Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 149, 1 (2018)	1-Jan-2018

$Q(\beta^-)$=565 *5*; S(n)=6599 *5*; S(p)=10733 *5*; $Q(\alpha)$=−6821 *5* 2017Wa10
S(2n)=18437 *5*, S(2p)=20924 *5* (2017Wa10).
First identification of ^{39}Ar nuclide by 1950Br66 from β-decay spectrum.
Other reactions:
2002Oz03: C(^{39}Ar,X): effective radii measured.
1979Lo11: ^{44}Ca(α,^{9}Be) E=100 MeV: measured $\sigma(\theta)$.
1979Sc02, 1982Ra15: ^{40}Ca(π^-,p) E=At rest.
1987Bl07: ^{40}Ca(π^-,p) E=120 MeV, measured $\sigma(\theta)$.
Hyperfine structure, isotope shift, etc: 1996Kl04, 1967Tr12.
Additional information 1.

^{39}Ar Levels

Cross Reference (XREF) Flags

A	^{39}Cl β^- decay (56.2 min)	G	^{39}K(n,p)	M	^{40}Ca(μ^-,νpγ)
B	^{36}S(α,nγ)	H	^{39}K(n,pγ)	N	^{40}Ca(^{14}C,^{15}O)
C	^{37}Cl(^{3}He,p)	I	^{40}Ar(p,d)	O	^{41}K(d,α)
D	^{37}Cl(α,d)	J	^{40}Ar(d,t),(pol d,t)	P	(HI,xnγ)
E	^{38}Ar(d,p)	K	^{40}Ar(^{3}He,α)		
F	^{38}Ar(d,pγ)	L	^{40}Ar(^{16}O,^{17}O)		

E(level)†	J$^{\pi}$	$T_{1/2}$‡	XREF	Comments
0	7/2$^-$	268 y *8*	ABCDEFGHIJKLMNOP	%β^-=100 μ=−1.588 *15* (1996Kl04) Q=−0.12 *3* (1996Kl04) J$^{\pi}$: spin from optical hyperfine structure (1967Tr12); parity from L(d,p)=L(p,d)=L(d,t)=L(^{3}He,α)=3. $T_{1/2}$: from re-evaluation of $T_{1/2}$=269 d *3* relative to $T_{1/2}$=35.1 d *1* for ^{37}Ar measured in 1965St09, using Adopted $T_{1/2}$=35.011 d *19*. Note that currently quoted uncertainty=8 is deduced based on the statement in 1965St09 that the systematic uncertainty is 3%. The same value is also from the re-evaluation by 1990Ho28 using $T_{1/2}$=35.02 d *2* for ^{37}Ar from 1975Ki10. Other: 265 y *30* (1952Ze01). μ,Q: from collinear laser spectroscopy (1996Kl04). Other: μ=−1.3 *3* (1967Tr12, optical method). Compilations: 2014StZZ, 2016St14. Experimental nuclear charge radius $<r^2>^{1/2}$=3.409 fm *3* (2013An02, evaluation). $\Delta<r^2>$(^{38}Ar,^{39}Ar)=0.04 fm^{-2} *7* (1996Kl04). Additional information 2.
1267.207 *8*	3/2$^-$	<0.5 ns	ABCDEFGHIJKLMNO	J$^{\pi}$: from L(pol d,t)=L(d,p)=L(p,d)=1 and L+1/2 transfer from analyzing powers in (pol d,t). $T_{1/2}$: from $\gamma\gamma$(t) in ^{39}Cl β^- decay (1956Pe38). Additional information 3.
1517.540 *8*	3/2$^+$	0.95 ns *5*	ABCDEFGHIJKLM O	XREF: G(1570)J(1530). J$^{\pi}$: L(pol d,t)=L(d,p)=L(p,d)=L(^{3}He,α)=2 and L-1/2 transfer from analyzing powers in (pol d,t); also L(^{3}He,p)=0 from 3/2$^+$. $T_{1/2}$: from $\gamma\gamma$(t) ^{39}Cl β^- decay (1956Pe38). Additional information 4.

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Adopted Levels, Gammas (continued)

^{39}Ar Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[‡]	XREF	Comments
2092.749 *19*	5/2$^-$	<35 fs	ABCDEFGHIJKLM O	XREF: G(2170). J^π: L(d,p)=L(p,d)=3; J=5/2 from $\gamma(\theta)$ in (α,nγ); L(^{3}He,p)=1 from 3/2$^+$.
2342.2 *2*	(5/2$^-$,7/2,9/2$^-$)	118 fs *35*	BcD F H M O	J^π: from (α,nγ) based on $\gamma(\theta)$ and considerations of transition strengths and RUL.
2358.284 *11*	1/2$^+$	>0.42 ps	ABc EF HIJK M	XREF: E(2347)J(2380). J^π: L(d,t)=L(d,p)=L(p,d)=L(^{3}He,α)=0. Additional information 5.
2433.48 *3*	3/2$^-$	0.69 ps *28*	AB EF HI M O	J^π: L(d,p)=1 ,2433.49γ to 7/2$^-$ and RUL. J=1/2 assigned by 1972Se04 in (d,p) based on J-dependence (Lee-Schiffer effect) is inconsistent.
2481.49 *13*	7/2$^-$	0.35 ps *15*	BCDEF H K M O	J^π: L(d,p)=3; J=7/2 from $\gamma(\theta)$ in (α,nγ).
2503.418 *11*	(5/2)$^+$	1.0 ps *4*	ABc FgHIjK M O	J^π: 2503.28γ to 7/2$^-$, 1236.19γ to 3/2$^-$ and 985.861γ to 3/2$^+$ give (3/2$^-$,5/2); negative parity would lead to unacceptably large M2 strengths for 985.861γ.
2523.74 *17*	(5/2$^-$,7/2,9/2$^-$)	0.23 ps *9*	Bc FgH j M	J^π: from (α,nγ) based on $\gamma(\theta)$ and considerations of transition strengths and RUL.
2631.56 *15*	3/2$^-$	0.7 ps *+10−4*	BC EF HIJ M O	XREF: J(2670). J^π: L(d,p)=L(p,d)=L(pol d,t)=1 and L+1/2 transfer from analyzing power in (pol d,t) for 2670.
2651.12 *25*	11/2$^-$	0.7 ps *2*	B D F H P	J^π: 2651.02γ stretched E2 to 7/2$^-$; no γ to 3/2$^-$, 3/2$^+$ levels. $T_{1/2}$: from RDM in (HI,xnγ).
2755.5 *3*	5/2$^-$	0.12 ps *5*	BCD F HI K M O	J^π: L(^{3}He,p)=1 from 3/2$^+$; J=5/2 from $\gamma(\theta)$ in (α,nγ).
2829.934 *17*	1/2$^+$	>0.69 ps	AB F IJK M O	XREF: J(2860)K(?). J^π: L(p,d)=0.
2949.95 *10*	(3/2$^+$,5/2)	0.30 ps *+28−14*	AB F I KLM O	J^π: from (α,nγ) based on $\gamma(\theta)$ and considerations of transition strengths and RUL.
3061.9 *2*	5/2$^-$,7/2$^-$	0.10 ps *4*	BCDEF IJK O	XREF: J(3100). J^π: L(d,p)=L(p,d)=3.
3090 *20*	(3/2$^-$,5/2)		GH	E(level): from (n,pγ). J^π: 3090γ to 7/2$^-$, 1823γ to 3/2$^-$ and 1574γ to 3/2$^+$.
3159.9 *3*	5/2$^-$,7/2$^-$	1.4 ps *+14−6*	BCDEF h K O	J^π: L(d,p)=3. (3/2)$^+$ from L(^{3}He,p)=0 is inconsistent with 3159.8γ to 7/2$^-$ and RUL.
3210 *20*			h J	E(level): from (d,t).
3265.6 *3*	3/2$^-$	<48 fs	BcDEF H M o	J^π: L(d,p)=1; J=3/2 from $\gamma(\theta)$ in (α,nγ). J^π=1/2 proposed in (d,p) based on J-dependence (Lee-Schiffer effect) is inconsistent with anisotropy of 1998.3γ in (d,pγ).
3287.0 *4*	1/2$^+$	0.25 ps *+28−12*	Bc F HI K M o	XREF: I(3277). J^π: L(p,d)=0.
3360.7 *3*	5/2$^+$	0.08 ps *6*	B F hIJK O	XREF: I(3350)J(3330). J^π: L(p,d)=L(pol d,t)=2 and L+1/2 transfer from analyzing powers in (pol d,t).
3381 *6*	3/2$^+$,5/2$^+$		CD hIJK O	XREF: J(3410). E(level): weighted average of 3379 *6* from (α,d), 3379 *8* from (p,d), 3385 *10* from (^{3}He,α) and 3382 *8* from (d,α). J^π: L(p,d)=2.
3448 *6*	(11/2 to 17/2)$^+$[#]		D GH K O	E(level): weighted average of 3450 *6* from (α,d), 3450 *8* from (d,α) and 3440 *10* from (^{3}He,α). J^π: L(α,d)=6.
3524 *8*			O	E(level): from (d,α).

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Adopted Levels, Gammas (continued)

^{39}Ar Levels (continued)

E(level)†	J$^{\pi}$	T$_{1/2}$‡	XREF	Comments
3562.6 *4*	3/2$^-$	<45 fs	BC EF H JK O	XREF: K(?). J$^{\pi}$: L(pol d,t)=1 and L+1/2 transfer from analyzing powers.
3625 *8*	1/2$^-$,3/2$^-$		C hIjK O	E(level): weighted average of 3619 *8* from (d,α), 3627 *8* from (p,d) and 3633 *10* from (^{3}He,α). J$^{\pi}$: L(p,d)=1.
3682 *8*			C h j O	E(level): from (d,α).
3740 *8*			O	E(level): from (d,α).
3836 *8*			C GHI K O	E(level): weighted average of 3820 *8* from (d,α), 3842 *8* from (p,d) and 3851 *10* from (^{3}He,α).
3890 *8*	(5/2)$^+$		C E HIJK O	XREF: H(3910). E(level): weighted average of 3885 *8* from (d,α), 3892 *8* from (p,d), 3895 *10* from (^{3}He,α) and 3887 *20* from (d,p). J$^{\pi}$: L(p,d)=2; L(d,p)=1,(2); L(pol d,t)=(2,3) and L+1/2 transfer from analyzing powers give 5/2$^+$ or 7/2$^-$.
3958 *8*			H JK O	XREF: H(?)J(3980)K(?). E(level): from (d,α), indicated as a doublet.
3992.0 *4*	(13/2)$^+$	0.8 ps *2*	D P	J$^{\pi}$: 1340.90γ E1, ΔJ=1 to 11/2$^-$. T$_{1/2}$: from RDM in (HI,xnγ).
4040 *30*			H	E(level): from (n,pγ).
4120 *30*			C J	XREF: C(4111). E(level): from (d,t).
4178 *8*	1/2$^-$,3/2$^-$		CDE I K O	E(level): weighted average of 4175 *8* from (d,α), 4177 *8* from (p,d), 4178 *10* from (^{3}He,α), 4184 *10* from (α,d), and 4180 *20* from (d,p). J$^{\pi}$: L(d,p)=1. 3/2$^-$ assigned by 1972Se04 in (d,p) based on L=1 and observed J-dependence (Lee-Schiffer effect).
4255 *8*	7/2$^-$		CDE HIJK O	E(level): weighted average of 4252 *8* from (d,α), 4257 *8* from (p,d), 4260 *10* from (^{3}He,α), 4250 *20* from (α,d), and 4250 *20* from (d,p). J$^{\pi}$: L(pol d,t)=L(d,p)=L(p,d)=3 and L+1/2 transfer from analyzing powers in (pol d,t).
4332 *8*			C H j O	XREF: H(?). E(level): from (d,α). Other: 4350 *30* from (d,t).
4375 *10*	1/2$^-$,3/2$^-$		E h j	E(level): from (d,p). Other: 4350 *30* from (d,t). J$^{\pi}$: L(d,p)=1.
4398 *8*			C h O	XREF: C(4408). E(level): from (d,α).
4473 *8*	3/2$^+$,5/2$^+$		Cd g IJK O	E(level): weighted average of 4466 *8* from (d,α), 4476 *8* from (p,d), 4481 *10* from (^{3}He,α). Other: 4475 *20* from (α,d). J$^{\pi}$: L(p,d)=2; L(d,t)=(2); (5/2$^+$) preferred from analyzing power in (pol d,t).
4504 *8*			d g I K	E(level): weighted average of 4495 *15* from (^{3}He,α) and 4506 *8* from (p,d).
4530 *10*	(3/2)$^+$		CD g K	J$^{\pi}$: L(^{3}He,p)=0 from 3/2$^+$.
4543.1 *4*	(15/2)$^+$	1.1 ps *2*	P	J$^{\pi}$: 551.08γ M1 to (13/2)$^+$. T$_{1/2}$: from RDM in (HI,xnγ).
4572 *8*			g K O	XREF: K(?). E(level): from (d,α). Other: 4588 *10* from (^{3}He,α).
4638 *8*			O	E(level): from (d,α).
4710 *8*			G O	XREF: G(?). E(level): from (d,α).
4816 *8*	(3/2)$^+$		CD I K O	E(level): weighted average of 4813 *8* from (d,α), 4815 *8* from (p,d), 4822 *10* from (^{3}He,α), 4816 *10* from (α,d). J$^{\pi}$: L(^{3}He,p)=0 from 3/2$^+$.
4911 *8*	(1/2$^-$,3/2,5/2$^+$)		C E IJK O	XREF: C(4925)K(4925).

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Adopted Levels, Gammas (continued)

^{39}Ar Levels (continued)

E(level)†	Jπ	$T_{1/2}$‡	XREF	Comments
				E(level): weighted average of 4904 *8* from (d,α), 4914 *8* from (p,d), 4925 *15* from (^{3}He,α), 4916 *20* from (d,p). Possibly a doublet. Jπ: possibily a doublet with 1/2⁻,3/2⁻ for one component and 3/2⁺,5/2⁺ for the other. L(d,p)=1 for 4916 *20*; L(p,d)=2 for 4914 *8*.
4927 *10*	(11/2,13/2)⁺#		D	E(level): from (α,d). Jπ: L(α,d)=4+6.
4991 *8*	(11/2 to 17/2)⁺#		cD g O	E(level): weighted average of 4998 *10* from (α,d) and 4987 *8* from (d,α); possibly a doublet. Jπ: L(α,d)=6.
5005 *8*	1/2⁻,3/2⁻		c E g I K	XREF: E(4990). E(level): weighted average of 4990 *20* from (d,p), 5006 *8* from (p,d) and 5008 *10* from (^{3}He,α). Jπ: L(d,p)=1.
5159 *8*	5/2⁻,7/2⁻		CDE IJ	E(level): weighted average of 5169 *8* from (p,d), 5147 *10* from (α,d), and 5149 *20* from (d,p). Jπ: L(d,p)=L(p,d)=3.
5198 *8*			I K	E(level): weighted average of 5189 *10* from (^{3}He,α) and 5203 *8* from (p,d).
5245 *15*	(11/2,13/2)⁺#		CD K	XREF: K(?). E(level): from (α,d). Other: 5263 *15* from (^{3}He,α). Jπ: L(α,d)=4+6.
5320 *8*	1/2⁻,3/2⁻		E g I K	XREF: K(?). E(level): weighted average of 5314 *20* from (d,p) and 5321 *8* from (p,d). Jπ: L(p,d)=1.
5385 *8*			E g I	XREF: E(5351). E(level): from (p,d). Other: 5351 *20* from (d,p).
5422 *8*	1/2⁺		C g I K	E(level): weighted average of 5431 *10* from (^{3}He,α) and 5417 *8* from (p,d). Jπ: L(p,d)=0.
5525 *8*	5/2⁻,7/2⁻		C E I K	XREF: E(5508). E(level): weighted average of 5526 *10* from (^{3}He,α), 5527 *8* from (p,d) and 5508 *20* from (d,p). Jπ: L(d,p)=3.
5535.5 *5*	(17/2)⁺	<0.7 ps	D P	E(level): 5543 *7* from (α,d). Jπ: L(α,d)=6 and 992.4γ D to (15/2)⁺. $T_{1/2}$: from RDM in (HI,xnγ).
5602 *8*			C g I K	E(level): weighted average of 5605 *8* from (p,d) and 5596 *10* from (^{3}He,α).
5670 *10*	1/2⁻,3/2⁻		E g K	E(level): weighted average of 5652 *20* from (d,p) and 5675 *10* from (^{3}He,α). Jπ: L(d,p)=1.
5742 *10*			C K	E(level): from (^{3}He,α).
5811 *10*	(11/2 to 17/2)⁺#		cD	E(level): from (α,d). Jπ: L(α,d)=6.
5821 *10*	1/2⁻,3/2⁻		c E K	XREF: E(5801). E(level): weighted average of 5801 *20* from (d,p) and 5826 *10* from (^{3}He,α). Jπ: L(d,p)=1.
5926 *10*	1/2⁻,3/2⁻		C E g K	XREF: C(5908). E(level): from (^{3}He,α). Other: 5925 *20* from (d,p). Jπ: L(d,p)=1.

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Adopted Levels, Gammas (continued)

^{39}Ar Levels (continued)

E(level)[†]	J$^{\pi}$	XREF	Comments
5946 *10*		g K	E(level): from (^{3}He,α).
6057 *20*	5/2^{-},7/2^{-}	C E g	E(level): from (d,p). J$^{\pi}$: L(d,p)=3.
6120 *10*	1/2^{-},3/2^{-}	C E K	XREF: C(6153). E(level): weighted average of 6133 *20* from (d,p) and 6117 *10* from (^{3}He,α). J$^{\pi}$: L(d,p)=1.
6230 *10*	(11/2,13/2)$^{+}$[#]	D	E(level): from (α,d). J$^{\pi}$: L(α,d)=4+6.
6278 *20*	5/2^{-},7/2^{-}	C E	E(level): from (d,p). J$^{\pi}$: L(d,p)=3.
6317 *10*		K	
6385 *20*	5/2^{-},7/2^{-}	C E	E(level): from (d,p). J$^{\pi}$: L(d,p)=3.
6490 *10*	5/2^{-},7/2^{-}	C E K	E(level): weighted average of 6488 *20* from (d,p) and 6490 *10* from (^{3}He,α). J$^{\pi}$: L(d,p)=3.
6591 *10*		C K	E(level): from (^{3}He,α).
6637		C	
6688 *20*		C E K	XREF: K(?). E(level): from (d,p). Other: 6721 *10* from (^{3}He,α).
6759 *20*		E	
6789 *20*	(1/2,5/2)$^{-}$[&]	E	
6820		C K	XREF: K(?). E(level): from (^{3}He,p). Other: 6817 *15* from (^{3}He,α).
6874 *10*		C E K	E(level): weighted average of 6878 *20* from (d,p) and 6873 *10* from (^{3}He,α).
6996 *20*	(1/2,5/2)$^{-}$[&]	C E	XREF: C(6950). E(level): from (d,p).
7073 *10*	(1/2,5/2)$^{-}$[&]	E K	E(level): weighted average of 7062 *20* from (d,p) and 7076 *10* from (^{3}He,α).
7137 *20*	(1/2,5/2)$^{-}$[&]	E	
7222 *20*	(5/2)$^{-}$[@]	E	
7288 *10*		K	
7356 *10*	(5/2)$^{-}$[@]	E K	E(level): weighted average of 7337 *20* from (d,p) and 7361 *10* from (^{3}He,α).
7401 *20*	(5/2)$^{-}$[@]	E	
7465 *15*	(5/2)$^{-}$[@]	E K	E(level): weighted average of 7497 *20* from (d,p) and 7457 *10* from (^{3}He,α).
7561 *10*	(5/2)$^{-}$[@]	E K	E(level): weighted average of 7060 *20* from (d,p) and 7561 *10* from (^{3}He,α).
7639 *15*	(5/2)$^{-}$[@]	E K	E(level): weighted average of 7628 *20* from (d,p) and 7645 *15* from (^{3}He,α).
7729 *10*	(5/2)$^{-}$[@]	E K	E(level): weighted average of 7727 *20* from (d,p) and 7729 *10* from (^{3}He,α).
7741 *15*		K	
7806 *10*		K	
7925 *10*		K	
8042 *10*		K	
8147 *10*		K	
8174 *10*		K	
8276 *15*		K	
8300 *20*		K	
8395 *15*		K	
8532 *20*		K	
8638 *10*		K	
8820 *15*		K	
8902 *15*		K	
9002 *10*		K	
9075 *10*	3/2^{+},5/2^{+}	C K	T=5/2 J$^{\pi}$: L(^{3}He,α)=2 from 0^{+} and L(^{3}He,p)=0 from 3/2^{+}.
9239 *10*		K	

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Adopted Levels, Gammas (continued)

^{39}Ar Levels (continued)

E(level)[†]	J^π	XREF	Comments
9463 *10*	$1/2^+$	K	T=5/2 J^π: L(^{3}He,α)=0.
9858 *15*		K	
10455?		K	E(level): this group is about 300 keV wide; probably an unresolved multiplet.
10755 *10*		K	
10857 *10*		K	
10947 *10*		K	
11148 *10*		K	
11312 *10*	$1/2^+$	K	T=5/2 J^π: L(^{3}He,α)=0.

† From a least-squares fit to γ-ray energies with uncertainties for levels connected by those γ rays, others are from (α,nγ) up to 3563 level if available or from (^{3}He,α) if only data from transfer reactions are available, unless otherwise noted.

‡ From DSAM in (α,nγ) (1978St16) for low-spin (J<11/2) levels, unless otherwise noted. For high-spin (J≥11/2) levels, values are from RDM in (HI,xnγ) (1977Ke13).

\# $(11/2:17/2)^+$ from L(α,d)=6; $(11/2,13/2)^+$ from L(α,d)=4+6. $J^\pi=7/2^+,9/2^+$ are also possible but less likely since such levels should be populated by lower (L=2 or 4) transfers.

@ L(d,p)=3 and J=5/2 preferred from shell-model considerations.

& L(d,p)=1,3 and 1/2,5/2 preferred from shell-model considerations.

Adopted Levels, Gammas (continued)

$\gamma(^{39}Ar)$

E_i(level)	J_i^π	E_γ‡	I_γ#	E_f	J_f^π	Mult.@	δ@	α†	Comments
1267.207	3/2$^-$	1267.191 *11*	100	0	7/2$^-$	E2(+M3)	+0.06 *4*	6.09×10^{-5} *10*	B(E2)(W.u.)>0.044 α=6.09×10^{-5} *10*; α(K)=3.60×10^{-5} *7*; α(L)=2.94×10^{-6} *6*; α(M)=2.87×10^{-7} *6* α(IPF)=2.17×10^{-5} *4* E_γ: others: 1266.5 *10* from (n,pγ). Mult.,δ: Q(+O) from $\gamma(\theta)$ in (α,nγ); polarity from no level-parity change based on transfer reaction data.
1517.540	3/2$^+$	250.333 *3*	100.0 *22*	1267.207	3/2$^-$	E1		9.86×10^{-4}	B(E1)(W.u.)=2.13×10^{-5} *+17−15* α(K)=0.000905 *13*; α(L)=7.41×10^{-5} *11*; α(M)=7.21×10^{-6} *10* Additional information 6. E_γ: other: 250 *1* from (n,pγ). I_γ: from (α,nγ). Other: 100 *4* from ^{39}Cl β^- decay. Mult.: from $\beta\gamma(\theta$,circ pol) (1976Fa10) and ce data (1956Pe38) in ^{39}Cl β^- decay.
		1517.498 *10*	85.0 *19*	0	7/2$^-$	M2+E3	+0.20 *4*	6.78×10^{-5} *10*	B(M2)(W.u.)=0.156 *+16−14*; B(E3)(W.u.)=13 *+8−6* α=6.78×10^{-5} *10*; α(K)=3.80×10^{-5} *6*; α(L)=3.11×10^{-6} *5*; α(M)=3.04×10^{-7} *5* α(IPF)=2.64×10^{-5} *4* E_γ: others: 1516.5 *10* from (n,pγ). I_γ: weighted average of 85.1 *19* from ^{39}Cl β^- decay (56.2 m), and 84.8 *22* from (α,nγ). Mult.,δ: from $\beta\gamma(\theta$,circ pol) in ^{39}Cl β^- decay. Other: δ=+1.0 *+10−9* from (α,nγ).
2092.749	5/2$^-$	825.54	4.4 *8*	1267.207	3/2$^-$				I_γ: weighted average of 10 *5* from ^{39}Cl β^- decay (56.2 m), 4.1 *8* from (α,nγ), and 9 *5* from (n,pγ).
		2092.74 *3*	100.0 *8*	0	7/2$^-$	M1+E2	−0.21 *6*	3.03×10^{-4}	B(M1)(W.u.)>0.061; B(E2)(W.u.)>1.1 α(K)=1.211×10^{-5} *18*; α(L)=9.88×10^{-7} *14*; α(M)=9.65×10^{-8} *14* α(IPF)=0.000289 *5* I_γ: from (α,nγ). Mult.,δ: D+Q from $\gamma(\theta)$ in (α,nγ); polarity from $\Delta\pi$=no based on transfer reaction data.
2342.2	(5/2$^-$,7/2,9/2$^-$)	2341 *1*	100	0	7/2$^-$				E_γ: from (n,pγ), 2342.1 from level-difference.
2358.284	1/2$^+$	840.775 *25*	5.50 *13*	1517.540	3/2$^+$				I_γ: from ^{39}Cl β^- decay. Other: 5.3 *21* from (α,nγ).
		1091.056 *8*	100.0 *20*	1267.207	3/2$^-$				E_γ: other: 1091 *1* from (n,pγ). I_γ: from ^{39}Cl β^- decay.
2433.48	3/2$^-$	915.86 *10*	7.8 *21*	1517.540	3/2$^+$	[E1]			B(E1)(W.u.)=6×10^{-5} *+7−3* I_γ: weighted average of 18 *12* from ^{39}Cl β^- decay and 7.5 *21* from (α,nγ).
		1166.25 *5*	100.0 *13*	1267.207	3/2$^-$	M1+E2	+0.41 *11*	4.16×10^{-5} *11*	B(M1)(W.u.)=0.012 *+11−5*; B(E2)(W.u.)=5 *+8−3*

From ENSDF

$^{39}_{18}Ar_{21}$-7

$\gamma(^{39}Ar)$ (continued)

E_i(level)	J^{π}_i	E_{γ}‡	I_{γ}#	E_f	J^{π}_f	Mult.@	δ@	α†	Comments
									α=4.16×10^{-5} *11*; α(K)=3.48×10^{-5} *9*; α(L)=2.85×10^{-6} *7*; α(M)=2.78×10^{-7} *7* α(IPF)=3.62×10^{-6} *13* E_{γ}: other: 1165.5 *10* from (n,pγ). I_{γ}: from (α,nγ). Mult.,δ: or δ=+1.3 *3*; from $\gamma(\theta)$ in (α,nγ) and RUL.
2433.48	3/2$^-$	2433.49 *8*	34.3 *13*	0	7/2$^-$	E2		5.36×10^{-4}	B(E2)(W.u.)=0.30 *+25−10* α(K)=1.012×10^{-5} *15*; α(L)=8.26×10^{-7} *12*; α(M)=8.07×10^{-8} *12* α(IPF)=0.000525 *8* E_{γ}: other: 2432 *2* from (n,pγ). I_{γ}: weighted average of 36.5 *23* from ^{39}Cl β^- decay (56.2 m), 33.6 *13* from (α,nγ), and 33 *13* from (n,pγ). Mult.,δ: δ(O/Q)=−0.01 *17* from $\gamma(\theta)$ in (α,nγ); M2 is ruled out by RUL.
2481.49	7/2$^-$	388.7	21.2 *7*	2092.749	5/2$^-$	M1(+E2)	+0.03 *12*	3.47×10^{-4} *18*	B(M1)(W.u.)=0.19 *+17−7* α(K)=0.000318 *17*; α(L)=2.62×10^{-5} *14*; α(M)=2.55×10^{-6} *14* E_{γ}: 389 *1* from (n,pγ). I_{γ}: from (α,nγ). Other: 25 *10* from ^{39}Cl β^- decay. Mult.,δ: D(+Q) from $\gamma(\theta)$ in (α,nγ); polarity from no level-parity change based on transfer reaction data.
		2481.4	100.0 *7*	0	7/2$^-$	M1+E2	−7 *+3−16*	5.57×10^{-4} *9*	B(M1)(W.u.)<4×10^{-4}; B(E2)(W.u.)=1.8 *+15−6* α(K)=9.78×10^{-6} *14*; α(L)=7.99×10^{-7} *12*; α(M)=7.79×10^{-8} *11* α(IPF)=0.000546 *9* E_{γ}: 2480 *2* from (n,pγ). I_{γ}: from (α,nγ). Mult.,δ: from $\gamma(\theta)$ in (α,nγ) and RUL.
2503.418	(5/2)$^+$	410.690 *20*	4.59 *10*	2092.749	5/2$^-$	[E1]		2.37×10^{-4}	B(E1)(W.u.)=0.00036 *+29−11* α(K)=0.000218 *3*; α(L)=1.783×10^{-5} *25*; α(M)=1.737×10^{-6} *25* I_{γ}: from ^{39}Cl β^- decay. Other: <11 from (α,nγ).
		985.861 *9*	100.0 *18*	1517.540	3/2$^+$				E_{γ}: other: 985.5 *10* from (n,pγ). I_{γ}: from ^{39}Cl β^- decay.
		1236.19 *5*	2.87 *13*	1267.207	3/2$^-$	[E1]		1.00×10^{-4}	B(E1)(W.u.)=8×10^{-6} *+7−3* α(K)=1.84×10^{-5} *3*; α(L)=1.500×10^{-6} *21*; α(M)=1.463×10^{-7} *21* α(IPF)=8.02×10^{-5} *12* I_{γ}: from ^{39}Cl β^- decay. Other: 10 *3* from (α,nγ).
		2503.28 *7*	0.26 *3*	0	7/2$^-$				I_{γ}: from ^{39}Cl β^- decay.

$^{39}_{18}Ar_{21}$-8

Adopted Levels, Gammas (continued)

$\gamma(^{39}Ar)$ (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[@]	δ[@]	α[†]	Comments
2523.74	$(5/2^-,7/2,9/2^-)$	2523.65	100	0	$7/2^-$				E_γ: 2523 *2* from (n,pγ).
2631.56	$3/2^-$	538.8	100.0 *25*	2092.749	$5/2^-$	M1(+E2)	+0.07 *14*	1.71×10^{-4} *9*	B(M1)(W.u.)=0.16 *+23−10* α(K)=0.000157 *8*; α(L)=1.29×10^{-5} *7*; α(M)=1.25×10^{-6} *7* E_γ: 540 *1* from (n,pγ). I_γ: from (α,nγ). Mult.,δ: D(+Q) from $\gamma(\theta)$ in (α,nγ); polarity from no level-parity change based on transfer reaction data.
		1114.0	16.5 *12*	1517.540	$3/2^+$	[E1]		3.96×10^{-5} *6*	B(E1)(W.u.)=8×10^{-5} *+13−5* α=3.96×10^{-5} *6*; α(K)=2.21×10^{-5} *3*; α(L)=1.81×10^{-6} *3*; α(M)=1.764×10^{-7} *25* α(IPF)=1.547×10^{-5} *22* I_γ: from (α,nγ).
		1364.3	7.0 *10*	1267.207	$3/2^-$				I_γ: from (α,nγ).
2651.12	$11/2^-$	2651.02 *25*	100	0	$7/2^-$	E2		6.37×10^{-4}	B(E2)(W.u.)=0.79 *+32−18* α(K)=8.77×10^{-6} *13*; α(L)=7.16×10^{-7} *10*; α(M)=6.99×10^{-8} *10* α(IPF)=0.000628 *9* E_γ: other: 2650 *2* from (n,pγ). Mult.: from $\gamma(\theta$,pol) in (HI,xnγ).
2755.5	$5/2^-$	1488.3	77.6 *25*	1267.207	$3/2^-$	M1(+E2)	−0.01 *5*	8.43×10^{-5} *12*	B(M1)(W.u.)=0.024 *+20−8* α=8.43×10^{-5} *12*; α(K)=2.15×10^{-5} *3*; α(L)=1.758×10^{-6} *25*; α(M)=1.715×10^{-7} *24* α(IPF)=6.08×10^{-5} *9* I_γ: from (α,nγ). Mult.,δ: D(+Q) from $\gamma(\theta)$ in (α,nγ); polarity from no level-parity change based on transfer reaction data.
		2755.4	100.0 *25*	0	$7/2^-$	M1+E2	+0.37 *10*	5.88×10^{-4} *11*	B(M1)(W.u.)=0.0043 *+39−16*; B(E2)(W.u.)=0.26 *+44−16* α(K)=7.85×10^{-6} *12*; α(L)=6.40×10^{-7} *10*; α(M)=6.25×10^{-8} *9* α(IPF)=0.000579 *11* E_γ: other: 2755 *2* from (n,pγ). I_γ: from (α,nγ). Mult.,δ: D+Q from $\gamma(\theta)$ in (α,nγ); polarity from no level-parity change based on transfer reaction data and RUL.
2829.934	$1/2^+$	396.46 *4*	15.3 *6*	2433.48	$3/2^-$	[E1]		2.61×10^{-4}	B(E1)(W.u.)<0.0010 α(K)=0.000240 *4*; α(L)=1.96×10^{-5} *3*; α(M)=1.91×10^{-6} *3* I_γ: from ^{39}Cl β^- decay. Other: <13 from (α,pγ).

$^{39}_{18}Ar_{21}$-9

Adopted Levels, Gammas (continued)

$\gamma(^{39}Ar)$ (continued)

E_i(level)	J_i^π	E_γ‡	I_γ#	E_f	J_f^π	Mult.@	δ@	α†	Comments
2829.934	1/2+	1312.360 *20*	87.0 *21*	1517.540	3/2+				I_γ: weighted average of 87.7 *21* from ^{39}Cl β^- decay (56.2 m), 86.2 *24* from (α,nγ).
		1562.704 *25*	100.0 *23*	1267.207	3/2−				I_γ: from ^{39}Cl β^- decay.
2949.95	(3/2+,5/2)	446.61 *13*	100.0 *20*	2503.418	(5/2)+				I_γ: from (α,nγ).
		1432.27 *15*	94.6 *20*	1517.540	3/2+				I_γ: from (α,nγ). Other: 92 *12* from ^{39}Cl β^- decay.
3061.9	5/2−,7/2−	969.1	30.7 *17*	2092.749	5/2−				I_γ: from (α,nγ).
		3061.8	100.0 *17*	0	7/2−				I_γ: from (α,nγ).
3090	(3/2−,5/2)	1574		1517.540	3/2+				E_γ: from (n,pγ) only.
		1823		1267.207	3/2−				E_γ: from (n,pγ) only.
		3090		0	7/2−				E_γ: from (n,pγ) only.
3159.9	5/2−,7/2−	636.2	40.0 *20*	2523.74	(5/2−,7/2,9/2−)				I_γ: from (α,nγ).
		678.4	28.9 *17*	2481.49	7/2−				I_γ: from (α,nγ).
		3159.8	100.0 *24*	0	7/2−				I_γ: from (α,nγ).
3265.6	3/2−	634.0	1.5 *2*	2631.56	3/2−				I_γ: from (d,pγ).
		832.1	0.7 *2*	2433.48	3/2−				I_γ: from (d,pγ).
		1998.3	100.0 *4*	1267.207	3/2−	M1+E2	−16 *6*	3.29×10^{-4}	B(M1)(W.u.)>0.00012; B(E2)(W.u.)>45 α(K)=1.431×10^{-5} *20*; α(L)=1.169×10^{-6} *17*; α(M)=1.141×10^{-7} *16* α(IPF)=0.000313 *5* I_γ: from (d,pγ). Mult.,δ: D+Q from γ(θ) in (d,pγ); polarity from no level-parity change based on transfer reaction data and RUL.
3287.0	1/2+	2019.7	100	1267.207	3/2−	[E1]		6.65×10^{-4}	B(E1)(W.u.)=0.00029 *+27−15* α(K)=8.41×10^{-6} *12*; α(L)=6.86×10^{-7} *10*; α(M)=6.70×10^{-8} *10* α(IPF)=0.000656 *10*
3360.7	5/2+	1843.1	100	1517.540	3/2+				
3562.6	3/2−	3562.4	100	0	7/2−	[E2]		1.02×10^{-3}	B(E2)(W.u.)>2.8 α(K)=5.51×10^{-6} *8*; α(L)=4.50×10^{-7} *7*; α(M)=4.39×10^{-8} *7* α(IPF)=0.001017 *15*
3992.0	(13/2)+	1340.90 *20*	100	2651.12	11/2−	E1		1.69×10^{-4}	B(E1)(W.u.)=0.00030 *+11−7* α(K)=1.595×10^{-5} *23*; α(L)=1.303×10^{-6} *19*; α(M)=1.271×10^{-7} *18* α(IPF)=0.0001515 *22* Mult.: from γ(θ,pol) in (HI,xnγ).
4543.1	(15/2)+	551.08 *10*	100	3992.0	(13/2)+	M1		1.62×10^{-4}	B(M1)(W.u.)=0.120 *+27−19* α(K)=0.0001485 *21*; α(L)=1.218×10^{-5} *17*; α(M)=1.188×10^{-6} *17* Mult.: from γ(θ,pol) in (HI,xnγ).
5535.5	(17/2)+	992.4 *3*	100	4543.1	(15/2)+	M1			B(M1)(W.u.)>0.032

$^{39}_{18}Ar_{21}$-10

$\gamma(^{39}Ar)$ (continued)

E_i(level)	E_γ[‡]	Comments
		Mult.: D from $\gamma(\theta)$ in (HI,xnγ); polarity from no level-parity change based on transfer reaction data.

† Additional information 7.

‡ Values with uncertainties are from ^{39}Cl β^- decay below 3287 level and from (HI,xnγ) above that; values without uncertainties are from level-energy differences, unless otherwise noted.

From ^{39}Cl β^- decay and/or (α,nγ); weighted average is taken where values from both available, unless otherwise noted.

@ Mainly from $\gamma(\theta)$ in (α,nγ) and RUL; for high-spin (J≥11/2) levels, assignments are from $\gamma(\theta$,pol) in (HI,xnγ). Arguments for each assignment are given under comments.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level