^{96}Zr(α,nγ) 1988Du02

History

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

E(α)=10, 12, 14, 16, 17, 18 MeV.
Measured: γ, $\gamma\gamma$, $\gamma(\theta)$, excit.
Iγ at E(α)=14 MeV, $\gamma(\theta)$ at E(α)=16 MeV, $\gamma\gamma$ at E=13, 16 MeV.

^{99}Mo Levels

E(level)	J$^\pi$ †	E(level)	J$^\pi$ †	E(level)	J$^\pi$ †	E(level)	J$^\pi$ †
0.0	$1/2^+$	867.1		1313.4	$11/2^+$	1675.7	$(9/2^+)$
97.7	$5/2^+$	905.4	$1/2^+$	1342.5	$(7/2^+)$	1680.0	$(13/2^+)$
235.5	$7/2^+$	906.5	$9/2^+$	1355.2		1858.0	$19/2^-$
351.3	$3/2^+$	945.1	$(3/2,5/2)^+$	1367.8		1884.9	$(15/2^-)$
525.4	$1/2^+$	1025.9	$(1/2,3/2)^+$	1400.5	(5/2,7/2)	2220.9	$(17/2^-)$
548.7	$3/2^+$	1048.5	$7/2^+$	1404.8	$(17/2^-)$	2232.2	$(15/2^-)$
615.3	$5/2^+$	1142.8	$(7/2^+)$	1449.8		2410.0	$(17/2^+)$
632.0	$(3/2^+)$	1165.4	$15/2^-$	1464.5	$(9/2^+)$	2441.6	$(13/2^+)$
684.1	$11/2^-$	1196.0		1472.3	$(11/2^+)$		
698.5	$(7/2^+)$	1273.8		1536.7	$(7/2^+)$		
754.4	$^+$	1283.3	$(7/2^+)$	1638.0			

† From 1988Du02, based on γ-ray angular distibution measurements.

γ(^{99}Mo)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[#]	α[‡]	Comments
97.7	75 *4*	97.7	5/2$^+$	0.0	1/2$^+$				Mult.: A_2=0.00 *4*, A_4=0.00 *5*.
137.8	100	235.5	7/2$^+$	97.7	5/2$^+$	D			α(K)=0.0913; α(L)=0.01070; α(M)=0.00192; α(N+..)=0.00035 Mult.: A_2=−0.17 *4*, A_4=+0.04 *5*.
174.1	0.3 *1*	525.4	1/2$^+$	351.3	3/2$^+$				E_γ: doublet.
197.4	0.9 *2*	548.7	3/2$^+$	351.3	3/2$^+$				
208.0	2.2 *2*	906.5	9/2$^+$	698.5	(7/2$^+$)	M1+E2	−0.8 *+4−6*	0.055 *14*	α(K)=0.047 *12*; α(L)=0.0062 *19*; α(M)=0.00111 *34* α(N)=1.64×10^{-4} *48*; α(O)=7.8×10^{-6} *17* Mult.: A_2=−0.32 *4*, A_4=+0.01 *4*.
239.4	0.4 *1*	1404.8	(17/2$^-$)	1165.4	15/2$^-$	D			Mult.: A_2=−0.38 *4*, A_4=+0.00 *5*.
250.8		867.1		615.3	5/2$^+$				
253.5	11.7 *9*	351.3	3/2$^+$	97.7	5/2$^+$				Mult.: A_2=−0.09 *4*, A_4=+0.02 *5*.
263.9	7.5 *5*	615.3	5/2$^+$	351.3	3/2$^+$	M1(+E2)	−0.9 *7*	0.0271 *77*	α(K)=0.0235 *66*; α(L)=0.00296 *98*; α(M)=5.3×10^{-4} *18* α(N)=7.9×10^{-5} *26*; α(O)=3.9×10^{-6} *10* Mult.: A_2=−0.37 *4*, A_4=+0.03 *5*.
280.7	0.4 *1*	632.0	(3/2$^+$)	351.3	3/2$^+$				
351.3	8.7 *7*	351.3	3/2$^+$	0.0	1/2$^+$				Mult.: A_2=−0.04 *4*, A_4=+0.03 *5*.
379.8	2.0 *2*	615.3	5/2$^+$	235.5	7/2$^+$				Mult.: A_2=+0.09 *4*, A_4=0.00 *5*.
396.0		945.1	(3/2,5/2)$^+$	548.7	3/2$^+$				
407.6	1.3 *2*	1313.4	11/2$^+$	906.5	9/2$^+$	M1+E2	−1.6 *+5−9*	0.0082 *5*	α(K)=0.0071 *4*; α(L)=0.00086 *6*; α(M)=0.000154 *10* α(N)=2.31×10^{-5} *15*; α(O)=1.20×10^{-6} *6* Mult.: A_2=−0.45 *4*, A_4=+0.03 *5*.
427.7	1.0 *2*	525.4	1/2$^+$	97.7	5/2$^+$				Mult.: A_2=−0.08 *4*, A_4=+0.08 *5*.
433.2	2.0 *2*	1048.5	7/2$^+$	615.3	5/2$^+$	M1+E2	−1.4 *+4−6*	0.0067 *4*	α(K)=0.0058 *3*; α(L)=0.00070 *4*; α(M)=0.000125 *7* α(N)=1.88×10^{-5} *11*; α(O)=9.9×10^{-7} *4* Mult.: A_2=−0.50 *4*, A_4=+0.07 *5*.
448.6	59 *3*	684.1	11/2$^-$	235.5	7/2$^+$				Mult.: A_2=+0.02 *4*, A_4=+0.4 *5*.
451.3	4.0 *3*	548.7	3/2$^+$	97.7	5/2$^+$				E_γ: doublet. Mult.: A_2=+0.03 *4*, A_4=−0.02 *5*.
463.0	2.0 *2*	698.5	(7/2$^+$)	235.5	7/2$^+$	D+Q			Mult.: A_2=+0.27 *4*, A_4=−0.03 *5*.
481.3	24.7 *15*	1165.4	15/2$^-$	684.1	11/2$^-$	E2		0.00532	α(K)=0.00464 *7*; α(L)=0.000559 *8*; α(M)=9.99×10^{-5} *14* α(N)=1.500×10^{-5} *21*; α(O)=7.79×10^{-7} *11* Mult.: A_2=+0.29 *4*, A_4=−0.08 *5*.
497.5	0.7 *1*	1196.0		698.5	(7/2$^+$)				
500.5[@]		1025.9	(1/2,3/2)$^+$	525.4	1/2$^+$				
500.5[@]		1048.5	7/2$^+$	548.7	3/2$^+$				
514.4		867.1		351.3	3/2$^+$				
517.4		615.3	5/2$^+$	97.7	5/2$^+$				E_γ: doublet.
518.9		754.4	$^+$	235.5	7/2$^+$				E_γ: doublet.
525.4	2.0 *2*	525.4	1/2$^+$	0.0	1/2$^+$				Mult.: A_2=−0.06 *4*, A_4=−0.07 *5*.
534.2	1.2 *2*	632.0	(3/2$^+$)	97.7	5/2$^+$	D			Mult.: A_2=−0.37 *5*, A_4=+0.01 *6*.
548.7	1.4 *2*	548.7	3/2$^+$	0.0	1/2$^+$				Mult.: A_2=+0.02 *4*, A_4=−0.05 *5*.
554.1	0.3 *1*	905.4	1/2$^+$	351.3	3/2$^+$				

$^{99}_{42}$Mo$_{57}$-2

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

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[#]	α[‡]	Comments
565.8	2.8 *3*	1472.3	$(11/2^+)$	906.5	$9/2^+$	M1+E2	−1.0 *5*	0.00310 *14*	α(K)=0.00272 *12*; α(L)=0.000315 *18*; α(M)=5.6×10^{-5} *4* α(N)=8.5×10^{-6} *5*; α(O)=4.68×10^{-7} *15* Mult.: A_2=−0.57 *4*, A_4=+0.05 *4*.
593.8	1.3 *2*	945.1	$(3/2,5/2)^+$	351.3	$3/2^+$	M1		0.00258	α(K)=0.00227 *4*; α(L)=0.000256 *4*; α(M)=4.58×10^{-5} *7* α(N)=6.98×10^{-6} *10*; α(O)=3.98×10^{-7} *6* Mult.: A_2=−0.25 *4*, A_4=−0.01 *5*.
600.8[&]	17.1[&] *12*	698.5	$(7/2^+)$	97.7	$5/2^+$	M1+E2	−0.9 *4*	0.00264 *8*	α(K)=0.00232 *7*; α(L)=0.000267 *11*; α(M)=4.77×10^{-5} *19* α(N)=7.2×10^{-6} *3*; α(O)=4.00×10^{-7} *9* Mult.: A_2=−0.59 *4*, A_4=+0.06 *5*.
600.8[&]	2.0[&] *3*	1355.2		754.4	+				
613.4	1.2 *2*	1367.8		754.4	+				Mult.: A_2=+0.31 *4*, A_4=−0.16 *5*.
631.7[@a]		632.0	$(3/2^+)$	0.0	$1/2^+$				
631.7[@]		867.1		235.5	$7/2^+$				
656.7	16.7 *10*	754.4	+	97.7	$5/2^+$	D,D+Q			Mult.: A_2=−0.19 *4*, A_4=+0.04 *5*. δ: δ=2.8 *−9+20* or δ≈0.0.
658.2		1273.8		615.3	$5/2^+$				
668.0	0.7 *1*	1283.3	$(7/2^+)$	615.3	$5/2^+$				Mult.: A_2=+0.31 *4*, A_4=+0.05 *6*.
670.2	2.0 *2*	906.5	$9/2^+$	235.5	$7/2^+$	M1+E2	+1.1 *+11−5*	0.00202 *5*	α(K)=0.00178 *4*; α(L)=0.000204 *6*; α(M)=3.64×10^{-5} *11* α(N)=5.52×10^{-6} *16*; α(O)=3.06×10^{-7} *5* Mult.: A_2=+0.53 *4*, A_4=+0.04 *5*.
674.6	1.0 *2*	1025.9	$(1/2,3/2)^+$	351.3	$3/2^+$				
692.6	6.4 *4*	1858.0	$19/2^-$	1165.4	$15/2^-$	E2		0.00190	α(K)=0.001670 *24*; α(L)=0.000194 *3*; α(M)=3.47×10^{-5} *5* α(N)=5.24×10^{-6} *8*; α(O)=2.84×10^{-7} *4* Mult.: A_2=+0.37 *5*, A_4=−0.11 *6*.
696.7	3.9 *3*	1048.5	$7/2^+$	351.3	$3/2^+$	E2		0.00187	α(K)=0.001644 *23*; α(L)=0.000191 *3*; α(M)=3.41×10^{-5} *5* α(N)=5.16×10^{-6} *8*; α(O)=2.80×10^{-7} *4* Mult.: A_2=+0.23 *7*, A_4=+0.01 *9*.
719.5	3.1 *4*	1884.9	$(15/2^-)$	1165.4	$15/2^-$				Mult.: A_2=−0.05 *7*, A_4=+0.02 *8*.
730.0	1.2 *2*	2410.0	$(17/2^+)$	1680.0	$(13/2^+)$	E2		1.66×10^{-3}	α(K)=0.001456 *21*; α(L)=0.0001686 *24*; α(M)=3.01×10^{-5} *5* α(N)=4.56×10^{-6} *7*; α(O)=2.48×10^{-7} *4* Mult.: A_2=+0.28 *4*, A_4=−0.11 *5*.
761.6	1.2 *2*	2441.6	$(13/2^+)$	1680.0	$(13/2^+)$	(D+Q)			Mult.: A_2=+0.22 *4*, A_4=−0.11 *5*.
766.4	3.6 *4*	1464.5	$(9/2^+)$	698.5	$(7/2^+)$	M1+E2	−2.6 *+4−5*	1.46×10^{-3}	α(K)=0.001284 *18*; α(L)=0.0001476 *21*; α(M)=2.64×10^{-5} *4*

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

^{96}Zr(α,nγ) 1988Du02 (continued)

γ(^{99}Mo) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[#]	α[‡]	Comments
									α(N)=3.99×10^{-6} *6*; α(O)=2.20×10^{-7} *3* Mult.: A_2=−0.37 *4*, A_4=+0.08 *5*.
773.5[@]		1472.3	(11/2$^+$)	698.5	(7/2$^+$)				
773.5[@]	9.8 *8*	1680.0	(13/2$^+$)	906.5	9/2$^+$	E2		1.43×10^{-3}	α(K)=0.001257 *18*; α(L)=0.0001449 *21*; α(M)=2.59×10^{-5} *4* α(N)=3.92×10^{-6} *6*; α(O)=2.15×10^{-7} *3* Mult.: A_2=+0.27 *4*, A_4=−0.07 *5*.
782.3	4.6 *4*	1536.7	(7/2$^+$)	754.4	$^+$	M1+E2	+2.0 *+6−3*	1.39×10^{-3}	α(K)=0.001220 *17*; α(L)=0.0001398 *20*; α(M)=2.50×10^{-5} *4* α(N)=3.78×10^{-6} *6*; α(O)=2.09×10^{-7} *3* Mult.: A_2=+0.18 *4*, A_4=−0.20 *5*.
808.8	16.9 *12*	906.5	9/2$^+$	97.7	5/2$^+$	E2		1.28×10^{-3}	α(K)=0.001125 *16*; α(L)=0.0001292 *18*; α(M)=2.31×10^{-5} *4* α(N)=3.50×10^{-6} *5*; α(O)=1.92×10^{-7} *3* Mult.: A_2=+0.30 *4*, A_4=−0.08 *5*.
812.4	1.7 *3*	1048.5	7/2$^+$	235.5	7/2$^+$				Mult.: A_2=+0.27 *4*, A_4=+0.00 *5*.
834.5		1449.8		615.3	5/2$^+$				
907.3	7.0 *1*	1142.8	(7/2$^+$)	235.5	7/2$^+$	D+Q	+0.3 *+4−3*		Mult.: A_2=+0.58 *4*, A_4=−0.09 *5*.
921.3	2.5 *3*	1675.7	(9/2$^+$)	754.4	$^+$	M1+E2	+3.1 *+21−10*	9.37×10^{-4}	α(K)=0.000824 *12*; α(L)=9.37×10^{-5} *14*; α(M)=1.672×10^{-5} *24* α(N)=2.54×10^{-6} *4*; α(O)=1.414×10^{-7} *21* Mult.: A_2=+0.37 *4*, A_4=+0.15 *5*.
927.6	2.0 *2*	1025.9	(1/2,3/2)$^+$	97.7	5/2$^+$				
1055.5	1.3 *2*	2220.9	(17/2$^-$)	1165.4	15/2$^-$	M1+E2	+3.1 *+20−11*	6.86×10^{-4} *11*	α(K)=0.000604 *9*; α(L)=6.82×10^{-5} *10*; α(M)=1.217×10^{-5} *18* α(N)=1.85×10^{-6} *3*; α(O)=1.039×10^{-7} *17* Mult.: A_2=+0.33 *5*, A_4=+0.15 *6*.
1066.8	1.7 *2*	2232.2	(15/2$^-$)	1165.4	15/2$^-$	(D+Q)			Mult.: A_2=+0.15 *4*, A_4=−0.13 *5*.
1077.9	8.6 *6*	1313.4	11/2$^+$	235.5	7/2$^+$	E2		6.52×10^{-4}	α(K)=0.000574 *8*; α(L)=6.48×10^{-5} *9*; α(M)=1.156×10^{-5} *17* α(N)=1.757×10^{-6} *25*; α(O)=9.85×10^{-8} *14* Mult.: A_2=+0.28.4, A_4=−0.07 *5*.
1107.0	4.1 *4*	1342.5	(7/2$^+$)	235.5	7/2$^+$	(D+Q)			Mult.: A_2=+0.28 *4*, A_4=+0.03 *5*.
1165.0	3.9 *4*	1400.5	(5/2,7/2)	235.5	7/2$^+$				Mult.: A_2=+0.04 *4*, A_4=+0.00 *5*.
1228.9	4.1 *3*	1464.5	(9/2$^+$)	235.5	7/2$^+$	M1+E2	−4.0 *+10−17*	5.04×10^{-4} *8*	α(K)=0.000433 *7*; α(L)=4.86×10^{-5} *7*; α(M)=8.67×10^{-6} *13* α(N)=1.319×10^{-6} *19*; α(O)=7.46×10^{-8} *11*; α(IPF)=1.200×10^{-5} *20* Mult.: A_2=−0.23 *4*, A_4=+0.06 *5*.
1366.8		1464.5	(9/2$^+$)	97.7	5/2$^+$				
1402.5		1638.0		235.5	7/2$^+$				

[†] From γ-ray angular distribution measurements (1988Du02).
[‡] Additional information 1.
[#] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.

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

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

@ Multiply placed.
& Multiply placed with intensity suitably divided.
a Placement of transition in the level scheme is uncertain.

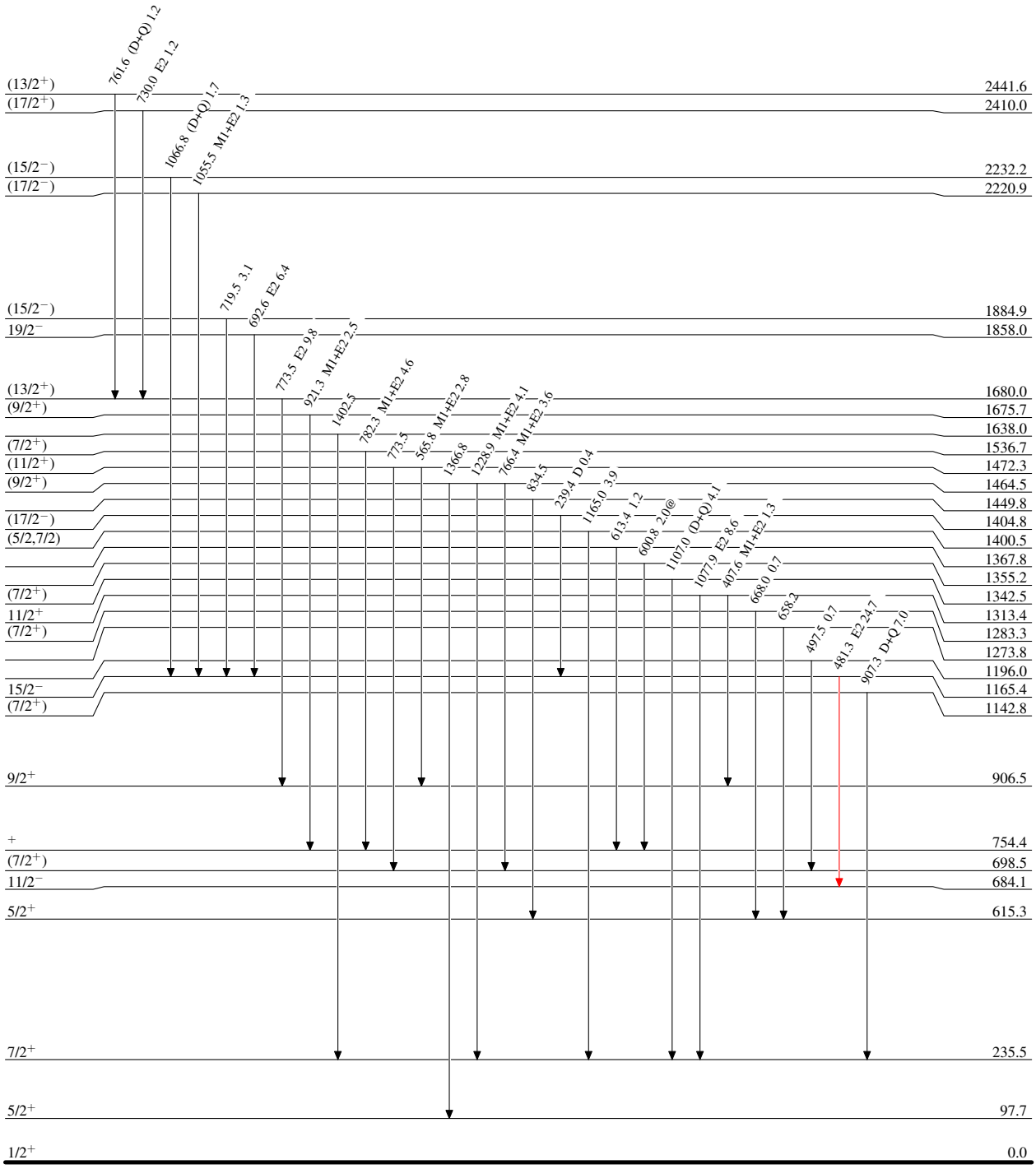
$^{99}_{42}Mo_{57}$-5

^{96}Zr(α,nγ) **1988Du02**

Level Scheme

Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{99}_{42}Mo_{57}$

^{96}Zr(α,nγ) 1988Du02

Level Scheme (continued)

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

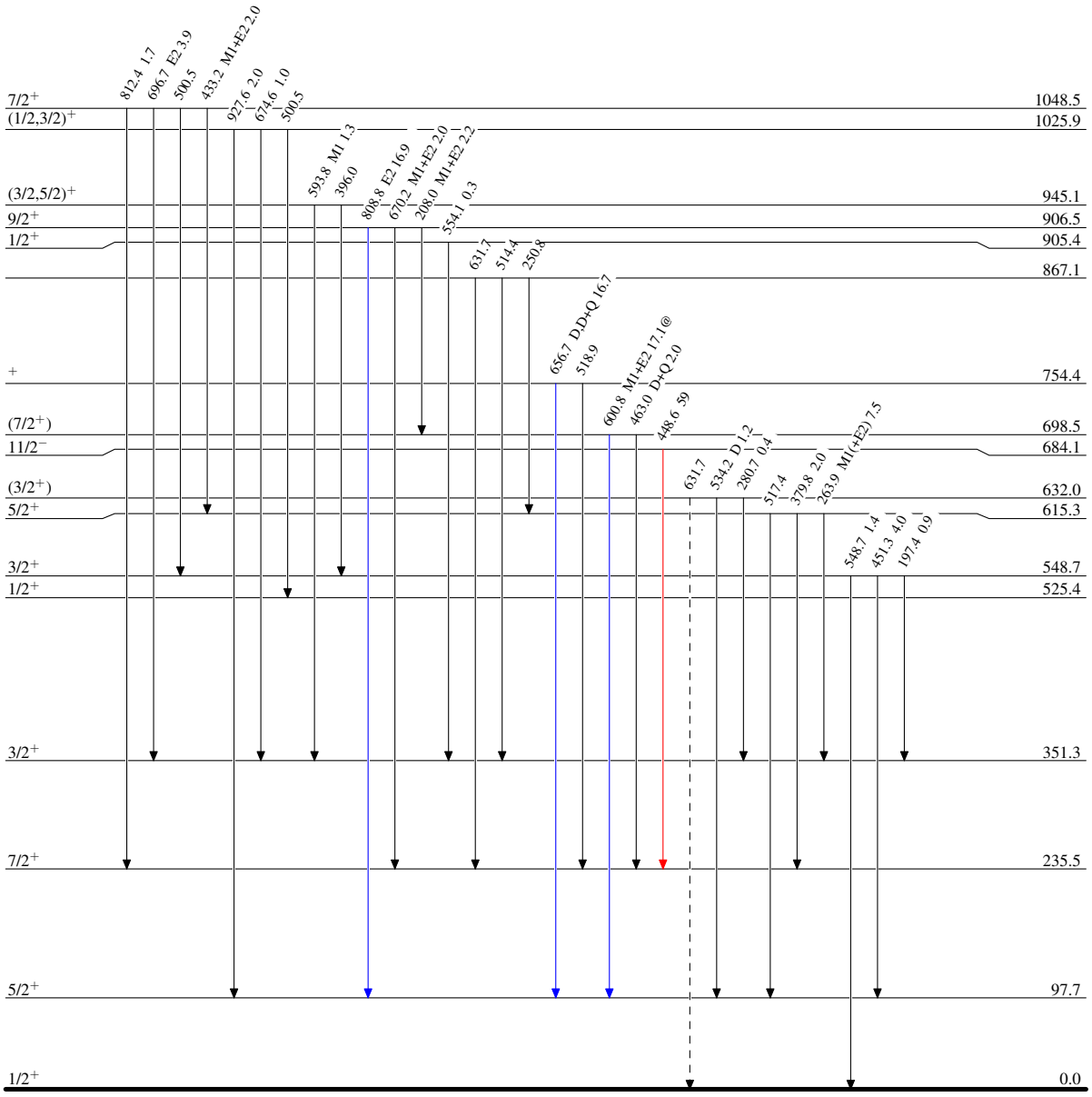
Legend

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

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

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

γ Decay (Uncertain)



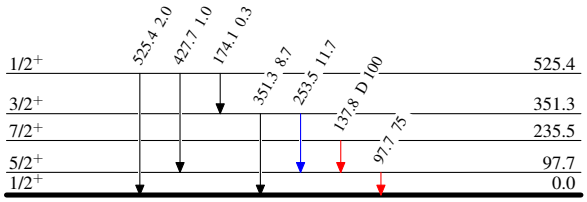
$^{99}_{42}Mo_{57}$

^{96}Zr(α,nγ) 1988Du02

Level Scheme (continued)

Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{99}_{42}Mo_{57}$