^{98}Mo(α,4nγ) 1981Du06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, Balraj Singh	NDS 164, 1 (2020)	15-Feb-2020

1981Du06: E=35-55 MeV alpha beams were produced from the 280-cm AVF cyclotron of the University of Groningen. Targets were 97% enriched metallic ^{98}Mo. γ rays were detected with Ge(Li) and NaI detectors and conversion electrons were detected with the mini-orange spectrometer. Measured Eγ, Iγ, ce, I(ce), γγ-coin, γ(θ). Deduced levels, J, π, conversion coefficients, γ-ray multipolarities, transition strengths. Comparisons with IBA calculations. Levels deduced up to 7621 keV.
All data are from 1981Du06.

^{98}Ru Levels

E(level)†	Jπ‡	Comments
0.0	0+	
652.8 *4*	2+	
1398.4 *5*	4+	
1415.0 *4*	2+	
1797.7 *4*	(3)+	
2013.7 *4*	3+	
2223.3 *6*	6+	
2267.5 *5*	(4)+	
2547.9 *6*	(4+,5,6+)	Jπ: γ(θ) and mult(1149.6γ) from ce data suggest 6+.
2658.0 *6*	(5−)	Jπ: proposed by 1981Du06 based on possible band structure and theoretical predictions. It is in disagreement with (3,5+) based on γγ(θ) and γ-decay pattern in a recent measurement of (^{3}He,2nγ) by 2016Gi05.
3127.6 *6*	8+	
3191.4 *6*	(8)+	
3284.9 *6*	(7)−	
3540.1 *6*	(6+,7,8+)	
3852.6 *7*	9−	
4002.1 *7*	(10)+	
4007.5 *6*	(6+,7+,8+)	
4224.6 *7*	(+)	
4673.7 *8*	(11)−	
4847.9 *8*		
4915.3 *8*	(12)+	
4989.7 *8*	(12)+	
5521.7 *9*	(13)−	
5889.5 *9*		
6591.6 *10*	(15)−	
7622.2 *11*		

† From a least-squares fit to γ-ray energies.
‡ From 1981Du06 based on γ(θ) and ce data, unless otherwise noted.

γ(^{98}Ru)

A_2 and A_4 values are from data at E(α)=45 MeV (1981Du06).

Eγ	Iγ†	Ei(level)	Jπi	Ef	Jπf	Mult.‡	δ#	Comments
253.9 *4*	1.0 *1*	2267.5	(4)+	2013.7	3+	(E2+M1)	+3.5 *+20−12*	A_2=−0.43 *8*; A_4=+0.36 *15* Mult.: large δ(E2/M1) favors M1+E2 rather than E1+M2 admixture.

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^{98}Mo(α,4nγ) 1981Du06 (continued)

γ(^{98}Ru) (continued)

$E_γ$	$I_γ$[†]	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.[‡]	δ[#]	Comments
382.7 *4*	0.8 *1*	1797.7	(3)$^+$	1415.0	2$^+$	(M1+E2)	+0.4 *+17−3*	A_2=−0.73 *15*; A_4=+0.05 *2*; α(K)exp=0.0035 *25* Mult.: α(K)exp is too low to be consistent with M1 or E2, it is in agreement with E1, but results of other experiments do not support E1. δ: from γ(θ) data.
412.3 *4*	1.3 *1*	3540.1	(6$^+$,7,8$^+$)	3127.6	8$^+$			A_2=+0.33 *9*; A_4=+0.03 *2*
469.7 *4*	4.6 *4*	2267.5	(4)$^+$	1797.7	(3)$^+$	M1+E2	−0.8 *+3−6*	A_2=+0.34 *7*; A_4=−0.09 *3*; α(K)exp=0.0069 *15* Note that negative A_4 is inconsistent with ΔJ=1 transition. The α(K)exp value agrees with E2, and only marginally with M1.
599.0 *4*	2.1 *2*	2013.7	3$^+$	1415.0	2$^+$	E2+M1	+2.8 *12*	A_2=−0.45 *8*; A_4=+0.26 *9*; α(K)exp=0.0027 *10*
615.1 *4*	1.0 *1*	2013.7	3$^+$	1398.4	4$^+$	(E2+M1)		α(K)exp=0.0055 *20* Mult.: α(K)exp is high for M1 or E2. Iγ(615γ)/Iγ(598γ)=0.48 (1981Du06). Additional information 1.
626.8 *4*	1.5 *2*	3284.9	(7)$^−$	2658.0	(5$^−$)			A_2=+1.17 *30*; A_4=+0.38 *40*
652.6 *4*	100.0	652.8	2$^+$	0.0	0$^+$	E2		A_2=+0.27 *5*; A_4=−0.04 *3*; α(K)exp=0.0022 *5*
661.3 *4*	0.7 *2*	3852.6	9$^−$	3191.4	(8)$^+$			
722.7 *4*	5.9 *5*	4007.5	(6$^+$,7$^+$,8$^+$)	3284.9	(7)$^−$			A_2=0.00 *4*; A_4=+0.14 *6*
724.9 *4*	17.1 *13*	3852.6	9$^−$	3127.6	8$^+$	E1(+M2)	+0.2 *2*	A_2=−0.32 *6*; A_4=+0.15 *5*; α(K)exp=0.0009 *3*
745.5 *4*	96 *5*	1398.4	4$^+$	652.8	2$^+$	E2		A_2=+0.28 *5*; A_4=−0.08 *3*; α(K)exp=0.0016 *4*
762.2 *4*	3.9 *4*	1415.0	2$^+$	652.8	2$^+$			A_2=+0.17 *16*; A_4=−0.19 *6*
810.5 *4*	8.2 *6*	4002.1	(10)$^+$	3191.4	(8)$^+$	E2		A_2=+0.26 *5*; A_4=−0.18 *6*; α(K)exp=0.0014 *4*
821.1 *4*	19 *3*	4673.7	(11)$^−$	3852.6	9$^−$	E2		A_2=+0.51 *9*; A_4=−0.34 *14*; α(K)exp=0.0018 *6*
824.9 *4*	83 *4*	2223.3	6$^+$	1398.4	4$^+$	E2		A_2=+0.31 *5*; A_4=−0.09 *3*; α(K)exp=0.0012 *2*
840.4 *4*	5.3 *4*	4847.9		4007.5	(6$^+$,7$^+$,8$^+$)	Q		A_2=+0.33 *6*; A_4=−0.14 *5*
848.0 *4*	13.0 *10*	5521.7	(13)$^−$	4673.7	(11)$^−$	(E2)		A_2=+0.15 *3*; A_4=+0.02 *2*; α(K)exp=0.0014 *3*
874.6 *4*	17.8 *14*	4002.1	(10)$^+$	3127.6	8$^+$	E2		A_2=+0.25 *5*; A_4=−0.08 *3*; α(K)exp=0.0014 *3*
879.8 *4*	5.0 *4*	4007.5	(6$^+$,7$^+$,8$^+$)	3127.6	8$^+$	E2+M1		A_2=+0.16 *10*; A_4=−0.18 *15*; α(K)exp=0.0010 *3*
899.8 *4*	1.8 *2*	5889.5		4989.7	(12)$^+$			
904.1 *4*	50 *4*	3127.6	8$^+$	2223.3	6$^+$	E2		A_2=+0.27 *4*; A_4=−0.11 *6*; α(K)exp=0.0012 *2*
913.2 *4*	10.0 *7*	4915.3	(12)$^+$	4002.1	(10)$^+$	E2		A_2=+0.29 *6*; A_4=−0.07 *5*; α(K)exp=0.0010 *3*
968.0 *4*	23.4 *17*	3191.4	(8)$^+$	2223.3	6$^+$	E2		A_2=+0.35 *7*; A_4=−0.09 *3*; α(K)exp=0.0009 *3*
987.6 *4*	6.8 *5*	4989.7	(12)$^+$	4002.1	(10)$^+$	(E2)		A_2=+0.47 *9*; A_4=+0.09 *7*; α(K)exp=0.0006 *2*

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^{98}Mo(α,4nγ) 1981Du06 (continued)

γ(^{98}Ru) (continued)

E_γ	I_γ†	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	δ#	Comments
992.3 *4*	1.6 *2*	3540.1	(6$^+$,7,8$^+$)	2547.9	(4$^+$,5,6$^+$)			
1030.6 *4*	4.1 *4*	7622.2		6591.6	(15)$^-$			
1033.2 *4*	6.8 *5*	4224.6	($^+$)	3191.4	(8)$^+$			A_2=+0.18 *4*; A_4=−0.19 *6* Additional information 2.
1061.8 *4*	5.2 *5*	3284.9	(7)$^-$	2223.3	6$^+$	E1		A_2=−0.26 *5*; A_4=−0.01 *5*; α(K)exp=0.00023 *10* δ(M2/E1)=0.0 +*50*−*1*.
1069.9 *4*	6.4 *5*	6591.6	(15)$^-$	5521.7	(13)$^-$	(E2)		A_2=+0.17 *1*; A_4=−0.01 *15*; α(K)exp=0.00052 *15*
1096.9 *4*	5.8 *5*	4224.6	($^+$)	3127.6	8$^+$	M1,E2		A_2=+0.04 *6*; A_4=−0.27 *10*; α(K)exp=0.0005 *2*
1145.0 *4*	4.1 *4*	1797.7	(3)$^+$	652.8	2$^+$	M1+E2	<−0.2	A_2=+0.07 *3*; A_4=+0.01 *5*; α(K)exp=0.0007 *3*
1149.6 *4*	5.5 *5*	2547.9	(4$^+$,5,6$^+$)	1398.4	4$^+$	E2		A_2=+0.22 *5*; A_4=−0.19 *6*; α(K)exp=0.0006 *3*
1259.4 *4*	3.4 *3*	2658.0	(5$^-$)	1398.4	4$^+$	D(+Q)	>−0.1	A_2=−0.22 *5*; A_4=−0.15 *7* Note that negative A_4 is inconsistent with ΔJ=1 transition.
1415.1 *4*	1.4 *1*	1415.0	2$^+$	0.0	0$^+$			

† Values are for γ(θ) data at E(α)=52 MeV (1981Du06).

‡ From γ(θ) and ce data in 1981Du06. For most cases, α(K)exp value within the uncertainties is in agreement with M1 or E2.

From γ(θ) data (1981Du06).

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Level Scheme

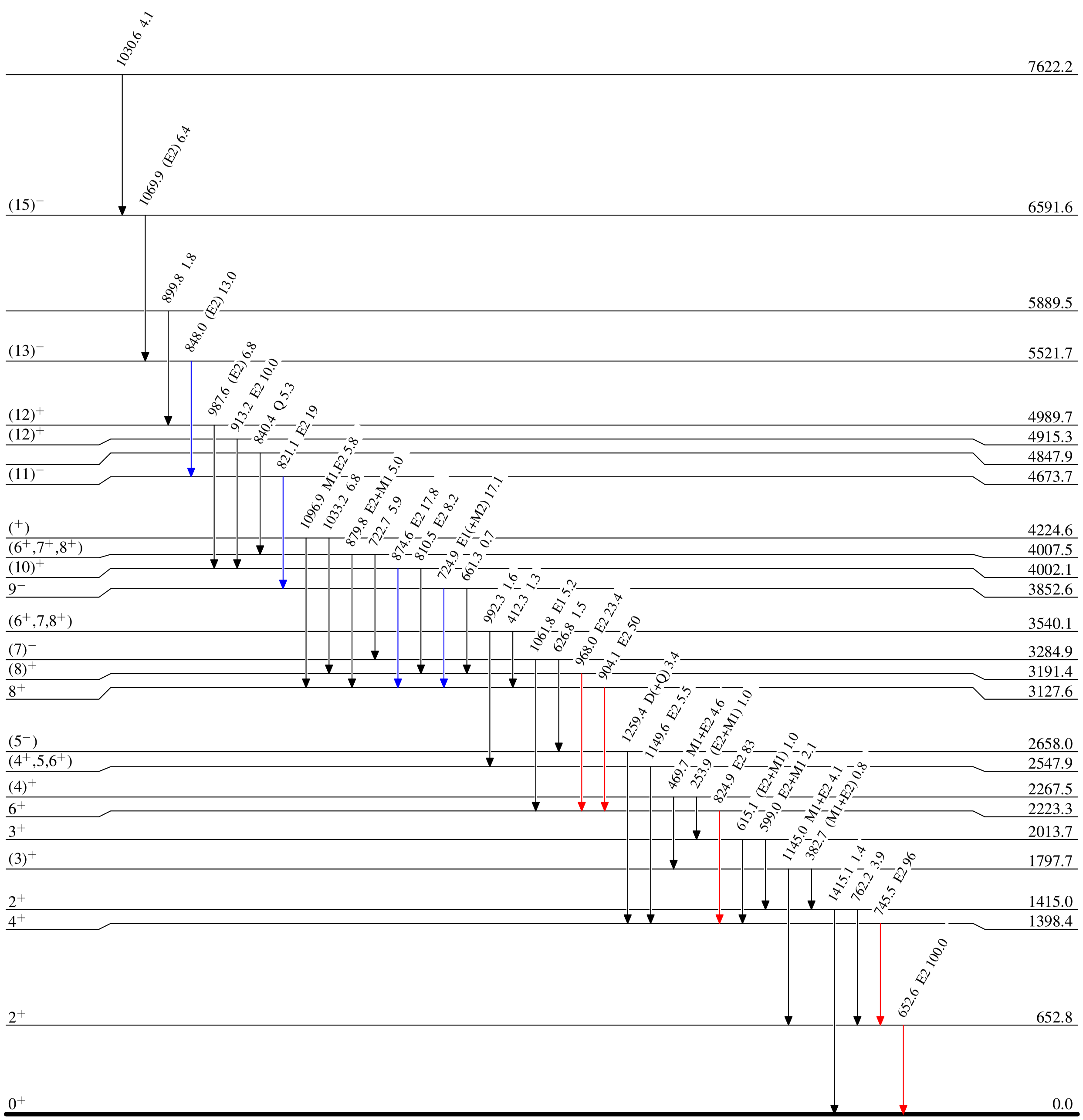
Intensities: Relative I_γ

Legend

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

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

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



$^{98}_{44}Ru_{54}$