^{139}La(γ,γ'):E=6.0-8.6 MeV 1972Wo21,1970Sz01,1970Mo30

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	P. K. Joshi, B. Singh, S. Singh, A. K. Jain	NDS 138, 1 (2016)	15-Oct-2016

E=6.0-8.6 MeV.

1970Mo30: E=6.0-7.7 MeV from (n,γ) on Ti and Fe. Measured γ's, $\gamma(\theta)$ and effective elastic cross section (NaI,Ge(Li)) and resonance γ polarization (Compton polarimeter).

1970Sz01: E=6.1-8.6 MeV from (n,γ) on Cl, Ti, Ni, Cu. Measured γ's, $\gamma(\theta)$, and intensity ratios at T=77° K and room temperature. See also (γ,γ').

1972Wo21: E=6.0-7.7 MeV from (n,γ) on Ti and Fe. Measured resonance γ's and $\gamma(\theta)$, γ polarization (Compton polarimeter), temperature variation of σ, and nuclear self-absorption.

1993BeZW: Cl(n,γ) source. Measured resonance γ's.

^{139}La Levels

E(level)[c]	J$^\pi$[†]	Γ[‡]	Comments
0.0	7/2$^+$[#]		
166.6 *13*	5/2$^+$[#]		
1184 *4*	(5/2)$^+$[#]		
1218.0 *9*	9/2$^{(+)}$		J$^\pi$: from $\gamma(\theta)$ (1970Sz01).
1257?	(5/2)$^+$[#]		
1385.4 *13*	(7/2)		J$^\pi$: 7/2,11/2 from 5034$\gamma(\theta)$ and 7/2,9/2 from γ's from 7/2 and 9/2 resonances (1970Mo30). Evaluators note that 5034$\gamma(\theta)$ may also be consistent with 9/2.
1423.9 *12*	7/2,11/2		
1477.6 *13*	(9/2$^+$)[#]		
1541.4 *10*	7/2[#]		
1581.0 *13*	9/2		J$^\pi$: 5/2,9/2 from 4838,4438$\gamma(\theta)$ and 7/2,9/2 from γ's from 7/2 and 9/2 resonances (1970Mo30).
1687.3 *13*	7/2,11/2		J$^\pi$: from $\gamma(\theta)$ (1970Sz01).
1714 *4*	5/2$^+$[#]		
1759 *5*	7/2[@]		
1774.0[b] *14*	3/2$^+$,5/2$^+$[#]		
1837 *4*			
1860.1[b] *14*	3/2$^+$,5/2$^+$[#]		
1898.1[b] *14*			
1919[b]			
1956[b]			
2064.2 *14*			
2123			
2163.2 *14*			
2232[b] *5*	(7/2,11/2)		
2291 *5*			
2390 *5*	(7/2$^+$)[#]		
6018.0 *17*	7/2$^-$[&]	0.051 eV *+14−6*	
6119.2[ab] *9*	9/2$^{(-)}$	0.068 eV *34*	J$^\pi$: 9/2 from $\gamma(\theta)$ (1970Sz01). π=(−) since E1 absorption is generally two orders of magnitude larger than M1 for heavier nuclei. Γ: from Γ_0=0.025 eV *10* and Γ_0/Γ=0.37 *11* (1993BeZW). Other: ≤0.022 eV *17* (1970Sz01) from Γ_0^2/Γ=0.015 eV and $\Gamma_0/\Gamma\geq$0.43 *1*.
6420.4 *24*	9/2$^-$[&]	0.081 eV *+13−7*	
6764.4 *17*	7/2		$\Gamma_\gamma\geq$0.060 eV (1970Sz01) Γ_γ: From source line-resonant level spacing<8 eV and elastic scattering effective σ=7 mb.

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^{139}La(γ,γ′):E=6.0-8.6 MeV 1972Wo21,1970Sz01,1970Mo30 (continued)

^{139}La Levels (continued)

E(level)[c]	Jπ†	Γ‡	Comments
7279 *3*			
7637 *4*	7/2−&	0.17 eV *4*	Γ: from Γ_0/Γ=0.28 *4* and Γ_0=0.047 *6*, both in 1972Wo21.
8528.0[b] *8*			
8581.4[ab] *13*	7/2,9/2		Jπ: from γ′s to 7/2+ and 9/2 (1970Sz01).

† From γ(θ) of 1970Mo30, except as noted.
‡ From J, branching ratios, and effective elastic cross sections.
# From the Adopted Levels.
@ From γ(θ) (1970Sz01).
& From γ(θ) and polarization of elastically scattered γ (1970Mo30).
[a] From 1993BeZW.
[b] From 1970Sz01.
[c] From 1970Mo30, unless otherwise mentioned.

γ(^{139}La)

Γ_γ values are from 1972Wo21.

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.‡	δ‡	Comments
1218.0	9/2(+)	1219# *2*	100#	0.0	7/2+			
1423.9	7/2,11/2	1419# *2*	100#	0.0	7/2+			
1541.4	7/2	1536# *6*	100#	0.0	7/2+			
1581.0	9/2	1572# *9*	100#	0.0	7/2+			
1687.3	7/2,11/2	1680# *9*	100#	0.0	7/2+			
1759	7/2	1760# *10*	100#	0.0	7/2+			
1774.0	3/2+,5/2+	1600# *9*	100#	166.6	5/2+			
6018.0	7/2−	3895 *4*	1.1	2123				
		4062 *4*	1.1	1956				
		4334 *4*	13.6	1687.3	7/2,11/2			
		4438 *4*	27.9	1581.0	9/2	D(+Q)	+0.005 *15*	
		4481 *4*	5.8	1541.4	7/2			
		4538 *4*	4.8	1477.6	(9/2+)			
		4798 *4*	14.4	1218.0	9/2(+)	D+Q	+0.15 *10*	
		5852 *4*	21.5	166.6	5/2+	(E1(+M2))	−0.02 *6*	Mult.: from γ(θ) and Iγ/Eγ^3 (1970Mo30).
		6018 *4*	100	0.0	7/2+	E1(+M2)@	−0.01 *3*	α(IPF)=0.00230 *4* Γ_γ: Γ_0/Γ=0.50 *6* (1972Wo21) compared to 0.52 from decay scheme of 1970Mo30.
6119.2	9/2(−)	3956#	8# *2*	2163.2				
		4055#	4# *2*	2064.2				
		4221#	4# *1*	1898.1				
		4259#	4# *1*	1860.1	3/2+,5/2+	[M2,E3]		
		4345#	21# *1*	1774.0	3/2+,5/2+	[M2,E3]		
		4428#	19# *1*	1687.3	7/2,11/2			

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^{139}La(γ,γ′):E=6.0-8.6 MeV 1972Wo21,1970Sz01,1970Mo30 (continued)

γ(^{139}La) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
6119.2	9/2(−)	4534[#]	7[#] *1*	1581.0	9/2			
		4575[#]	5[#] *1*	1541.4	7/2			
		4638[#]	11[#] *1*	1477.6	(9/2+)			
		4694[e#]	22[e#] *1*	1423.9	7/2,11/2			
		4734[#]	9[#] *1*	1385.4	(7/2)			
		4858[#f]	<2[#]	1257?	(5/2)+			
		4896[#]	19[#] *1*	1218.0	9/2(+)			
		5949[#]	≈1[#]	166.6	5/2+			
		6115[#c] *2*	100[#] *1*	0.0	7/2+			
6420.4	9/2−	4186[&f] *4*	3.0	2232	(7/2,11/2)	D(+Q)		δ: δ(9/2→7/2)=+0.07 *18*; δ(9/2→11/2)=+0.01 *23*.
		4356[&f] *4*	1.0	2064.2				
		4459[&f] *4*	1.0	1956				
		4498[&f] *4*	0.6	1919				
		4580[&f] *4*	0.9	1837				
		4661 *4*	<1[#]	1759	7/2			
		4704[daf] *4*	2	1714	5/2+			
		4838[bf]	4[#] *1*	1581.0	9/2	D(+Q)	−0.1 *+3−2*	
		4882 *4*	6[#] *1*	1541.4	7/2	D(+Q)	−0.03 *8*	
		4999[bf] *4*	4[#] *1*	1423.9	7/2,11/2	D(+Q)		δ: δ(9/2→7/2)=+0.06 *12*; δ(9/2→11/2)=+0.02 *4*.
		5034 *4*	2[#] *1*	1385.4	(7/2)	D(+Q)		δ: δ(9/2→7/2)=+0.10 *18*. A_2: A_2(theory)=+0.092 (9/2→7/2), −0.133 (9/2→9/2), (9/2→11/2)=+0.05, assuming pure dipole. Evaluators note that 9/2→9/2 is not ruled out.
		6418 *4*	100[#] *1*	0.0	7/2+	E1(+M2)[@]	−0.001 *4*	Γ_γ: Γ_0/Γ=0.78 *8* (1972Wo21).
6764.4	7/2	4704[daf]	48[#] *9*	2064.2				E_γ: from 1970Sz01.
		5075 *4*	10[#] *6*	1687.3	7/2,11/2			
		5180 *4*	20[#] *6*	1581.0	9/2	D(+Q)	+0.03 *18*	
		5221 *4*	14[#] *6*	1541.4	7/2			
		5375 *4*	68[#] *6*	1385.4	(7/2)			
		5502[&f] *4*	60	1257?	(5/2)+			E_γ: from 1970Sz01.
		5540 *4*	13[#] *6*	1218.0	9/2(+)			
		6594 *4*	100[#] *7*	166.6	5/2+	D(+Q)	−0.01 *6*	
		6760[#] *4*	48[#] *7*	0.0	7/2+			
7279		5150 *4*	100	2123				
		5360 *4*	74	1919				
		5459 *4*	44	1837				
		5699 *4*	48	1581.0	9/2			
		7279 *4*	70	0.0	7/2+			
7637	7/2−	5867[#]	16[#] *2*	1774.0	3/2+,5/2+			E_γ: 1970Sz01 in level-scheme Fig. 3 show a 5687γ feeding a 1770 level, but the level-energy difference gives Eγ=5867 keV. It is possible that Eγ=5687 in authors′ Fig. 3 is a typo and that

Continued on next page (footnotes at end of table)

^{139}La(γ,γ′):E=6.0-8.6 MeV 1972Wo21,1970Sz01,1970Mo30 (continued)

γ(^{139}La) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	Comments
							it should be 5867 keV, which the evaluators list here.
							E_γ: from 1970Sz01.
7637	7/2$^-$	7637 *4*	100[#] *6*	0.0	7/2$^+$	E1[@]	α(IPF)=0.00268 *4*
							Γ_γ: Γ_0/Γ=0.28 *4* (1972Wo21) compared to 0.86 *2* from decay scheme of 1970Mo30.
8528.0		6985[#]	27[#] *2*	1541.4	7/2		
		7312[#]	15[#] *2*	1218.0	9/2$^{(+)}$		
		8527[#]	100[#] *5*	0.0	7/2$^+$		
8581.4	7/2,9/2	7002[#f]	9[#] *6*	1581.0	9/2		
		7363[#]	23[#] *10*	1218.0	9/2$^{(+)}$		
		8582[#c] *3*	100[#] *2*	0.0	7/2$^+$		

[†] Eγ and relative photon branching from each level are from 1970Mo30, except as noted.
[‡] From γ(θ) of 1970Mo30, except as noted.
[#] From 1970Sz01. At θ=90°.
[@] From γ(θ) and polarization (1970Mo30).
[&] Not assigned by 1970Sz01.
[a] Assigned to 6760 resonance by 1970Sz01 and to 6418 resonance by 1970Mo30.
[b] Ambiguity in placement from 6418 or 6760 resonances. Placed with 6418 based on energy considerations and on γ(θ).
[c] From 1993BeZW.
[d] Multiply placed.
[e] Multiply placed with undivided intensity.
[f] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

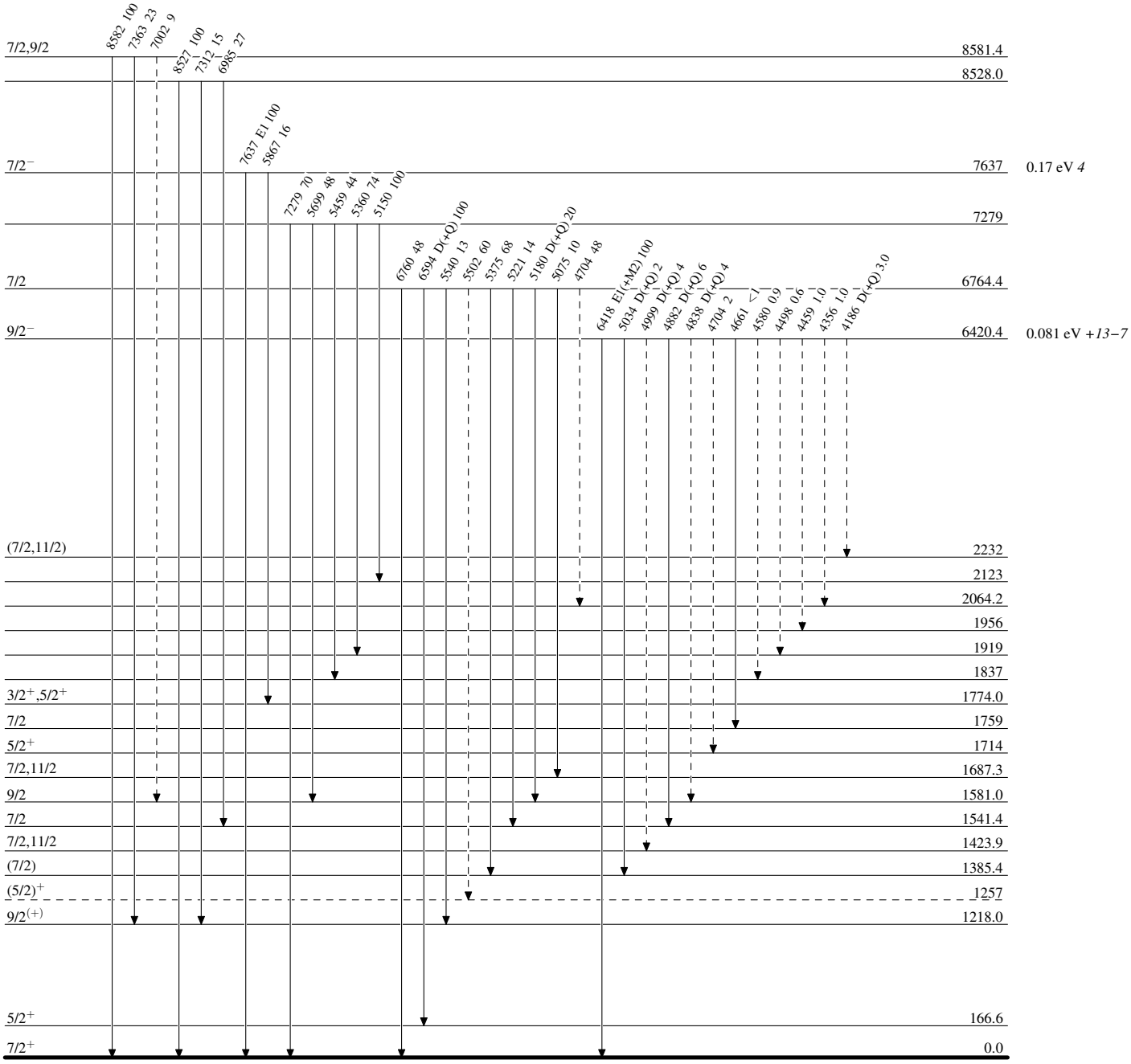
^{139}La(γ,γ′):E=6.0-8.6 MeV 1972Wo21,1970Sz01,1970Mo30

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{139}_{57}La_{82}$

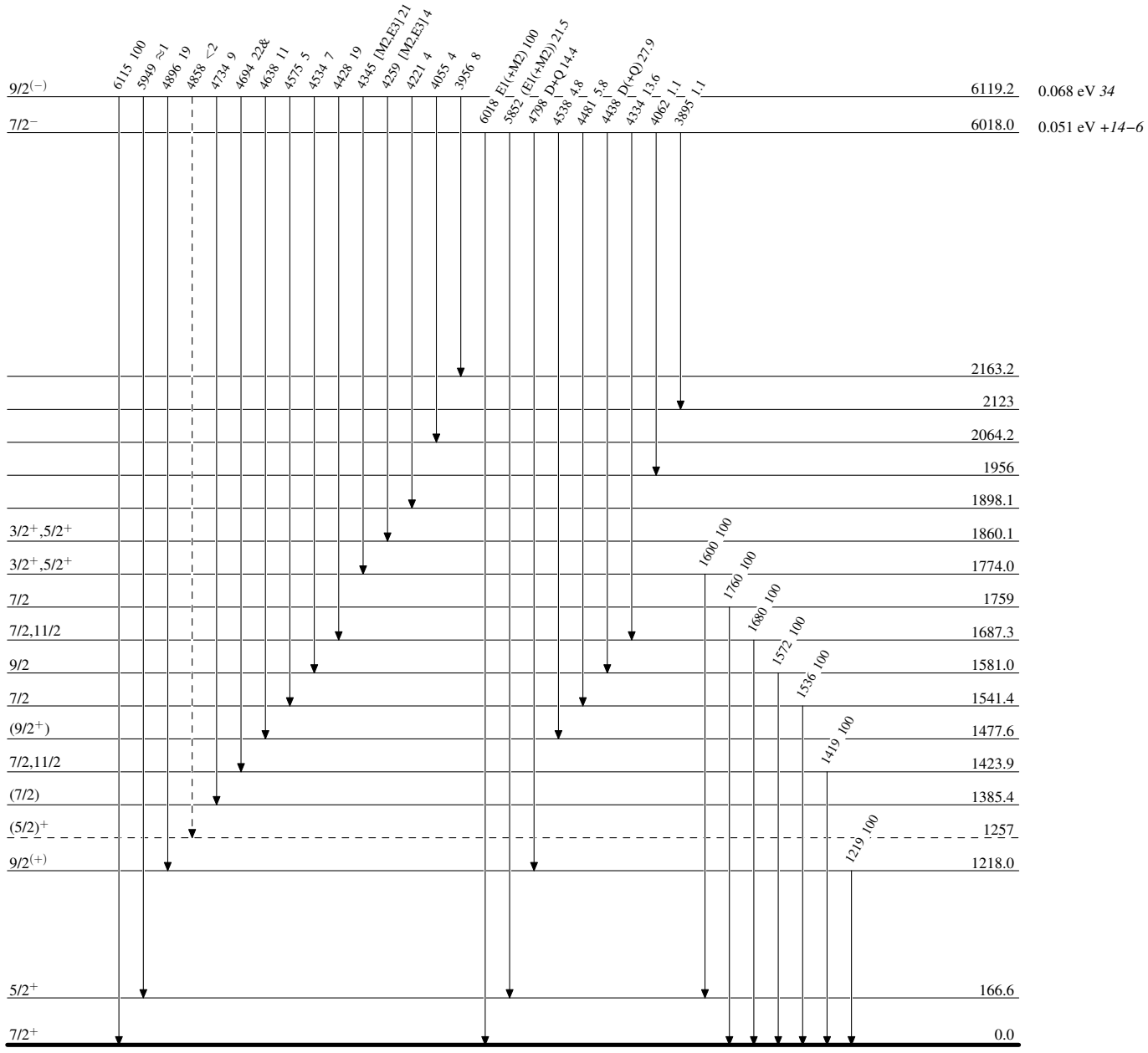
^{139}La(γ,γ′):E=6.0-8.6 MeV 1972Wo21,1970Sz01,1970Mo30

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

γ Decay (Uncertain)



$^{139}_{57}La_{82}$