^{96}Mo(^{7}Li,3nγ) 1986Du04,1987Bi23

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 172, 1 (2021)	31-Jan-2021

1986Du04: E=30 MeV ^{7}Li beam was produced from the CRN Strasbourg Tandem Accelerator. Target was 5 mg/cm^2 self-supporting Mo metal. γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma$(t), γ(t), $\gamma(\theta)$, γ(lin pol), excitation functions. Deduced levels, J, π, $T_{1/2}$, γ-ray multipolarities.

1987Bi23: ^{7}Li beam was produced from the Tandem XTU of Laboratori Nazionali di Legnaro (LNL). Target was ^{96}Mo. γ rays were detected with a Ge(Li) detector at 90° and conversion electrons were detected with the SPEL spectrometer consisting of a magnetic transport system and a Si(Li) detector. Measured Eγ, Iγ, E(ce), I(ce). Deduced levels, J, π, band structures, conversion coefficients, γ-ray multipolarities. Comparisons with theoretical calculations.

1990Bi03 (same group as 1987Bi23): E=30 MeV ^{7}Li beam at LNL. Target was a 3.8 mg/cm^2 rolled foil of enriched ^{96}Mo. γ rays were detected with two planar Ge detectors. Measured g-factor of the 7^+ level by the time-differential perturbed γ-ray angular distribution (TDPAD) method.

Other:

1986RaZU: ^{90}Zr(^{12}C,pnγ) and ^{89}Y(^{13}C,2nγ). Measured γ(t) and g factor by PAD method.

^{100}Rh Levels

E(level)†	Jπ‡	$T_{1/2}$	Comments
0.0	1^-		
32.7 *3*	$(2)^-$	27.6# ns *6*	
74.5 *3*	$(2)^+$	214.3# ns *20*	
107.2 *5*	(5^+)	4.6# min *2*	%IT≈98.3; %ε+%β^+≈1.7
219.2 *5*	(7^+)	140 ns *5*	g=+0.67 *2* (1990Bi03) $T_{1/2}$: from $\gamma\gamma$(t) (1986Du04). Other: 165 ns (1986RaZU). g factor from TDPAD method in 1990Bi03 using $T_{1/2}$=140 ns *5* from 1986Du04. Other: +0.69 *6*, with $T_{1/2}$=165 ns in 1986RaZU. Configuration=$\pi g_{9/2}\otimes\nu d_{5/2}$ (1990Bi03).
243.2 *5*	(6^+)		
357.2 *5*	(6^+)		
438.2 *5*	(7^+)		
886.6 *5*	(8^+)		
1197.1 *5*	(9^+)		
1269.9 *5*	(8^-)		
1402.9 *5*	(9^-)		
1732.3 *7*	(9,10)		
1800.4 *6*	(10^-)		
2126.9 *6*	(11^-)		
2189.9 *6*	(10^-)		
2595.4 *6*	(12^-)		
3063.8 *6*	(13^-)		
3489.8 *12*	(14^-)		E(level): level from 1987Bi23.
3580.4? *5*			

† From least-squares fit to Eγ data, assuming ΔEγ=0.3 keV if not given.

‡ From the Adopted Levels. Assignments are supported by $\gamma(\theta)$ and ce data in this dataset where applicable.

From the Adopted Levels.

^{96}Mo(^{7}Li,3nγ) 1986Du04,1987Bi23 (continued)

γ(^{100}Rh)

Values of A_2, A_4 and POL are from 1986Du04; values of α(K)exp are from 1987Bi23. α(K)exp were measured at 90° to the beam without correction for angular distribution effects which would increase the quoted values about (10-20)% for pure E1 and (5-8)% for pure M1 (E2 almost unaffected) (1987Bi23).

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[@]	Comments
32.7		32.7	(2)$^-$	0.0	1$^-$				E_γ: from the Adopted Gammas.
74.5[a‡]	300[a]	74.5	(2)$^+$	0.0	1$^-$				
74.5[a‡]	300[a]	107.2	(5$^+$)	32.7	(2)$^-$	[E3]			
81.1 *1*	3.5 *10*	438.2	(7$^+$)	357.2	(6$^+$)	D+Q			A_2=−0.35 *10*; A_4=+0.10 *12*
112.0 *1*	48 *5*	219.2	(7$^+$)	107.2	(5$^+$)	E2		0.898	α(K)=0.716 *11*; α(L)=0.1492 *22*; α(M)=0.0283 *5* α(N)=0.00439 *7*; α(O)=0.0001065 *16* A_2=+0.16 *4*; A_4=−0.12 *5* Mult.: Q from γ(θ) and M2 ruled out by RUL.
133.1 *2*	35 *4*	1402.9	(9$^-$)	1269.9	(8$^-$)	D(+Q)	−0.06 *+9−3*		A_2=−0.23 *6*; A_4=+0.01 *7*
136.0 *1*	100	243.2	(6$^+$)	107.2	(5$^+$)	M1+E2	+0.38 *8*	0.184 *15*	α(K)=0.157 *12*; α(L)=0.022 *3*; α(M)=0.0041 *5* α(N)=0.00067 *8*; α(O)=2.79×10^{-5} *17* A_2=+0.25 *4*; A_4=+0.04 *5* Mult.: from RUL, for δ=0.38, E1+M2 is ruled out since 136γ appears strongly in prompt spectrum.
138.1 *2*	18 *2*	357.2	(6$^+$)	219.2	(7$^+$)	D(+Q)	+0.05 *+3−8*		A_2=−0.18 *6*; A_4=−0.04 *7*
195.2 *2*	51 *5*	438.2	(7$^+$)	243.2	(6$^+$)	M1(+E2)	<0.09	0.0553 *9*	α(K)=0.0483 *8*; α(L)=0.00580 *10*; α(M)=0.001079 *18* α(N)=0.000179 *3*; α(O)=8.99×10^{-6} *14* A_2=−0.21 *5*; A_4=−0.03 *6* POL=−0.37 *10*.
218.8 *2*	8 *1*	438.2	(7$^+$)	219.2	(7$^+$)	M1(+E2)	+0.27 *+9−45*	0.0436 *21*	α(K)=0.0379 *17*; α(L)=0.0047 *3*; α(M)=0.00087 *6* α(N)=0.000144 *9*; α(O)=6.95×10^{-6} *25* A_2=+0.32 *7*; A_4=−0.03 *8* Mult.: ΔJ=0 from γ(θ) in 1986Du04. POL=+0.49 *12*.
249.9 *2*	29 *3*	357.2	(6$^+$)	107.2	(5$^+$)	M1(+E2)	−0.08 *+12−5*	0.0289 *5*	α(K)=0.0253 *4*; α(L)=0.00301 *6*; α(M)=0.000560 *11* α(N)=9.30×10^{-5} *17*; α(O)=4.69×10^{-6} *8* A_2=−0.29 *6*; A_4=−0.01 *8*; α(K)exp=0.027 *4* POL=−0.24 *7*. δ: α(K)exp gives δ<0.65.
310.6 *3*	7 *1*	1197.1	(9$^+$)	886.6	(8$^+$)	D			A_2=−0.17 *9*; A_4=−0.02 *10*
326.6 *3*	15 *2*	2126.9	(11$^-$)	1800.4	(10$^-$)	M1(+E2)		0.018 *4*	α(K)=0.015 *3*; α(L)=0.0020 *5*; α(M)=0.00037 *9* α(N)=6.0×10^{-5} *14*; α(O)=2.7×10^{-6} *4* A_2=−0.20 *6*; A_4=−0.06 *8*; α(K)exp=0.018 *4* POL=−0.06 *7*. Mult.: α(K)exp gives M1,E2.
331.1 *3*	8 *1*	438.2	(7$^+$)	107.2	(5$^+$)	E2		0.0204	α(K)=0.0175 *3*; α(L)=0.00234 *4*; α(M)=0.000438 *7*

γ(^{100}Rh) (continued)

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[#]	δ[#]	α[@]	Comments
									α(N)=7.10×10^{-5} *11*; α(O)=2.98×10^{-6} *5* A$_2$=+0.15 *9*; A$_4$=−0.15 *10*; α(K)exp=0.016 *2* POL=+0.51 *15*. δ: α(K)exp gives δ>0.7.
383.2 *3*	12 *2*	1269.9	(8$^-$)	886.6	(8$^+$)	E1		0.00345	α(K)=0.00303 *5*; α(L)=0.000349 *5*; α(M)=6.46×10^{-5} *10* α(N)=1.067×10^{-5} *15*; α(O)=5.28×10^{-7} *8* A$_2$=+0.35 *7*; A$_4$=−0.02 *8*; α(K)exp=0.0028 *4* Mult.: ΔJ=0 from $\gamma(\theta)$ in 1986Du04. POL=−0.50 *12*.
397.5 *2*	27 *3*	1800.4	(10$^-$)	1402.9	(9$^-$)	M1		0.00890	α(K)=0.00779 *11*; α(L)=0.000914 *13*; α(M)=0.0001696 *24* α(N)=2.82×10^{-5} *4*; α(O)=1.440×10^{-6} *21* A$_2$=−0.19 *6*; A$_4$=+0.03 *7*; α(K)exp=0.0070 *5* POL=−0.26 *7*. Mult.: from α(K)exp. $\gamma(\theta)$ data give δ<0.05.
426 *1*		3489.8	(14$^-$)	3063.8	(13$^-$)	M1,E2		0.0083 *9*	α(K)exp=0.0066 *12* α(K)=0.0072 *7*; α(L)=0.00089 *13*; α(M)=0.000166 *23* α(N)=2.7×10^{-5} *4*; α(O)=1.29×10^{-6} *9* Mult.: from α(K)exp.
448.4 *2*	35 *4*	886.6	(8$^+$)	438.2	(7$^+$)	M1(+E2)	<0.12	0.00664	α(K)=0.00581 *9*; α(L)=0.000679 *10*; α(M)=0.0001261 *18* α(N)=2.10×10^{-5} *3*; α(O)=1.072×10^{-6} *15* A$_2$=−0.13 *6*; A$_4$=+0.04 *8*; α(K)exp=0.0066 *6* POL=−0.18 *5*. Mult.: α(K)exp gives M1,E2.
468.4[b] *2*	12[b] *4*	2595.4	(12$^-$)	2126.9	(11$^-$)	(M1)		0.00596	α(K)=0.00522 *8*; α(L)=0.000609 *9*; α(M)=0.0001131 *16* α(N)=1.88×10^{-5} *3*; α(O)=9.63×10^{-7} *14* A$_2$=−0.21 *7*; A$_4$=+0.10 *9*; α(K)exp=0.0059 *6* I$_\gamma$: total Iγ=14 *2* divided (evaluators) from intensity balance considerations at 2596 level. POL=−0.45 *9* and α(K)exp for unresolved doublet. Mult.: α(K)exp gives M1,E2.
468.4[b] *2*	<8[b]	3063.8	(13$^-$)	2595.4	(12$^-$)	(M1)		0.00596	α(K)=0.00522 *8*; α(L)=0.000609 *9*; α(M)=0.0001131 *16* α(N)=1.88×10^{-5} *3*; α(O)=9.63×10^{-7} *14*
516.2[&] *3*	8 *1*	1402.9	(9$^-$)	886.6	(8$^+$)	E1		1.66×10^{-3}	α(K)=0.001454 *21*; α(L)=0.0001666 *24*; α(M)=3.08×10^{-5} *5* α(N)=5.10×10^{-6} *8*; α(O)=2.56×10^{-7} *4* A$_2$=−0.23 *9*; A$_4$=+0.02 *12*; α(K)exp=0.0014 *3* POL=+0.04 *8*. I$_\gamma$: deexcitation from 1401 level suggested by 1984Ma30 and 1987Bi23, which is consistent with mult=E1. 1986Du04 placed it from a 3581 level. All the intensity is assigned from the 1401 level. It is possible, however, that a weak component may also be from 3581 level. Mult.: from α(K)exp.
516.2[&c] *3*		3580.4?		3063.8	(13$^-$)				

$^{100}_{45}$Rh$_{55}$-3

γ(^{100}Rh) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[@]	Comments
535.2 *4*	6.5 *10*	1732.3	(9,10)	1197.1	(9$^+$)	D			A_2=−0.41 *10*; A_4=+0.16 *13*
723.8 *4*	8 *1*	2126.9	(11$^-$)	1402.9	(9$^-$)	(E2)		0.00205	α(K)=0.00179 *3*; α(L)=0.000215 *3*; α(M)=3.99×10^{-5} *6* α(N)=6.58×10^{-6} *10*; α(O)=3.19×10^{-7} *5* A_2=+0.05 *10*; A_4=−0.01 *12* POL=+0.37 *15*.
758.8 *3*	19 *2*	1197.1	(9$^+$)	438.2	(7$^+$)	(E2)		0.00182	A_2=+0.30 *7*; A_4=−0.08 *10* POL=+0.31 *10*.
787.0 *3*	14 *2*	2189.9	(10$^-$)	1402.9	(9$^-$)				A_2=+0.16 *8*; A_4=−0.07 *9* POL=+0.08 *6*.
795.1 *5*	1.4 *5*	2595.4	(12$^-$)	1800.4	(10$^-$)				A_2=+0.11 *5*; A_4=−0.10 *21*
832.0 *3*	14 *2*	1269.9	(8$^-$)	438.2	(7$^+$)	E1(+M2)	<0.011	5.80×10^{-4}	A_2=+0.20 *10*; A_4=+0.10 *13* δ: from RUL(M2)=1 and $T_{1/2}$<0.1 ps. From $\gamma(\theta)$, 1986Du04 give +0.27 *5*, but point out that the apparent large δ is probably due to an unidentified impurity. POL=+0.23 *7*.
937.0 *3*	13 *3*	3063.8	(13$^-$)	2126.9	(11$^-$)	(E2)		1.10×10^{-3}	α(K)=0.000959 *14*; α(L)=0.0001125 *16*; α(M)=2.08×10^{-5} *3* α(N)=3.45×10^{-6} *5*; α(O)=1.717×10^{-7} *24* α(K)exp=0.00074 *25* I_γ: complex γ. Total Iγ=33 *3*. Mult.: α(K)exp gives M1,E2, but ΔJ^π consistent with E2.
1050.4 *3*	31 *3*	1269.9	(8$^-$)	219.2	(7$^+$)	E1		3.68×10^{-4}	α(K)=0.000323 *5*; α(L)=3.65×10^{-5} *6*; α(M)=6.74×10^{-6} *10* α(N)=1.119×10^{-6} *16*; α(O)=5.75×10^{-8} *8* A_2=−0.18 *6*; A_4=−0.04 *7*; α(K)exp=0.00023 *6* POL=+0.24 *6*.

[†] From 1986Du04, unless otherwise noted.

[‡] Placements from the Adopted Gammas. Transition is from 107.6 isomer through cascades: 74.9-32.7 and 32.7-74.9, with 32.7γ too weak to be observed in this measurement. See also ^{98}Mo(^{6}Li,4nγ) and ^{100}Rh IT decay (4.6 min) for details.

[#] From $\gamma(\theta)$ and γ(lin pol) in 1986Du04 and/or ce data in 1987Bi23, with ΔJ=1 for dipole transitions and ΔJ=2 for quadrupole from $\gamma(\theta)$ in 1986Du04, unless otherwise noted.The evaluators have replaced M1 or E1 with D and E2 with Q if there is no experimental evidence such as ce data or γ(lin pol) for the assigned electric or magnetic nature in 1986Du04.

[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[&] Multiply placed.

[a] Multiply placed with undivided intensity.

[b] Multiply placed with intensity suitably divided.

[c] Placement of transition in the level scheme is uncertain.

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Level Scheme

Intensities: Relative I_γ

& Multiply placed: undivided intensity given

@ Multiply placed: intensity suitably divided