^{40}Ar(γ,γ'),(pol γ,γ') 1988Mo12,2006Li23,1986Wi08

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 140, 1 (2017)	30-Sep-2015

1988Mo12: (γ,γ') E=8.5, 10.3, 11.8 MeV bremsstrahlung electron beams were produced from the MUSL-2 accelerator of the University of Illinois. Target was natural liquid argon. γ rays were detected with two Ge(Li) detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, γ-ray intensity ratios. Deduced levels, J, π, widths. Comparisons with theoretical calculations.

2006Li23: (pol γ,γ') E=7.8-10.8 MeV linearly-polarized photon beams were produced from HIγS facility at the Duke FEL. Target was natural argon gas with an effective thickness of 6.64 g/cm^2. γ rays were detected with four HPGe detectors. Measured Eγ, Iγ, γ(pol asymmetry). Deduced levels, J, π, transition strengths. Comparisons with shell-model calculations.

1986Wi08: (pol γ,γ') E=17 MeV bremsstrahlung was produced from the linearly-polarized bremsstrahlung beam facility at the University of Giessen electron linear accelerator. Target was argon gas. γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, γ(pol asymmetry). Deduced levels, J, π.

^{40}Ar Levels

Transition strengths are deduced by 2006Li23 based on ground state decay widths Γ_0 from 1988Mo12.

E(level)[†]	J$^\pi$[#]	(2J+1)Γ_0^2/Γ (eV)[d]	Comments
0	0$^+$		
1461	2$^+$		
4473 *3*	1	0.21[e] *4*	
4768[‡] *1*	1$^-$[&]	2.46[e] *17*	
4901? *3*		0.05 *2*	
5110? *3*	(1,2$^+$)	0.07 *2*	
5393 *3*	1	0.09 *2*	
5880 *3*	1	0.35 *4*	
5912 *3*	1	0.15 *5*	
6056[‡] *2*	1[@]	1.24 *19*	
6102 *3*	1,2$^+$	0.17 *5*	
6339[‡] *2*	1[@]	0.87[e] *10*	
6450? *3*		0.17 *4*	
6477[‡] *3*	1[@]	1.29[e] *16*	
6703 *3*	1	0.38 *6*	
7168 *3*	1	0.24 *7*	
7246 *3*	1	0.37 *7*	
7281 *3*	1	0.48 *10*	
7519 *3*	1	0.46 *10*	
7626 *3*	1	0.33 *8*	
7708[‡] *3*	1$^-$[@a]	2.2 *3*	
7918[‡] *2*	1$^-$[@a]	1.84 *24*	
7993[‡] *3*	1$^-$[@a]	0.78 *14*	
8032 *3*	1$^-$	1.13 *20*	J$^\pi$: from 2006Li23. J^π=1,2$^+$ from 1988Mo12.
8163[‡] *2*	1$^-$[&a]	5.7 *10*	
8191[‡] *3*	1$^-$[@a]	2.2 *3*	
8303 *3*	1$^-$[a]	1.14 *19*	
8552 *3*	1$^-$[a]	1.66 *18*	
8585[‡] *3*	1$^-$[@a]	2.6 *4*	
8644 *3*	1$^-$[a]	0.80 *21*	
8676 *3*	1,2$^+$	1.8 *7*	
8834 *4*	1$^-$		E(level): observed only in 2006Li23. J$^\pi$: from polarization asymmetry in 2006Li23.

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^{40}Ar(γ,γ′),(pol γ,γ′) 1988Mo12,2006Li23,1986Wi08 (continued)

^{40}Ar Levels (continued)

E(level)[†]	Jπ[#]	Γ[b]	$(2J+1)\Gamma_0^2/\Gamma$ (eV)[d]	Comments
8884[‡] *3*	1^-[@a]		2.5 *4*	
8918 *3*	1^-[a]	0.34[c] eV *14*	0.81 *21*	
9128 *3*	1^-[a]	0.71 eV *14*	1.8 *3*	
9314	1^-			E(level): observed only in 2006Li23. Jπ: from polarization asymmetry in 2006Li23.
9337 *3*	$1,2^+$		0.76 *18*	
9356 *3*	1^-[a]	1.0 eV *3*	0.96 *24*	
9416 *3*	1^-[a]	3.4 eV *18*	1.2 *6*	
9502[‡] *2*	1^-[&a]	7.9 eV *13*	13.8 *12*	
9582 *3*	$1^{(-)}$[a]	7.3 eV *21*	0.99 *25*	E(level),Γ: doublet: 9580+9585.
9617	1^-			E(level): observed only in 2006Li23. Jπ: from polarization asymmetry in 2006Li23.
9757 *3*	1^+[a]	0.56[c] eV *22*	1.5 *3*	
9840 *3*	1		4.0 *10*	
9850[‡] *2*	1^-[&a]	21 eV *4*	13.4 *20*	E(level),Γ: doublet: 9848+9851.
9950 *3*	1^-[a]	10 eV *3*	0.95 *26*	
10090 *3*	1^-[a]		1.4 *3*	
10151 *3*	1^-[a]		3.4 *5*	
10179[‡] *2*	1^-[@a]		4.5 *6*	
10362 *3*	$1,2^+$		1.5 *4*	
10745 *3*	1^-[a]		1.6 *3*	
10857 *3*	1^-[a]		1.7 *4*	

[†] From 1988Mo12, unless otherwise noted.
[‡] Weighted average of values from 1988Mo12 and 1986Wi08.
[#] From 1988Mo12 based on measured γ-ray intensity ratio R=Iγ(90°)/Iγ(127°), unless otherwise noted. For most levels, the intensity ratios agree with those expected for 0-1-0 cascade.
[@] 1986Wi08 give $1,2^+$.
[&] Parity from polarization asymmetry in 1986Wi08.
[a] Parity from polarization asymmetry in 2006Li23.
[b] Deduced by 1988Mo12 from their $(2J+1)\Gamma_0^2/\Gamma$ values, and $S(\alpha,\gamma)=(2J+1)\Gamma_\alpha\Gamma_\gamma/\Gamma$ and Γ_0/Γ_γ from 1986Jo09.
[c] Lower limit using $\Gamma_0/\Gamma_\gamma=1$.
[d] From 1988Mo12, J=spin of excited state.
[e] For $\Gamma_0/\Gamma_\gamma=1$.

γ(^{40}Ar)

E_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	E_γ[†]	E_i(level)	J_i^π	E_f	J_f^π
1461	1461	2^+	0	0^+	6102 *3*	6102	$1,2^+$	0	0^+
4473 *3*	4473	1	0	0^+	6165[&] *3*	7626	1	1461	2^+
4641[&] *3*	6102	$1,2^+$	1461	2^+	6339 *2*	6339	1	0	0^+
4768 *1*	4768	1^-	0	0^+	6449[&] *3*	6450?		0	0^+
4901[&] *3*	4901?		0	0^+	6476 *3*	6477	1	0	0^+
5110[&] *3*	5110?	$(1,2^+)$	0	0^+	6570[&] *3*	8032	1^-	1461	2^+
5393 *3*	5393	1	0	0^+	6701[@‡&] *2*	8163	1^-	1461	2^+
5880 *3*	5880	1	0	0^+	6702[@‡] *3*	6703	1	0	0^+
5912 *3*	5912	1	0	0^+	7167 *3*	7168	1	0	0^+
6056 *2*	6056	1	0	0^+	7245 *3*	7246	1	0	0^+

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^{40}Ar(γ,γ'),(pol γ,γ') 1988Mo12,2006Li23,1986Wi08 (continued)

$\gamma(^{40}Ar)$ (continued)

E_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
7280 *3*	7281	1	0	0^+		
7518 *3*	7519	1	0	0^+		
7625 *3*	7626	1	0	0^+		
7707 *3*	7708	1^-	0	0^+	E1	POL=−0.58 *10*.
7917 *2*	7918	1^-	0	0^+	E1	POL=−0.72 *12*.
7992 *3*	7993	1^-	0	0^+	E1	POL=−0.49 *15*.
8031 *3*	8032	1^-	0	0^+	E1	POL=−0.55 *12*.
8162 *2*	8163	1^-	0	0^+	E1	POL=−0.65 *8*.
8190 *3*	8191	1^-	0	0^+	E1	POL=−0.59 *11*.
8302 *3*	8303	1^-	0	0^+	E1	POL=−0.47 *19*.
8551 *3*	8552	1^-	0	0^+	E1	POL=−0.70 *9*.
8584 *3*	8585	1^-	0	0^+	E1	POL=−0.49 *11*.
8643 *3*	8644	1^-	0	0^+	E1	POL=−0.57 *13*.
8675 *3*	8676	$1,2^+$	0	0^+		
8833 *4*	8834	1^-	0	0^+		POL<−0.33.
8883 *3*	8884	1^-	0	0^+	E1	POL<−0.50.
8917 *3*	8918	1^-	0	0^+	E1	POL<−0.33.
9127 *3*	9128	1^-	0	0^+	E1	POL<−0.10 (2006Li23).
9314	9314	1^-	0	0^+		POL<−0.44.
9336 *3*	9337	$1,2^+$	0	0^+		
9355 *3*	9356	1^-	0	0^+	E1	POL=−0.43 *13*.
9415 *3*	9416	1^-	0	0^+	E1	POL=−0.28 *13*.
9501 *2*	9502	1^-	0	0^+	E1	POL=−0.44 *13*.
9581 *3*	9582	$1^{(-)}$	0	0^+	(E1)	
9617	9617	1^-	0	0^+		POL<−0.16 *26*.
9756 *3*	9757	1^+	0	0^+	M1	POL=+0.48 *14*.
9839 *3*	9840	1	0	0^+		
9849 *2*	9850	1^-	0	0^+	E1	POL=−0.53 *15*.
9949 *3*	9950	1^-	0	0^+	E1	POL<−0.08.
10089 *3*	10090	1^-	0	0^+	E1	POL<−0.16.
10150 *3*	10151	1^-	0	0^+	E1	POL=−0.74 *13*.
10178 *2*	10179	1^-	0	0^+	E1	POL=−0.56 *14*.
10361 *3*	10362	$1,2^+$	0	0^+		
10743 *3*	10745	1^-	0	0^+	E1	POL<−0.20.
10855 *3*	10857	1^-	0	0^+	E1	POL<−0.06.

[†] 1988Mo12 and 1986Wi08 only give excitation energies from measured γ-ray energies which are not given in the papers. The evaluator has therefore taken the γ-ray energies from excitation energies.

[‡] In Table I of 1988Mo12 6703γ is shown to deexcite only the 8162 level, but in authors′ Table II, 6703 level is also given.

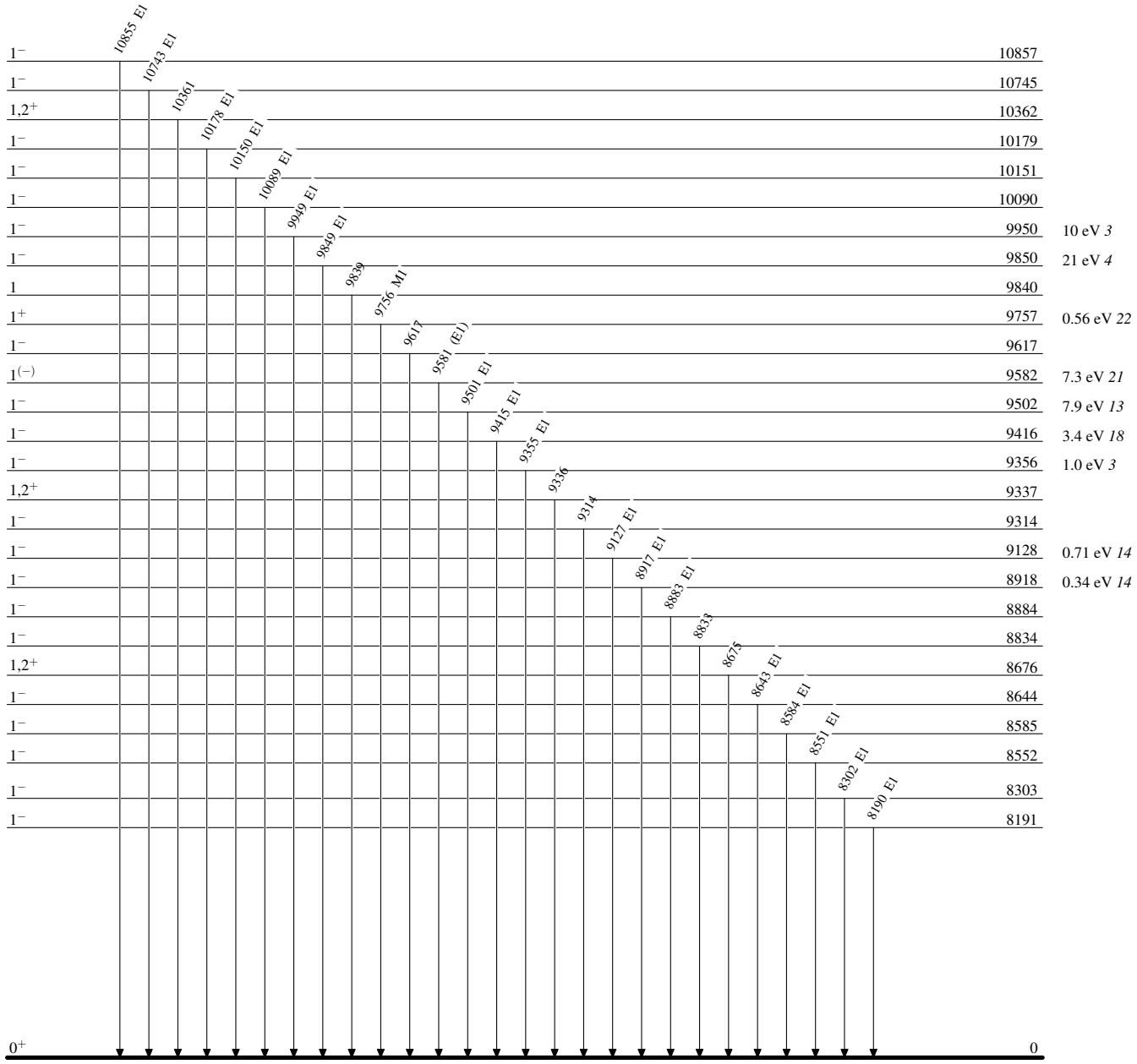
[#] From 2006Li23 based on polarization asymmetry.

[@] Multiply placed.

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

^{40}Ar(γ,γ′),(pol γ,γ′) 1988Mo12,2006Li23,1986Wi08

Level Scheme



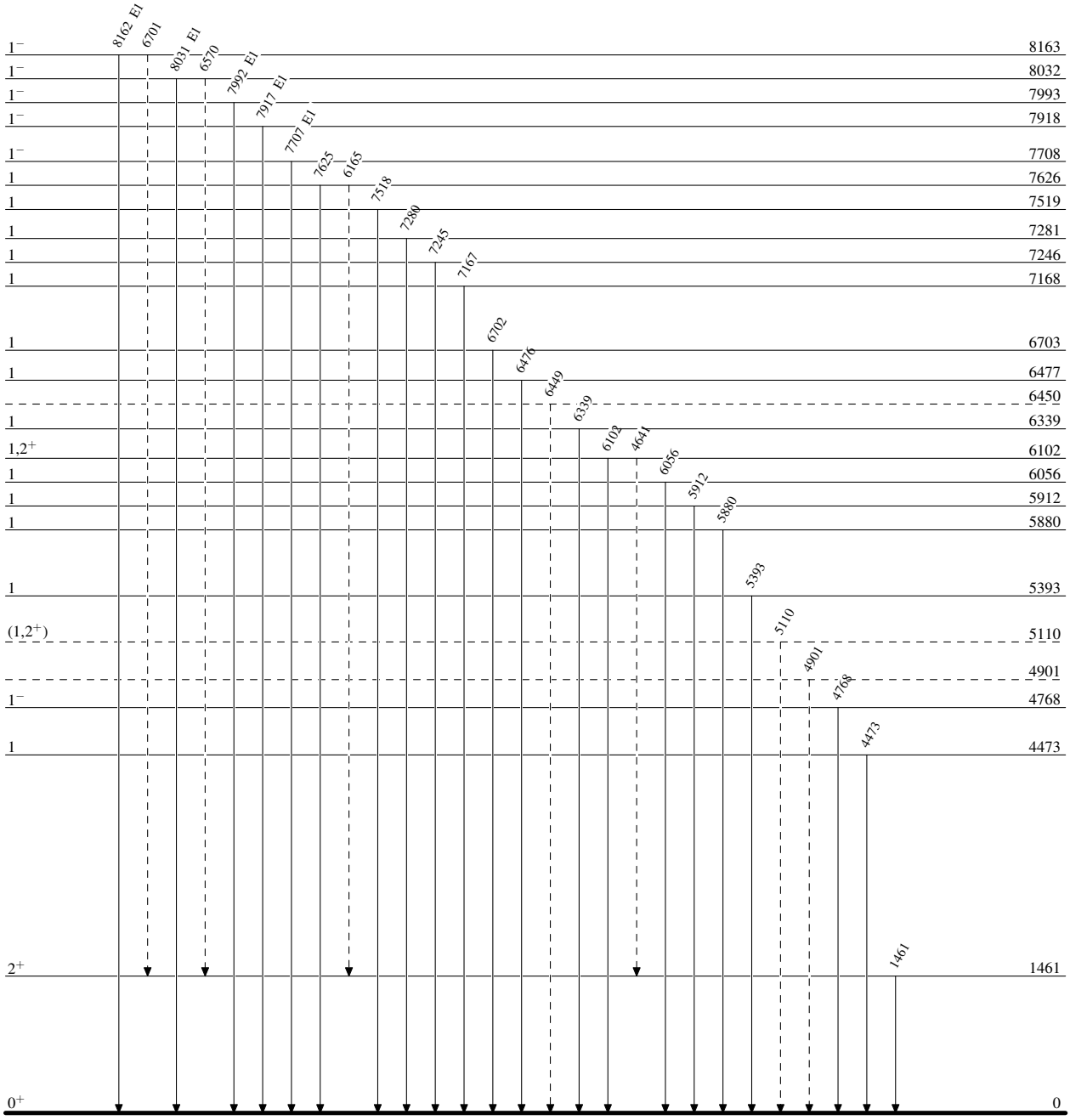
$^{40}_{18}Ar_{22}$

Legend

^{40}Ar(γ,γ′),(pol γ,γ′) 1988Mo12,2006Li23,1986Wi08

Level Scheme (continued)

- - - - - - ► γ Decay (Uncertain)



$^{40}_{18}Ar_{22}$