^{48}Ca(p,Xγ) IAR: ^{49}Ca g.s.

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	T. W. Burrows[a]	NDS 109, 1879 (2008)	14-Jul-2008

1968Vi01: (p,γ),(p,p),(p,nγ) E=1940-2000 keV. Measured elastic $\sigma(\theta)$ and excitation functions (Si, FWHM=800 eV), 0.78-MeV γ-excitation function (NaI), and γ's.

1972Ga09: (p,γ),(p,p),(p,nγ) E=1.94-2.01 MeV. Measured elastic excitation functions (Si′s) and 370γ-excitation function and primary γ's and $\gamma(\theta)$ from 1959, 1964, and 1974 resonances one-channel multilevel and single-level Breit-Wigner calculations. Also compared Gamow-Teller β^- decay with M1 decay.

1973Ad05: (p,γ), (p,nγ) E=1.94-2.00 MeV. Measured Γ-excitation functions; NaI. (p,γ) E=1974 keV. Measured γ's, $\gamma\gamma'$s (Ge(Li),NaI), and primary $\gamma(\theta=0°-90°$ In 18° steps). (d,nγ) E=3.0, 3.5 MeV. Measured γ's (Eγ<4.5 MeV).

1973St03: (p,γ) E=1975 keV. Measured Eγ's. DSAM.

See also discussion In 1978Ha15; particularly In regard to the placement of the ≈4830Γ.

^{49}Sc Levels

1982Si19: (p,n) E=1.885-5.1 MeV. Measured σ(E); 4π neutron detector. Deduced <Γ>, IAR parameters for E(p)≈1.97 MeV and E(p)≈4 MeV, optical model parameters, and intermediate Γ structure.

Γ_p, Γ_n: from 1972Ga09 (Σ Γ_p=2.0 keV *4*). 1982Si19 obtained Γ=24.7 keV *10*, Γ_p=1.97 keV *10*, and Γ_n=13.8 keV *7*, neutron S-factor=0.63, by analysis of the average resonance shape (E(p)(C.M.)=1934 keV *1*). S-factor In agreement with result from ^{48}Ca(d,p).

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	Comments
0.0	7/2$^-$		
2228.7 *5*	1/2$^+$		
2370.8 *4*	3/2$^+$		J^π: 3/2 from primary $\gamma(\theta)$.
3084.8 *5*	3/2$^-$	48 fs *29*	
3516[@] *2*	3/2$^-$		J^π: 3/2 from primary $\gamma(\theta)$.
3808.8 *5*	7/2$^-$	21 fs *19*	J^π: 7/2,(5/2) from primary $\gamma(\theta)$.
3990.8 *16*	1/2$^+$	≥0.7 ns	
4072.1 *5*	5/2$^-$	28 fs *14*	J^π: 5/2 from primary $\gamma(\theta)$.
4493.9 *7*	1/2$^-$	≤23 fs	
4739.6 *5*	5/2$^-$	≤14 fs	J^π: 5/2 from primary $\gamma(\theta)$.
5376.3 *5*	5/2$^-$	21 fs *10*	
6010.7 *11*		≤50 fs	
6306[@] *2*	5/2$^-$		J^π: 5/2 from primary $\gamma(\theta)$.
6414.7 *4*	7/2$^-$	21 fs *9*	J^π: 3/2,(7/2) from primary $\gamma(\theta)$. Note: 1973Ad05 recommended 3/2$^-$.
6502.1 *5*	3/2		J^π: 3/2 from primary $\gamma(\theta)$.
6728[@] *2*	3/2$^-$		J^π: 3/2,7/2 from primary $\gamma(\theta)$.
6984.5 *4*	5/2$^-$	≤14 fs	J^π: 5/2 from primary $\gamma(\theta)$.
7061.3 *5*	1/2$^-$		J^π: 1/2 from $\gamma(\theta)$.
7193[@] *2*	5/2[&]		
7228.2 *5*	5/2[&]		
S(p)+1949.7 *10*	(3/2$^-$)[a]		Γ_p=50 eV *50*; Γ_n=70 eV *70*
S(p)+1959.0 *10*	3/2$^-$[a]		Γ_p=0.10 keV *5*; Γ_n=0.40 keV *20*
S(p)+1964.1 *10*	3/2$^-$[a]		Γ_p=0.40 keV *10*; Γ_n=0.22 keV *6*
S(p)+1974.2 *10*	3/2$^-$[a]	1.5 keV *3*	Γ_p=1.2 keV *3*; Γ_n=0.32 keV *8*; Γ_γ=4.8 eV *5* $T_{1/2}$: from $\Gamma_p+\Gamma_n+\Gamma_\gamma$ (evaluator). Other: $T_{1/2}$≤14 fs (1973St03). Γ_γ: from Σ Γ_γ's(partial)/(1−(Iγ(4333γ)+Iγ(7068γ))); Γ_γ's(partial) from 1972Ga09 (evaluator). neutrons decay primarily (≥95%) to 1402 state of ^{48}Sc (1968Ch02; (p,nγ). 370γ- and 780γ-excit; NaI,Ge(Li)).
S(p)+1981.5 *10*	(3/2$^-$)[a]		Γ_p=50 eV *50* or 70 eV *70*; Γ_n=50 eV *50* or 100 eV *50*.

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^{48}Ca(p,Xγ) IAR: ^{49}Ca g.s. (continued)

^{49}Sc Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$[#]	Comments
S(p)+1991.5 *10*	(3/2$^-$)[a]	0.29[b] keV *14*	Γ_p=40 eV *40*; Γ_n=0.25 keV *13*
S(p)+1996.3 *10*	(3/2$^-$)[a]	0.17[b] keV *8*	Γ_p=20 eV *20*; Γ_n=0.15 keV *8*

† Except As noted, bound-state energies calculated by evaluator using least-squares adjustment procedures and Eγ's from 1973St03. Proton energies from 1972Ga09; relative uncertainties shown (absolute ΔE=5 keV). S(p)=9627.2 keV *29* (2003Au03).
‡ From the Adopted Levels, except As noted. Arguments based on primary $\gamma(\theta)$ (1973Ad05) assuming J(1974 IAS)=3/2 are given As comments.
# From 1973St03, except As noted. Uncertainty shown represents that of the peak centroids. ≈10% uncertainty due to stopping-power theory estimated.
@ From 1972Ga09.
& From primary $\Gamma(\theta)$ (1973Ad05).
a From analysis of elastic scattering excitation functions (1968Vi01); identified by 1968Vi01 As components of the ^{49}Ca g.s. analog.
b Estimated by evaluator from $\Gamma=\Gamma_p+\Gamma_n$ assuming Γ_γ<<Γ.

γ(^{49}Sc)

Γ_γ's: from 1972Ga09.

E$_\gamma$[†]	I$_\gamma$[‡]	E$_i$(level)	J$^{\pi}_i$	E$_f$	J$^{\pi}_f$	Mult.[#]	Comments
1145		3516	3/2$^-$	2370.8	3/2$^+$		
1288		3516	3/2$^-$	2228.7	1/2$^+$		
1409.1 *5*	5.0 *10*	4493.9	1/2$^-$	3084.8	3/2$^-$		
1620.0 *15*		3990.8	1/2$^+$	2370.8	3/2$^+$		
1762		3990.8	1/2$^+$	2228.7	1/2$^+$		
2228.6 *5*	27.0 *30*	2228.7	1/2$^+$	0.0	7/2$^-$		
2371.8 *5*	25.1 *27*	2370.8	3/2$^+$	0.0	7/2$^-$		
2436	1.5 *6*	6502.1	3/2	4072.1	5/2$^-$		
3084.7 *5*	15.3 *15*	3084.8	3/2$^-$	0.0	7/2$^-$		
3225		6306	5/2$^-$	3084.8	3/2$^-$		
3640	2.3 *10*	6728	3/2$^-$	3084.8	3/2$^-$		
3808.6 *5*	7.0 *15*	3808.8	7/2$^-$	0.0	7/2$^-$		
3978	2.6 *12*	7061.3	1/2$^-$	3084.8	3/2$^-$		
4071.9 *5*	15.8 *16*	4072.1	5/2$^-$	0.0	7/2$^-$		
4275	0.8 *7*	6502.1	3/2	2228.7	1/2$^+$		
4333.1 *5*	6.8 *21*	S(p)+1974.2	3/2$^-$			D+Q	not observed by 1972Ga09. δ: −0.0 *5* or −4.3 *+8−11*.
x4341.7 *5*							$T_{1/2}$(DSAM)≤14 fs.
4354	6.6 *28*	S(p)+1959.0	3/2$^-$	7228.2	5/2		
4359	7.6 *17*	S(p)+1964.1	3/2$^-$	7228.2	5/2		
4370.2	6.2 *12*	S(p)+1974.2	3/2$^-$	7228.2	5/2	D+Q	Γ_γ=0.23 eV *7* δ: +0.02 *8* or −5 *+2−3*.
4484	11.7 *28*	S(p)+1959.0	3/2$^-$				
4489	10.1 *13*	S(p)+1964.1	3/2$^-$				
4500.0 *5*	8.4 *10*	S(p)+1974.2	3/2$^-$			D+Q	Γ_γ=0.45 eV *14* δ: +0.01 *5* or −1.75 *+21−24*.
x4538.6 *15*							$T_{1/2}$(DSAM)≤19 fs.
4561	15 *4*	S(p)+1959.0	3/2$^-$				

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^{48}Ca(p,Xγ) IAR: ^{49}Ca g.s. (continued)

γ(^{49}Sc) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ [#]	Comments
4566	17.7 *17*	S(p)+1964.1	3/2⁻					
4577.8 *5*	15.3 *13*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.70 eV *21* δ: −0.04 *5* or −3.9 *+7−9*.
4614.6 *5*	4.2 *11*	6984.5	5/2⁻	2370.8	3/2⁺			
4688	2.8 *12*	7061.3	1/2⁻	2370.8	3/2⁺			
4739.4 *5*	7.5 *11*	4739.6	5/2⁻	0.0	7/2⁻			
4819	8.5 *28*	S(p)+1959.0	3/2⁻					
4824	11.8 *17*	S(p)+1964.1	3/2⁻					
4835.2	11.0 *14*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.66 eV *20* δ: −0.12 *4* or −8 *+4−2*.
ˣ4938 [@]								double-escape peak At 3916 keV In singles spectrum (1973Ad05).
5042	8.9 *28*	S(p)+1959.0	3/2⁻					
5047	8.8 *17*	S(p)+1964.1	3/2⁻					
5059.1 *5*	13.7 *14*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.63 eV *19* δ: +0.10 *4* or +2.7 *+3−28*.
ˣ5087 [@]								Γ_γ=0.50 eV *15* placed As primary γ to 6474 by 1972Ga09. Not placed by 1973Ad05 since Iγ(5087γ)/(5059γ)=0.14,≈1/9 of that obtained by 1972Ga09. Iγ=13.5 *18* (1972Ga09).
5131	10.8 *28*	S(p)+1959.0	3/2⁻					
5136	11.8 *17*	S(p)+1964.1	3/2⁻					
5147.7 *5*	7.4 *12*	S(p)+1974.2	3/2⁻			E2(+M3)	−0.058	Γ_γ=0.50 eV *15* Mult.,δ: see note on J^π(6415). δ<0.00154 *23* from comparison to RUL (evaluator).
5241	5.2 *28*	S(p)+1959.0	3/2⁻					
5246	5.1 *13*	S(p)+1964.1	3/2⁻					
5257.2	1.7 *8*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.27 eV *8* δ: +0.04 *13* or −6 *+3−16*.
5376.0 *5*		5376.3	5/2⁻	0.0	7/2⁻			
6010.3 *11*		6010.7		0.0	7/2⁻			
6307	1.0 *4*	6306	5/2⁻	0.0	7/2⁻			
6415.4 *5*	5.6 *8*	6414.7	7/2⁻	0.0	7/2⁻			
6808	7.5 *19*	S(p)+1959.0	3/2⁻					
6813	3.8 *9*	S(p)+1964.1	3/2⁻					
6824.8	4.6 *7*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.14 eV *5* δ: −0.06 *+8−9* or −3.6 *+9−16*.
6984	1.1 *5*	6984.5	5/2⁻	0.0	7/2⁻			
7067 [@]	2.0 *4*	S(p)+1974.2	3/2⁻					not observed by 1972Ga09.
7224	1.8 *7*	7228.2	5/2	0.0	7/2⁻			
7475	6.1 *19*	S(p)+1959.0	3/2⁻					
7480	6.2 *9*	S(p)+1964.1	3/2⁻					
7491.2	6.6 *7*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.21 eV *7* δ: −0.08 *6* or −3.3 *+6−8*.
7561	1.6 *8*	S(p)+1964.1	3/2⁻					
7572.2	3.7 *10*	S(p)+1974.2	3/2⁻					Γ_γ=0.069 eV *21*
7754.4	3.7 *15*	S(p)+1974.2	3/2⁻			E2(+M3)		δ≥−1.75≤+0.09; Γ_γ=0.077 eV *23* δ: δ<0.0164 *25* from comparison to RUL.
8030	1.4 *14*	S(p)+1959.0	3/2⁻					
8035	2.1 *13*	S(p)+1964.1	3/2⁻					
8041.5	1.5 *6*	S(p)+1974.2	3/2⁻			D+Q		Γ_γ=0.025 eV *8* δ: −0.01 *+28−24* or +4 *+115−2*.
8462	2.3 *9*	S(p)+1959.0	3/2⁻					
8467	2.9 *4*	S(p)+1964.1	3/2⁻					

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^{48}Ca(p,Xγ) IAR: ^{49}Ca g.s. (continued)

γ(^{49}Sc) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	Mult. [#]	δ [#]	Comments
8478.7	0.9 *4*	S(p)+1974.2	3/2⁻	D+Q		Γ_γ=0.014 eV *4* δ: −0.31 *+11−13* or −6.0≤δ≤+17.6.
9175	11 *4*	S(p)+1959.0	3/2⁻			
9180	7.6 *26*	S(p)+1964.1	3/2⁻			
9191.4	1.5 *4*	S(p)+1974.2	3/2⁻	D(+Q)		δ=−0.20 *+95−6*; Γ_γ=0.055 eV *17* δ: δ<0.55 *11* from comparison to RUL (evaluator).
9318	5.2 *10*	S(p)+1959.0	3/2⁻			
9323	3.0 *4*	S(p)+1964.1	3/2⁻			
9334.6	2.1 *2*	S(p)+1974.2	3/2⁻	D+Q	+0.07 *3*	Γ_γ=0.064 eV *20*
11563.2	3.2 *3*	S(p)+1974.2	3/2⁻	(E2+M3)	+0.09 *5*	Γ_γ=0.073 eV *22* δ: δ<0.068 *10* from comparison to RUL (evaluator).

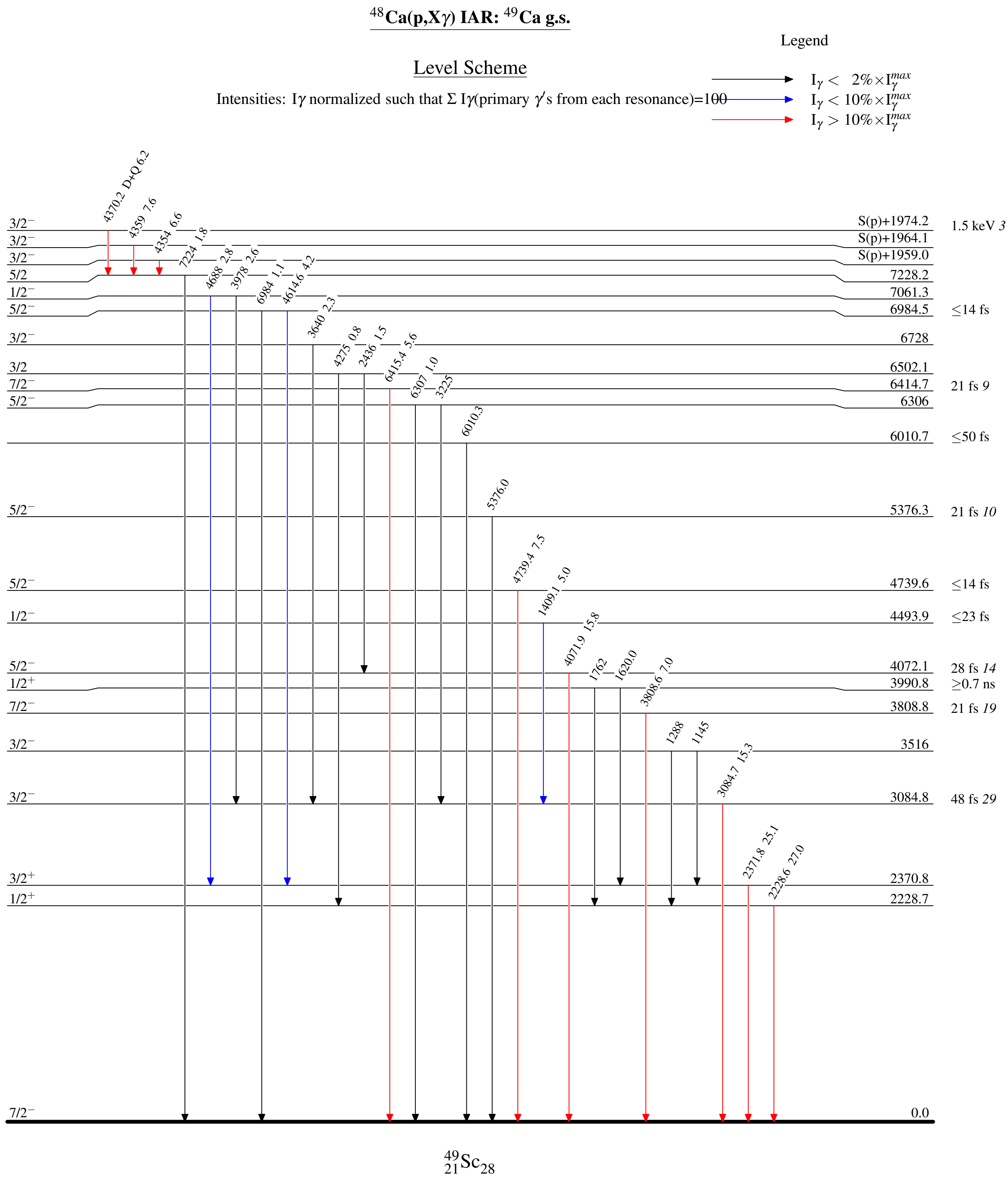
[†] Energies with ΔE(γ) given are from 1973St03. Other energies calculated by the evaluator from difference In the adopted excitation energies, except As noted.

[‡] From 1973Ad05 (secondaries and 1974 primary γ's) and 1972Ga09 (other primary γ's). Iγ normalized such that Σ Iγ(primary γ's from each resonance)=100. Iγ(E(p)=1974 res) from 1972Ga09 agree within a factor of 2 for weak transitions and are In good agreement for strong transitions, As are the Γ_γ's.

[#] From $\gamma(\theta)$ (1973Ad05). Other choices excluded by adopted J$^\pi$ or comparison to RUL (evaluator).

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

[x] γ ray not placed in level scheme.


^{48}Ca(p,Xγ) IAR: ^{49}Ca g.s.
Legend
Level Scheme
Intensities: Iγ normalized such that Σ Iγ(primary γ's from each resonance)=100
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
3/2⁻ S(p)+1974.2 1.5 keV 3
3/2⁻ S(p)+1964.1
3/2⁻ S(p)+1959.0
5/2 7228.2
1/2⁻ 7061.3
5/2⁻ 6984.5 ≤14 fs
3/2⁻ 6728
3/2 6502.1
7/2⁻ 6414.7 21 fs 9
5/2⁻ 6306
6010.7 ≤50 fs
5/2⁻ 5376.3 21 fs 10
5/2⁻ 4739.6 ≤14 fs
1/2⁻ 4493.9 ≤23 fs
5/2⁻ 4072.1 28 fs 14
1/2⁺ 3990.8 ≥0.7 ns
7/2⁻ 3808.8 21 fs 19
3/2⁻ 3516
3/2⁻ 3084.8 48 fs 29
3/2⁺ 2370.8
1/2⁺ 2228.7
7/2⁻ 0.0
4370.2 D+Q 6.2
4359 7.6
4354 6.6
7224 1.8
4688 2.8
3978 2.6
6984 1.1
4614.6 4.2
3640 2.3
4275 0.8
2436 1.5
6415.4 5.6
6307 1.0
3225
6010.3
5376.0
4739.4 7.5
1409.1 5.0
4071.9 15.8
1762
1620.0
3808.6 7.0
1288
1145
3084.7 15.3
2371.8 25.1
2228.6 27.0
$^{49}_{21}Sc_{28}$