975.27	4	740.59 *10*	59.8 *12*	2234.55	3^-			
		1347.26 *10*	40.2 *12*	1628.12	4^+			
2986.76	2^+	891.03 *10*	18.6 *7*	2095.73	2^+	M1+E2	−0.26 *11*	
		1008.30 *10*	10.1 *5*	1978.42	3^+	M1+E2		δ: −0.31 *16* or +3.1 *+32−12*.
		1360.91 *10*	32.2 *8*	1625.79	2^+	M1+E2		δ: −0.69 *13* or −5 *+2−1*.
		2208.55 *10*	26.8 *8*	778.18	2^+	M1+E2		δ: −0.16 *8* or +4 *2*.
		2986.76 *10*	12.3 *15*	0.0	0^+	E2		
3006.32	0^+	1508.65[a] *10*	100	1497.66	2^+	E2		
3024.46	2^+	1045.80 *10*	16.5 *7*	1978.42	3^+	M1+E2		δ: −0.32 *+16−32* or −1.9 *1*.
		1155.64 *10*	8.9 *3*	1869.41	4^+	E2		
		1396.26 *10*	42.8 *8*	1628.12	4^+	E2		
		1398.36 *10*	31.7 *7*	1625.79	2^+	M1+E2	−0.48 *10*	
3053.12	(4^+)	1424.99 *10*	100	1628.12	4^+			
3087.62	3^+	992.18 *10*	21.0 *10*	2095.73	2^+	M1+E2	+0.11 *10*	
		1459.36 *10*	43.4 *10*	1628.12	4^+	M1+E2		δ: −1.4 *2* or −0.52 *10*.
		1461.64 *10*	35.8 *10*	1625.79	2^+	M1+E2	−2.9 *7*	
3089.53	2,3	1591.89 *10*	66.7 *11*	1497.66	2^+			
		2311.29 *10*	33.3 *11*	778.18	2^+			
3134.51	2^+	1508.65[a] *10*	50 *4*	1625.79	2^+	M1+E2	+2.6 *6*	
		3134.50 *10*	50 *4*	0.0	0^+	E2		
3154.10	1	2375.88 *11*	100	778.18	2^+			
3178.63	3^-	944.10 *10*	13.4 *6*	2234.55	3^-	M1+E2	−0.31 *12*	
		1082.81 *10*	5.3 *5*	2095.73	2^+	E1		
		1680.87 *10*	16.4 *6*	1497.66	2^+	E1		
		2400.54 *10*	64.9 *10*	778.18	2^+	E1		
3211.31	3^+	1232.94 *10*	31.4 *11*	1978.42	3^+	M1+E2		δ: +2.4 *+10−6* or −0.22 *12*.
		1341.70 *10*	26.0 *11*	1869.41	4^+	M1+E2	+1.8 *13*	
		1713.58 *10*	27.1 *10*	1497.66	2^+	M1+E2	−5.2 *+13−27*	
		2433.27 *10*	15.5 *8*	778.18	2^+	M1+E2		δ: +0.41 *10* or +5.4 *+5−2*.
3232.48	3	1606.80 *10*	61.2 *13*	1625.79	2^+			
		2454.13 *10*	38.8 *13*	778.18	2^+			
3255.54		1629.66 *10*	56.4 *20*	1625.79	2^+			
		2477.40 *10*	43.6 *20*	778.18	2^+			

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^{96}Mo(n,n′γ) 2007Le05 (continued)

γ(^{96}Mo) (continued)

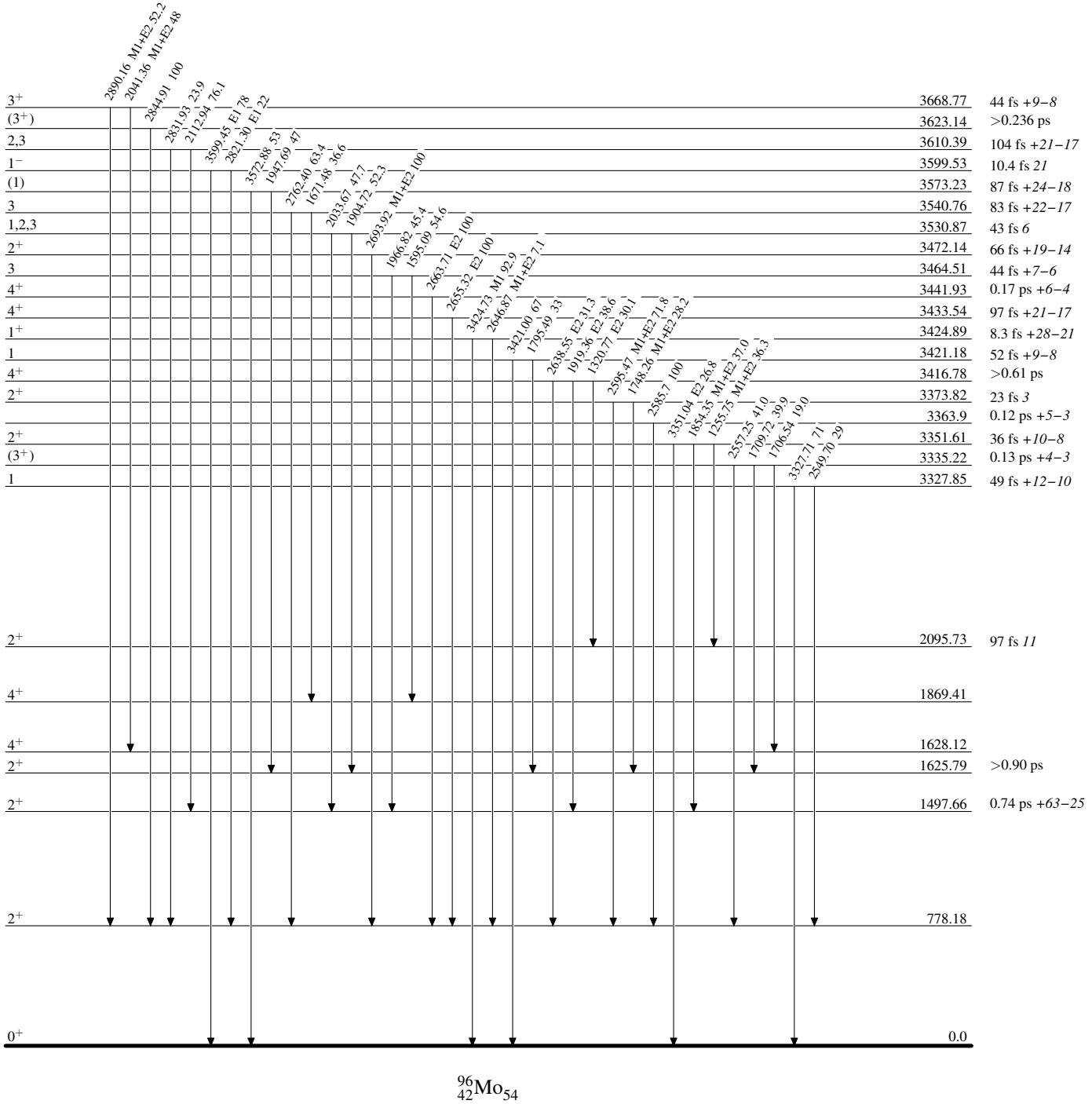
E_i(level)	J_i^π	E_γ	I_γ &	E_f	J_f^π	Mult.	δ	Comments
3284.86	2^+	2506.64 *10*	100	778.18	2^+	M1+E2	−1.5 *+6−16*	
3300.31	1^+	1802.81 *10*	8.7 *15*	1497.66	2^+	M1+E2		
		3300.08 *10*	91.3 *15*	0.0	0^+	M1		
3327.85	1	2549.70 *10*	29 *4*	778.18	2^+			
		3327.71 *10*	71 *4*	0.0	0^+			
3335.22	(3^+)	1706.54 *10*	19.0 *7*	1628.12	4^+			E_γ: poor fit. Level-energy difference=1707.11.
		1709.72 *10*	39.9 *9*	1625.79	2^+			
		2557.25 *10*	41.0 *10*	778.18	2^+			
3351.61	2^+	1255.75 *10*	36.3 *18*	2095.73	2^+	M1+E2	−0.10 *+13−28*	
		1854.35 *10*	37.0 *18*	1497.66	2^+	M1+E2	−1.5 *+4−8*	E_γ: poor fit. Level-energy difference=1853.87.
		3351.04 *13*	26.8 *18*	0.0	0^+	E2		
3363.9		2585.7 *3*	100	778.18	2^+			
3373.82	2^+	1748.26 *10*	28.2 *11*	1625.79	2^+	M1+E2		δ: +3.4 *+29−12* or −0.12 *+14−38*.
		2595.47 *7*	71.8 *11*	778.18	2^+	M1+E2	−0.51 *8*	
3416.78	4^+	1320.77 *10*	30.1 *13*	2095.73	2^+	E2		
		1919.36 *10*	38.6 *13*	1497.66	2^+	E2		
		2638.55 *10*	31.3 *13*	778.18	2^+	E2		
3421.18	1	1795.49 *10*	33 *4*	1625.79	2^+			
		3421.00 *10*	67 *4*	0.0	0^+			
3424.89	1^+	2646.87 *15*	7.1 *16*	778.18	2^+	M1+E2		
		3424.73 *10*	92.9 *16*	0.0	0^+	M1		
3433.54	4^+	2655.32 *10*	100	778.18	2^+	E2		
3441.93	4^+	2663.71 *10*	100	778.18	2^+	E2		
3464.51	3	1595.09 *10*	54.6 *12*	1869.41	4^+			
		1966.82 *10*	45.4 *12*	1497.66	2^+			
3472.14	2^+	2693.92 *10*	100	778.18	2^+	M1+E2		
3530.87	1,2,3	1904.72 *10*	52.3 *11*	1625.79	2^+			
		2033.67 *12*	47.7 *11*	1497.66	2^+			
3540.76	3	1671.48 *10*	36.6 *19*	1869.41	4^+			
		2762.40 *10*	63.4 *19*	778.18	2^+			
3573.23	(1)	1947.69 *10*	47 *6*	1625.79	2^+			
		3572.88 *10*	53 *6*	0.0	0^+			
3599.53	1^-	2821.30 *10*	22 *6*	778.18	2^+	E1		
		3599.45 *24*	78 *4*	0.0	0^+	E1		
3610.39	2,3	2112.94 *10*	76.1 *16*	1497.66	2^+			
		2831.93 *10*	23.9 *16*	778.18	2^+			
3623.14	(3^+)	2844.91 *10*	100	778.18	2^+			
3668.77	3^+	2041.36 *14*	48 *3*	1628.12	4^+	M1+E2	−3.8 *+15−52*	E_γ: poor fit. Level-energy difference=2040.82.
		2890.16 *10*	52.2 *22*	778.18	2^+	M1+E2		δ: −0.45 *+11−16* or −1.2 *+10−4*. E_γ: poor fit. Level-energy difference=2890.70.

† The γ ray mixed with a laboratory background line and could not be separated.
‡ The γ ray mixed with a contaminant.
# Peak is an unresolved doublet.
@ 2007Le05 states that ΔEγ=0.05 keV unless otherwise indicated. This value gave a poor fit to level energies, so the default ΔEγ was increased to 0.10 keV.
& Photon branching ratio from each level.
a Multiply placed.
b Placement of transition in the level scheme is uncertain.

^{96}Mo(n,n′γ) 2007Le05

Level Scheme

Intensities: % photon branching from each level

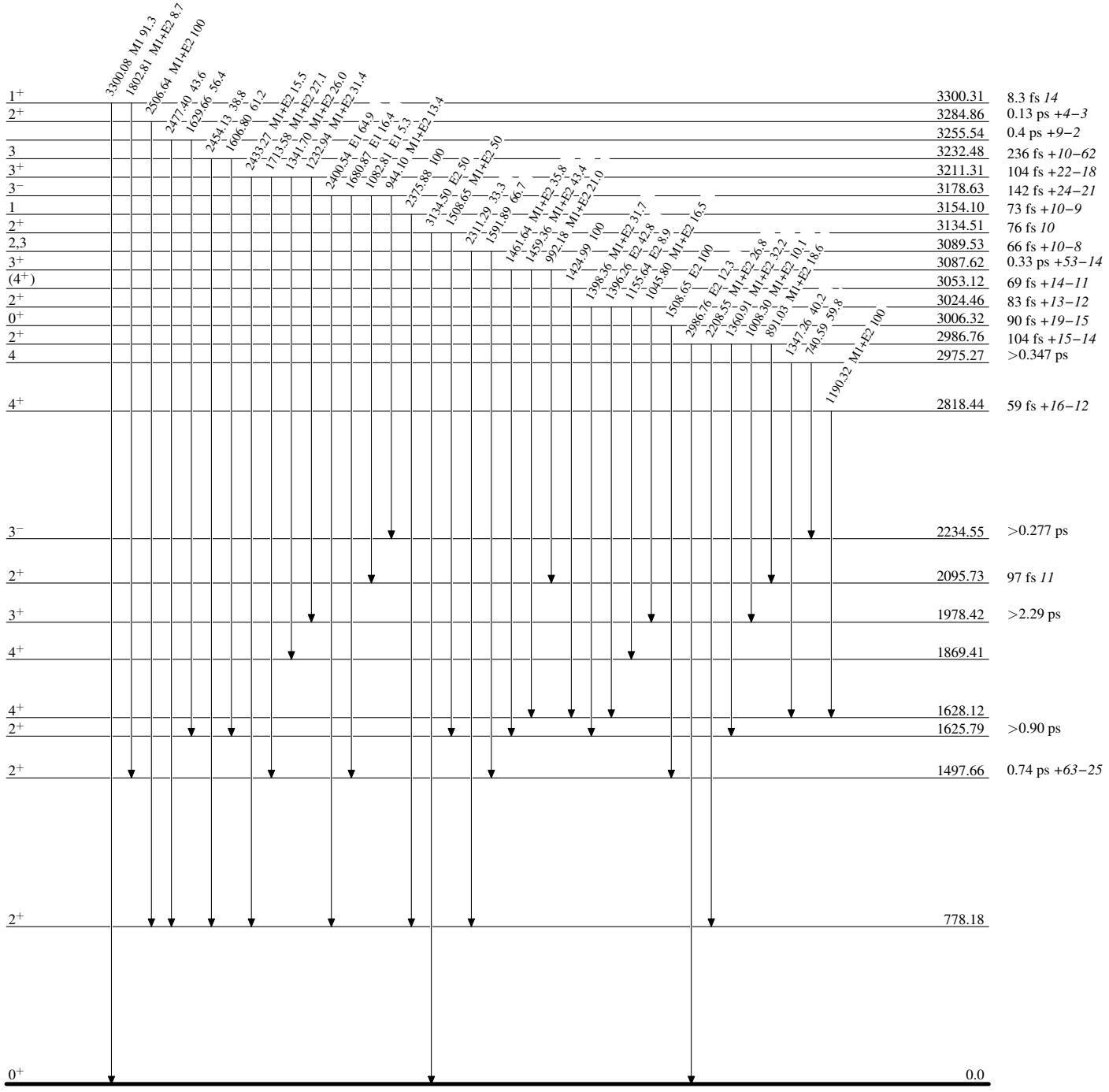


$^{96}_{42}Mo_{54}$

^{96}Mo(n,n′γ) 2007Le05

Level Scheme (continued)

Intensities: % photon branching from each level



$^{96}_{42}Mo_{54}$

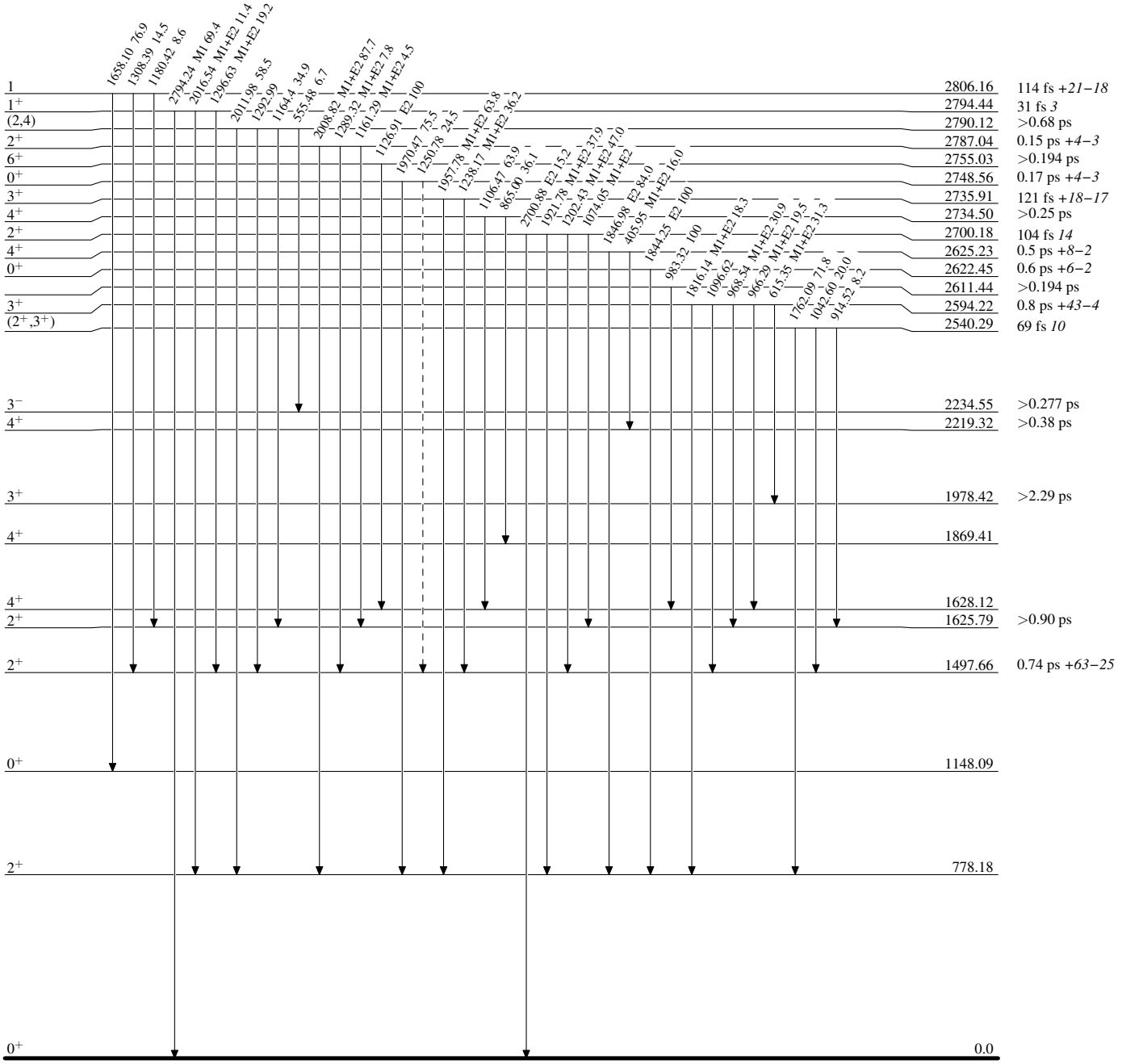
^{96}Mo(n,n′γ) 2007Le05

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

– – – – – – ► γ Decay (Uncertain)

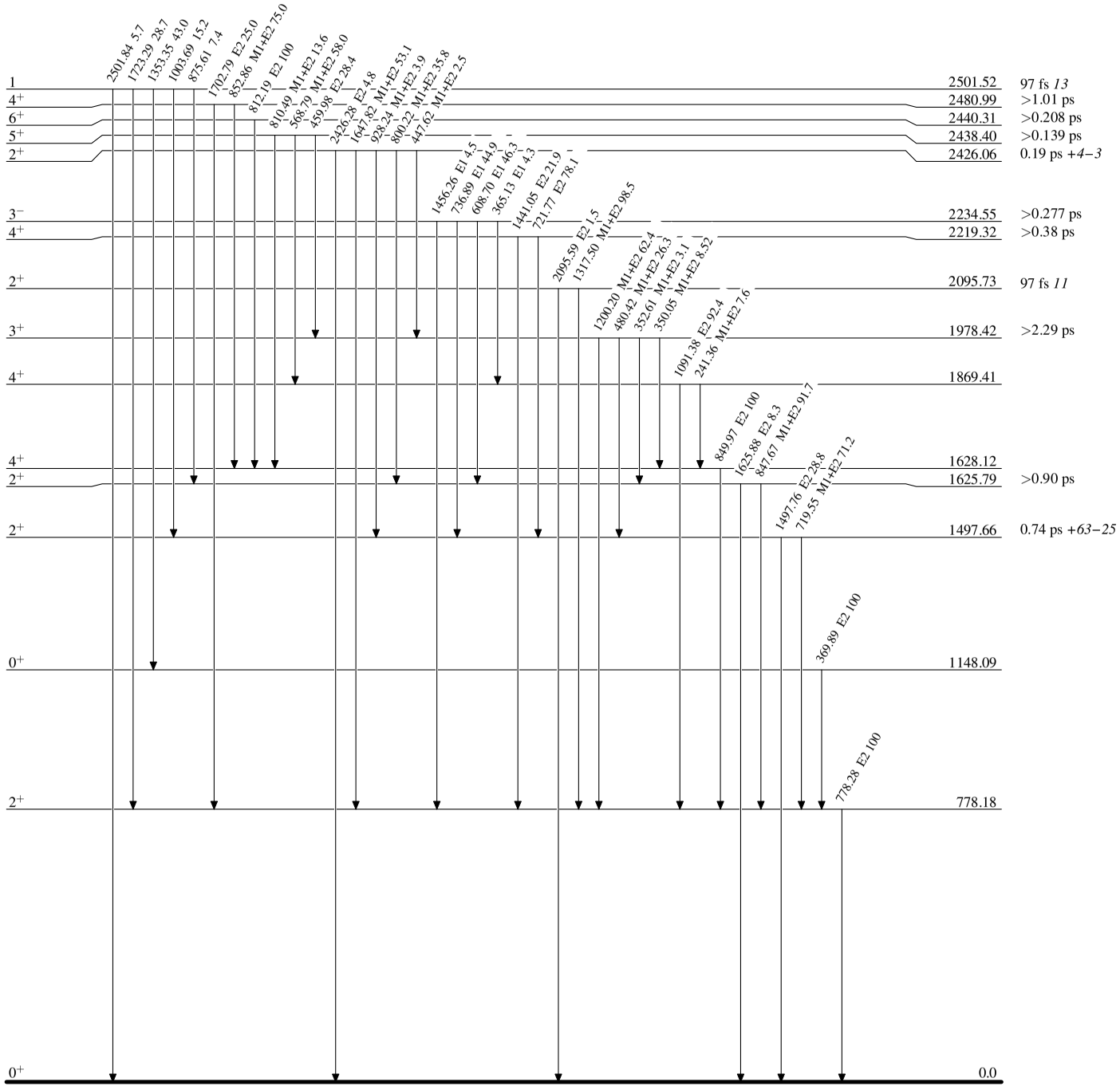


$^{96}_{42}Mo_{54}$

^{96}Mo(n,n′γ) 2007Le05

Level Scheme (continued)

Intensities: % photon branching from each level



$^{96}_{42}Mo_{54}$