Adopted Levels, Gammas

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

Q(β^-)=5261 *3*; S(n)=5146.45 *18*; S(p)=16304.4 *8*; Q(α)=−13954.0 *6* 2012Wa38
Note: Current evaluation has used the following Q record.
Q(β^-)=5262.1 *29*; S(n)=5146.45 *18*; S(p)=16454 *24*; Q(α)=−13944 *4* 2003Au03

^{49}Ca Levels

Analog states: see ^{48}Ca(p,X),(d,n),(^{3}He,d),(α,t) In ^{49}Sc.
Configuration: from analysis of ^{48}Ca(^{3}He,dp) data by 1978He15. See ^{48}Ca(d,n),(^{3}He,d),(α,t) In ^{49}Sc.
%n: inferred by the evaluator from the lack of competing γ deexcitation In β^- decay or calculated from g$\Gamma_n\Gamma_\gamma/\Gamma$, Γ_n, Γ_γ, and adopted J.
%γ: calculated from g$\Gamma_n\Gamma_\gamma/\Gamma$, Γ_n, Γ_γ, and adopted J.
Γ_n,Γ_γ: from the R-matrix analysis of 1987Ca11 In (n,X),(n,γ).
J(F),E(γ) from the R-matrix analysis of 1987Ca11 In (n,X),(n,γ).

Cross Reference (XREF) Flags

A	^{49}K β^- decay	F	^{48}Ca(d,p),(pol d,p)
B	^{50}K β^-n decay	G	^{48}Ca(d,pγ) E=6 MeV
C	^{2}H(^{48}Ca,^{49}Caγ) E=105 MeV	H	^{48}Ca(t,d) E=37.3 MeV
D	^{48}Ca(n,γ) E=thermal	I	^{48}Ca(^{48}Ca,Xγ) E=210 MeV
E	^{48}Ca(n,X),(n,γ) E=0.01-2 MeV		

E(H) (d,p),(pol d,p)	TV Mean of the following excitation energies: E_n(lab) (n,X),(n,γ)	R-matrix (n,X),(n,γ)
5314	5304.7	
5552	5553.5	
6066		6087
6373		6380

E(level)†	J$^\pi$‡	$T_{1/2}$#	XREF	Comments
0.0	3/2$^-$	8.718& min *6*	ABCD FGHI	%β^-=100 μ=−1.38 *6* (1993VeZY) μ: preliminary; collinear LASER spectroscopy. −0.06 fm^2<δ<r^2>$^{49-48}$<+0.29 fm^2 assumed in derivation of μ.
2023.2 *3*	1/2$^-$	<5.5 fs	ABCD FGHI	E(level): from (n,γ).
3354.7[a] *6*	(9/2$^+$)		BC FGHI	$T_{1/2}$>17.9 ps<0.3 ns $T_{1/2}$: lower limit from RUL(E3); upper limit from delayed-coincidence measurement In (d,pγ). Other: $T_{1/2}$>693 fs from DSAM In (d,pγ).
3585.0[b] *8*	5/2$^-$	40 fs *+23−16*	ABC FGH	Configuration=((48CA 2$^+$) (ν 2p$_{3/2}$))5/2$^-$ (1978He15)
3861[d] *2*	(1/2$^-$,3/2$^-$)		BC FG I	J$^\pi$: L=1 In ^{49}Sc IAR data.
3991[d] *2*	5/2$^-$	9.7 fs *+49−35*	C FG	Configuration=((48CA 2$^+$) (ν 2p$_{3/2}$))5/2$^-$ (1978He15)
4013.6[a] *6*	7/2$^+$,9/2$^+$	0.60 ps *+35−18*	C FG I	Configuration=((48CA 3$^-$)(ν 2p$_{3/2}$))9/2$^+$ (1978He15) configuration: if J$^\pi$=9/2$^+$.
4072[c] *1*	3/2$^-$	60 fs *+21−19*	ABC FG	
4261	1/2$^-$		F	
4272[d] *1*	1/2$^-$	25 fs *+22−17*	A C FG	
4416[d] *2*	5/2$^+$	<32 fs	C FG	

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Adopted Levels, Gammas (continued)

^{49}Ca Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#	$g\Gamma_n\Gamma_\gamma/\Gamma$ (eV)@	XREF	Comments
4617? *6*				F	
4757.0[a] *10*	(5/2+)			F I	
4788? *6*				F	
4885[d] *3*	9/2+			FG	
5132.8[a] *10*				I	
5165.5[e]			9.5×10^{-3} *14*	E	
5251.3[e]			0.124 *24*	E	
5309	1/2	59 eV *34*	0.15 *6*	A EF	%n=99.75 *10*; %g=0.25 *10* Γ_n=59 eV *5*; Γ_γ=0.15 eV *6*
5378	9/2+			F	
5443.9[e]	1/2−[f]	2.5 keV *+36−25*	0.3 *3*	E	%n=99.988 *12*; %g=0.012 *12* Γ_n=2.5 keV *3*; Γ_γ=0.3 eV *3*
5539.5[e]	3/2−[f]	3.3 keV *18*	1.6 *6*	E	%n=99.976 *8*; %g=0.024 *8* Γ_n=3.3 keV *2*; Γ_γ=0.8 eV *3*
5553	≥5/2		1.5 *4*	EF	%n≥99.87 *5*; %γ≤0.13 *5* $T_{1/2}$≥0.38 keV *15*; Γ_n=0.38 keV *8*; Γ_γ=0.5 eV *1*
5568	1/2−[f g]			a F	
5587.7[e]	1/2−[f g]	4.3 keV *27*	2.5 *10*	a E	%n=99.942 *24*; %g=0.058 *24* Γ_n=4.3 keV *4*; Γ_γ=2.5 eV *10* Jπ: π=(+) from (n,x),(n,γ) discrepant.
5612				a F	
5680.2 *9*				I	
5693	g			a F	
5722	g			a F	
6076	5/2+[f]			EF	
6257	1/2			E	Γ_n=6 keV *3*
6262				F	
6.33×10^3[b] *2*	(1/2+,3/2+,5/2+)[h]			A	%n≈100
6376	(5/2+)			A EF	%n≈100 Γ_n= 1.2 keV *4* Jπ: ≥5/2 from the R-matrix analysis of 1987Ca11 In (n,X),(n,γ). (1/2+,3/2+,5/2+) from log *ft*<5.9 from 3/2+ In β− decay.
6425[f]	3/2[f]	10[f] keV		F	
6443	3/2[f]	3[f] keV		F	
6492	3/2−	8[f] keV		E	Γ_n=5 keV *1*
6513	5/2+			A E	%n≈100 Γ_n=4 keV *2*
6529	9/2+			F	
6595				F	
6707	5/2+			A E	%n≈100 Γ_n=160 keV *20*
6753	9/2+			F	
6882				F	
6924	5/2+			A E	%n≈100 Γ_n=240 keV *20*
6971				F	
7070	5/2+			A E	%n≈100 Γ_n=18 keV *2*
7070	≥7/2			E	Γ_n=2.9 keV *6*

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Adopted Levels, Gammas (continued)

^{49}Ca Levels (continued)

E(level)[†]	Jπ[‡]	XREF		Comments
7335	(1/2+,3/2+,5/2+)[h]	A	F	%n≈100
7428	(1/2+,3/2+,5/2+)[h]	A	F	%n≈100
7529	(9/2+)		F	
7612		A	F	%n≈100
7705	(9/2+)		F	
7872		A	F	%n≈100
8.14×10³ ?[b] *7*		A		%n≈100
8.39×10³ ?[b] *8*	(1/2+,3/2+,5/2+)[h]	A		%n≈100
8.67×10³ ?[b] *9*		A		%n≈100
9.10×10³[b]		A		%n≈100
9.28×10³[b] *10*		A		%n≈100
9.58×10³[b] *11*		A		%n≈100
10.10×10³ ?[b] *13*		A		%n≈100

[†] From (d,p),(pol d,p), except As noted. Note that the correspondence between unbound states observed In (d,p), β^- decay, and (n,X),(n,γ) should not Be considered As well established.
[‡] From comparison of $\sigma(\theta)$ and A(θ) to DWBA In (pol d,p), except As noted.
[#] $T_{1/2}$'s are from DSAM In (d,pγ), except As noted. Γ's are from $g\Gamma_n\Gamma_\gamma/\Gamma$, Γ_n, Γ_γ, and adopted J, except As noted.
[@] From the R-matrix analysis of 1987Ca11 In (n,X),(n,γ).
[&] Weighted av (internal) of 8.718 min *7* (1989Ab05; NaI), 8.715 min *23* (1970Ha22; NaI,chem,>20 $T_{1/2}$'s), and 8.719 min *13* (1970Re13; 7 $T_{1/2}$'s); all groups used (n,γ) to produce ^{49}Ca. Others: see 1995Bu23.
[a] From least-squares fit to Eγ's assuming $\Delta E\gamma$=1 keV when not given and holding the 3585 and 3861 states fixed.
[b] From β^- decay.
[c] Unweighted average of 4065 *2* from (d,pγ) and 4072 *1* from β^- decay.
[d] From (d,pγ).
[e] From E(n)(lab) In (n,X),(n,γ).
[f] From the evaluation of 2006MuZX.
[g] (1/2+,3/2+,5/2+) for the multiplet from log *ft*<5.9 from (3/2+).
[h] log *ft*<5.9 from (3/2+) In β^- decay.

$\gamma(^{49}Ca)$

See (d,pγ) for questionably placed γ's which have not been ADOPTED.

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[g]	Comments
2023.2	1/2−	2023.12[@] *26*	100[&]	0.0	3/2−	(M1,E2)	0.000314 *5*	α=0.000314 *5*; α(K)=1.82×10^{-5} *9*; α(L)=1.56×10^{-6} *7*; α(M)=1.85×10^{-7} *9*; α(N+..)=0.00029 *4* α(N)=1.05×10^{-8} *5*; α(IPF)=0.00029 *4*
3354.7	(9/2+)	3356.7[a] *10*	100[a]	0.0	3/2−	[E3]	6.83×10^{-4} *10*	α=6.83×10^{-4} *10*; α(K)=1.131×10^{-5} *16*; α(L)=9.69×10^{-7} *14*; α(M)=1.151×10^{-7} *17* α(N+..)=0.000671 *10*; α(N)=6.55×10^{-9} *10*; α(IPF)=0.000671 *10* B(E3)(W.u.)<99>5.9

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Adopted Levels, Gammas (continued)

γ(^{49}Ca) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[g]	Comments
3585.0	5/2⁻	3585.0[b]	100	0.0	3/2⁻	(M1,E2)	0.000977 *14*	α=0.000977 *14*; α(K)=7.25×10⁻⁶ *17*; α(L)=6.20×10⁻⁷ *14*; α(M)=7.36×10⁻⁸ *17*; α(N+..)=0.00096 *7* α(N)=4.20×10⁻⁹ *10*; α(IPF)=0.00096 *7*
3861	(1/2⁻,3/2⁻)	3859.7[a] *9*	100	0.0	3/2⁻			
3991	5/2⁻	3991[c]	100	0.0	3/2⁻	(M1,E2)	0.001117 *14*	α=0.001117 *14*; α(K)=6.19×10⁻⁶ *13*; α(L)=5.29×10⁻⁷ *12*; α(M)=6.29×10⁻⁸ *14*; α(N+..)=0.00110 *7* α(N)=3.58×10⁻⁹ *8*; α(IPF)=0.00110 *7*
4013.6	7/2⁺,9/2⁺	150.9[h]		3861	(1/2⁻,3/2⁻)			
		660.3		3354.7	(9/2⁺)			
		4017.5[dh]		0.0	3/2⁻			
4072	3/2⁻	4072.0[a]	100	0.0	3/2⁻	(M1,E2)	0.001137 *16*	α=0.001137 *16*; α(K)=6.02×10⁻⁶ *13*; α(L)=5.14×10⁻⁷ *11*; α(M)=6.11×10⁻⁸ *13*; α(N+..)=0.00113 *7* α(N)=3.48×10⁻⁹ *8*; α(IPF)=0.00113 *7*
4272	1/2⁻	2249[b]	87[e] *16*	2023.2	1/2⁻	(M1,E2)	0.000415 *6*	α=0.000415 *6*; α(K)=1.52×10⁻⁵ *6*; α(L)=1.30×10⁻⁶ *5*; α(M)=1.54×10⁻⁷ *6*; α(N+..)=0.00039 *5* α(N)=8.8×10⁻⁹ *4*; α(IPF)=0.00039 *5*
		4272[b]	100[e] *16*	0.0	3/2⁻	(M1,E2)	0.001208 *17*	α=0.001208 *17*; α(K)=5.62×10⁻⁶ *12*; α(L)=4.80×10⁻⁷ *10*; α(M)=5.70×10⁻⁸ *12*; α(N+..)=0.00120 *8* α(N)=3.25×10⁻⁹ *7*; α(IPF)=0.00120 *8*
4416	5/2⁺	4416[c]	100	0.0	3/2⁻	(E1)	0.00184 *3*	B(E1)(W.u.)>0.00018 α=0.00184 *3*; α(K)=4.07×10⁻⁶ *6*; α(L)=3.48×10⁻⁷ *5*; α(M)=4.13×10⁻⁸ *6*; α(N+..)=0.00184 *3* α(N)=2.35×10⁻⁹ *4*; α(IPF)=0.00184 *3*
4757.0	(5/2⁺)	743.3		4013.6	7/2⁺,9/2⁺			
4885	9/2⁺	875[cd]	100[f] *20*	4013.6	7/2⁺,9/2⁺			
		1531[c]	25[f] *5*	3354.7	(9/2⁺)			
5132.8		1119.1		4013.6	7/2⁺,9/2⁺			
5680.2		547.4		5132.8				
		923.2		4757.0	(5/2⁺)			
		1666.5		4013.6	7/2⁺,9/2⁺			

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Adopted Levels, Gammas (continued)

$\gamma(^{49}Ca)$ (continued)

† From (^{48}Ca,Xγ), except As noted.
‡ Relative photon branching from each level. From β^- decay, except As noted.
# D,E2 from comparison to RUL and $\Delta\pi$ from level scheme, except As noted.
@ Weighted average (internal) of 2023.5 *5* from β^-n decay and 2023.16 *30* from (n,γ) E=thermal.
& From (n,γ).
[a] From β^-n decay.
[b] From β^- decay.
[c] From (d,pγ).
[d] Eγ discrepant with energy level difference by more than three σ.
[e] Note discrepancy between β^- decay and (d,pγ). Iγ(4272γ)/Iγ(2250γ)=100 *20*/43 *9* In (d,pγ).
[f] From (d,pγ).
[g] 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.
[h] Placement of transition in the level scheme is uncertain.

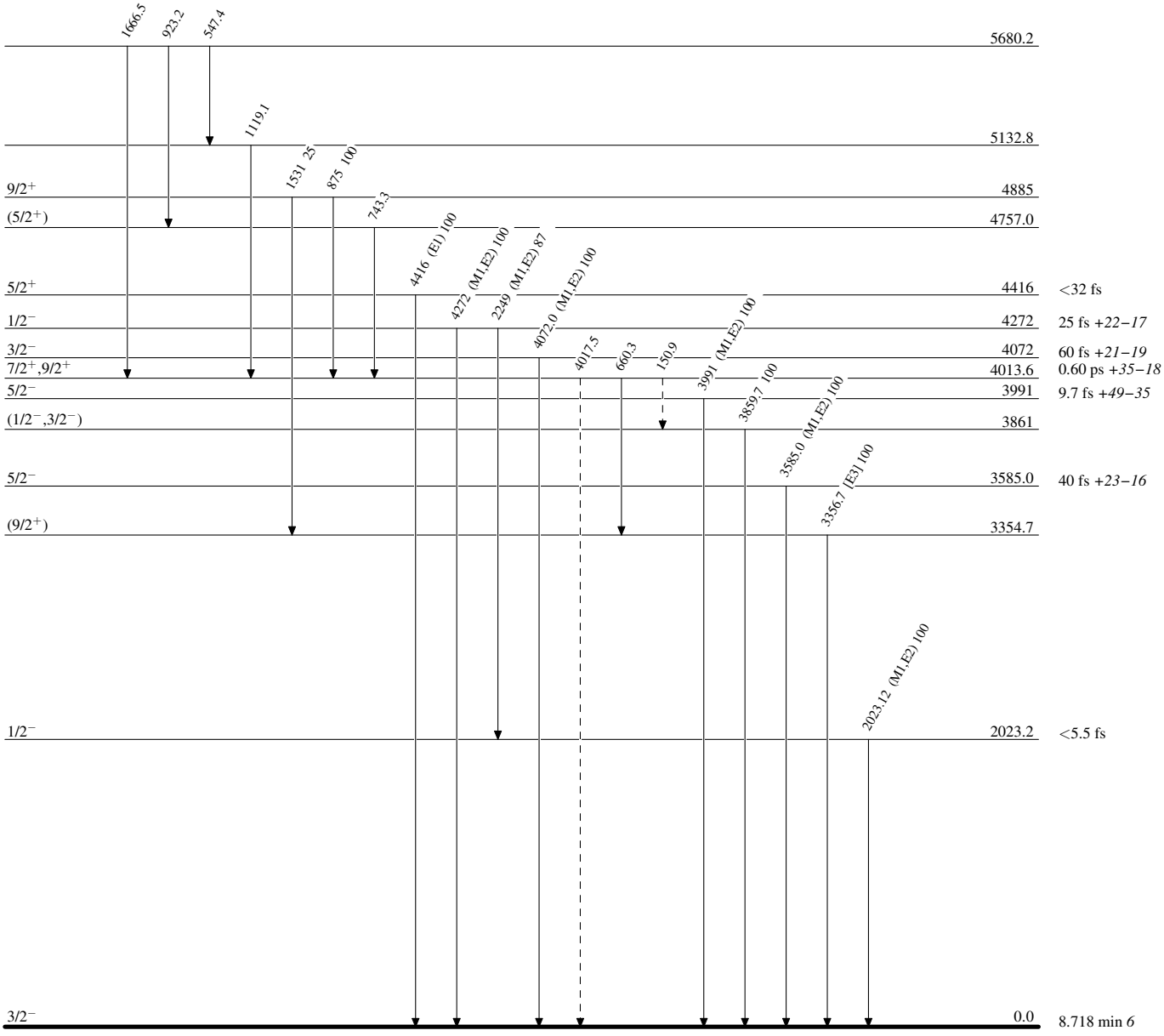
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{49}_{20}Ca_{29}$