Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 152, 1 (2018)	30-Sep-2017

Q(β^-)=−17810 *SY*; S(n)=16993.8 *7*; S(p)=4547.27 *22*; Q(α)=−6105.12 *21* 2017Wa10
Δ(Q(β^-))=200 (syst,2017Wa10).
S(2n)=31750 *40*, S(2p)=6404.90 *20*, Q(εp)=1600.19 *28* (2017Wa10).
First identification of ^{38}Ca nuclide was by 1966Ha32 via ^{40}Ca(p,t) according to 2011Am01 compilation of isotope discovery.
Additional information 1.
Mass measurement: 2011Er02, 2008Ge08, 2007Ge07, 2007Ri08, 2006Bo11.

^{38}Ca Levels

Cross Reference (XREF) Flags

A	^{39}Ti εp decay (28.5 ms)	E	^{36}Ar(^{3}He,nγ)
B	^{39}Sc p decay:?	F	^{40}Ca(p,t)
C	^{24}Mg(^{16}O,2nγ)	G	Coulomb excitation
D	^{36}Ar(^{3}He,n)		

```
--------------------------------------------------------
               Isospin T=1 (triplet) states

38Ar          38Ca         ΔE(1)      38K            ΔE(2)
   0,0+         0,0+                130,0+  T=1
2167,2+      2213,2+    +46      2401,2+  T=1    +104,+58
3377,0+      3084,0+    -293
3810,3-      3704,3-    -106
3937,2+      3684,2+    -253
ΔE(1)=E(38Ca)-E(38Ar)
ΔE(2)=E(38K)-E(38Ar)-130,        E(38K)-E(38Ca)-130
--------------------------------------------------------
```

E(level)[†]	J$^\pi$	T$_{1/2}$[‡]	XREF	Comments
0	0$^+$	443.76 ms *35*	A CDEFG	%ε+%β^+=100 T$_{1/2}$: weighted average of 443.63 ms *35* (2015Bl02), 443.77 ms *36* (2011Pa38), 443.8 ms *19* (2010Bl09), 430 ms *12* (1980Wi13), 450 ms *70* (1972Zi02), 439 ms *12* (1969Ga27), and 470 ms *20* (1968Ka15). Other: 660 ms *50* (1957Cl23), based on the observation of a 3.5 MeV γ which could not be confirmed in the studies afterwards.
2213.2 *10*	2$^+$	0.56 ps *+16−10*	A CDEFG	B(E2)↑=0.0096 *21* XREF: D(2224). J$^\pi$: L(p,t)=2 from 0$^+$; Coulomb excitation from 0$^+$. T$_{1/2}$: from B(E2)↑. Other: 68 fs *+30−28* from DSAM in (^{3}He,nγ). B(E2)↑ from 1999Co23 in Coulomb excitation.
3083.7 *12*	0$^+$	19 ps *+10−7*	DEF	J$^\pi$: L(p,t)=0 from 0$^+$.
3683.9 *5*	2$^+$	29 fs *+15−9*	dEfG	B(E2)↑=0.0122 *30* J$^\pi$: L(p,t)=2; L(^{3}He,n)=2 or 2+3 for a doublet; Coulomb excitation from 0$^+$. T$_{1/2}$: from B(E2)↑ and adopted γ-ray branching ratios. Other: <5.5 fs from DSAM in (^{3}He,nγ). B(E2)↑ from 1999Co23 in Coulomb excitation.
3703.5 *10*	(3$^-$)	0.16 ps *+7−6*	dEf	J$^\pi$: systematics of even-even nuclides; L(^{3}He,n)=2+3 for a doublet composed of 3684 and 3703 levels. L(p,t) also shows some evidence of presence of L=3 component.
4193.5 *15*	(5$^-$)		EF	E(level): other: 4191 *5* from (p,t). J$^\pi$: L(p,t)=(5) from 0$^+$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{38}Ca Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[‡]	XREF	Comments
4383.9 *11*	2^+	24 fs *+12−8*	dEF	E(level): other: 4385 *4* from (p,t). J^π: L(p,t)=2 from 0^+; L(^{3}He,n)=2+5 for a doublet.
4412 *30*	(5^-)		d	J^π: L(^{3}He,n)=2+5 for a doublet.
4748 *5*	0^+		D F	E(level): other: 4751 *5* from (^{3}He,n). J^π: L(^{3}He,n)=0 from 0^+. L(p,t)=(3) is inconsistent. There may be a doublet near this energy, but due to tentative nature of L(p,t), the evidence for two levels is not sufficient.
4860 *40*	(3^-)		D	E(level): from (^{3}He,n). J^π: L(^{3}He,n)=3,(2+4). This group may be a doublet in (^{3}He,n); L=(2+4) may correspond to 4899, 2^+ level from (p,t).
4902 *4*	2^+		F	J^π: L(p,t)=2 from 0^+.
5164 *7*	2^+		D F	XREF: D(5140). E(level): other: 5140 *60* from (^{3}He,n). J^π: L(^{3}He,n)=2 from 0^+.
5266 *4*	2^+		F	J^π: L(p,t)=2 from 0^+.
5430 *6*			F	
5601 *7*	3^-		D F	XREF: D(5560). E(level): other: 5560 *60* from (^{3}He,n). J^π: L(^{3}He,n)=3 from 0^+.
5704 *5*			F	
5816 *7*	(4^+)		D F	XREF: D(5790). E(level): other: 5790 *40* from (^{3}He,n). J^π: L(^{3}He,n)=(4) from 0^+.
6136 *6*			F	
6277 *3*	0^+		F	J^π: L(p,t)=0 from 0^+.
6485 *6*			F	
6601 *3*			F	
6704 *3*			F	
6770 *13*			D F	E(level): other: 6760 *50* from (^{3}He,n).
6801 *12*			F	
6950 *5*			F	
7041 *8*			F	
7176 *4*			d F	XREF: d(7200).
7208 *15*			d F	XREF: d(7200).
7480 *9*			D F	E(level): other: 7470 *50* from (^{3}He,n).
7801 *3*			F	
8026 *5*			F	
8189 *6*			F	
8322 *5*			F	
8507 *9*			F	
8587 *3*			F	
8672 *6*			F	
8717 *8*			F	
8924 *9*			F	
8994 *9*			F	
9073 *9*			F	
9157 *8*			F	
9230 *9*			F	
9296 *8*			F	
9735 *8*			F	
9809 *6*			F	
10104 *9*			F	
10410 *9*			F	
10557 *8*			F	
10946 *11*			F	
11089 *11*			F	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{38}Ca Levels (continued)

E(level)[†]	XREF
11189 *13*	F
11861 *11*	F

[†] From a least-squares fit to γ-ray energies for levels connected with γ transitions and from (p,t) for the rest, unless otherwise noted.
[‡] From DSAM in (^{3}He,nγ), unless otherwise noted.

$\gamma(^{38}Ca)$

E_i(level)	J^π_i	E_γ[†]	I_γ	E_f	J^π_f	Comments
2213.2	2^+	2213.13	100	0	0^+	B(E2)(W.u.)=2.5 *6* E_γ: other: 2212.5 *14* from ^{39}Ti εp decay, 2206 *10* from Coulomb excitation.
3083.7	0^+	870.5 *5*	100	2213.2	2^+	B(E2)(W.u.)=8 *+3−5*
3683.9	2^+	1471[‡]	19 *14*	2213.2	2^+	E_γ: other: 1448 *25* from Coulomb excitation. I_γ: from Coulomb excitation.
		3683.7 *5*	100 *14*	0	0^+	B(E2)(W.u.)=3.2 *12* E_γ: other: 3685 *21* from Coulomb excitation. I_γ: from Coulomb excitation.
3703.5	(3^-)	1490.22 *11*	100	2213.2	2^+	B(E1)(W.u.)=0.0011 *+7−3*
4193.5	(5^-)	490		3703.5	(3^-)	
4383.9	2^+	2170.6 *4*	100	2213.2	2^+	

[†] From (^{3}He,nγ), unless otherwise noted.
[‡] Placement of transition in the level scheme is uncertain.

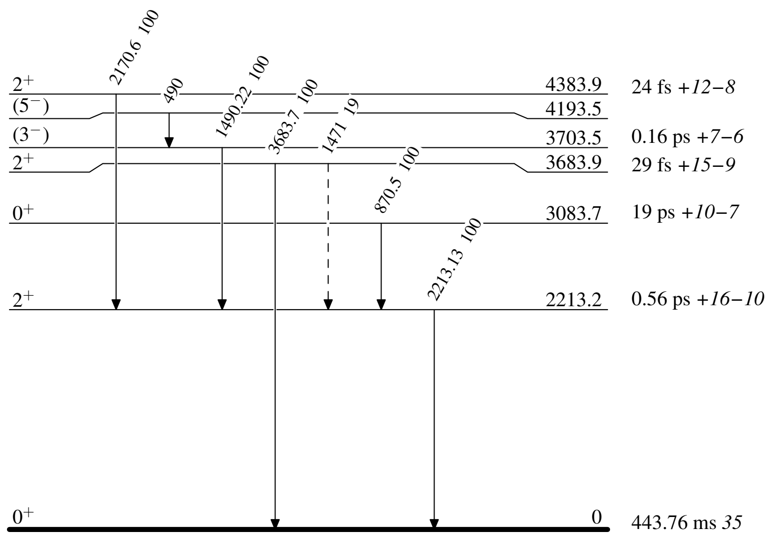
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{38}_{20}$Ca$_{18}$

Adopted Levels, Gammas

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

Q(β^-)=−14323.0 *28*; S(n)=15635.0 *6*; S(p)=8328.17 *2*; Q(α)=−7039.76 *3* 2012Wa38
S(2n)=28930.52 *20*, S(2p)=14709.51 *20* (2012Wa38).
First identification of ^{40}Cl nuclide by A. J. Dempster (Phys. Rev., 20 (1922), p. 631).
Additional details of data for resonances in different reactions can be found in the following datasets:
^{36}Ar(α,γ):resonances: 24 resonances from Eα(lab)=5486 to 13330 (excitation energy in ^{40}Ca=11978-19038).
^{39}K(p,γ): excitation energies and γ-decays for about 160 resonances.
^{39}K(p,p),(p,α):resonances: 267 resonances from E(p)(lab)=1102-6660 (excitation energy in ^{40}Ca=9403-14680).
^{40}Ca(p,pα),(p,2p):resonances: two resonances with excitation energies (in ^{40}Ca) at 11700 and 12300.

Other reactions (giant resonances, properties of compound nucleus, reaction mechanism, etc.):
^{12}C(^{28}Si,X) or ^{28}Si(^{12}C,X): 2002Ro35, 1995Na09, 1986Ha33, 1983Ra26, 1979Os01, 1979Cl02, 1979Ba49, 1973Ho37: reaction mechanisms.
Additional information 1.
^{24}Mg(^{16}O,X): 1991Fo08, 1985Sa11, 1981Nu02, 1980Sa31, 1980Sa12, 1980Pa08, 1979Le02, 1979Cl02, 1973Ho37.
^{27}Al(^{16}O,t): 1982Aw01, 1981Aw02: reaction mechanism.
^{39}K(p,p),(p,α):resonances: 1987WaZI, 1990Bu02, 1970De30: see dataset.
^{40}Ca(^{40}Ca,X): 1997Sc40: giant quadrupole resonance.
^{40}Ca(p,π^-): 1983Sh31: E=190 MeV. Measured σ.
^{40}Ca(p,pα),(p,2p):resonances: 2001Sc25: see dataset.
Photonuclear reactions: ^{40}Ca(γ,n),(γ,p),(γ,2n),(γ,pn), etc: 1974Br15, 1972Br58, 1971Sh23, 1971Is06, 1968Go29, 1966An03, 1964Ba24.
^{40}Ca(γ,π): 2002Kr02: deduced Δ' resonance. Others: 1988St12, 1982Do12.
^{40}Ca(e,X): 1976Zi02.
^{40}Ca(μ^-,ν): 2003Po09: photon asymmetry measured in radiative muon capture in ^{40}Ca.
^{40}Ca(π^+,K$^+$): 1991Pi07.
^{40}Ca(K,π^-): 1981Be17, 1989Ta16: hypernuclear production.
^{40}Ca(p-bar,X): 2002Ha01, 2001Tr23, 2001Tr19: measured anti-protonic x-rays.
^{40}Ca(p-bar,p-bar): 1984Ga32.
^{40}Ca(p,np): 1984Ah04 (also 1983AhZY): deduced neutron hole states.
^{40}Ca(pol p,pol n): 1986Wa28: deduced spin-flip probability.
^{40}Ca(^{20}Ne,^{16}Oα): 1986Sh30.
Hyperfine structure, isotope shifts, nuclear radius measurements: 2000Mu17, 2000Ga58, 1995Ku41, 1993Si20, 1992Ve02, 1992Ma20, 1991As06, 1990Go10, 1984Va08, 1983Lo13, 1982Ay02, 1982An15, 1980Be13, 1979Kl01, 1978Br31, 1976Ne08.
Mesic atoms: 1983Ku10, 1981Wo02, 1980Po01, 1979Ba07, 1971Ku08, 1970Ma26, 1970Ku03, 1966Co02.
Mesic atoms, in most studies, deduced isotope shifts, root-mean square radius.
1983Ku10, 1980Po01, 1979Ba07, 1970Ku03: measured pionic x rays.
1981Wo02, 1970Ma26, 1966Co02: measured muonic x rays.
1971Ku08: measured kaonic x rays.

Giant (dipole, quadrupole and octupole) resonances: see inelastic scattering datasets: ^{40}Ca(e,e$'$); (π^+,$\pi^{+\prime}$),(π^-,$\pi^{-\prime}$); (p,p$'$),(pol p,p$'$); (d,d$'$),(pol d,d$'$); (^{3}He,^{3}He$'$); (α,α'); (HI,HI$'$).

In XREF column, level population indicated by letter Z or z refers to the following level energies in different reactions:
^{41}Ti εp decay (80.4 ms): 0, 3353.62, 3737, 3904.
^{43}Cr β3p decay (21.2 ms): 0.
^{44}V $\varepsilon\alpha$ decay (111 ms): 0.
^{14}N(^{28}Si,d): 6930, 8098.
^{36}Ar(^{7}Li,t): 3900, 5265, 5615, 6290, 6525, 7010.
^{36}Ar(^{16}O,^{12}C): 3353, 3900, 5250, 6900, 9900, 12400.

Adopted Levels, Gammas (continued)

^{40}Ca(p,pα),(p,2p):resonances: 11700, 12300.
^{40}Ca(t,t),(pol t,t): 0.
Inelastic scattering: 0, 3740, 3900, 4490, 5900, 6290, 6400, 6940, 7300. Giant resonances at 7.8, 10.7, 14.0, 17.6 and 26 MeV.
^{40}Ca(n,n′),(pol n,n′): 0, 3353, 3737, 3904, 4491.
^{40}Ca(π+,π+′),(π-,π-′): 0, 3353, 3736, 3908, 4492, 6256, 6583, 6700, 11700, 13400, 17500.
^{42}Ca(^{16}O,^{18}O): 0.

^{40}Ca Levels

Cross Reference (XREF) Flags

A	^{40}K β^- decay (1.248×10^9 y)	N	^{40}Ca(e,e′)	Others:	
B	^{40}Sc ε decay (182.3 ms)	O	^{40}Ca(n,n′γ)	AA	^{43}Cr β^+3p decay (21.2 ms)
C	^{4}He(^{36}Ar,α):resonances	P	^{40}Ca(p,p′γ)	AB	^{44}V $\varepsilon\alpha$ decay (111 ms)
D	^{32}S(^{12}C,α)	Q	^{40}Ca(p,p′),(pol p,p′)	AC	^{14}N(^{28}Si,d)
E	^{36}Ar(α,γ):resonances	R	^{40}Ca(d,d′),(pol d,d′)	AD	^{36}Ar(^{7}Li,t)
F	^{36}Ar(^{6}Li,d)	S	^{40}Ca(^{3}He,^{3}He′)	AE	^{36}Ar(^{16}O,^{12}C)
G	^{38}Ar(^{3}He,n)	T	^{40}Ca(α,α′γ)	AF	^{40}Ca(p,pα),(p,2p):resonances
H	^{39}K(p,γ)	U	^{40}Ca(α,α′)	AG	^{40}Ca(t,t),(pol t,t)
I	^{39}K(p,p),(p,α):resonances	V	^{41}Ca(d,t)	AH	^{40}Ca(n,n′),(pol n,n′)
J	^{39}K(d,n)	W	^{41}Ca(^{3}He,α)	AI	^{40}Ca(π^+,π^+′),(π^-,π^-′)
K	^{39}K(^{3}He,d)	X	^{42}Ca(p,t)	AJ	^{42}Ca(^{16}O,^{18}O)
L	^{39}K(^{3}He,dγ)	Y	(HI,xnγ)	AK	Inelastic scattering
M	^{40}Ca(γ,γ′)	Z	^{41}Ti εp decay (80.4 ms)		

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#@]	XREF	Comments
0.0	0$^+$	stable	AB DEFGH JK MNOPQRSTUVWXYZ	XREF: Others: AA, AB, AG, AH, AI, AJ, AK Double β decay ($\varepsilon\varepsilon$) is possible, but only limits have been set on half-life from measurements. T$_{1/2}$: experimental limits from 2$\varepsilon\varepsilon$ decay (2001Be79,1999Be64): >3.0×10^{21} y for 0-neutrino mode; >5.9×10^{21} y for 2-neutrino mode. Evaluated rms charge radius=3.4776 fm *19* (2013An02). Additional information 2.
3352.62[&] *9*	0$^+$	2.17 ns *8*	D FGH JKL NOPQRSTUVWXYZ	XREF: Others: AE, AH, AI XREF: T(?). J$^\pi$: L(α,α′)=L(^{3}He,n)=L(p,t)=0 from 0$^+$; E0 excitation in (e,e′). T$_{1/2}$: weighted average of 2.21 ns *10* in (n,n′) and 2.15 ns *8* in (p,p′γ). Additional information 3.
3736.69 *5*	3$^-$	41 ps *4*	B D F H JKL NOPQRSTUVWXYZ	XREF: Others: AH, AI, AK μ=+1.6 *3* (2014StZZ,1979Ni04,1976Ja16) T=0 (1972Sc19) J$^\pi$: L(α,α′)=L(^{3}He,n)=L(p,t)=3 from 0$^+$; E3 excitation in (e,e′). μ: from tilted-foil hyperfine field IPAC in (α,α′)(1979Ni04) and recoil into gas in (α,α′) (1976Ja16). Other: 1.56 *30* (IMPAC, relative to g-factor for 4491 level in (α,α′), 1987Ma25). T$_{1/2}$: from (p,p′γ). Additional information 4.
3904.38[&] *3*	2$^+$	35 fs *7*	D FGH JKLMNOPQR TU XYZ	XREF: Others: AD, AE, AH, AI, AK J$^\pi$: L(α,α′)=L(^{3}He,n)=L(p,t)=2 from 0$^+$; E2 excitation in (e,e′) and (γ,γ′).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
				$T_{1/2}$: weighted average of 40 fs *7* in (p,γ), 29 fs *+10−6* in (γ,γ'), 36 fs *14* in (n,n'γ), and 33 fs *7* in (p,p'γ). Additional information 5.
4491.43 *4*	5^-	289 ps *8*	B D F H JKL NOPQRSTUVWXY	XREF: Others: AH, AI, AK μ=+2.6 *5* (2014StZZ,1974He13) T=0 (1972Sc19) J^{π}: L(α,α')=L(p,t)=5 from 0^+; E5 excitation in (e,e'). $T_{1/2}$: weighted average of 295 ps *5* in ($\alpha,\alpha'\gamma$), 272 ps *8* in (p,p'γ), and 0.38 ns *8* in (HI,xnγ). μ: IPAD method in (p,p'γ) (1974He13). Additional information 6.
5211.56[d] *17*	0^+	1.02 ps *21*	D fgH KL OPQ XY	J^{π}: L(p,t)=L(^{6}Li,d)=0 from 0^+. $T_{1/2}$: from (p,p'γ).
5248.79 *5*	2^+	83 fs *+11−9*	d fgH KLMNOPQ S U XY	XREF: Others: AD J^{π}: L(p,t)=L(^{6}Li,d)=L(p,p')=2 from 0^+; E2 excitation in (e,e'). $T_{1/2}$: weighted average of 0.15 ps *7* in (p,γ) and 94 fs *17* in (p,p'γ) and 79 fs *+11−9* in (γ,γ').
5278.80[&] *6*	4^+	0.21 ps *4*	d FgH KL OPQ U Y	XREF: Others: AD, AE J^{π}: L(^{6}Li,d)=L(p,p')=4 from 0^+; $\gamma(\theta)$ in (p,'γ). $T_{1/2}$: weighted average of 0.19 ps *4* in (n,n'γ), 0.225 ps *35* in (p,p'γ), and 0.16 ps *+13−4* in (p,γ).
5613.52 *3*	4^-	0.69 ps *11*	B d H JKL OPQ sT VW Y	XREF: Others: AD J^{π}: spin from $\gamma(\theta)$ in (HI,xnγ) and $\gamma\gamma(\theta)$ in (p,γ); parity from L(d,n)=L(^{3}He,d)=3 from $3/2^+$ and L(d,t)=L(^{3}He,α)=2 from $7/2^-$. $T_{1/2}$: from (p,p'γ). Other: 69 fs *55* in (p,γ). Additional information 7.
5629.41[d] *6*	2^+	40 fs *15*	d F H MNOPQ stU XY	XREF: Others: AD XREF: N(5610). J^{π}: L(p,t)=2 from 0^+; E2 excitation in (e,e'). $T_{1/2}$: weighted average of 42 fs *15* from (p,p'γ) and 38 fs *+20−10* from (γ,γ').
5902.63 *7*	1^-	15.8 fs *22*	D F H JKLMNOPQ U WX	XREF: Others: AK XREF: D(5900)N(5940). J^{π}: L(p,t)=L(^{6}Li,d)=1 from 0^+. $T_{1/2}$: weighted average of 42 fs *14* from (p,p'γ) and 15.2 fs *+23−18* (γ,γ'). 2004To07 in (HI,xnγ) propose this as 1^- member of $K^{\pi}=0^-$ band, not observed by 2004To07. Additional information 8.
6025.47 *5*	2^-	171 fs *21*	f H JKL OPQ uVWx	J^{π}: L(^{3}He,d)=3 and L(d,n)=1+3 from $3/2^+$; analyzing power in (pol p,p'). $T_{1/2}$: from (p,p'γ). Additional information 9.
6029.71[b] *6*	3^+	0.40 ps *8*	f H OP u xY	J^{π}: 780.8γ and 2124.4γ E2(+M1) to 2^+; band assignment in (HI,xnγ). $T_{1/2}$: from (p,p'γ).
6160	(3^-)		N TU	XREF: T(6100). J^{π}: L(α,α')=(3).
6285.15 *4*	3^-	0.33 ps *4*	D F H JKL NOPQ STU WX	XREF: Others: AD, AI, AK J^{π}: L(α,α')=L(p,t)=L(^{6}Li,d)=3 from 0^+. $T_{1/2}$: weighted average of 0.27 ps *8* in (p,γ) and 0.35 ps *4* in (p,p'γ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#@]	XREF	Comments
				2004To07 in (HI,xnγ) propose this as (3^-) member of $K^\pi=0^-$ band, not observed by 2004To07. Additional information 10.
6422.4 *10*	2^+	12 fs *+5−3*	M Q	XREF: Others: AK J^π: from (pol p,p′). $T_{1/2}$: from (γ,γ').
6507.87 *13*	4^+	128 fs *21*	d F H OPQ U XY	XREF: Others: AD J^π: L(p,t)=L(^{6}Li,d)=L(pol p,p′)=4 from 0^+. $T_{1/2}$: from (p,p′γ).
6542.80[d] *9*	4^+	121 fs *21*	d F H OPQ Y	XREF: Others: AD XREF: O(?). J^π: L(^{6}Li,d)=4 from 0^+; 913.3γ stretched E2 to 2^+; band assignment in (HI,xnγ). $T_{1/2}$: from (p,p′γ).
6582.47 *10*	3^-	0.173 fs *28*	B d F H JKL NOPQ STUVWX	XREF: Others: AI XREF: O(?)T(6560). J^π: L(α,α')=L(p,t)=L(^{6}Li,d)=L(pol p,p′)=3. $T_{1/2}$: from (p,p′γ). 2004To07 in (HI,xnγ) propose this as possible (3^-) member of $K^\pi=0^-$ band, not observed by 2004To07. Additional information 11.
6750.41 *7*	2^-	96 fs *28*	F H JKL OPQ UVWX	XREF: Others: AI J^π: from analyzing power in (pol p,p′) with L=3; L(^{3}He,d)=1 and L(d,n)=1+3 from $7/2^+$. $T_{1/2}$: from (p,p′γ). Additional information 12.
6908.70 *8*	2^+	2.41 fs *+29−23*	d F H MNOPQ X	XREF: Others: AD J^π: L(p,t)=L(^{6}Li,d)=L(p,p′)=2 from 0^+. $T_{1/2}$: from (γ,γ'). Others: <35 fs from (p,γ), <10 fs from (p,p′γ).
6930.2[&] *3*	6^+	0.34 ps *+9−17*	d F l O v Y	XREF: Others: AC, AD, AE, AK J^π: L(^{6}Li,d)=6; $\gamma(\theta)$ and band assignment in (HI,xnγ). $T_{1/2}$: from (HI,xnγ) by DSAM.
6931.29 *6*	3^-	1.4 ps *6*	d H l nOPQ stuvW	XREF: Others: AD, AK J^π: L(^{3}He,α)=2 from $7/2^-$; 2439.8γ to 5^-, 1301.8γ, 1682.4γ and 3026.8γ to 2^+. $T_{1/2}$: from (p,γ). Other: 104 fs *28* from (p,p′γ).
6938.0 *18*	(1^- to 5^-)	0.42 fs *17*	d n P stuv	XREF: Others: AD, AK J^π: γ to 3^-. $T_{1/2}$: from (p,p′γ).
6950.48 *7*	1^-	1.01 fs *5*	d GH JKLMNOPQ tuvWX	XREF: Others: AD, AK J^π: L(p,t)=L(^{3}He,n)=1 from 0^+. $T_{1/2}$: from (γ,γ'). Other: <10 fs from (p,p′γ). Additional information 13.
7100	(2^+)		N	XREF: Others: AD E(level),J^π: from (e,e′).
7113.1 *10*	1^-	55 fs *28*	H jK P x	XREF: Others: AD J^π: 1899.8γ and 7112.9γ to 0^+, 1485γ and 3206.8γ to 2^+; L(^{3}He,d)=1 from $3/2^+$; L(d,n)=1(+3) from $3/2^+$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
				$T_{1/2}$: from (p,p′γ).
7113.73 *5*	4^-	50 fs *21*	H jKL PQ UVWx	XREF: Others: AD XREF: K(7117)U(7120). J^{π}: L(p,p′)=5 from 0^+; L(d,t)=L(^{3}He,α)=0+2 from $7/2^-$. $T_{1/2}$: weighted average of 35 fs *21* in (p,p′γ) and 76 fs *28* in (p,γ).
7239.07 *8*	(3^-,4,5^-)	0.10 ps *5*	d H PQ	J^{π}: 3501.4γ to 3^- and 2746γ to 5^-. $T_{1/2}$: from (p,p′γ).
7277.82 *8*	$(2,3)^+$	49 fs *35*	d f H PQ	XREF: Others: AK J^{π}: 3541.0γ to 3^-; L(p,p′)=2 from 0^+ for 7278+7301. $T_{1/2}$: from (p,p′γ).
7300.67 *11*	0^+	118 fs *35*	d f H PQ U X	XREF: Others: AK J^{π}: L(α,α′)=L(p,t)=L(^{6}Li,d)=0. $T_{1/2}$: from (p,p′γ).
7397.2[b] *10*	(5^+)	0.47 ps *14*	PQ Y	J^{π}: γ to 4^+ and band assignment in (HI,xnγ). 2004To07 in (HI,xnγ) proposed this as (5^-) member of $K^{\pi}=0^-$ band. $T_{1/2}$: from (p,p′γ).
7421.9 *15*		0.20 ps *14*	PQ X	XREF: X(7433). $T_{1/2}$: from (p,p′γ).
7446.23 *6*	3^+,4^+	0.14 ps *5*	H PQ X	J^{π}: L(p,p′)=4 from 0^+; γ to 2^+. $T_{1/2}$: from (p,p′γ).
7466.35 *7*	2^+	8 fs *4*	F H PQ TU X	XREF: T(7500)U(?). J^{π}: L(p,t)=L(p,p′)=2 from 0^+; 4113.5γ and 7465.6γ to 0^+. $T_{1/2}$: from (p,γ). Other: <10 fs in (p,p′γ).
7481?			H	
7532.26 *5*	2^-	0.16 ps *4*	H JKL PQ W	J^{π}: L(^{3}He,d)=1 from $3/2^+$; L(^{3}He,α)=2; L(p,p′)=3; not 3^- from (p,γ). $T_{1/2}$: weighted average of 0.22 ps *7* in (p,γ) and 0.149 ps *35* in (p,p′γ).
7561.17 *7*	4^+	0.17 ps *4*	F H PQR U X	XREF: U(?). J^{π}: L(^{6}Li,d)=4. Note that L(p,t)=(2) is inconsistent and tentative. $T_{1/2}$: from (p,p′γ). Other: 0.18 ps *+10−5* in (p,γ). Additional information 14.
7623.11 *8*	(2^-,3,4^+)	0.111 ps *28*	H PQ X	XREF: X(7625). J^{π}: 1993.6γ and 2374.2γ to 2^+ and 2009.5γ to 4^-. However, L(p,t)=0 for a level at 7625 could indicate there may be a separate level, if this assignment is correct. $T_{1/2}$: from (p,p′γ).
7658.23 *5*	4^-	<10 fs	B H jKL PQ vWX	T=1 J^{π}: log *ft*=3.3 from 4^-; analog of g.s. in ^{40}K (see 1966Er05, 1966An01). $T_{1/2}$: from (p,p′γ).
7676.6 *5*	(6^+)	0.20 ps *5*	H j PQ uv Y	J^{π}: 2399.2γ (E2) to 4^+. $T_{1/2}$: from (p,p′γ).
7694.08 *4*	3^-	<6 fs	H JKL PQ uvW	T=1 J^{π}: L(d,n)=1 and L(^{3}He,d)=3 from $3/2^+$; 2080.6γ to 4^-; analog of the 29.8, 3^- level in ^{40}K, see 1966Er05 in (^{3}He,d). $T_{1/2}$: from (p,γ). Other: <10 fs in (p,p′γ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
7701.8 *4*	0^+		F H Q u X	J^{π}: L(^{6}Li,d)=L(p,t)=0.
7769.4 *10*	$(3,4,5^-)$	166 fs *35*	H PQ X	XREF: X(7757). J^{π}: 2155.8γ to 4^- and 4032.5γ to 3^-; J=(3,4,5) from γ feeding in (p,γ) (1990Ki07). $T_{1/2}$: from (p,p′γ).
7814.7 *6*	0^+		G PQ X	E(level): from (p,p′). J^{π}: L(^{3}He,n)=0.
7870	3^-		F	J^{π}: L(^{6}Li,d)=3.
7872.18 *9*	2^+	2.44 fs *+24−20*	H Mn PQ U X	XREF: Others: AK J^{π}: L(p,t)=L(α,α′)=2 from 0^+. $T_{1/2}$: from (γ,γ′). Other: <14 fs from (p,p′γ).
7928.42 *10*	4^+	49 fs *35*	H n PQ s U X	XREF: Others: AK J^{π}: L(α,α′)=L(p,p′)=4 from 0^+. Note that L(p,t)=(3) is inconsistent and tentative. $T_{1/2}$: from (p,p′γ).
7972.5	$(\le3)^-$		d J s x	J^{π}: L(d,n)=1.
7974.4[d] *8*	(6^+)		H Y	E(level): band assignment in (HI,xnγ).
7976.55 *3*	2^+	21 fs *21*	d PQ s x	J^{π}: 4624γ and 7977γ to 0^+ and 2699γ to 4^+. $T_{1/2}$: from (p,p′γ).
8018.8 *10*	0^+		d PQ X	E(level): from (p,p′γ). J^{π}: L(p,t)=0 from 0^+.
8051.8 *6*			Q	E(level): from (p,p′).
8091.61 *17*	2^+	2.94 fs *+20−18*	d FGH M PQ U X	XREF: F(8050)G(8050). J^{π}: L(α,α′)=L(^{6}Li,d)=L(^{3}He,n)=L(p,p′)=2 from 0^+; E2 excitation in (γ,γ′); but L(p,t)=4 from 0^+ for a level at 8085 is inconsistent and it could imply that there may be a separate level if the assignment is correct. $T_{1/2}$: from (γ,γ′). Other: <28 fs in (p,p′γ).
8100.1[a] *7*	8^+	12.5 ps *17*	d Y	XREF: Others: AC J^{π}: 1168.8γ ΔJ=2, E2 to 6^+. $T_{1/2}$: from (HI,xnγ) by recoil-distance method.
8113.2 *5*	1^-	30 fs *+20−9*	d F j M PQ X	XREF: F(8150). J^{π}: spin=1 from dipole excitation in (γ,γ′); L(p,p′)=3 and L(^{6}Li,d)=1 from 0^+. $T_{1/2}$: from (γ,γ′). Other: <14 fs in (p,p′γ).
8134.77 *10*	(3^-)	<28 fs	d H j PQ	J^{π}: 2505.3γ and 4229.4γ to 2^+ and 2521.2γ to 4^-. Possible 3643.1γ to 5^- would disfavor 2^- and 3^+. L(d,n)=1+3 from $3/2^+$ for 8113 and 8135 doublet. $T_{1/2}$: from (p,p′γ).
8187.5 *8*	$(3,4,5^-)$	<17 fs	H j PQ x	J^{π}: 4451.6γ to 3^-; J=(3,4,5) based on γ feeding in (p,γ) (1990Ki07). $T_{1/2}$: from (p,p′γ).
8195.9 *6*			Q x	E(level): from (p,p′).
8271 *1*	$(\le3)^-$		J L PQ U	XREF: U(?). E(level): from (p,p′). J^{π}: L(d,n)=1 from $3/2^+$; 1315γ and 2364γ to 1^-. But L(^{6}Li,d)=4 from 0^+ is suggested for a 8270 group.
8276 *1*	0^+		FG PQ X	J^{π}: L(p,t)=L(^{3}He,n)=L(^{6}Li,d)=0 from 0^+.
8323.16 *8*	$(1^-,2^+)$	58 fs *21*	d H PQ	J^{π}: 8322.2γ to 0^+, 2038.0γ and 4586.2γ to 3^-. $T_{1/2}$: weighted average of 83 fs *28* in (p,γ) and 42 fs *21* in (p,p′γ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#@]	XREF	Comments
8338.0 *3*	(2$^+$,3,4)		d H Q X	J^π: 1795.2γ and 1830.1γ to 4$^+$; J=(2,3,4) based on γ feeding in (p,γ) (1990Ki07).
8358.9 *6*	(0,1,2)$^-$	104 fs *21*	d J L PQ	XREF: J(8371). J^π: L(d,n)=1 from 3/2$^+$; 1405γ to 1$^-$ is unlikely to be Mult=Q, ΔJ=2 based on RUL. $T_{1/2}$: from (p,p′γ).
8364 *5*	(3$^-$ to 7$^-$)		P	J^π: 3872γ to 5$^-$.
8373.94 *15*	4$^+$		F H Q U WX	XREF: F(8380). J^π: L(α,α')=L(p,t)=L(^{6}Li,d)=4 from 0$^+$.
8424.81 *11*	2$^-$	<17 fs	H JKL N PQ vW	T=1 (1990Ki07) XREF: K(8435). J^π: L(^{3}He,α)=2 from 7/2$^-$, L(p,p′)=3 from 0$^+$, L(d,n)=1+3 from 3/2$^+$; M2 excitation in (e,e′); analog of the 800, 2$^-$ level in ^{40}K, see 1966Er05 in (^{3}He,d). $T_{1/2}$: from (p,p′γ).
8439.0 *5*	0$^+$		FgH PQ s X	XREF: F(8420). J^π: L(p,t)=L(^{6}Li,d)=0 from 0$^+$.
8484.02 *13*	(1$^-$,2$^-$,3$^-$)	24 fs *14*	gH k PQ s vWX	J^π: 2581.3γ to 1$^-$, 4747.0γ to 3$^-$; L(^{3}He,α)=(2) from 7/2$^-$. But L(p,t)=0 from 0$^+$ for a level at 8483 is inconsistent and it is unlikely the same level based on RUL for the 4747.0γ, unless L(p,t)=0 is questionable. $T_{1/2}$: from (p,p′γ).
8540 *4*	1,2$^+$	14 fs *14*	f P vw	J^π: 5188γ and 8540γ to 0$^+$; M2 is ruled out by RUL for these transitions. $T_{1/2}$: from (p,p′γ).
8551.1 *7*	5$^-$	<17 fs	f JK N PQ v X	T=1 XREF: N(8500). J^π: L(p,t)=L(p,p′)=5 from 0$^+$, L(d,n)=L(^{3}He,d)=3 from 3/2$^+$; analog of the 891, 5$^-$ level in ^{40}K, see 1966Er05 in (^{3}He,d). $T_{1/2}$: from (p,p′γ).
8578.80 *9*	2$^+$	3.6 fs *+13−8*	d f H M PQ u x	J^π: L(p,p′)=2 from 0$^+$; E2 excitation in (γ,γ'). $T_{1/2}$: from (γ,γ'). Other: <21 fs from (p,p′γ).
8587 *2*	(2$^+$,3)		d f P u x	J^π: 2562γ to 2$^-$, 3904γ to 2$^+$, 3308γ to 4$^+$.
8633 *6*			PQ	E(level): from ^{40}Ca(p,p′γ).
8665.3 *8*	1$^-$		J PQ	XREF: P(8671). E(level): from (p,p′). J^π: L(d,n)=1; 8665γ to 0$^+$.
8678.29 *10*	4$^+$	42 fs *35*	H P X	J^π: L(p,t)=4. $T_{1/2}$: from (p,γ).
8701 *1*	(6$^-$)		Y	J^π: suggested in (HI,xnγ); 3088γ to 4$^-$ and 4209γ to 5$^-$.
8717 *8*			P	
8748.22 *9*	2$^+$	5.8 fs *+11−8*	f H j M PQ T	XREF: P(8756)T(8700). J^π: L(p,p′)=2 from 0$^+$; E2 excitation in (γ,γ'). $T_{1/2}$: from (γ,γ').
8764.18 *6*	3$^-$		d H j P X	XREF: P(8769)X(8752). J^π: L(p,t)=3.
8810 *7*	2$^+$		d f PQ U	XREF: P(8819). J^π: L(α,α')=2 from 0$^+$ for a 8780 group.
8850.6 *9*	6$^-$,7$^-$,8$^-$		J PQ X	XREF: P(8860). E(level): from (p,p′). J^π: L(p,p′)=7 from 0$^+$. J^π=(0)$^-$ is proposed for a

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
				8860 group in (d,n).
8909.0 *9*			Q X	E(level): from (p,p′).
8934.81 *7*	2^+		F H j P	XREF: P(8922). J^{π}: L(^{6}Li,d)=2 from 0^+; 3722.1γ, 5581.8γ and 8933.7γ to 0^+, 2352.2γ and 5197.8γ to 3^-, 2905.0γ to 3^+.
8935.8[b] *9*	(7^+)		Y	J^{π}: band assignment in (HI,xnγ).
8938.4 *9*	0^+		J PQ X	XREF: P(8949). E(level): from (p,p′). J^{π}: L(p,t)=0. But L(d,n)=1 from $3/2^+$ is suggested for a level at 8931.
8978 *6*	$5^+,6^+,7^+$		H Q V x	XREF: H(?)V(?). E(level): from (p,p′). J^{π}: L(p,p′)=6 from 0^+.
8982.5 *5*	2^+	4.5 fs *+39−14*	j M r UV x	XREF: U(8970)V(?). J^{π}: E2 excitation in (γ,γ'). $T_{1/2}$: from (γ,γ').
8994.50 *11*	$(1^-,2^+)$		H j PQr x	XREF: P(9011). J^{π}: 5641.5γ and 8993.4γ to 0^+, 2411.0γ, 2709.3γ to 3^-.
9031.9 *3*	4^-		H Q VWX	J^{π}: L(d,t)=L(^{3}He,α)=0 from $7/2^-$, L(p,p′)=5 from 0^+. 2004To07 in (HI,xnγ) propose (7^-) for this level, but γ's to 3^- and 4^- states are inconsistent with this assignment.
9033?[c] *1*	(7^-)		Y	E(level): it is possible that this level is the same as the 9031.9 seen in other reactions and the 4542γ reported by 2004To07 in (HI,xnγ) could correspond to 4540.2γ in (p,γ). But the most intense 3418γ from 9031.9 level is not reported by 2004To07. J^{π}: band assignment in (HI,xnγ).
9050.1 *10*			Q	E(level): from (p,p′).
9080.3 *11*			Q w	E(level): from (p,p′).
9091.70 *6*	3^-		H k Q w	T=(0) (1990Ki07) J^{π}: 1977.9γ to 4^- and 3812.7γ to 4^+, 5187.0γ to 2^+ and 3066.1γ to 2^-, 3188.9γ to 1^-.
9135.66 *5*	$2^-,3^-$		f H Jk Q Wx	T=0 (1990Ki07) J^{π}: L(d,n)=1 from $3/2^+$, L(p,p′)=3 from 0^+.
9162.1 *11*			f k Q x	Additional information 15. E(level): from (p,p′).
9185.3 *12*			k Q	E(level): from (p,p′).
9209.77 *3*	$(2,3)^-$		H j Q w	T=0 (1990Ki07) J^{π}: 2096.0γ to 4^-, 2259.2γ and 3307.0γ to 1^-; L(d,n)=1 from $3/2^+$. Additional information 16.
9226.69 *5*	$(1^-,2,3^-)$		H j q w	J^{π}: 2276.1γ to 1^- and 2941.4γ to 3^-. Possible 9225.6γ to 0^+ would disfacvor 3^-. Additional information 17.
9227.43 *7*	$(1,2^+)$		H j q w	J^{π}: 5874.4γ to 0^+ and 3201.8γ to 2^-.
9246.0 *12*	$(7)^-$		F Q X	XREF: X(9250). E(level): from (p,p′). J^{π}: L(p,p′)=7. But L(^{6}Li,d)=6 for a 9240 group. Additional information 18.
9274.5 *12*			Q X	XREF: X(9263). E(level): from (p,p′).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
9304 *5*	0^+		X	T=1 (1972Sc19) J^{π}: L(p,t)=0.
9305.2[&] *8*	(8^+)		Y	J^{π}: band assignment in (HI,xnγ).
9362.54 *6*	3^-		B F H k U x	T=0 (1990Ki07) XREF: U(9340). J^{π}: log *ft*=5.4 from 4^-; 937.7γ to 2^-, 4113.5γ to 2^+. Γ_{α}/Γ_p=0.0119 *5* from ^{40}Sc ε decay.
9377.7 *2*	$2^-,3^-,4^-$		H k Q x	E(level): from (p,γ). J^{π}: L(p,p′)=3 from 0^+.
9388.20 *19*	2^+		H k	J^{π}: 2087.4γ, 4176.3γ and 9387.0γ to 0^+, and 2845.3γ, 2880.3γ and 4109.2γ to 4^+.
9395.6 *3*			H jk	E(level): from (p,γ).
9404.85 *19*	2^-	0.14 keV	HIJk	T=1 XREF: J(9408). J^{π}: 9403.7γ to 0^+, 2822.2γ, 3119.6γ and 5667.7γ to 3^-, 2291.1γ to 4^-; L(p,p)=1 from $3/2^+$; $\gamma\gamma(\theta)$ in (p,γ) give J=2. $T_{1/2}$: from (p,p),(p,α): resonances.
9406.3 *6*	0^+		GH k X	T=1 XREF: G(9380). E(level): from (p,γ). J^{π}: L(^{3}He,n)=L(p,t)=0 from 0^+.
9412.3 *2*			H Jk q	XREF: J(9408). E(level): from (p,γ).
9418.8 *2*	3^-		B H Jk q	T=1 XREF: J(9408). J^{π}: log *ft*=5.6 from 4^-; 3516.0γ to 1^-.
9429.11 *5*	$(3,4)^-$		B H Jk w	T=0 (1990Ki07) XREF: J(9431). J^{π}: log *ft*=5.5 from 4^-; L(^{3}He,α)=(0) from $7/2^-$.
9432.46 *18*	1^-	0.23 keV	HIJk w	T=1 (1990Ki07) XREF: J(9431). J^{π}: L(p,p)=1 from $3/2^+$; 9431.3γ to 0^+. $T_{1/2}$: from (p,p),(p,α):resonances.
9453.95 *5*	3^-	0.09 keV	B HIJk Q W	T=0 XREF: Q(?). J^{π}: log *ft*=5.2 from 4^-; L(d,n)=1 from $3/2^+$. $T_{1/2}$: from (p,p),(p,α):resonances.
9499.9 *15*	2^+		F H U	E(level): from (p,γ). J^{π}: L(^{6}Li,d)=2 from 0^+.
9536.24 *16*			H	E(level): from (p,γ).
9537.8 *5*	1^-	0.4 keV	HIJ Q	XREF: Q(?). E(level): from (p,γ). Other: 9535.2 *14* in (p,p):resonances. J^{π},$T_{1/2}$: from (p,p),(p,α):resonances. L(p,p)=L(d,n)=1 from $3/2^+$.
9564 *5*	(2^+)		G WX	T=(1) XREF: G(9600). J^{π}: L(^{3}He,n)=2 for a 9600 group.
9603.0 *4*	3^-	0.4 keV	B HIj T wx	T=1 J^{π}: log *ft*=5.6 from 4^-; L(p,p)=1 from $3/2^+$; $\gamma\gamma(\theta)$ in (p,γ) gives J=3. $T_{1/2}$: from (2J+1)×Γ=3.4 keV for the 9603+9605 levels in (p,p),(p,α):resonances, and Γ=0.19 keV *5* from (γ,γ') for the 9605 level.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$[#@]	XREF	Comments
9604.6 *4*	1$^-$	0.19 keV *5*	HIj M wx	T=1 T$_{1/2}$: from (γ,γ'). Other: 1.3 keV from (p,p),(p,α):resonances.
9632.7? *11*			H	E(level): from (p,γ).
9640.89 *7*	2$^-$		H wX	T=1 XREF: X(9620). J$^{\pi}$: spin from $\gamma\gamma(\theta)$ and parity from a resonance formation fit in (p,γ).
9655.5 *9*			H q WX	XREF: W(9647)X(9665). E(level): from (p,γ).
9662.2 *2*	≤3$^-$		Hij q WX	XREF: W(9647)X(9665). E(level): from (p,γ). J$^{\pi}$: L(p,p)=(d,n)=1 from 3/2$^+$ for 9662+9669.
9668.71 *8*	3$^-$		F HijK WX	T=1 XREF: F(9700)K(9700)W(9673)X(9665). J$^{\pi}$: L(^{6}Li,d)=3 from 0$^+$.
9779.47 *7*	3		H	T=1 J$^{\pi}$: from $\gamma\gamma(\theta)$ in (p,γ).
9785.3 *2*	(1,2$^+$)		H	J$^{\pi}$: 2484.5γ, 6432.1γ and 9784.0γ to 0$^+$.
9802.1 *7*	≤3$^-$		HI	E(level): from (p,γ). J$^{\pi}$: L(p,p)=1 from 3/2$^+$.
9807.2? *11*			H	
9811.0 *2*	(3$^-$,4$^-$,5$^-$)		B H	E(level): from (p,γ). J$^{\pi}$: log *ft*=6.1 from 4$^-$.
9829.43 *16*			B H	E(level): from (p,γ).
9834.97 *19*			B H	
9853.5[d] *8*	(8$^+$)		Y	XREF: Others: AE J$^{\pi}$: band assignment in (HI,xnγ).
9854.43 *17*	≤3$^-$		HI	E(level): from (p,γ). J$^{\pi}$: L(p,p)=1 from 3/2$^+$.
9859.6 *3*	4$^-$,5$^-$,6$^-$		H Q	J$^{\pi}$: L(p,p$'$)=5 from 0$^+$.
9865.15 *11*	1	0.100 keV *24*	ef H M	T=1 J$^{\pi}$: from $\gamma\gamma(\theta)$ in (p,γ). T$_{1/2}$: from (γ,γ').
9869.3 *4*	1$^+$,2$^+$	0.90 keV *21*	ef H MN Q U	XREF: Q(9877)U(9870). J$^{\pi}$: γ's to 0$^+$ and 2$^+$; M1 or E2 excitation in (e,e$'$). L(^{6}Li,d)=2 for a 9870 group and a doublet at 9868 suggested by 1980St17 in (e,e$'$) could indicate there is a separate level with J^{π}=2$^+$. T$_{1/2}$: from (γ,γ').
9898.5 *3*			H	
9921.3 *2*	(3$^-$,4$^-$,5$^-$)		B f H	E(level): from (p,γ). J$^{\pi}$: log *ft*=6.3 from 4$^-$.
9939.7 *2*			f H	
9954.00 *9*	4$^+$		B f H	T=0 J$^{\pi}$: spin=4 from $\gamma\gamma(\theta)$ in (p,γ); observed α decay from this level in ^{40}Sc ε decay implies π=natural.
9977.09 *17*	(3,4,5)		B f H	E(level): from (p,γ). J$^{\pi}$: log *ft*=7.0 from 4$^-$.
9993.6 *15*			H	
10040.54 *9*	(2$^-$,3$^-$)		H j v	T=1 J$^{\pi}$: γ's to 1$^-$ and 4$^-$.
10045.6 *5*	(3$^-$ to 7$^-$)		H j v	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
10049.38 *7*	4^-		B H jK q vw	T=1 XREF: K(?). J^{π}: log *ft*=6.3 from 4^-; γ's to 2^- and 5^-; L(p,p')=5 from 0^+, L(^{3}He,α)=0 from $7/2^-$.
10057.9 *3*			f H j q vw	
10065 *2*	$(1^-,2^+)$		f I q v	T=0
10080.6 *2*			f H Uv	E(level): from (p,γ).
10130.59 *19*	$(3^-,4^+)$		B f HI v	T=0 E(level): from (p,γ).
10154 *8*	$(3^-,4^+,5^-)$		B f	T=0 E(level): from ^{40}Sc ε decay. J^{π}: log *ft*=7.3 from 4^-; observed α decay from this level in ^{40}Sc ε decay implies π=natural.
10193 *7*	$(3^-,4^+,5^-)$		b	T=0 J^{π}: log *ft*=7.5 from 4^-; observed α decay from this level in ^{40}Sc ε decay implies π=natural.
10199.1 *4*	1^-		HI	T=0 E(level): from (p,γ).
10205.0 *8*			H	
10210.5 *2*	$3^-,4^-$		B H W	E(level): from (p,γ). J^{π}: log *ft*=5.7 from 4^-; L(^{3}He,α)=0 from $7/2^-$.
10232.7 *7*			H	
10262.53 *10*	3^-		HI	T=0+1. J^{π}: γ's to 1^-, 3^-, 3^+; L(p,p)=1 from $3/2^+$ for 10263+10268; π=natural from (p,α):resonances.
10267.6 *5*	1^-	0.9 keV	HI	T=0 J^{π},$T_{1/2}$: from (p,p),(p,α):resonances for a 10265 group.
10274.7 *3*	$3^+,4^+,5^+$		H Q	XREF: Q(10287). J^{π}: L(p,p')=4 from 0^+.
10277.8 *2*	(1^-)	1.6 keV	HI Q	T=0 XREF: I(10275)Q(10290). E(level): from (p,γ).
10284.9 *3*	1^-	1.1 keV	Hi Q	XREF: Q(10290). E(level): from (p,γ).
10318.8 *4*	1^+	26 eV *7*	E H MN Q	T=1 XREF: Q(10328). J^{π}: M1 excitation in (e,e'). $T_{1/2}$: from (γ,γ').
10333.7 *5*	$(3)^-$	0.11 keV	B HI Q	T=0 XREF: Q(10344). J^{π}: $(1,3)^-$ from (p,p),(p,α):resonances; log *ft*=7.1 from 4^-.
10340 *20*	4^+		Q U	XREF: Q(10344). J^{π}: L(α,α')=4.
10358.5 *15*			F H	XREF: F(10340). J^{π}: L(^{6}Li,d)=8 for a level at 10340 could indicate there may be a different level.
10361.4 *15*			B H	T=0
10362.8 *5*	1^-	0.60 keV	I	E(level): could be the same level as the 10361.4 level in (p,γ).
10364.8 *5*	$(1,3)^-$		I	
10376.6 *5*	1^-	0.6 keV	HI	
10383.79 *16*	$(1^-,2^+)$		HI K	T=0 XREF: K(?).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#@	XREF	Comments
10415.06 *6*	3		H	T=1 Jπ: 2853.8γ to 4⁺, 3301.2γ to 4⁻, 2948.6γ to 2⁺, 3664.5γ to 2⁻.
10420.4 *5*	1⁻	0.5 keV	HI	T=0 E(level): from (p,γ).
10430.47 *19*	(2⁺)		HI	T=0 E(level): from (p,γ).
10441.3 *6*			H	E(level): from (p,γ).
10443.8 *2*	2⁻	4.0 keV	HI	E(level): from (p,γ). 10443.5 *5* in (p,p),(p,α):resonances.
10447.0 *5*	3⁻	0.44 keV	B f I	T=0 E(level): $ from (p,p),(p,α):resonances. Jπ: (1,3)⁻ in (p,p),(p,α):resonances with L(p)=1 from 3/2⁺; log *ft*=6.2 from 4⁻.
10469.9 *15*	(3,5)⁻		B f H	E(level): from (p,γ). Jπ: log *ft*=5.7 from 4⁻; α decay of this level in ^{40}Sc ε decay implies π=natural.
10474 *2*	(8⁻)		Y	Jπ: proposed in (HI,xnγ).
10478.6 *15*			H	
10503.0 *15*	(3,4,5)⁻		B H	E(level): from (p,γ). Jπ: log *ft*=5.5 from 4⁻.
10514.7 *15*	(3⁻,4⁺,5⁻)		B H	XREF: B(10519). Jπ: log *ft*=6.7 from 4⁻; α decay of this level in ^{40}Sc ε decay implies π=natural.
10516.5 *5*	1⁻	1.2 keV	I	T=0 E(level): could be the same level as the 10514.7 level in (p,γ).
10517.4 *5*	1$^{(+)}$	0.30 keV	I	
10529.8 *5*	(1⁺)	0.40 keV	HI	E(level): from (p,p),(p,α):resonances. 10527.8 *15* from (p,γ). Additional information 19.
10541.7 *5*	2⁺	0.19 keV	HI	T=0 E(level): from (p,p),(p,α):resonances. 10540.0 *15* from (p,γ).
10552.1 *15*			H	
10582 *5*	(3,4,5)		B	Jπ: log *ft*=6.3 from 4⁻.
10596.4 *5*	3⁻	0.16 keV	B F I U	T=0 XREF: F(10590). E(level): from (p,p),(p,α):resonances.
10598.6 *5*	(1⁺)	0.20 keV	I	
10607.6 *5*	0$^{(+)}$	0.20 keV	g I	
10618.8 *5*	2⁻	3.5 keV	I	
10621.6 *5*	0⁺	0.04 keV	g I	T=0
10633.8 *5*	(1,3)⁻	1.1 keV	HI	E(level): from (p,p),(p,α):resonances. 10632.7 *2* in (p,γ).
10639.07 *7*	(3⁻,4,5⁻)		H	T=1 Jπ: 3707.6γ and 4056.3γ to 3⁻, 6147.7γ to 5⁻.
10646.3 *4*	NATURAL		gHI	T=0 E(level): from (p,γ).
10653.12 *16*			H	
10656.1 *5*	(1⁻)	0.60 keV	I	T=0
10657.6 *5*	2⁺	0.35 keV	I	T=0
10666.6 *5*	2⁻	2.0 keV	I	
10670.3 *3*			H	
10673.58 *17*	2⁻		H N	Jπ: M2 excitation in (e,e′).
10675.6 *5*	1⁻	1.6 keV	HI	T=0

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#@	XREF	Comments
				E(level): from (p,p),(p,α):resonances. 10673.69 *15* in (p,γ).
10690.9 *3*			H	XREF: Others: AK
10693.1 *5*	1^+	1.1 keV	I	XREF: Others: AK
10699.50 *10*	3		B H N	XREF: Others: AK XREF: N(10680). Jπ: 2325.5γ to 4^+, 5085.6γ to 4^-, 2607.8γ to 2^+, 3167.1γ to 2^-.
10701.1 *5*	0^+	0.60 keV	I	
10720.7 *3*	$(3,5)^-$		B H	XREF: Others: AK E(level): from (p,γ). Jπ: log *ft*=5.7 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
10722.3 *5*	1^+	1.1 keV	I	
10737.7 *3*	1^-		F H	T=0+1 XREF: F(10700). Jπ: 10736.2γ to 0^+, 3043.4 and 4452.3γ to 3^-; L(^{6}Li,d)=1 from 0^+.
10740.3 *5*	1^-	2.2 keV	I	
10747.8 *4*	(4^+)		HI	T=0 Jπ: $(1^-,2,3,4^+)$ from 5118.0γ and 6842.8γ to 2^+, 7010.5γ to 3^-; $J^\pi=(4^+,5^-)$ from (p,p),(p,α):resonances for a level at 10751.
10749.0 *5*	0^+	0.31 keV	I	
10753.74 *18*	(3,4,5)		B H	Jπ: log *ft*=6.5 from 4^-.
10770.2 *3*	(1^+)	0.05 keV	HI	XREF: I(10772.3). E(level): from (p,γ).
10776.2 *3*	(1^-)		H N	Jπ: possible E1 excitation in (e,e′) for 10776.
10778.3 *5*	2^+	0.18 keV	I	T=0
10780.7 *5*	3^-	1.0 keV	B HI	T=0 E(level): from (p,p),(p,α):resonances. 10780.9 *3* in (p,γ).
10783.2 *5*	(0^-)	0.70 keV	I	
10787.6 *3*			F H u	XREF: F(?).
10799.9 *10*			H u	
10802.8 *5*	$0^{(+)}$	0.70 keV	I	T=0
10813.6 *5*	$(3^-,4^+,5^-)$		B f H u	T=0 Jπ: log *ft*=6.3 from 4^-; L(^{6}Li,d)=5 for 10800 group; α decay of this level in ^{40}Sc ε decay implies π=natural.
10816.4 *5*	2^-	6.0 keV	I	
10816.6 *5*	3^+	0.50 keV	I	
10829.9 *6*			f H	
10833.2 *5*	3^-	0.026 keV	f I	T=0
10848.4 *4*	$(3,4,5)^-$		B f H	Jπ: log *ft*=5.8 from 4^-.
10849.3 *5*	2^-	11 keV	I	
10852.2 *5*	1^-	2.5 keV	I	T=0
10861.4 *5*	2^+	0.045 keV	I	T=0
10869.0 *5*	1^-	26 keV	HI	E(level): from (p,p),(p,γ):resonances. 10868.8 *4* in (p,γ).
10869.7 *5*	0^+	0.40 keV	I	
10873.9 *5*	1^-	4.0 keV	I	
10895[c] *1*	(9^-)		Y	Jπ: band assignment in (HI,xnγ).
10899.3 *5*	1^+	0.41 keV	I	
10910.0 *4*	$(3,4,5^-)$		B f H	E(level): from (p,γ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#@]	XREF	Comments
				J^π: log *ft*=6.8 from 4^-; 7172.6γ to 3^-; L(^{6}Li,d)=3 for 10900 group.
10914.8 *5*	1^-	5.0 keV	I	T=0
10915.7 *5*	3^+	0.70 keV	I	
10921.1 *4*	$(2^+,3,4^-)$		f H	J^π: 4895.3γ to 2^- and 5641.9γ to 4^+.
10932.7 *5*	1^-	2.0 keV	I	T=0
10933.2 *5*	2^-	0.10 keV	I	
10934.3 *5*			H	
10946.9 *5*	2^+	0.23 keV	I	T=0
10950.8 *5*	1^-	7.0 keV	HI	T=0 E(level): from (p,p),(p,α):resonances. 10951.5 *4* in (p,γ).
10953.6 *5*	$0^{(+)}$	0.22 keV	I	T=0
10956.0 *4*	3^-		B H	E(level): from (p,γ). J^π: 5676.8γ to 4^+, 5342.1γ to 4^-, 5053.0γ to 1^-.
10976.2 *5*	(3,4,5)		B H n	J^π: log *ft*=6.0 from 4^-.
10988.0 *4*	$(3^-,4^+)$		B H n	E(level): from (p,γ). J^π: log *ft*=7.2 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural; 4079.1γ, 5358.2γ to 2^+.
10988.7 *5*	2^-	9.0 keV	I	
10989.4 *5*	(1^+)	0.4 keV	I	
10994.7 *4*	$(2^+,3,4^+)$		H	J^π: 5715.5γ to 4^+, 5745.3γ to 2^+.
10995 *3*	(1^-)	6.7 keV	I	
10998.9 *5*	$(1,3)^-$	0.20 keV	I	T=0
11002.3 *5*			H n	
11003.0[a] *9*	(10^+)		Y	J^π: band assignment in (HI,xnγ).
11007.2 *5*	1^-	5.0 keV	I	
11011.0 *4*	3^-		H n	T=0+1 J^π: 6519.0γ to 5^-, 11009.4γ to 0^+.
11024.0 *5*	$(1^-,3^-)$	0.11 keV	HI	T=0
11036.3 *5*	(1^+)	0.10 keV	I	
11037 *7*	(3,4,5)		B	J^π: log *ft*=6.4 from 4^-.
11042.0 *5*	$(1^-$ to $4^+)$		H	J^π: 7136.9γ to 2^+ and 7304.6γ to 3^-.
11044.5 *5*	2^+	0.50 keV	I	T=0
11070.6 *4*	$(3,4^+)$		H	J^π: 5456.1γ to 4^-, 5790.7γ to 4^+, 5820.7γ to 2^+.
11073.5 *5*	2^+	0.66 keV	I	
11078.4 *5*	1^-	1.2 keV	f HI	T=0 E(level): from(p,p),(p,α):resonances.
11083.6 *5*	(1^+)	0.35 keV	I	T=0
11089.3 *5*	$0^{(+)}$	0.10 keV	F I	XREF: F(11100).
11091 *3*	$(3^-,4^+)$		B I	T=0 E(level): from 1970De30 in (p,p),(p,α):resonance. 11088 *12* in ^{40}Sc ε decay. J^π: log *ft*=7.1 from 4^-; 4+$(1^-,3^-)$ for a 11901 level from 1970De30 in (p,p),(p,α):resonance.
11107.0 *5*	1^-	3.9 keV	I	
11112 *3*	0^-	5.2 keV	I	
11117.0 *5*			b H	
11119.0 *5*	2^+	0.046 keV	b I U	XREF: U(11100).
11127.1 *5*			H	
11129.1 *5*	4^+	0.11 keV	I	T=0
11142 *6*	$(3,4,5)^-$		B	J^π: log *ft*=5.8 from 4^-.
11145.2 *5*	$1^{(-)}$	0.20 keV	I	
11145.8 *5*	1^+	0.20 keV	I	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
11157.2 *5*	2^-	48 keV	I	
11161.5 *5*	$4^{(+)}$	0.040 keV	I V	T=0
11162.9 *5*	2^+	3.5 keV	I	
11165.2 *4*			H	
11167.4 *5*	4^+	0.083 keV	I	T=0
11187.6 *5*	3^-	1.4 keV	I k	
11202.9 *5*	$(3)^-$		B I k v	T=0 E(level): from (p,p),(p,α):resonances. J^{π}: log *ft*=5.5 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural; (1,2^-,3) from (p,p),(p,α):resonances.
11210	(0^+)		F k	J^{π}: L(^{6}Li,d)=0.
11212.6 *5*	3^-	2.8 keV	I k	
11217 *3*	3^-	25 keV	B k v	J^{π}: log *ft*=5.2 from 4^-.
11217.8 *5*	4^+	1.4 keV	I k	
11231.4 *5*	2^-	3.0 keV	I v	
11236 *3*	1^-	3.9 keV	I v	
11246.8 *5*	3^-	0.092 keV	I v	T=0
11255.9 *5*	1^+	0.30 keV	I	
11260.8 *5*	(0^-)	6.0 keV	I	
11264.4 *5*	2^+	0.34 keV	I	T=0
11284.3 *5*	(2^-)	0.60 keV	I	
11289.8 *5*	1^+	1.0 keV	I	
11300.3 *5*	1^+	0.40 keV	I	
11302.5 *5*	(1^-)	1.2 keV	I	
11311 *4*	$(3^-,4^+,5^-)$		B F v	J^{π}: log *ft*=6.2 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
11320.0 *5*	(0^-)	1.8 keV	I	
11322.0 *5*	2^+	0.52 keV	I	T=0
11329.3 *5*	2^+		I	
11330.7 *5*	1^-	4.0 keV	f I	T=0
11338.7 *5*	(1^+)	0.20 keV	I	
11342.6 *5*	2^-	40 keV	I	
11346.4 *5*	$4^{(+)}$	0.020 keV	I	T=0
11351.5 *5*	1^+	0.80 keV	I	
11362.4 *5*	1^+	1.2 keV	I	
11366.0 *5*	2^+	0.19 keV	I	T=0
11367.0 *5*	2^-	4.4 keV	I	
11368.3 *5*	$4^{(+)}$	0.021 keV	I	
11370	(5^-)		F	J^{π}: L(^{6}Li,d)=5.
11371.4 *5*	2^+	1.4 keV	I	T=0
11382.1 *5*	2^+	2.6 keV	I	T=0
11393.0 *5*	$1^{(-)}$	0.10 keV	I	
11404.2 *5*	1^-	3.5 keV	I	T=0
11407.0 *5*	1^+	0.22 keV	I	
11414.8 *5*	4^+	0.10 keV	B I	T=0
11420.3 *5*	3^-	0.30 keV	I	
11432.7 *5*	1^-	0.30 keV	I	T=0
11436.8 *5*	2^+	0.22 keV	I	T=0 Additional information 20.
11447.2 *5*	1^-	5.3 keV	I	T=0
11451.4 *5*	1^+	0.60 keV	I	
11455.4 *5*	3^-	0.060 keV	b I U	T=0 XREF: U(11470).
11460.4 *5*	2^+	1.17 keV	I	T=0

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#@]	XREF	Comments
11465.1 *5*	$2^{(+)}$	0.13 keV	I	T=0
11468 *3*	$(3^-,4^+,5^-)$		B F	T=0 J^π: log *ft*=6.2 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
11468.7 *5*	2^-	0.40 keV	I	
11479.8 *5*	1^+	0.30 keV	I	
11486.7 *5*	0^+	0.11 keV	I	
11489.6 *5*	1^+	0.40 keV	I	
11514.6 *5*	2^+	0.62 keV	I	
11515.2 *5*	$1^{(-)}$	4.23 keV	I	
11519.0 *5*	2^+	0.70 keV	I	
11537.9 *5*	2^-	8.0 keV	I	
11542.2 *5*	2^+	0.62 keV	I	
11543.7 *5*	(1^+)	0.90 keV	I	
11546.7 *5*	2^-	18 keV	I	
11549 *6*	$(3,5)^-$		B	J^π: log *ft*=5.9 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
11554.5 *5*	1^-	31 keV	I	
11559.1 *5*	(2^+)	0.40 keV	I	
11563.5 *5*	(2^-)	0.40 keV	I	
11577.9 *5*	2^-	1.0 keV	I	
11578.0 *5*	2^+	0.23 keV	I	
11585.6 *5*	2^-	0.15 keV	I	
11597.2 *5*	(2^+)	0.30 keV	I	
11602.3 *5*	2^+	0.30 keV	I	
11603.4 *5*	2^+	0.28 keV	I	
11605.3 *5*	1^-	13 keV	I	
11611.1 *5*	1^-	0.86 keV	I	
11614.0 *5*	(2^-)	0.50 keV	I	
11616 *10*	(3,4,5)		B v	J^π: log *ft*=6.3 from 4^-.
11628.5 *5*	(3^+)	0.70 keV	I	
11629.1 *5*	2^+	0.085 keV	I	
11638.1 *5*	1^-	0.09 keV	I	
11645.0 *5*	(2^-)	0.60 keV	I	
11646.9 *5*	2^+	0.60 keV	I	
11650.8 *5*	$2^{(+)}$	0.18 keV	I	
11652.2 *5*	3^-		I	
11653.5 *5*	2^+	1.59 keV	I	
11661.7 *5*	1^-	1.56 keV	I	
11663 *7*	$(3^-,4^+,5^-)$		B v	T=0 J^π: log *ft*=6.2 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
11672.8 *5*	(2^-)	0.20 keV	I	
11677.1 *5*	2^+	0.96 keV	I U	XREF: U(11690).
11685.8[&] *9*	(10^+)		Y	J^π: from band assignment in (HI,xnγ).
11687.5 *5*	(1^+)	0.50 keV	I	
11689.2 *5*	(2^-)	0.60 keV	I	
11690	7^-		F	J^π: L(^{6}Li,d)=7.
11692.8 *5*	$4^{(+)}$	0.021 keV	I	
11696.3 *5*	$0^{(-)}$	0.60 keV	I	
11703.6 *5*	0^+	4.65 keV	I	
11704.6 *5*	2^-	3.0 keV	I	
11707.8 *5*	1^-	0.30 keV	I	
11708.7[b] *12*	(9^+)		Y	J^π: from band assignment in (HI,xnγ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)†	Jπ‡	T$_{1/2}$#@	XREF	Comments
11713.6 *5*	1^+	0.20 keV	I	
11715.7 *5*	2^-	1.5 keV	I	
11721.2 *5*	1^+	1.5 keV	I	
11724.1 *5*	$3^{(-)}$	0.060 keV	I	
11726 *5*	$(3,5)^-$		B v	XREF: Others: AI T=0 Jπ: log *ft*=5.7 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
11731.0 *5*	$1^{(-)}$	3.6 keV	I	
11731.1 *5*	1^+	0.40 keV	I	
11738.8 *5*	2^+	3.0 keV	I	
11742.8 *5*	4^+	1.07 keV	I	
11744.6 *5*	$1^{(-)}$	0.55 keV	I	
11749.5 *5*	2^-	2.57 keV	I	
11753.4 *5*	3^-		I	
11754.0 *5*	1^+	0.35 keV	I	
11757.3 *5*	2^-	0.60 keV	I	
11760 *10*	1^+		N	Jπ: M1 excitation in (e,e′).
11768.0 *5*	2^-	15 keV	I	
11782.6 *5*	$3^{(-)}$	0.041 keV	I	
11788.5 *5*	2^+	2.5 keV	I	
11792.4 *5*	1^+	0.46 keV	I	
11799.2 *5*	$4^{(+)}$	0.18 keV	B I v	XREF: Others: AI
11804.1 *5*	0^+	0.26 keV	I	
11809.0 *5*	(1^+)	1.1 keV	I	
11810.9 *5*	2^+	1.8 keV	I	
11811.6 *5*	3^-	0.26 keV	I	
11820.6 *5*	3^-	3.5 keV	I	
11830.8 *5*	2^+	0.30 keV	I	
11839.2 *5*	0^+	1.05 keV	I	
11841 *6*	$(3^-,4^+,5^-)$		B F	T=0 XREF: F(11800). Jπ: log *ft*=5.9 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
11844.1 *5*	1^+	0.78 keV	I	
11855.8 *5*	2^+	0.39 keV	I	
11857.3 *5*	(1^+)	1.3 keV	I	
11863.3 *5*	(3^-)	0.41 keV	I	
11864.7 *5*	(0^+)	1.6 keV	I	
11868.8 *5*	(4^+)	0.032 keV	I	
11870.0 *5*	3^-	0.040 keV	I	
11872.2 *5*	2^+	0.87 keV	I	
11878.0 *5*	1^-	0.32 keV	I	
11884.5 *5*	1^+	0.80 keV	I	
11888.3 *5*	4^+	0.13 keV	I	
11890.9 *5*	1^-	20 keV	I	
11894.0 *5*	(2^-)	1.0 keV	I	
11901.4 *5*	1^+	0.70 keV	I	
11915.9 *5*	3^-	1.0 keV	I	
11924.6 *5*	2^+	2.2 keV	I	
11930.0 *5*	$4^{(+)}$	0.030 keV	I	
11933.3 *5*	1^-	16.1 keV	I	
11935.0 *5*	1^+	0.9 keV	I	
11937.3 *5*	2^-	0.60 keV	I	
11940.4 *5*	1^+	0.40 keV	I	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#@	XREF	Comments
11942.8 *5*	3^-	0.48 keV	I	
11945.0 *5*	1^-	0.40 keV	I	
11948.4 *5*	0^+	0.31 keV	I	
11958.7 *5*	(2^+)	1.0 keV	I U	XREF: U(11940).
11962.9 *5*	0^+	0.30 keV	I	
11969.8 *5*	1^+	0.80 keV	I	
11971.0 *5*	2^+	0.26 keV	I	
11975.1 *5*	1^-	0.055 keV	E I	
11983.3 *5*	(2^-)	1.0 keV	I	
11987.1 *5*	3^-	0.38 keV	E I	
11988 *1*	0^+	81 eV *10*	E G X	T=2 Jπ: L(^{3}He,n)=0; IAR state. %α=93 *9* to ^{36}Ar g.s.; %α<3% to first 2^+ in ^{36}Ar; %p<5% ro ^{39}K g.s.
11994.0 *5*	0^-	3.0 keV	E I	
12000 *5*	$(3,5)^-$		B	T=0 Jπ: log *ft*=5.4 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
12001.3 *5*	(2^+)	1.02 keV	E I	
12007.4 *5*	1^+	0.55 keV	I	
12010.4 *5*	2^-	6.0 keV	I	
12012.2 *5*	4^+	0.010 keV	I	
12023.6 *5*	1^+	0.90 keV	I	
12026.9 *5*	4^+	0.22 keV	I	
12033.8 *5*	3^-	0.31 keV	I	
12038 *3*	$(3,4,5)^-$		B H Q	Jπ: log *ft*=5.8 from 4^-.
12047.7 *5*	2^+	2.65 keV	f HI N	
12056.4 *5*	1^-	2.0 keV	f I	
12058.9 *5*	2^+	1.11 keV	I	
12067.3 *5*	2^+	1.15 keV	I	
12067.8 *5*	4^+	1.11 keV	I	
12068 *3*	$(3,5)^-$		B H	T=0 Jπ: log *ft*=5.6 from 4^-; α decay of this level in ^{40}Sc ε decay implies π=natural.
12076.8 *5*	2^-	3.07 keV	HI	
12082.0 *5*	$4^{(+)}$	0.021 keV	I	
12086.1 *5*	$4^{(+)}$	0.011 keV	I	
12088.8 *5*	2^-	10 keV	I	
12089.7 *5*	2^+	24 keV	f I	
12093.1 *5*	$4^{(+)}$	0.060 keV	I	
12095.1 *5*	2^+	9.4 keV	Ef HI	
12106.0 *5*	$4^{(+)}$	0.090 keV	I	
12110.7 *5*	2^+	2.0 keV	f HI	
12115.1 *5*	3^-	0.78 keV	I	
12125.9 *5*	(3^+)		I	
12132.7 *5*	(4^+)	0.13 keV	I	
12134.9 *5*	(4^+)	0.10 keV	I	
12141.2 *5*	2^+	1.24 keV	I	
12152.3 *5*	4^+	0.36 keV	I	
12157.8 *5*	$4^{(+)}$	0.12 keV	I	
12159.4 *5*	$4^{(+)}$	0.083 keV	I	
12177.7 *5*	$1^{(-)}$	0.22 keV	I	
12180.2 *5*	2^+	1.50 keV	F I	XREF: F(12170).
12184.5 *5*	2^-	2.0 keV	I	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
12192.7 *5*	2^+	1.24 keV	I	
12196.3 *5*	$1^{(-)}$	0.95 keV	I	
12201.2 *5*	3^-	2.1 keV	E HI N	E(level): from (p,p),(p,α):resonances. J^{π}: from (p,p),(p,α):resonances and E3 excitation in (e,e′).
12209.3 *5*	0^-	1.0 keV	I	
12211.9 *5*	4^+	0.021 keV	I	
12217.7 *5*	1^+	1.5 keV	I	
12224.3 *5*	1^-	1.46 keV	I	
12226.4 *5*	2^+	0.43 keV	I	
12237.7 *5*	1^+	2.0 keV	I	
12244.0 *5*	4^+	0.030 keV	I	
12245.2 *5*	1^-	2.0 keV	I	
12256 *4*		5.5 keV	I	
12270 *4*	(2^+)	5.8 keV	I	
12280 *4*		4.2 keV	I	
12292 *4*		4.0 keV	I	
12299 *4*	(2^+)	4.0 keV	I	XREF: Others: AF
12305 *4*	(1^-)	6.7 keV	I	
12331 *4*	2^+	7.3 keV	HI	
12334.9[d] *10*	(10^+)		Y	XREF: Others: AE J^{π}: from band assignment in (HI,xnγ).
12340	5^-		F	J^{π}: L(^{6}Li,d)=5.
12350 *10*	2^-		N	J^{π}: M2 excitation in (e,e′).
12357 *4*	$(3^-,1^-)$	5.5 keV	I	
12368 *4*		6.7 keV	I	
12376 *4*		5.9 keV	I	
12381 *4*		4.0 keV	I	
12399 *4*	$(2^+,1^-)$	6.7 keV	I	
12406 *4*		3.5 keV	I	
12411 *4*		4.0 keV	I	
12419 *4*		5.4 keV	HI	
12420	(1^-)	<0.05 MeV	C	J^{π}: L(^{36}Ar,α)=1.
12425 *4*		6.4 keV	I	
12450	(4^+)		F U	J^{π}: L(^{6}Li,d)=4, but L(α,α')=3 for a 12450 group is inconsistent and could indicate there may be a separate level.
12488	2^-		N	J^{π}: M2 excitation in (e,e′).
12490 *10*	1^+		N	J^{π}: M1 excitation in (e,e′).
12503	2^-		N	J^{π}: M2 excitation in (e,e′).
12530	1^-	<0.03 MeV	C F	XREF: F(12520). J^{π}: L(^{36}Ar,α)=1.
12580	1^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=1.
12591.9 *10*	(10^+)		Y	XREF: Others: AE J^{π}: proposed in (HI,xnγ).
12604			H	
12622	(2)		N	J^{π}: from (e,e′).
12650	7^-		F H	J^{π}: L(^{6}Li,d)=7.
12668	1^-	<0.05 MeV	C H	J^{π}: L(^{36}Ar,α)=1.
12688			H	
12720	3^-		F	J^{π}: L(^{6}Li,d)=3.
12750 *10*	2^-		N	J^{π}: M2 excitation in (e,e′).
12830 *10*	$1^+,(2^-)$		N	J^{π}: most likely M1 excitation in (e,e′).
12875			H	
12900	4^+		F	J^{π}: L(^{6}Li,d)=4.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$[#@]	XREF	Comments
12923[c] 2	(11$^-$)		Y	J$^{\pi}$: from band assignment in (HI,xnγ).
12965	2$^+$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=2.
12980			E H	
12996			H	
13050 10	1$^+$		N	J$^{\pi}$: M1 excitation in (e,e′).
13050	4$^+$		F	J$^{\pi}$: L(^{6}Li,d)=4.
13086			H	
13113			H	
13115.1[a] 10	(12$^+$)		Y	J$^{\pi}$: from band assignment in (HI,xnγ).
13125	2$^+$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=2.
13150 10	2$^-$		N	J$^{\pi}$: M2 excitation in (e,e′).
13170	3$^-$	<0.02 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13194			H	
13195	(10$^-$)		Y	J$^{\pi}$: proposed in (HI,xnγ).
13200	4$^+$		F	J$^{\pi}$: L(^{6}Li,d)=4.
13203			H	
13250			E	
13289			H	
13300	4$^+$		F	J$^{\pi}$: L(^{6}Li,d)=4.
13301	2$^+$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=2.
13345	3$^-$	<0.03 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13400	0$^+$		f U	XREF: Others: AI J$^{\pi}$: L(α,α')=0.
13410	3$^-$	<0.04 MeV	C f	J$^{\pi}$: L(^{36}Ar,α)=3.
13445	2$^-$		N q	XREF: Others: AI J$^{\pi}$: M2 excitation in (e,e′).
13470	4$^+$		F q	XREF: Others: AI J$^{\pi}$: L(^{6}Li,d)=4.
13480	3$^-$	<0.03 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13480 10	1$^+$		E N	XREF: Others: AI J$^{\pi}$: M1 excitation in (e,e′).
13520	3$^-$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13535.5[b] 13	(11$^+$)		Y	J$^{\pi}$: from band assignment in (HI,xnγ).
13570	3$^-$	<0.05 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13.6×10^3 4			N	
13610	1$^+$,2$^+$,3$^+$		Q	J$^{\pi}$: L(p,p′)=2 from 0$^+$.
13620	6$^+$		C	J$^{\pi}$: L(^{6}Li,d)=6.
13620	3$^-$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13645	3$^-$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13670 10	2$^-$		N	J$^{\pi}$: M2 excitation in (e,e′).
13710	3$^-$	<0.03 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13720	6$^+$		EF	J$^{\pi}$: L(^{6}Li,d)=6.
13760	3$^-$	<0.04 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13822			H	
13830	7$^-$		F	J$^{\pi}$: L(^{6}Li,d)=7.
13830	(1$^+$,2$^+$,3$^+$)		Q	J$^{\pi}$: L(p,p′)=(2) from 0$^+$.
13850	3$^-$	<0.03 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13890	(0$^+$,1$^+$)		Q	J$^{\pi}$: L(p,p′)=(0) from 0$^+$.
13900	2$^+$		N	J$^{\pi}$: E2 excitation in (e,e′).
13910	3$^-$	<0.02 MeV	C	J$^{\pi}$: L(^{36}Ar,α)=3.
13913			H	
13921 15	4		QR	T=(0) J$^{\pi}$: $\sigma(\theta)$ in (p,p′).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
13952	4^+		E	J^{π}: L(^{6}Li,d)=4.
13960	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
13993			H	
14000	4^+		F	J^{π}: L(^{6}Li,d)=4.
14005	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14020	$(2^-,3^-,4^-)$		Q	J^{π}: L(p,p′)=(3) from 0^+.
14047	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14070 *50*	(0^+)		U	J^{π}: L(α,α')=(0).
14096			E	
14100	$1^+,2^+,3^+$		Q	J^{π}: L(p,p′)=2 from 0^+.
14150	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14177	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14190	4^+		F	J^{π}: L(^{6}Li,d)=4.
14200	$0^+,1^+$		S	XREF: Others: AK J^{π}: L(^{3}He,^{3}He′)=0.
14210	$(2^-,3^-,4^-)$		Q	J^{π}: L(p,p′)=(3) from 0^+.
14225	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14232.4[&] *10*	(12^+)		Y	J^{π}: from band assignment in (HI,xnγ).
14262	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14283 *15*	(6)		Q	T=1 J^{π}: $\sigma(\theta)$ in (p,p′).
14292	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14312	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14320	$(2^-,3^-,4^-)$		Q	J^{π}: L(p,p′)=(3) from 0^+.
14335	3^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14370	6^+		F I	XREF: F(14380). J^{π}: L(^{6}Li,d)=6.
14390	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14410	$2^-,3^-,4^-$		E Q	XREF: E(14420). J^{π}: L(p,p′)=3 from 0^+.
14419			E	
14435	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14460	$(2)^+$		I qr	J^{π}: L(p,p′)=2 for 14500 group; L(d,d′)=0+2 for 14500 group;
14490	3^-	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14530	(6^+)		EF I qr	XREF: E(14509)F(14500). J^{π}: L(^{6}Li,d)=6.
14540	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14600	$(1,2^+,3^-,4^+)$		I N r	J^{π}: from (e,e′).
14605	3^-	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14640	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14660	$1^+,2^+,3^+$		f Qr	J^{π}: L(p,p′)=2 from 0^+.
14680			f I r	J^{π}: 1^+ for a 15000 group in (d,d′).
14690	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14725	3^-	<0.05 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14750	4^+		F	J^{π}: L(^{6}Li,d)=4.
14760	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14780	$1^+,2^+,3^+$		Q	J^{π}: L(p,p′)=2 from 0^+.
14790	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14835	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14869	(9^-)		EF	XREF: F(14850). J^{π}: L(^{6}Li,d)=(9).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
14888	3^-	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=3.
14942	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
15002	3^-	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=3.
15080			F Qr	
15101	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
15140			F r	
15150	3^-	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=3.
15152.4[a] *12*	(13^+)		Y	J^{π}: from band assignment in (HI,xnγ).
15220	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
15250			F	
15260	3^-	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=3.
15267.1[d] *14*	(12^+)		Y	J^{π}: from band assignment in (HI,xnγ).
15285	4^+	<0.05 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15306[c] *2*	(13^-)		Y	J^{π}: from band assignment in (HI,xnγ).
15330			F	
15345	4^+	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15384	4^+	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15435	4^+	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15490	4^+	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15525	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15550	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15580	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15600			F	
15620	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15670	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15700			F	
15707	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15748.1 *14*	(12^+)		Y	J^{π}: from band assignment in (HI,xnγ).
15790	4^+	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15840	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15875	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15900	3^-		U	J^{π}: L(α,α')=3.
15915	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15950	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
15960	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16000	5^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=5.
16000 *50*	3^-	0.63 MeV *10*	U	J^{π}: L(α,α')=3 from 0^+.
16020	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16065	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16110	5^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=5.
16120	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16160	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16210	4^+	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16255	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16290	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16360	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16395	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16450	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16510	4^+	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=4.
16529.4[&] *12*	(14^+)		Y	J^{π}: from band assignment in (HI,xnγ).
16545	5^-	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=5.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#@]	XREF	Comments
16579.7[b] *16*	(13^+)		Y	J^π: from band assignment in (HI,xnγ).
16585	5^-	<0.02 MeV	C	J^π: L(^{36}Ar,α)=5.
16610	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
16640	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
16665	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
16700	$(2^-,3^-,4^-)$	0.90 MeV *2*	S	J^π: L(^{3}He,^{3}He′)=(3).
16735	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
16810	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
16910	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
16945	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
17010	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17065	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
17113	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
17170	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
17210	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17280	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17320	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
17360	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17410	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17450	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17513	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
17590	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
17669			E	XREF: Others: AI, AK XREF: AI(17500). E(level): possibly GQR.
17670	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
17698.6 *14*	(14^+)		Y	J^π: from band assignment in (HI,xnγ).
17700	2^+		U	J^π: L(α,α')=2.
17730	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17790	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
17855	6^+	<0.04 MeV	C	J^π: L(^{36}Ar,α)=6.
17859			E	
17915	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
17950	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
18000 *50*	2^+	2.25 MeV *20*	U	J^π: L(α,α')=2 from 0^+.
18010	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.
18054.6 *14*	(14^+)		Y	J^π: proposed in (HI,xnγ).
18077	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
18139	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
18146			E	
18174	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
18200	2^+		N RS	XREF: N(18400). J^π: L(d,d′)=0+2; L(^{3}He,^{3}He′)=2(+0).
18215?[c] *2*	(15^-)		Y	J^π: from band assignment in (HI,xnγ).
18260 *5*	1		H	J^π: 18256γ D to 0^+.
18260	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
18326			E	
18328	6^+	<0.05 MeV	C	J^π: L(^{36}Ar,α)=6.
18406	6^+	<0.03 MeV	C	J^π: L(^{36}Ar,α)=6.
18452			E	
18485	6^+	<0.02 MeV	C	J^π: L(^{36}Ar,α)=6.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#@]	XREF	Comments
18497.2[d] *17*	(14$^+$)		Y	J^{π}: from band assignment in (HI,xnγ).
18547	6$^+$	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=6.
18605	6$^+$	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=6.
18659	6$^+$	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=6.
18680 *5*	1		H	J^{π}: 18675γ D to 0$^+$.
18705	6$^+$	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=6.
18719.2 *17*	(14$^+$)		Y	J^{π}: from band assignment in (HI,xnγ).
18731			E	
18765	6$^+$	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=6.
18865	6$^+$	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=6.
18930	6$^+$	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19020	6$^+$	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19037			E	
19070 *5*	1		H	J^{π}: 19065γ D to 0$^+$.
19080	6$^+$	<0.05 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19150	6$^+$	<0.07 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19.18×10^3 *37*	0$^+$	4.9 MeV *6*	U	J^{π}: L(α,α')=0.
19195.6[a] *16*	(15$^+$)		Y	J^{π}: from band assignment in (HI,xnγ).
19230	6$^+$	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19280	6$^+$	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19385	6$^+$	<0.03 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19450 *5*	1		H	J^{π}: 19445γ D to 0$^+$.
19467	6$^+$	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19525	6$^+$	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19597	6$^+$	<0.02 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19667	6$^+$	<0.04 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19780	6$^+$	<0.06 MeV	C	J^{π}: L(^{36}Ar,α)=6.
19850 *5*	1		H	J^{π}: 19845γ D to 0$^+$.
20130 *5*			H	
20430 *5*	1		H	J^{π}: 19845γ D to 0$^+$.
20578.6[&] *15*	(16$^+$)		Y	J^{π}: from band assignment in (HI,xnγ).
20650 *5*	1		H	J^{π}: 20644γ D to 0$^+$.
20940 *5*	1		H	J^{π}: 20934γ D to 0$^+$.
21000 *50*			U	J^{π}: L(α,α')=0+2.
21490			H	
21690			H	
22060			H	
22060.4[d] *20*	(16$^+$)		Y	J^{π}: from band assignment in (HI,xnγ).
23360	1$^-$		M U	XREF: Others: AK J^{π}: L(α,α')=1; GDR.
31×10^3 *2*	2$^-$,3$^-$,4$^-$		Q	J^{π}: L(p,p$'$)=3 from 0$^+$.
35.3×10^3 *5*			N	
42.0×10^3			N	
58.4×10^3 *11*			N	

[†] From (p,γ), ^{40} Sc ε decay, (γ,γ') or (HI,xnγ) based on γ-ray energies. In other cases, a large number of excitation energies are from (p,p),(p,α):resonances. When levels are known from transfer particle-reactions, weighted averages of available values are taken. The following reactions have imprecise excitation energies above ≈8 MeV, hence level correspondence between various reactions (as given in XREF column) is considered (by the evaluator) as tentative: resonances in (α,γ); (^{6}Li,d); (^{3}He,n); (d,d$'$), (^{3}He,^{3}He$'$); (α,α'); (HI,HI$'$) and (d,t).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{40}Ca Levels (continued)

‡ When no arguments are given (above 9600), the assignments are based on J^{π}'s determined in ^{39}K(p,γ) or ^{39}K(p,p),(p,α):resonances. For high-spin structures (J>6), assignments are based on $\gamma(\theta)$ data and expected band associations. In particle-transfer reactions, target (^{39}K) J^{π}=3/2$^+$ for (d,n) and (^{3}He,d) reactions; target (^{41}Ca) J^{π}=7/2$^-$ for (^{3}He,α) and (d,t) reactions. In arguments based on γ decays, RUL (for E2 and M2 transitions) is also used when level lifetimes are known. For some of the high-energy levels populated only in (e,e′), J^{π} assignments are from measurements of $\sigma(\theta)$ and deduced transition strengths in that reaction.

Lifetimes are available from DSAM in (p,p′γ), (p,γ) and (HI,xnγ), and measured widths in (γ,γ'). Widths are from (γ,γ'), (p,γ) and (p,p),(p,α):resonances and for some levels, values are for Γ_p or deduced from (p,p) resonance strengths by assuming Γ_p/Γ=1 if spin values is firmly assigned. Consult individual data sets for corresponding resonance strengths.

@ Additional information 21.

& Band(A): 4p-4h, 0$^+$ band. Q(transition)=0.74 *14* from life-time data; corresponds to $\beta_2\approx$0.27.

[a] Band(B): γ sequence based on 8$^+$.

[b] Band(C): 3$^+$ band.

[c] Band(D): K^{π}=0$^-$ band (2004To07) (?). This band is proposed (2004To07) as a partner of 4p-4h band based on the 3353,0$^+$ state; the 1$^-$, 3$^-$ and 5$^-$ members of this band are proposed at 5902, 1$^-$; 6280, 3$^-$ or 6580, 3$^-$; and 7399, (5$^-$), respectively. However, the 7399 level is assigned (5$^+$) in another in-beam γ-ray study. Assignment of (7$^-$) by 2004To07 for 9033 level is inconsistent with L(p,p′)=5 for a 9029 *5* group and γ's to 3$^-$ and 4$^-$ states seen in (p,γ). The 7$^-$ assignment is only possible if the 9033 level in 2004To07 is different from a 9032 seen in other reactions.

[d] Band(E): SD band (2001Id01,2003Ch22). Q(transition)=1.30 *15* over the whole band; 1.81 *+46−33* for high-spin states; 1.18 *14* for low-spin states (2003Ch22). Q(transition)=1.80 *+39−29* (2001Id01). Q(transition) from 2001Id01 corresponds to β_2=0.59 *+11−7*. Configuration=8p−8h defined by $\pi3^4\nu3^4$, where superscripts are the number of protons and neutrons occupying the N=3 ($f_{7/2}$) intruder orbital.

$\gamma(^{40}Ca)$

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[#]	δ[#]	Comments
3352.62	0^+	3352.6		0.0	0^+	E0		Decay is mainly by e^+e^- pair emission. Monopole strength: ρ^2(E0)=0.0256 *7* (2005Ki02, deduced from $T_{1/2}$). Other: 0.025 *8* in (e,e′) deduced from measured matrix element.
3736.69	3^-	3736.5 *3*	100	0.0	0^+	E3		B(E3)(W.u.)=31 *+4−3* E_γ: weighted average of 3735.6 *8* from ^{40}Sc ε decay, 3736.8 *3* from ^{39}K(p,γ), 3737 *2* from ^{40}Ca(n,n′γ), 3736.7 *3* from ^{40}Ca(p,p′γ), and 3736.1 *3* from (HI,xnγ). Mult.: from $\gamma(\theta)$ in (p,p′γ), M3 ruled out by RUL.
3904.38	2^+	551.8	<0.10	3352.62	0^+	[E2]		B(E2)(W.u.)<49 E_γ: from (p,γ). I_γ: from (p,γ). Others: <1.5 in (p,p′γ).
		3903.9 *1*	100	0.0	0^+	E2		B(E2)(W.u.)=2.2 *+6−4* E_γ: weighted average of 3904.5 *3* from ^{39}K(p,γ), 3903.8 *1* from ^{40}Ca(γ,γ'), 3904.2 *4* from ^{40}Ca(n,n′γ), 3904.4 *4* from ^{40}Ca(p,p′γ), and 3904.0 *3* from (HI,xnγ). Mult.: Q from $\gamma(\theta)$ in (p,p′γ) and (HI,xnγ), M2 ruled out by RUL.
4491.43	5^-	754.8 *2*	100	3736.69	3^-	E2		B(E2)(W.u.)=0.98 *3* E_γ: weighted average of 755.6 *8* from ^{40}Sc ε decay, 754.8 *3* from ^{39}K(p,γ), 755 *2* from ^{40}Ca(n,n′γ), 754.7 *2* from ^{40}Ca(p,p′γ), and 754.8 *2* from (HI,xnγ). Mult.: from $\gamma\gamma(\theta)$ and γ(pol) in in (p,γ). δ(O/Q)=−0.01 *2* from (p,γ), +0.05 *5* in (p,p′γ).
5211.56	0^+	1307.7 *3*	100	3904.38	2^+	[E2]		B(E2)(W.u.)=17 *+4−3* E_γ: from (p,p′γ).
5248.79	2^+	1344.4 *3*	19.4 *12*	3904.38	2^+	M1+E2	+13 *+6−3*	B(M1)(W.u.)=8×10^{-5} *+11−6*; B(E2)(W.u.)=25 *+8−6* E_γ,Mult.,δ: from (p,p′γ). I_γ: weighted average of 18.9 *11* from ^{39}K(p,γ), 27 *7* from ^{40}Ca(n,n′γ), and 25 *5* from ^{40}Ca(p,p′γ).
		1896.1	6.3 *8*	3352.62	0^+	(E2)		B(E2)(W.u.)=1.5 *+6−4* E_γ: from (p,γ), 1897 *2* from (n,n′γ). I_γ: weighted average of 6.4 *8* from ^{39}K(p,γ), 7 *4* from ^{40}Ca(n,n′γ), and 5.2 *26* from ^{40}Ca(p,p′γ). Mult.: from (p,p′γ).
		5248.9 *3*	100.0 *15*	0.0	0^+	E2		B(E2)(W.u.)=0.143 *+35−24* E_γ: weighted average of 5248.9 *6* from ^{39}K(p,γ), 5247.9 *6* from ^{40}Ca(p,p′γ), 5249.2 *3* from ^{40}Ca(γ,γ'), and 5249 *2* from ^{40}Ca(n,n′γ). I_γ: from (p,γ). δ: from (p,p′γ).
5278.80	4^+	787.4	3.1 *15*	4491.43	5^-	[E1]		B(E1)(W.u.)=6×10^{-5} *+7−5* E_γ,I_γ: from (p,γ).
		1374.0 *3*	100.0 *15*	3904.38	2^+	E2		B(E2)(W.u.)=67 *+17−12* E_γ: unweighted average of 1374.5 *4* from ^{39}K(p,γ), 1374.0 *2* from ^{40}Ca(n,n′γ), 1373.1 *1* from ^{40}Ca(p,p′γ), and 1374.30 *20* from (HI,xnγ).

Adopted Levels, Gammas (continued)

$\gamma(^{40}\mathrm{Ca})$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ ‡	E_f	J_f^π	Mult.#	δ#	Comments
								I_γ: from (p,γ). Mult.: from $\gamma\gamma(\theta)$ and γ(pol) in (p,γ). δ(O/Q)=+0.02 *4* from (p,p′γ), −0.02 *5* from (p,γ).
5613.52	4^-	1122.7 *2*	41.4 *28*	4491.43	5^-	M1+E2	−0.7 *2*	B(M1)(W.u.)=0.0046 *+23−16*; B(E2)(W.u.)=6 *+4−3* E_γ: weighted average of 1126 *3* from ^{40}Sc ε decay, 1121.5 *6* from ^{39}K(p,γ), 1122 *2* from ^{40}Ca(n,n′γ), and 1122.8 *2* from ^{40}Ca(p,p′γ). I_γ: weighted average of 48 *8* from ^{40}Sc ε decay, 41.8 *28* from ^{39}K(p,γ), and 39 *4* from ^{40}Ca(p,p′γ). Mult.,δ: from γ(pol) in (p,γ).
		1877.0 *2*	100 *3*	3736.69	3^-	M1+E2	−0.27 *5*	B(M1)(W.u.)=0.0033 *+8−6*; B(E2)(W.u.)=0.21 *+15−9* E_γ: weighted average of 1877.8 *7* from ^{40}Sc ε decay, 1877.0 *3* from ^{39}K(p,γ), 1877 *2* from ^{40}Ca(n,n′γ), and 1876.9 *2* from ^{40}Ca(p,p′γ). I_γ: from (p,γ). Mult.,δ: from γ(pol) in (p,γ).
5629.41	2^+	2277.0 *10*	14.0 *10*	3352.62	0^+	[E2]		B(E2)(W.u.)=3.3 *+23−11* E_γ: weighted average of 2275 *2* from ^{40}Ca(n,n′γ) and 2277.5 *10* from ^{40}Ca(p,p′γ). I_γ: weighted average of 14.0 *10* from ^{39}K(p,γ), and 14 *6* from ^{40}Ca(p,p′γ). Other: 48 *12* from ^{40}Ca(n,n′γ),
		5628.5 *2*	100.0 *10*	0.0	0^+	E2		B(E2)(W.u.)=0.26 *+15−7* E_γ: weighted average of 5628.5 *2* from ^{40}Ca(γ,γ'), 5629 *2* from ^{40}Ca(n,n′γ), and 5628.3 *5* from ^{40}Ca(p,p′γ). I_γ: from (p,γ). Mult.: from $\gamma(\theta)$ in (p,p′γ) and RUL.
5902.63	1^-	5902.0 *2*	100	0.0	0^+	E1		B(E1)(W.u.)=6.7×10^{-5} *+34−17* E_γ: weighted average of 5902.0 *2* from ^{40}Ca(γ,γ'), 5903 *2* from ^{40}Ca(n,n′γ), and 5902.6 *15* from ^{40}Ca(p,p′γ). Mult.: D from $\gamma\gamma(\theta)$ in (p,p′γ), polarity from level-parity change determined from other experimental evidence.
6025.47	2^-	2121.0 *6*	23 *3*	3904.38	2^+	[E1]		B(E1)(W.u.)=6.1×10^{-5} *+19−15* E_γ: from (p,p′γ). I_γ: from (p,γ).
		2289.0 *3*	100 *3*	3736.69	3^-	M1+E2	−2.8 *5*	B(M1)(W.u.)=0.0010 *+7−4*; B(E2)(W.u.)=4.7 *+11−9* E_γ: from (p,p′γ). I_γ: from (p,γ). Mult.,δ: D+Q from $\gamma\gamma(\theta)$ in (p,p′γ), polarity from no level-parity change determined from other experimental evidence.
6029.71	3^+	750.9	<1.2	5278.80	4^+			E_γ,I_γ: from (p,γ). Other: Iγ<3.4 in (p,p′γ).
		780.7 *4*	20 *4*	5248.79	2^+	E2(+M1)	>2	B(M1)(W.u.)<0.0037; B(E2)(W.u.)>77 E_γ: from (p,p′γ).

From ENSDF

$^{40}_{20}\mathrm{Ca}_{20}$-27

Adopted Levels, Gammas (continued)

$\gamma(^{40}\mathrm{Ca})$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[#]	δ[#]	Comments
								I_γ: weighted average of 25 *4* from ^{39}K(p,γ), 18 *6* from ^{40}Ca(n,n$'\gamma$), and 15 *5* from ^{40}Ca(p,p$'\gamma$). Mult.,δ: Q(+D) from $\gamma\gamma(\theta)$ in (p,p$'\gamma$); M2(+E1) is ruled out by RUL.
6029.71	3^+	2124.4 *3*	100 *4*	3904.38	2^+	E2(+M1)	>4	B(M1)(W.u.)<0.00027; B(E2)(W.u.)>3.0 E_γ: from (p,p$'\gamma$). I_γ: from (p,γ). Mult.,δ: Q(+D) from $\gamma\gamma(\theta)$ in (p,p$'\gamma$); M2(+E1) is ruled out by RUL.
		2293.0	<8	3736.69	3^-			E_γ,I_γ: from (p,γ). Other: Iγ<23 in (p,p$'\gamma$).
6285.15	3^-	671.6	1.3 *3*	5613.52	4^-			E_γ,I_γ: from (p,γ) only.
		1793.4 *2*	100.0 *11*	4491.43	5^-	E2		B(E2)(W.u.)=8.2 *+14−13* E_γ: weighted average of 1793.9 *6* from ^{39}K(p,γ), 1793 *2* from ^{40}Ca(n,n$'\gamma$), and 1793.3 *2* from ^{40}Ca(p,p$'\gamma$). I_γ: from (p,γ). Mult.: Q(+O) from $\gamma\gamma(\theta)$ in (p,p$'\gamma$), M2 ruled out by RUL. δ(O/Q)=−0.03 *17* from (p,p$'\gamma$), +0.03 *2* from (p,γ).
		2380.0 *5*	27.4 *7*	3904.38	2^+	E1		B(E1)(W.u.)=2.6×10^{-5} *+5−4* E_γ: from (p,p$'\gamma$). I_γ: from (p,γ). Others: 80 *33* from (n,n$'\gamma$), 30 *7* from (p,p$'\gamma$), and 33 *7* from (α,$\alpha'\gamma$). Mult.: D from $\gamma\gamma(\theta)$ in (p,p$'\gamma$), polarity from level-parity change determined from other experimental evidence.
		2548.4	4.4 *6*	3736.69	3^-			E_γ,I_γ: from (p,γ). Other: Iγ<13 in (p,p$'\gamma$).
		6284.6	5.8 *7*	0.0	0^+	[E3]		B(E3)(W.u.)=4.2 *+13−10* E_γ,I_γ: from (p,γ).
6422.4	2^+	6420.6 *9*	100	0.0	0^+	[E2]		B(E2)(W.u.)=0.49 *+22−12* E_γ: from (γ,γ').
6507.87	4^+	1229.0[&]	4 *3*	5278.80	4^+			E_γ,I_γ: from (p,p$'\gamma$). Other: Iγ<3.5 in (p,γ).
		1259.0	17 *4*	5248.79	2^+	[E2]		B(E2)(W.u.)=24 *+13−9* E_γ: from (p,γ). I_γ: weighted average of 18 *4* from ^{39}K(p,γ) and 15 *4* from ^{40}Ca(p,p$'\gamma$).
		2603.2 *3*	100 *4*	3904.38	2^+	E2		B(E2)(W.u.)=3.7 *+11−8* E_γ: from (p,p$'\gamma$). I_γ: from (p,γ). Mult.: O(+Q) from $\gamma\gamma(\theta)$ in (p,p$'\gamma$), M2 ruled out by RUL. δ(O/Q)=−0.09 *9* from (p,p$'\gamma$).
6542.80	4^+	913.3	32 *3*	5629.41	2^+	E2		B(E2)(W.u.)=1.7×10^2 *+7−5* E_γ,I_γ: from (p,γ). Other: Iγ=17 *4* in (p,p$'\gamma$). Mult.: from $\gamma\gamma(\theta)$ in (p,p$'\gamma$) and RUL. B(E2)(W.u.)>100 consistent with 6543, 4^+ state as a member of SD band.
		1264.0	14 *3*	5278.80	4^+			E_γ,I_γ: from (p,γ). Other: Iγ=10 *4* in (p,p$'\gamma$).
		1294.0	24 *3*	5248.79	2^+	(E2)		B(E2)(W.u.)=22 *+10−7*

From ENSDF

$^{40}_{20}\mathrm{Ca}_{20}$-28

γ(^{40}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.#	δ#	Comments
								E_γ,I_γ: from (p,γ). Other: Iγ=12 *4* in (p,p′γ). Mult.: (Q) from (HI,xnγ), M2 ruled out by RUL.
6542.80	4^+	2638.1 *3*	100 *3*	3904.38	2^+	E2(+M3)	−0.07 *7*	B(E2)(W.u.)=2.6 *+8−6* E_γ: from (p,p′γ). I_γ: from (p,γ). Mult.: Q(+O) from $\gamma\gamma(\theta)$ in (p,p′γ), M2 ruled out by RUL. δ(O/Q)=−0.07 *7* from (p,p′γ).
6582.47	3^-	969.0	26 *5*	5613.52	4^-			E_γ,I_γ: from (p,γ). Other: Iγ=7.5 *30* in (p,p′γ).
		2091.0	<1.1	4491.43	5^-	[E2]		B(E2)(W.u.)=0.39 *+36−24* E_γ: from (p,γ). I_γ: from (p,γ). Other: 7.5 *30* from (p,p′γ).
		2678.1	24.7 *21*	3904.38	2^+	[E1]		B(E1)(W.u.)=2.8×10^{-5} *+11−7* E_γ: from (p,γ). I_γ: weighted average of 24.2 *18* from ^{39}K(p,γ), and 34 *8* from ^{40}Ca(p,p′γ).
		2845.1 *3*	100.0 *20*	3736.69	3^-	M1+E2	+3.1 *+26−11*	B(M1)(W.u.)=0.00034 *+60−26*; B(E2)(W.u.)=1.3 *+5−4* E_γ: from (p,p′γ). I_γ: from (p,γ). Mult.,δ: D+Q from $\gamma\gamma(\theta)$ in (p,p′γ), M2 ruled out by RUL.
6750.41	2^-	2848.4& *10*	<10	3904.38	2^+			E_γ: from (p,p′γ). Other: 2845.9 from (p,γ). I_γ: from (p,γ). Others: 22 *10* in (n,n′γ), 18 in (p,p′γ).
		3014.0 *3*	100	3736.69	3^-	M1+E2	−0.84 *16*	B(M1)(W.u.)=0.0047 *+36−17*; B(E2)(W.u.)=1.1 *+10−5* E_γ: from (p,p′γ). Mult.,δ: from $\gamma\gamma(\theta)$ in (p,p′γ) and RUL.
6908.70	2^+	6907.6 *1*	100	0.0	0^+	[E2]		B(E2)(W.u.)=2.1 *+5−4* E_γ: from (γ,γ′).
6930.2	6^+	1651.8 *4*	100	5278.80	4^+	E2		B(E2)(W.u.)=17 *+17−4* E_γ: weighted average of 1651.9 *7* from (HI,xnγ) and 1651.7 *4* from (^{3}He,dγ). Other: 1651 *2* from (n,n′γ). Mult.: from $\gamma(\theta)$ and γ(DCO) in (HI,xnγ) and RUL.
6931.29	3^-	1301.8	7.0 *4*	5629.41	2^+	[E1]		B(E1)(W.u.)=1.1×10^{-5} *+10−4* E_γ,I_γ: from (p,γ).
		1317.7	2.4 *4*	5613.52	4^-			E_γ,I_γ: from (p,γ).
		1682.4	7.4 *4*	5248.79	2^+	[E1]		B(E1)(W.u.)=5.3×10^{-6} *+47−19* E_γ,I_γ: from (p,γ).
		2439.8	1.7 *4*	4491.43	5^-	[E2]		B(E2)(W.u.)=0.008 *+10−4* E_γ,I_γ: from (p,γ).
		3026.8	2.4 *6*	3904.38	2^+	[E1]		B(E1)(W.u.)=3.0×10^{-7} *+37−15* E_γ,I_γ: from (p,γ).
		3194.5	100.0 *9*	3736.69	3^-			E_γ,I_γ: from (p,γ). Other: Eγ=3190.0 *15* in (p,p′γ), 3193 *2* in (n,n′γ).

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

E_i(level)	J_i^π	E_γ†	I_γ‡	E_f	J_f^π	Mult.#	Comments
6938.0	(1^- to 5^-)	3201.0 *15*	100	3736.69	3^-		E_γ: from (p,p′γ).
6950.48	1^-	6949.7 *8*	100	0.0	0^+	[E1]	B(E1)(W.u.)=0.0019 *+4−3* E_γ: weighted average of 6949.3 *7* from ^{40}Ca(γ,γ′), 6949 *2* from ^{40}Ca(n,n′γ), and 6952.2 *15* from ^{40}Ca(p,p′γ).
7113.1	1^-	1485	5	5629.41	2^+	[E1]	B(E1)(W.u.)=0.00010 *+11−4* E_γ,I_γ: (p,p′γ) only.
		1899.8 *7*	22	5211.56	0^+	[E1]	B(E1)(W.u.)=0.00022 *+23−8* E_γ,I_γ: (p,p′γ) only.
		3206.8 *6*	28	3904.38	2^+	[E1]	B(E1)(W.u.)=5.8×10^{-5} *+60−20* E_γ,I_γ: from (p,p′γ). Other: Eγ=3208.5 in (p,γ).
		7112.9 *10*	100	0.0	0^+	[E1]	B(E1)(W.u.)=1.9×10^{-5} *+20−7* E_γ,I_γ: from (p,p′γ). Other: Eγ=7113.3 in (p,γ).
7113.73	4^-	1088.2	1.7 *5*	6025.47	2^-	[E2]	B(E2)(W.u.)=7 *+8−4* E_γ,I_γ: from (p,γ).
		1500.2	10.3 *11*	5613.52	4^-		E_γ,I_γ: from (p,γ).
		1834.9	2.6 *5*	5278.80	4^+	[E1]	B(E1)(W.u.)=2.1×10^{-5} *+22−9* E_γ,I_γ: from (p,γ).
		2623.2 *3*	40.7 *20*	4491.43	5^-		E_γ: from (p,p′γ). Other: 2622.2 in (p,γ). I_γ: from (p,γ).
		3378.5 *3*	100.0 *14*	3736.69	3^-		E_γ: from (p,p′γ). Other: 3376.9 in (p,γ). I_γ: from (p,γ).
7239.07	(3^-,4,5^-)	1624.5 *7*	50	5613.52	4^-		E_γ,I_γ: from (p,p′γ) only.
		2746	100	4491.43	5^-		E_γ,I_γ: from (p,p′γ) only.
		3501.4 *5*	100	3736.69	3^-		E_γ,I_γ: from (p,p′γ). Other: Eγ=3502.2 in (p,γ).
7277.82	$(2,3)^+$	3541.0	100	3736.69	3^-	[E1]	B(E1)(W.u.)=0.00027 *+67−11* E_γ: from (p,γ).
7300.67	0^+	1671.3	5.3 *16*	5629.41	2^+	[E2]	B(E2)(W.u.)=1.8 *+18−10* E_γ,I_γ: from (p,γ).
		2050.3 *5*	100.0 *16*	5248.79	2^+	[E2]	B(E2)(W.u.)=16 *+8−4* E_γ: from (p,p′γ). Other: 2051.9 in (p,γ).
7397.2	(5^+)	1369		6029.71	3^+	(E2)	E_γ: from (HI,xnγ) only. Mult.: (Q) from (HI,xnγ), M2 ruled by RUL.
		2119.2 *6*		5278.80	4^+	(D)	E_γ: from (p,p′γ). Mult.: from (HI,xnγ).
7421.9		3684.9 *12*	100	3736.69	3^-		E_γ: from (p,p′γ).
7446.23	3^+,4^+	1816.8	30.0 *17*	5629.41	2^+		E_γ,I_γ: from (p,γ).
		1831.5 *10*	48.5 *19*	5613.52	4^-	[E1]	B(E1)(W.u.)=0.00014 *+10−5* E_γ: from (p,p′γ). Other: 1832.7 in (p,γ). I_γ: from (p,γ).
		2167.4	56 *3*	5278.80	4^+		E_γ,I_γ: from (p,γ). Other: Eγ=2169.1 *15* in (p,p′γ).

From ENSDF

Adopted Levels, Gammas (continued)

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

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	Comments
7446.23	$3^+,4^+$	2198.0 *10*	100 *3*	5248.79	2^+		E_γ: from (p,p′γ). Other: 2197.4 in (p,γ). I_γ: from (p,γ).
7466.35	2^+	2217.5	24 *3*	5248.79	2^+		E_γ,I_γ: from (p,γ).
		3561.8	36.0 *25*	3904.38	2^+		E_γ,I_γ: from (p,γ).
		4113.5	21.0 *18*	3352.62	0^+	[E2]	B(E2)(W.u.)=0.9 *+12−4* E_γ,I_γ: from (p,γ).
		7465.6	100 *4*	0.0	0^+	[E2]	B(E2)(W.u.)=0.21 *+24−8* E_γ,I_γ: from (p,γ). Other: Eγ=7467.8 *10* in (p,p′γ).
7481?		7480		0.0	0^+		
7532.26	2^-	1247.1	23.1 *21*	6285.15	3^-		E_γ,I_γ: from (p,γ).
		1506.8	11.3 *10*	6025.47	2^-		E_γ,I_γ: from (p,γ).
		1629.6	8.0 *24*	5902.63	1^-		E_γ,I_γ: from (p,γ).
		1917.6 *10*	57 *3*	5613.52	4^-	[E2]	B(E2)(W.u.)=4.1 *+19−12* E_γ: from (p,p′γ). Other: 1918.7 in (p,γ). I_γ: from (p,γ).
		3627.7	36 *3*	3904.38	2^+	[E1]	B(E1)(W.u.)=1.2×10^{-5} *+6−4* E_γ,I_γ: from (p,γ).
		3795.4 *10*	100 *4*	3736.69	3^-		E_γ,I_γ: from (p,γ).
7561.17	4^+	1531.4	44 *5*	6029.71	3^+		E_γ,I_γ: from (p,γ).
		2312.1 *10*	100 *13*	5248.79	2^+	[E2]	B(E2)(W.u.)=3.9 *+17−11* E_γ: unweighted average of 2313.0 *6* from ^{39}K(p,γ) and 2311.1 *3* from ^{40}Ca(p,p′γ). I_γ: from (p,γ).
		3824.3	14 *3*	3736.69	3^-	[E1]	B(E1)(W.u.)=5.4×10^{-6} *+41−23* E_γ,I_γ: from (p,γ).
7623.11	$(2^-,3,4^+)$	1993.6	100 *3*	5629.41	2^+		E_γ,I_γ: from (p,γ).
		2009.5 *7*	90 *3*	5613.52	4^-		E_γ: from (p,p′γ). I_γ: from (p,γ).
		2374.2	31.5 *20*	5248.79	2^+		E_γ,I_γ: from (p,γ).
		3886.2	57.4 *20*	3736.69	3^-		E_γ,I_γ: from (p,γ).
7658.23	4^-	1373.1	33 *5*	6285.15	3^-		E_γ,I_γ: from (p,γ).
		2045.6 *7*	100 *6*	5613.52	4^-		E_γ: weighted average of 2045.8 *7* from ^{40}Sc ε decay and 2045.0 *10* from ^{40}Ca(p,p′γ). Other: 2045.6 in (p,γ). I_γ: from ^{40}Sc ε decay.
		3167.9 *7*	52 *8*	4491.43	5^-		E_γ: from ^{40}Sc ε decay. Other: 3166.7 in (p,γ). I_γ: weighted average of 47 *8* from ^{40}Sc ε decay and 56 *8* from ^{39}K(p,γ).
		3920.0 *10*	59 *8*	3736.69	3^-		E_γ: from ^{40}Sc ε decay. Other: 3921.3 in (p,γ). I_γ: weighted average of 51 *8* from ^{40}Sc ε decay and 67 *8* from ^{39}K(p,γ).
7676.6	(6^+)	2399.2 *5*	100	5278.80	4^+	(E2)	B(E2)(W.u.)=4.4 *+15−9* E_γ: from (p,p′γ). Mult.: (Q) from γ(θ) in (HI,xnγ), M2 ruled out by RUL.

$^{40}_{20}Ca_{20}$-31

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

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[‡]	E_f	J^{π}_f	Mult.[#]	Comments
7694.08	3^-	2080.6	10.1 *13*	5613.52	4^-		E_{γ},I_{γ}: from (p,γ).
		3957.5 *5*	100.0 *13*	3736.69	3^-		E_{γ}: from (p,p′γ). Other: 3957.3 in (p,γ). I_{γ}: from (p,γ).
7701.8	0^+	3797.2	100	3904.38	2^+		E_{γ}: from (p,γ).
7769.4	$(3,4,5^-)$	2155.8	52 *9*	5613.52	4^-		E_{γ},I_{γ}: from (p,γ).
		4032.5	100 *9*	3736.69	3^-		E_{γ},I_{γ}: from (p,γ).
7814.7	0^+	2565	43	5248.79	2^+		E_{γ},I_{γ}: from (p,p′γ).
		3908	100	3904.38	2^+		E_{γ},I_{γ}: from (p,p′γ).
7872.18	2^+	7871.1 *1*	100	0.0	0^+	[E2]	B(E2)(W.u.)=0.89 *+22−15* E_{γ}: from (γ,γ'). Others: 7871.4 in (p,γ), 7872.9 *10* in (p,p′γ). I_{γ}: 1982Mo05 in (γ,γ') report Γ_0/Γ=0.84 *6* without indicating the observation of other γ branches other than the ground transition and no other γ branches were observed in other studies. So this value is not considered.
7928.42	4^+	2314.8	100 *18*	5613.52	4^-	[E1]	B(E1)(W.u.)=0.00046 *+151−25* E_{γ},I_{γ}: from (p,γ). Other: Eγ=2313.7 *17* in (p,p′γ).
		3436.8	100 *18*	4491.43	5^-	[E1]	B(E1)(W.u.)=0.00014 *+46−8* E_{γ},I_{γ}: from (p,γ).
		4191.5	<14	3736.69	3^-		E_{γ},I_{γ}: from (p,γ). Other: Iγ=20 in (p,p′γ).
7974.4	(6^+)	1432		6542.80	4^+	(Q)	E_{γ},Mult.: from (HI,xnγ).
		2695		5278.80	4^+	(Q)	E_{γ},Mult.: from (HI,xnγ).
7976.55	2^+	2699	20	5278.80	4^+	[E2]	B(E2)(W.u.)>1.2
		4072.1 *6*	100	3904.38	2^+		
		4624	60	3352.62	0^+	[E2]	B(E2)(W.u.)>0.24
		7977	20	0.0	0^+	[E2]	B(E2)(W.u.)>0.0051
8018.8	0^+	2770	100	5248.79	2^+		
8091.61	2^+	8090.6 *2*	100	0.0	0^+	[E2]	B(E2)(W.u.)=0.72 *+9−7* E_{γ}: from (γ,γ'). Other: 8092.4 *20* in (p,p′γ).
8100.1	8^+	1168.8 *3*	100	6930.2	6^+	E2	B(E2)(W.u.)=2.6 *+4−3* E_{γ}: from (HI,xnγ). Mult.: from $\gamma\gamma(\theta)$ and γ(DCO) in (HI,xnγ) and RUL.
8113.2	1^-	8111.0 *6*	100	0.0	0^+	[E1]	B(E1)(W.u.)=6.0×10^{-5} *+39−17* E_{γ}: from (γ,γ').
8134.77	(3^-)	2505.3	82 *9*	5629.41	2^+		E_{γ},I_{γ}: from (p,γ).
		2521.2	24 *9*	5613.52	4^-		E_{γ},I_{γ}: from (p,γ).
		3643.1[&]	<15	4491.43	5^-		E_{γ},I_{γ}: from (p,γ). Other: Iγ=100 in (p,p′γ).
		4229.4 *10*	100 *30*	3904.38	2^+		E_{γ}: from (p,p′γ). Other: 4230.1 in (p,γ). I_{γ}: from (p,γ).
8187.5	$(3,4,5^-)$	4451.6 *8*	100	3736.69	3^-		E_{γ}: from (p,p′γ). Other: 4450.7 in (p,γ).
8271	$(\leq3)^-$	1321	100	6950.48	1^-		E_{γ},I_{γ}: from (p,p′γ).
		2368	67	5902.63	1^-		E_{γ},I_{γ}: from (p,p′γ).
8276	0^+	2646	100	5629.41	2^+		

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

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.#	Comments
8323.16	$(1^-,2^+)$	1572.7	12.5 *10*	6750.41	2^-		
		2038.0	2.2 *5*	6285.15	3^-		
		2297.6	26.3 *17*	6025.47	2^-		
		2420.5	1.9 *12*	5902.63	1^-		
		3074.2	4.5 *9*	5248.79	2^+		
		4586.2	100 *3*	3736.69	3^-		
		8322.2	3.4 *12*	0.0	0^+		Unobserved intensity=18 *3* in (p,γ).
8338.0	$(2^+,3,4)$	1795.2	100 *10*	6542.80	4^+		
		1830.1	42 *10*	6507.87	4^+		Unobserved intensity=25 *13* in (p,γ).
8358.9	$(0,1,2)^-$	1405	100	6950.48	1^-		E_γ: from (p,p′γ).
8364	$(3^-$ to $7^-)$	3872	100	4491.43	5^-		
8373.94	4^+	4469.3	100	3904.38	2^+		
8424.81	2^-	2399.3	19 *4*	6025.47	2^-		
		2522.1	24 *4*	5902.63	1^-		
		4687.8	100 *6*	3736.69	3^-		E_γ: from (p,γ). Other: 4688.2 *15* in (p,p′γ).
8439.0	0^+	2809.5	100	5629.41	2^+		
8484.02	$(1^-,2^-,3^-)$	2581.3	59 *11*	5902.63	1^-		
		4747.0	100 *11*	3736.69	3^-		Additional information 22.
8540	$1,2^+$	5188	67	3352.62	0^+		E_γ,I_γ: from (p,p′γ).
		8540 *4*	100	0.0	0^+		E_γ,I_γ: from (p,p′γ).
8551.1	5^-	4060.8 *15*		4491.43	5^-		E_γ,I_γ: from (p,p′γ).
8578.80	2^+	8577.7 *2*	100	0.0	0^+	[E2]	B(E2)(W.u.)=0.54 *+7−6* E_γ: from (γ,γ′).
8587	$(2^+,3)$	2562	25	6025.47	2^-		E_γ,I_γ: from (p,p′γ).
		3308	25	5278.80	4^+		E_γ,I_γ: from (p,p′γ).
		4682	17	3904.38	2^+		E_γ,I_γ: from (p,p′γ).
		4850	100	3736.69	3^-		E_γ,I_γ: from (p,p′γ).
8665.3	1^-	8665	100	0.0	0^+		
8678.29	4^+	2393.1	20 *8*	6285.15	3^-	[E1]	B(E1)(W.u.)=0.00017 *+145−12*
		4941.3	100 *23*	3736.69	3^-	[E1]	B(E1)(W.u.)=0.00010 *+53−5* Unobserved intensity=34 *25* in (p,γ).
8701	(6^-)	3088		5613.52	4^-		
		4209		4491.43	5^-		
8748.22	2^+	8748.4 *2*	100	0.0	0^+	[E2]	B(E2)(W.u.)=0.26 *+4−3* E_γ: from (γ,γ′). Other: 8747.2 in (p,γ).
8764.18	3^-	2734.4	47 *18*	6029.71	3^+		
		3134.6	56 *21*	5629.41	2^+		
		3485.2	100 *30*	5278.80	4^+		
		4859.5	65 *18*	3904.38	2^+		Unobserved intensity ≈26 in (p,γ).
8934.81	2^+	1402.5	12.2 *11*	7532.26	2^-		
		1657.0	3.5 *5*	7277.82	$(2,3)^+$		
		1821.0	1.7 *4*	7113.1	1^-		

$^{40}_{20}Ca_{20}$-33

Adopted Levels, Gammas (continued)

γ(^{40}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.#	Comments
8934.81	2^+	1984.3	5.6 *8*	6950.48	1^-		
		2184.3	5.6 *8*	6750.41	2^-		
		2352.2	1.9 *3*	6582.47	3^-		
		2905.0	3.2 *11*	6029.71	3^+		
		2909.2	17.6 *19*	6025.47	2^-		
		3032.1	1.7 *5*	5902.63	1^-		
		3305.2	2.9 *5*	5629.41	2^+		
		3685.8	5.6 *24*	5248.79	2^+		
		3722.9	3.5 *8*	5211.56	0^+		
		5030.1	100 *5*	3904.38	2^+		
		5197.8	2.9 *13*	3736.69	3^-		
		5581.8	21.8 *21*	3352.62	0^+		
		8933.7	77 *5*	0.0	0^+		
8935.8	(7^+)	1538		7397.2	(5^+)	(Q)	
		2004		6930.2	6^+	(D)	
8982.5	2^+	8981.4 *5*	100	0.0	0^+	[E2]	B(E2)(W.u.)=0.38 *+6−5* E_γ: from (γ,γ').
8994.50	$(1^-,2^+)$	1880.7	0.44 *11*	7113.1	1^-		
		2085.7	0.62 *15*	6908.70	2^+		
		2244.0	0.60 *8*	6750.41	2^-		
		2411.9	0.44 *14*	6582.47	3^-		
		2709.3	0.64 *16*	6285.15	3^-		
		2968.9	1.5 *3*	6025.47	2^-		
		3364.9	8.7 *7*	5629.41	2^+		
		3782.6	8.2 *7*	5211.56	0^+		
		5089.8	8.3 *8*	3904.38	2^+		
		5257.4	2.4 *4*	3736.69	3^-		
		5641.5	2.1 *6*	3352.62	0^+		
		8993.4	100.0 *22*	0.0	0^+		
9031.9	4^-	1337.7	25 *8*	7694.08	3^-		
		2746.6	25 *8*	6285.15	3^-		
		3418.2	100 *13*	5613.52	4^-		
		3752.9	30 *13*	5278.80	4^+		
		4540.2	70 *13*	4491.43	5^-		
9033?	(7^-)	4542&		4491.43	5^-		E_γ: this γ may correspond to 4540.2γ from 9031.9 level.
9091.70	3^-	1397.5	3.7 *3*	7694.08	3^-		
		1468.6	1.31 *16*	7623.11	$(2^-,3,4^+)$		
		1625.3	0.71 *5*	7466.35	2^+		
		1813.8	2.17 *24*	7277.82	$(2,3)^+$		
		1852.6	1.26 *17*	7239.07	$(3^-,4,5^-)$		
		1977.9	0.95 *16*	7113.73	4^-		

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

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.#
9091.70	3^-	2341.2	0.98 *24*	6750.41	2^-	
		2509.1	1.79 *24*	6582.47	3^-	
		2806.4	8.8 *5*	6285.15	3^-	
		3061.9	4.3 *7*	6029.71	3^+	
		3066.1	5.0 *9*	6025.47	2^-	
		3188.9	2.6 *4*	5902.63	1^-	
		3812.7	14.6 *7*	5278.80	4^+	
		3842.7	7.7 *4*	5248.79	2^+	
		5187.0	16.2 *7*	3904.38	2^+	
		5354.6	100.0 *17*	3736.69	3^-	
9135.66	$2^-,3^-$	710.8	1.72 *15*	8424.81	2^-	
		1263.5	0.55 *9*	7872.18	2^+	
		1441.5	8.9 *4*	7694.08	3^-	
		1603.4	6.3 *4*	7532.26	2^-	
		1857.8	0.43 *7*	7277.82	$(2,3)^+$	
		2021.9	3.13 *21*	7113.73	4^-	
		2185.1	0.78 *14*	6950.48	1^-	
		2385.2	1.06 *15*	6750.41	2^-	
		2553.0	3.5 *3*	6582.47	3^-	
		2850.4	23.5 *7*	6285.15	3^-	
		3110.1	0.43 *17*	6025.47	2^-	
		3232.9	5.1 *4*	5902.63	1^-	
		3522.0	0.51 *17*	5613.52	4^-	
		3886.7	0.8 *3*	5248.79	2^+	
		5230.9	13.6 *7*	3904.38	2^+	
		5398.6	100.0 *15*	3736.69	3^-	
9209.77	$(2,3)^-$	725.7	1.53 *16*	8484.02	$(1^-,2^-,3^-)$	
		785.0	5.4 *3*	8424.81	2^-	
		1515.6	7.3 *3*	7694.08	3^-	
		2096.0	2.60 *20*	7113.73	4^-	
		2259.2	4.5 *3*	6950.48	1^-	
		2459.3	3.2 *3*	6750.41	2^-	
		2627.1	3.6 *3*	6582.47	3^-	
		2924.5	6.5 *3*	6285.15	3^-	
		3184.2	2.6 *3*	6025.47	2^-	
		3307.0	17.4 *5*	5902.63	1^-	
		3580.2	3.4 *3*	5629.41	2^+	
		5305.0	4.7 *5*	3904.38	2^+	
		5472.7	100.0 *16*	3736.69	3^-	
9226.69	$(1^-,2,3^-)$	1694.4	100 *5*	7532.26	2^-	
		2276.1	15.9 *14*	6950.48	1^-	
		2476.2	24.1 *15*	6750.41	2^-	
9226.69	$(1^-,2,3^-)$	2941.4	27.8 *15*	6285.15	3^-	
		3323.9	<3.0	5902.63	1^-	
		3977.7	<14	5248.79	2^+	
		5321.9	<3.1	3904.38	2^+	
		5489.6	39 *3*	3736.69	3^-	
		9225.6	<97	0.0	0^+	
9227.43	$(1,2^+)$	3201.8	35.0 *13*	6025.47	2^-	
		3324.7	<1.0	5902.63	1^-	
		3978.4	<4.7	5248.79	2^+	
		5322.7	<1.0	3904.38	2^+	
		5874.4	100 *3*	3352.62	0^+	
		9226.3	<33	0.0	0^+	
9305.2	(8^+)	1628		7676.6	(6^+)	(Q)
		2375		6930.2	6^+	(Q)
9362.54	3^-	937.7	4.4 *7*	8424.81	2^-	
		1668.4	100.0 *25*	7694.08	3^-	
		1704.3	26.6 *20*	7658.23	4^-	
		1739.4	3.9	7623.11	$(2^-,3,4^+)$	
		2412.0	3.2	6950.48	1^-	
		2612.0	3.7	6750.41	2^-	
		2779.9	6.3 *7*	6582.47	3^-	
		3077.3	9.5 *25*	6285.15	3^-	
		3748.8	29.8 *22*	5613.52	4^-	
		4113.5	10.7 *20*	5248.79	2^+	
		5457.8	14.4 *20*	3904.38	2^+	
		5625.4	8.3 *15*	3736.69	3^-	
9388.20	2^+	1694.0	7	7694.08	3^-	
		2087.4	2.5	7300.67	0^+	
		2845.3	28	6542.80	4^+	
		2880.3	9	6507.87	4^+	
		3102.9	3.2	6285.15	3^-	
		3362.6	6	6025.47	2^-	
		3758.6	19	5629.41	2^+	
		4109.2	15	5278.80	4^+	
		4139.2	8	5248.79	2^+	
		4176.3	28	5211.56	0^+	
		5483.4	8	3904.38	2^+	
		5651.1	17	3736.69	3^-	
		9387.0	100	0.0	0^+	
9404.85	2^-	1872.5	43	7532.26	2^-	
		2127.0	2.2	7277.82	$(2,3)^+$	
		2291.1	20	7113.73	4^-	

Adopted Levels, Gammas (continued)

$\gamma(^{40}\mathrm{Ca})$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ ‡	E_f	J_f^π	Mult.#	δ#	Comments
9404.85	2^-	2454.3	4	6950.48	1^-			
		2496.1	8	6908.70	2^+			
		2822.2	10	6582.47	3^-			
		3119.6	100	6285.15	3^-	M1		Mult.: δ(Q/D)=0.0 *3* in (p,γ), polarity from no level-parity change determined from other experimental evidence.
		3502.1	20	5902.63	1^-			
		5500.1	7	3904.38	2^+			
		5667.7	49	3736.69	3^-	M1+E2	−0.03 *2*	Mult.: D+Q in (p,γ), polarity from no level-parity change determined from other experimental evidence.
		9403.7	7	0.0	0^+			
9418.8	3^-	1724.6	10	7694.08	3^-			
		1760.5	7	7658.23	4^-			
		1795.6	4	7623.11	$(2^-,3,4^+)$			
		1886.5	5	7532.26	2^-			
		2305.0	62	7113.73	4^-			
		2668.3	6	6750.41	2^-			
		3133.5	100	6285.15	3^-			
		3393.2	5	6025.47	2^-			
		3516.0	12	5902.63	1^-			
		3805.1	5	5613.52	4^-			
		4169.8	4	5248.79	2^+			
		5681.7	18	3736.69	3^-			
9429.11	$(3,4)^-$	1734.9	21 *3*	7694.08	3^-			
		1770.8	100 *6*	7658.23	4^-			
		1806.0	3.3 *11*	7623.11	$(2^-,3,4^+)$			
		2315.3	3.6 *8*	7113.73	4^-			
		2846.5	26 *5*	6582.47	3^-			
		3143.8	9.4 *17*	6285.15	3^-			
		4937.3	81 *6*	4491.43	5^-			
		5692.0	33 *6*	3736.69	3^-			
9432.46	1^-	1900.2	2.5	7532.26	2^-			
		2481.9	0.8	6950.48	1^-			
		2681.9	1.0	6750.41	2^-			
		3406.8	2.3	6025.47	2^-			
		5527.7	1.1	3904.38	2^+			
		9431.3	100	0.0	0^+			
9453.95	3^-	1029.1	4.9 *6*	8424.81	2^-			
		1759.8	73.2 *23*	7694.08	3^-			
		1795.7	23.4 *20*	7658.23	4^-			
		1830.8	5.9 *10*	7623.11	$(2^-,3,4^+)$			
		1921.6	3.3 *7*	7532.26	2^-			
		2007.7	2.3 *7*	7446.23	$3^+,4^+$			

$^{40}_{20}\mathrm{Ca}_{20}$-36

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

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[#]	δ[#]	Comments
9453.95	3^-	2340.2	34.7 *17*	7113.73	4^-			
		2703.4	6.9 *7*	6750.41	2^-			
		3168.7	100.0 *23*	6285.15	3^-			
		3428.3	5.9 *10*	6025.47	2^-			
		3824.3	8.3 *10*	5629.41	2^+			
		3840.2	33.7 *20*	5613.52	4^-			
		4174.9	5	5278.80	4^+			
		5549.2	16.2 *20*	3904.38	2^+			
		5716.8	11.2 *13*	3736.69	3^-			
9603.0	3^-	2489.2	61	7113.73	4^-			
		3317.7	100	6285.15	3^-	M1+E2	0.42 *6*	Mult.,δ: D+Q from (p,γ), polarity form no level-parity change determined from other experimental evidence.
		5865.8	24	3736.69	3^-	M1+E2	+0.18 *3*	Mult.,δ: D+Q from (p,γ), polarity form no level-parity change determined from other experimental evidence.
9604.6	1^-	2072.3	6	7532.26	2^-			
		2654.0	1.3	6950.48	1^-			
		2854.1	2.0	6750.41	2^-			
		3579.0	5	6025.47	2^-			
		5699.8	1.0	3904.38	2^+			
		6251.4	1.4	3352.62	0^+			
		9603.4	100	0.0	0^+			
9640.89	2^-	2174.5	16.7 *6*	7466.35	2^+			
		2690.3	0.32 *6*	6950.48	1^-			
		2732.1	1.06 *11*	6908.70	2^+			
		3355.6	0.99 *23*	6285.15	3^-			
		4011.2	9.94 *21*	5629.41	2^+			
		5736.1	100.0 *11*	3904.38	2^+			
		5903.7	82.5 *11*	3736.69	3^-			
		9639.6	3.2	0.0	0^+			
9668.71	3^-	1974.5	1.5 *3*	7694.08	3^-			
		2136.4	4.1 *4*	7532.26	2^-			
		2222.4	1.53 *25*	7446.23	$3^+,4^+$			
		2554.9	60.6 *16*	7113.73	4^-			
		2759.9	1.5 *3*	6908.70	2^+			
		2918.2	4.6 *4*	6750.41	2^-			
		3383.4	100.0 *14*	6285.15	3^-			
		3643.1	6.8 *7*	6025.47	2^-			
		5176.9	6.76 *23*	4491.43	5^-			
		5763.9	8.1 *5*	3904.38	2^+			
		5931.6	29.7 *14*	3736.69	3^-			
9779.47	3	1031.3	17.1 *15*	8748.22	2^+			
		1101.2	16.6 *20*	8678.29	4^+			

$^{40}_{20}Ca_{20}$-37

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

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	Comments
9779.47	3	1200.7	25.1 *15*	8578.80	2^+			
		1644.7	13.6 *10*	8134.77	(3^-)			
		1851.0	26.6 *15*	7928.42	4^+			
		1907.3	28.6 *25*	7872.18	2^+			
		2218.2	95 *4*	7561.17	4^+			
		2313.1	15	7466.35	2^+			
		2870.7	21.1 *25*	6908.70	2^+			
		3196.8	7.5 *20*	6582.47	3^-			
		3236.6	6.5 *15*	6542.80	4^+			
		3271.5	3.5 *10*	6507.87	4^+			
		3749.6	6	6029.71	3^+			
		4149.8	10.1 *10*	5629.41	2^+			
		4165.7	100 *4*	5613.52	4^-	D+Q	+0.07 *4*	Mult.,δ: from (p,γ).
		4500.4	27.1 *20*	5278.80	4^+			
		4530.4	3.5 *10*	5248.79	2^+			
		5874.7	73 *5*	3904.38	2^+			
		6042.3	27 *3*	3736.69	3^-			
9785.3	$(1,2^+)$	2484.5	2.6	7300.67	0^+			
		2876.5	0.8	6908.70	2^+			
		5880.5	2.9	3904.38	2^+			
		6432.1	11	3352.62	0^+			
		9784.0	100	0.0	0^+			
9853.5	(8^+)	1880		7974.4	(6^+)	(Q)		
		2176		7676.6	(6^+)	(Q)		
		2921		6930.2	6^+	(Q)		
9865.15	1	1426.1	0.25 *7*	8439.0	0^+			
		1773.5	1.02 *11*	8091.61	2^+			
		1992.9	0.29 *4*	7872.18	2^+			
		2163.3	0.74 *25*	7701.8	0^+			
		2398.7	0.57 *9*	7466.35	2^+			
		2564.3	4.5 *3*	7300.67	0^+			
		2587.2	0.28 *10*	7277.82	$(2,3)^+$			
		2914.6	0.45 *6*	6950.48	1^-			
		2956.3	1.54 *14*	6908.70	2^+			
		3114.6	0.29 *3*	6750.41	2^-			
		3962.3	0.48 *7*	5902.63	1^-			
		4235.5	0.57 *10*	5629.41	2^+			
		4616.1	0.35 *4*	5248.79	2^+			
		4653.2	0.64 *10*	5211.56	0^+			
		5960.3	7.1 *3*	3904.38	2^+	D+Q	−0.18 *3*	Mult.,δ: from (p,γ).
		6512.0	21.0 *7*	3352.62	0^+			
		9863.8 *20*	100.0 *17*	0.0	0^+			

$^{40}_{20}Ca_{20}$-38

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

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[#]	δ[#]	Comments
9869.3	$1^+,2^+$	2167.4	1.1	7701.8	0^+			
		2568.5	3.0	7300.67	0^+			
		2960.5	1.2	6908.70	2^+			
		4620.2	1.1	5248.79	2^+			
		4657.3	0.8	5211.56	0^+			
		5964.4	7	3904.38	2^+			
		6516.1	17	3352.62	0^+			
		9868.0	100	0.0	0^+			
9954.00	4^+	1580.0	6.5 *5*	8373.94	4^+			
		3022.6	5.2 *5*	6931.29	3^-			
		3371.3	2.1 *5*	6582.47	3^-			
		3411.1	18.2 *10*	6542.80	4^+			
		3446.0	7.2 *4*	6507.87	4^+			
		4340.2	8.2 *7*	5613.52	4^-			
		4674.9	100 *3*	5278.80	4^+	M1+E2	+0.04 *3*	Mult.,δ: from γ(pol) in (p,γ).
		5462.2	4.6 *7*	4491.43	5^-			
		6216.8	11.2 *10*	3736.69	3^-			
10040.54	$(2^-,3^-)$	1276.3	10.4 *14*	8764.18	3^-			
		1556.5	3.5 *6*	8484.02	$(1^-,2^-,3^-)$			
		1717.3	100.0 *19*	8323.16	$(1^-,2^+)$			
		2417.4	4.4 *6*	7623.11	$(2^-,3,4^+)$			
		2508.2	1.8 *4*	7532.26	2^-			
		2762.6	16.1 *6*	7277.82	$(2,3)^+$			
		2926.7	8.5 *6*	7113.73	4^-			
		3089.9	12.8 *12*	6950.48	1^-			
		3457.8	2.7 *4*	6582.47	3^-			
		4014.9	3.9 *4*	6025.47	2^-			
		4137.7	26.3 *12*	5902.63	1^-			
		6303.3	3.9 *4*	3736.69	3^-			
10049.38	4^-	1017.5	26.3 *12*	9031.9	4^-			
		1861.6	1.17 *12*	8187.5	$(3,4,5^-)$			
		2279.9	5.4 *3*	7769.4	$(3,4,5^-)$			
		2810.2	1.7 *3*	7239.07	$(3^-,4,5^-)$			
		2935.5	32.0 *9*	7113.73	4^-			
		3466.7	16.7 *7*	6582.47	3^-			
		3764.0	2.88 *21*	6285.15	3^-			
		4023.7	2.97 *23*	6025.47	2^-			
		4435.6	2.17 *21*	5613.52	4^-			
		5557.5	37.3 *9*	4491.43	5^-			
		6312.2	100.0 *21*	3736.69	3^-			
10262.53	3^-	2639.3	3.9 *6*	7623.11	$(2^-,3,4^+)$			
		2796.1	43.3 *25*	7466.35	2^+			

$^{40}_{20}Ca_{20}$-39

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

E_i(level)	J^π_i	E_γ †	I_γ ‡	E_f	J^π_f	Mult. #	δ #	Comments
10262.53	3^-	2816.2	13.1 *11*	7446.23	$3^+,4^+$			
		3148.7	3.9 *8*	7113.1	1^-			
		3679.8	11.4 *8*	6582.47	3^-			
		4232.6	45 *4*	6029.71	3^+			
		4359.7	7.5 *11*	5902.63	1^-			
		4632.8	8.1 *11*	5629.41	2^+			
		5013.4	10.0 *11*	5248.79	2^+			
		6357.6	100 *3*	3904.38	2^+			
		6525.3	32 *3*	3736.69	3^-			
10318.8	1^+	2616.9	0.86 *9*	7701.8	0^+			
		3368.2	0.50 *9*	6950.48	1^-			
		4689.1	0.33 *9*	5629.41	2^+			
		5106.8	0.93 *7*	5211.56	0^+			
		6413.9	4.12 *24*	3904.38	2^+	M1+E2	−0.16 *3*	Mult.,δ: D+Q from (p,γ), polarity from no level-parity change determined from other evidence.
		6965.5	14.4 *5*	3352.62	0^+			
		10317.4	100.0 *9*	0.0	0^+			
10415.06	3	2720.8	2.3 *12*	7694.08	3^-			
		2791.8	96 *3*	7623.11	$(2^-,3,4^+)$			
		2853.8	6.5 *6*	7561.17	4^+			
		2948.6	33.9 *12*	7466.35	2^+			
		2968.7	100.0 *23*	7446.23	$3^+,4^+$			
		3137.1	5.1 *8*	7277.82	$(2,3)^+$			
		3301.2	9.0 *10*	7113.73	4^-			
		3483.6	23.0 *12*	6931.29	3^-			
		3506.2	90.2 *23*	6908.70	2^+			
		3664.5	14.4 *6*	6750.41	2^-			
		3832.3	7.7 *8*	6582.47	3^-			
		3907.0	5.9 *9*	6507.87	4^+			
		4129.7	2.1 *5*	6285.15	3^-			
		4389.3	33.9 *17*	6025.47	2^-			
		4785.3	4.7 *9*	5629.41	2^+			
		4801.2	39.7 *17*	5613.52	4^-			
		5135.9	15.5 *12*	5278.80	4^+			
		5165.9	9.7 *10*	5248.79	2^+			
		6510.1	20.1 *17*	3904.38	2^+			
		6677.8	40.8 *23*	3736.69	3^-			
10474	(8^-)	1773		8701	(6^-)			
10639.07	$(3^-,4,5^-)$	2504.2	3.1 *5*	8134.77	(3^-)			
		3525.2	9.5 *7*	7113.73	4^-			
		3707.6	100 *3*	6931.29	3^-			
		4056.3	3.8 *5*	6582.47	3^-			

$^{40}_{20}Ca_{20}$-40

Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f	Mult.#
10639.07	$(3^-,4,5^-)$	4096.1	6.89 *24*	6542.80	4^+	
		4131.0	9.5 *5*	6507.87	4^+	
		5025.2	32.3 *14*	5613.52	4^-	
		5359.9	10.5 *10*	5278.80	4^+	
		6147.1	8.6 *7*	4491.43	5^-	
		6901.7	53.4 *24*	3736.69	3^-	
10699.50	3	2325.5	2.0 *3*	8373.94	4^+	
		2607.8	1.40 *18*	8091.61	2^+	
		3167.1	2.0 *3*	7532.26	2^-	
		3233.0	1.8 *4*	7466.35	2^+	
		3253.1	1.8 *3*	7446.23	$3^+,4^+$	
		3790.6	5.1 *4*	6908.70	2^+	
		4156.5	3.9 *4*	6542.80	4^+	
		4414.1	2.7 *4*	6285.15	3^-	
		4669.5	7.4 *6*	6029.71	3^+	
		5069.7	10.7 *6*	5629.41	2^+	
		5085.6	3.9 *4*	5613.52	4^-	
		5420.3	17.9 *10*	5278.80	4^+	
		6794.5	100 *3*	3904.38	2^+	
		6962.2	16 *3*	3736.69	3^-	
10737.7	1^-	3043.4	17 *3*	7694.08	3^-	
		3828.8	8 *3*	6908.70	2^+	
		4452.3	14.2 *24*	6285.15	3^-	
		10736.2	100 *6*	0.0	0^+	
10747.8	(4^+)	5118.0	14.8 *11*	5629.41	2^+	
		6842.8	100.0 *12*	3904.38	2^+	
		7010.5	3.8 *7*	3736.69	3^-	
10770.2	(1^+)	3656.3	7.9 *17*	7113.1	1^-	
		3861.3	14.3 *17*	6908.70	2^+	
		5521.0	100 *5*	5248.79	2^+	
		10768.6	76 *5*	0.0	0^+	
10895	(9^-)	1862		9033?	(7^-)	(Q)
10910.0	$(3,4,5^-)$	7172.6	100	3736.69	3^-	
10921.1	$(2^+,3,4^-)$	4895.3	20	6025.47	2^-	
		5641.9	100	5278.80	4^+	
10956.0	3^-	2768.2	11	8187.5	$(3,4,5^-)$	
		3474.8	23	7481?		
		5053.0	23	5902.63	1^-	
		5342.1	18	5613.52	4^-	
		5676.8	100	5278.80	4^+	
		7218.6	57	3736.69	3^-	

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

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[#]
10988.0	$(3^-,4^+)$	2010[&]	12	8978	$5^+,6^+,7^+$	
		4079.1	12	6908.70	2^+	
		4702.6	25	6285.15	3^-	
		5358.2	25	5629.41	2^+	
		7083.0	100	3904.38	2^+	
		7250.6	88	3736.69	3^-	
10994.7	$(2^+,3,4^+)$	5715.5		5278.80	4^+	
		5745.3		5248.79	2^+	
		7257.3		3736.69	3^-	
11003.0	(10^+)	1698		9305.2	(8^+)	(Q)
		2902		8100.1	8^+	(Q)
11011.0	3^-	2672.9	27 *7*	8338.0	$(2^+,3,4)$	
		3334.3	16 *4*	7676.6	(6^+)	[E3]
		6519.0	100 *7*	4491.43	5^-	[E2]
		7273.6	29	3736.69	3^-	
		11009.4	14	0.0	0^+	[E3]
11042.0	$(1^-$ to $4^+)$	7136.9		3904.38	2^+	
		7304.6		3736.69	3^-	
11070.6	$(3,4^+)$	5456.1	8	5613.52	4^-	
		5790.7	15	5278.80	4^+	
		5820.7	15	5248.79	2^+	
		7164.9	100	3904.38	2^+	
		7332.6	15	3736.69	3^-	
11078.4	1^-	11078		0.0	0^+	
11685.8	(10^+)	2381		9305.2	(8^+)	(Q)
		3585		8100.1	8^+	(Q)
11708.7	(9^+)	2773		8935.8	(7^+)	(Q)
11988	0^+	1666.5[@] *4*	75 *9*	10318.8	1^+	
		2119.5 *4*	100 *9*	9869.3	$1^+,2^+$	
12201.2	3^-	12202		0.0	0^+	[E3]
12331	2^+	12332		0.0	0^+	
12334.9	(10^+)	2481		9853.5	(8^+)	(Q)
		3030		9305.2	(8^+)	(Q)
12591.9	(10^+)	3287		9305.2	(8^+)	(Q)
		4491		8100.1	8^+	(Q)
12604		12602		0.0	0^+	
12668	1^-	9314		3352.62	0^+	
		12666		0.0	0^+	
12688		12686		0.0	0^+	
12875		9521		3352.62	0^+	
		12873		0.0	0^+	

$^{40}_{20}Ca_{20}$-42

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

E_i(level)	J^π_i	E_γ[†]	E_f	J^π_f	Mult.[#]	Comments
12923	(11$^-$)	2028	10895	(9$^-$)		
12980		12978	0.0	0$^+$		
12996		9642	3352.62	0$^+$		
13086		13084	0.0	0$^+$		
13113		9759	3352.62	0$^+$		
		13111	0.0	0$^+$		
13115.1	(12$^+$)	1429	11685.8	(10$^+$)	(Q)	
		2112	11003.0	(10$^+$)	(Q)	
13194		9840	3352.62	0$^+$		
		13192	0.0	0$^+$		
13195	(10$^-$)	2300	10895	(9$^-$)		
13203		13201	0.0	0$^+$		
13289		9935	3352.62	0$^+$		
		13287	0.0	0$^+$		
13535.5	(11$^+$)	1827	11708.7	(9$^+$)	(Q)	
13822		13819	0.0	0$^+$		
13913		10559	3352.62	0$^+$		
		13910	0.0	0$^+$		
13993		10639	3352.62	0$^+$		
		13990	0.0	0$^+$		
14232.4	(12$^+$)	2547	11685.8	(10$^+$)	(Q)	
		3229	11003.0	(10$^+$)	(Q)	
15152.4	(13$^+$)	1617	13535.5	(11$^+$)	(Q)	
		2037	13115.1	(12$^+$)	(D)	
15267.1	(12$^+$)	2932	12334.9	(10$^+$)	(Q)	
15306	(13$^-$)	2383	12923	(11$^-$)		
15748.1	(12$^+$)	3156	12591.9	(10$^+$)	(Q)	
16529.4	(14$^+$)	2297	14232.4	(12$^+$)	(Q)	
		3414	13115.1	(12$^+$)	(Q)	
16579.7	(13$^+$)	3044	13535.5	(11$^+$)	(Q)	
17698.6	(14$^+$)	3466	14232.4	(12$^+$)	(Q)	
18054.6	(14$^+$)	3822	14232.4	(12$^+$)	(Q)	
18215?	(15$^-$)	2909[&]	15306	(13$^-$)		
18260	1	18256	0.0	0$^+$	D	Mult.: from $\gamma(\theta)$ in (p,γ).
18497.2	(14$^+$)	3230	15267.1	(12$^+$)	(Q)	
18680	1	18675	0.0	0$^+$	D	
18719.2	(14$^+$)	3452	15267.1	(12$^+$)	(Q)	
19070	1	19065	0.0	0$^+$	D	
19195.6	(15$^+$)	4043	15152.4	(13$^+$)	(Q)	
19450	1	19445	0.0	0$^+$	D	
19850	1	19845	0.0	0$^+$	D	

$^{40}_{20}$Ca$_{20}$-43

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

E_i(level)	J_i^π	E_γ †	E_f	J_f^π	Mult. #
20130		20125	0.0	0^+	
20430	1	20424	0.0	0^+	D
20578.6	(16^+)	4049	16529.4	(14^+)	(Q)
20650	1	20644	0.0	0^+	D
20940	1	20934	0.0	0^+	D
21490		21484	0.0	0^+	
21690		21684	0.0	0^+	
22060		22053	0.0	0^+	
22060.4	(16^+)	3563	18497.2	(14^+)	(Q)

† Values with uncertainties are averaged values from different γ-ray studies. A large number of values without uncertainties are from ^{39}K(p,γ), which are from level-energy differences since most γ-ray energies are not available. In ^{39}K(p,γ), many γ rays are shown with upper limits on intensities, these are not given here. See ^{39}K(p,γ) for details.

‡ Averaged values from different γ-ray studies if available, but most values are available only from ^{39}K(p,γ).

From $\gamma(\theta)$ in (HI,xnγ) and (p,p$'\gamma$), unless otherwise noted.

@ Poor fit. Level-energy difference=1669.2.

& Placement of transition in the level scheme is uncertain.

$^{40}_{20}Ca_{20}$-44

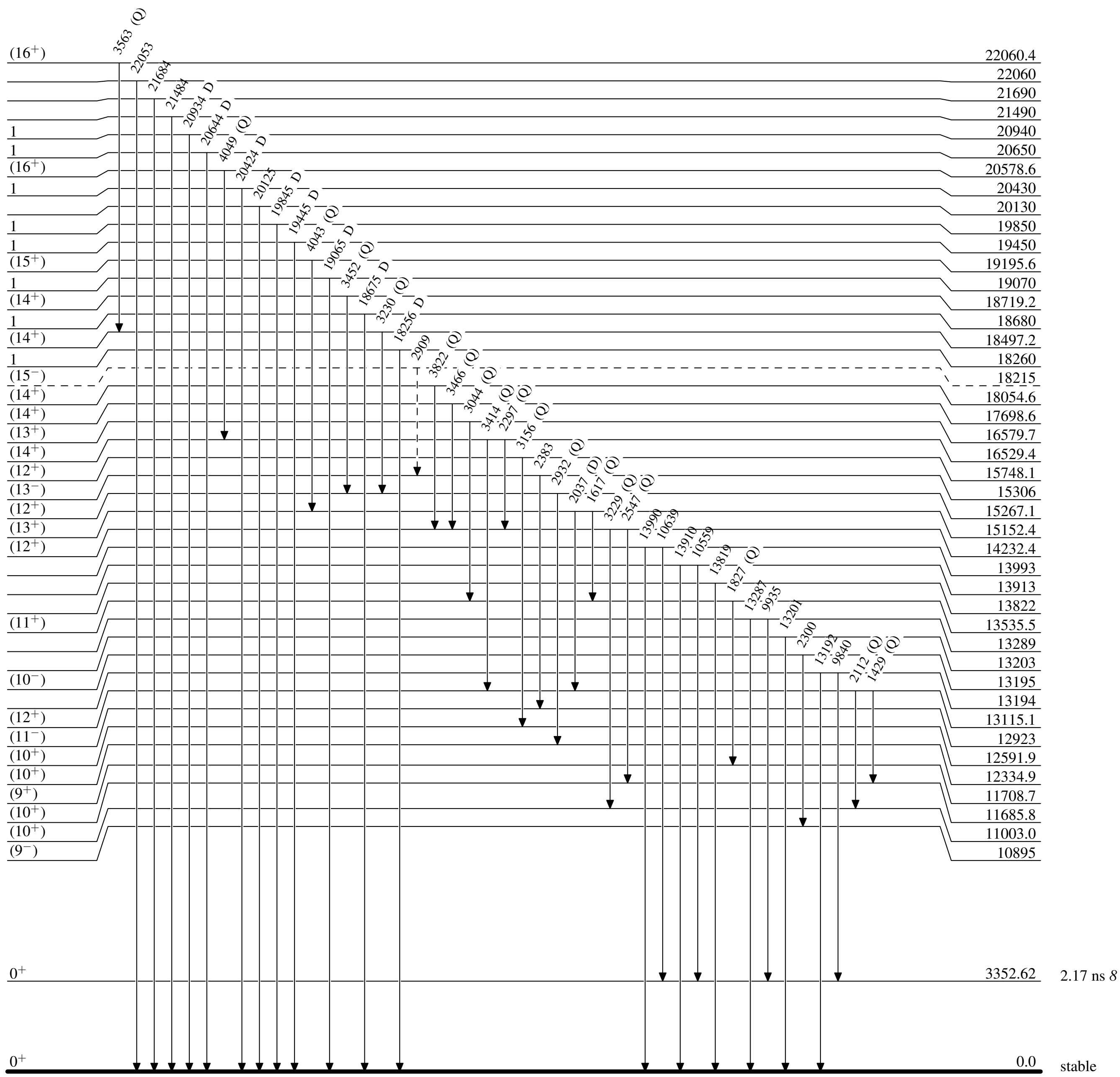
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

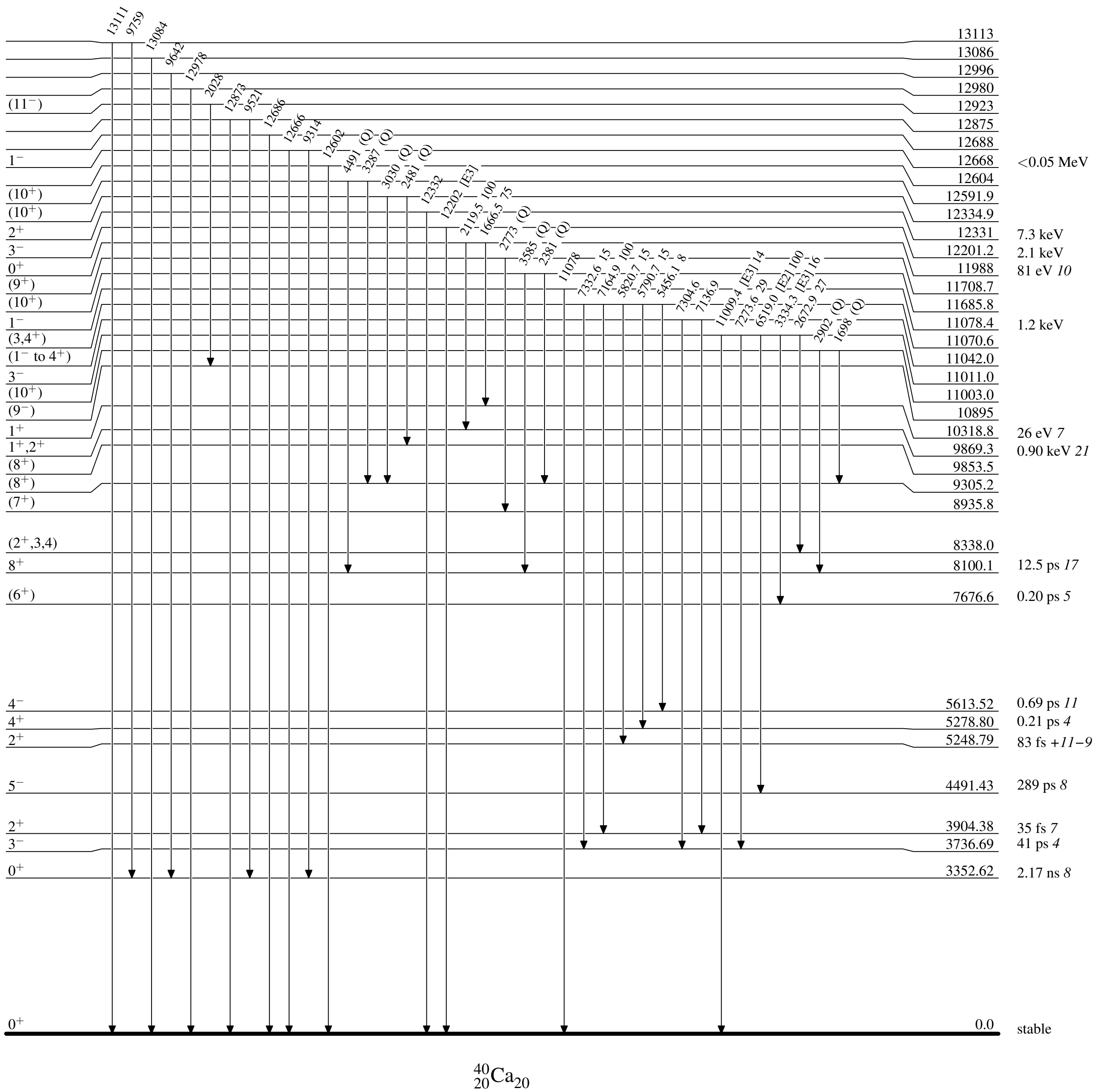


$^{40}_{20}$Ca$_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



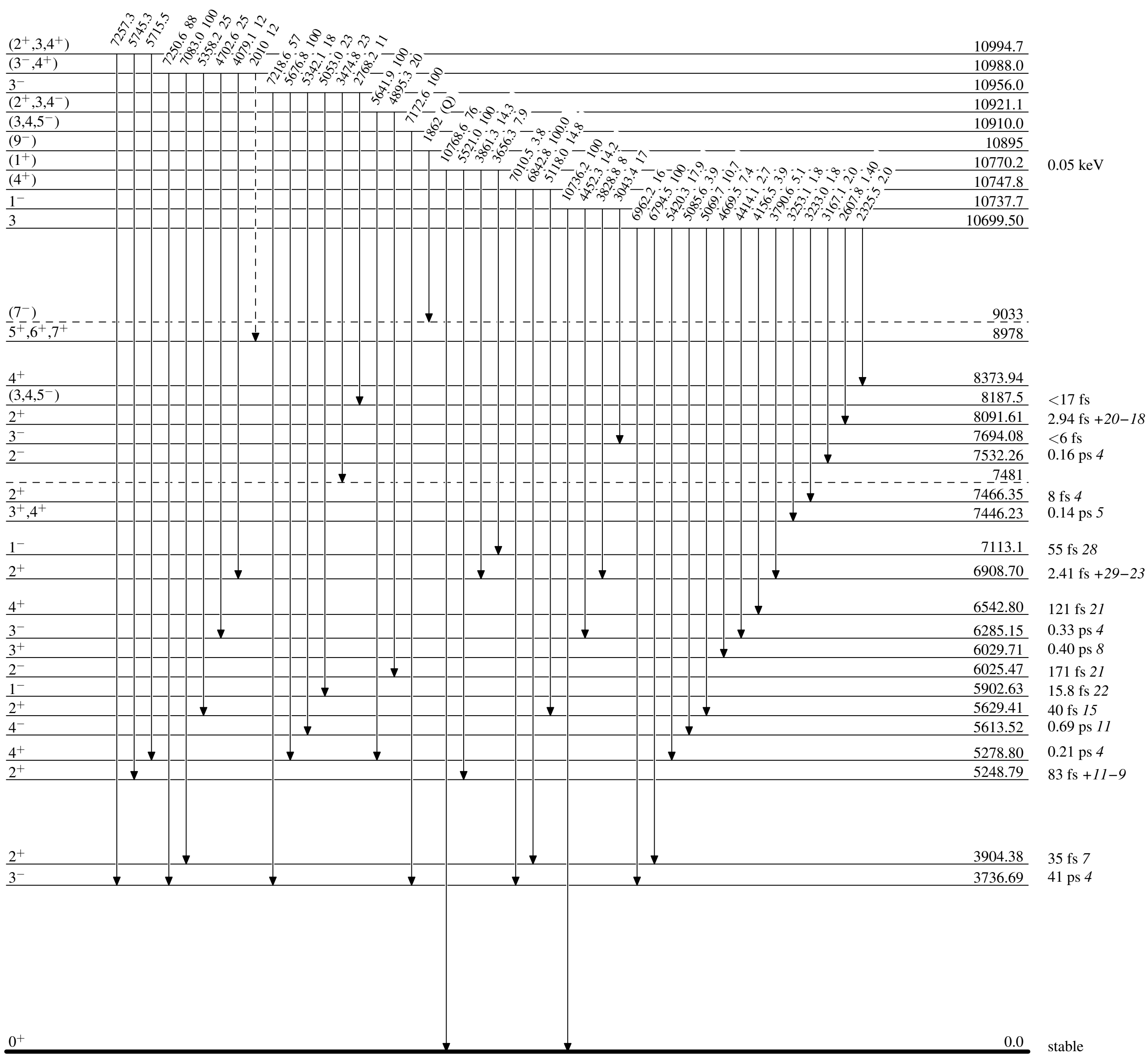
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

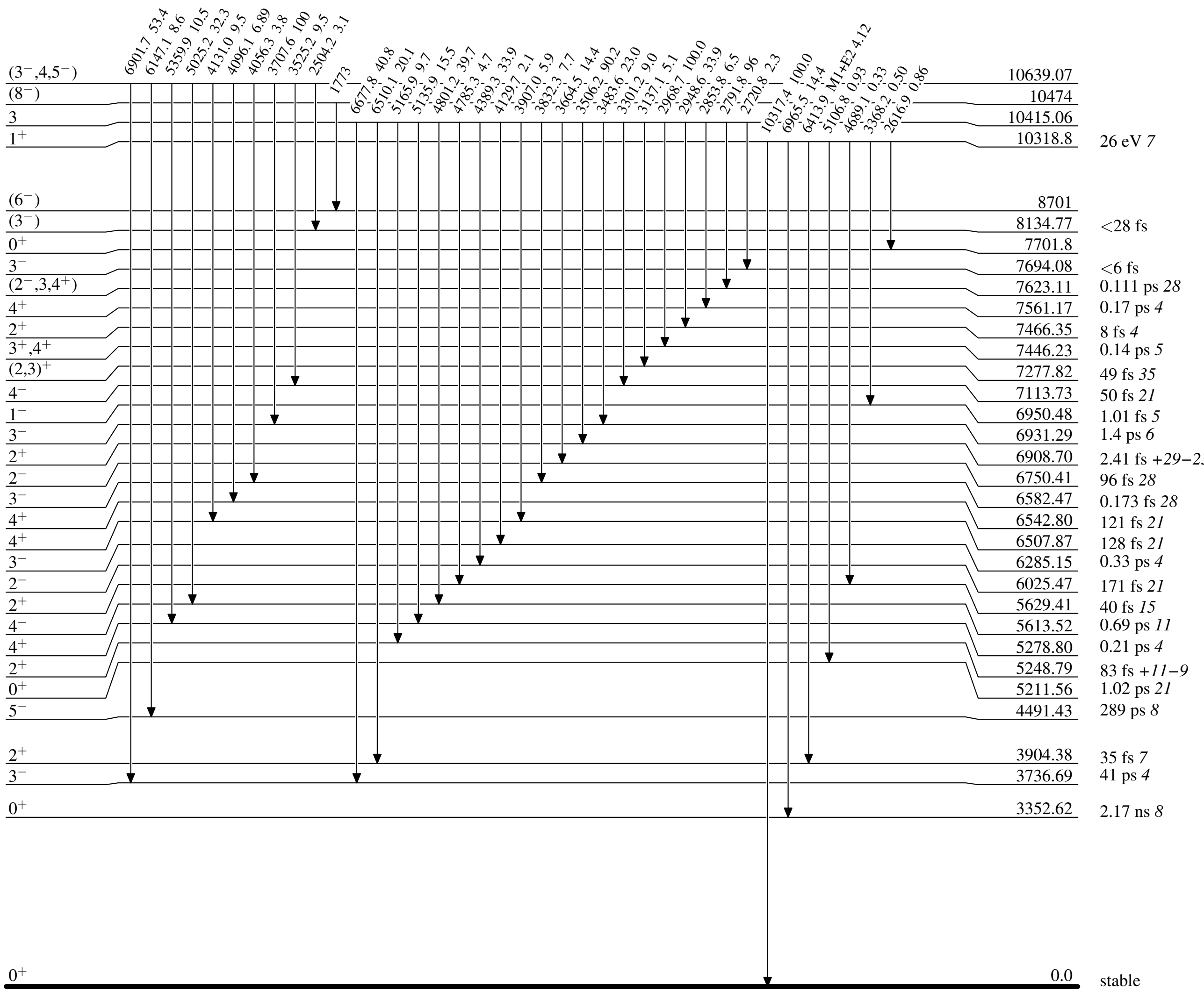


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

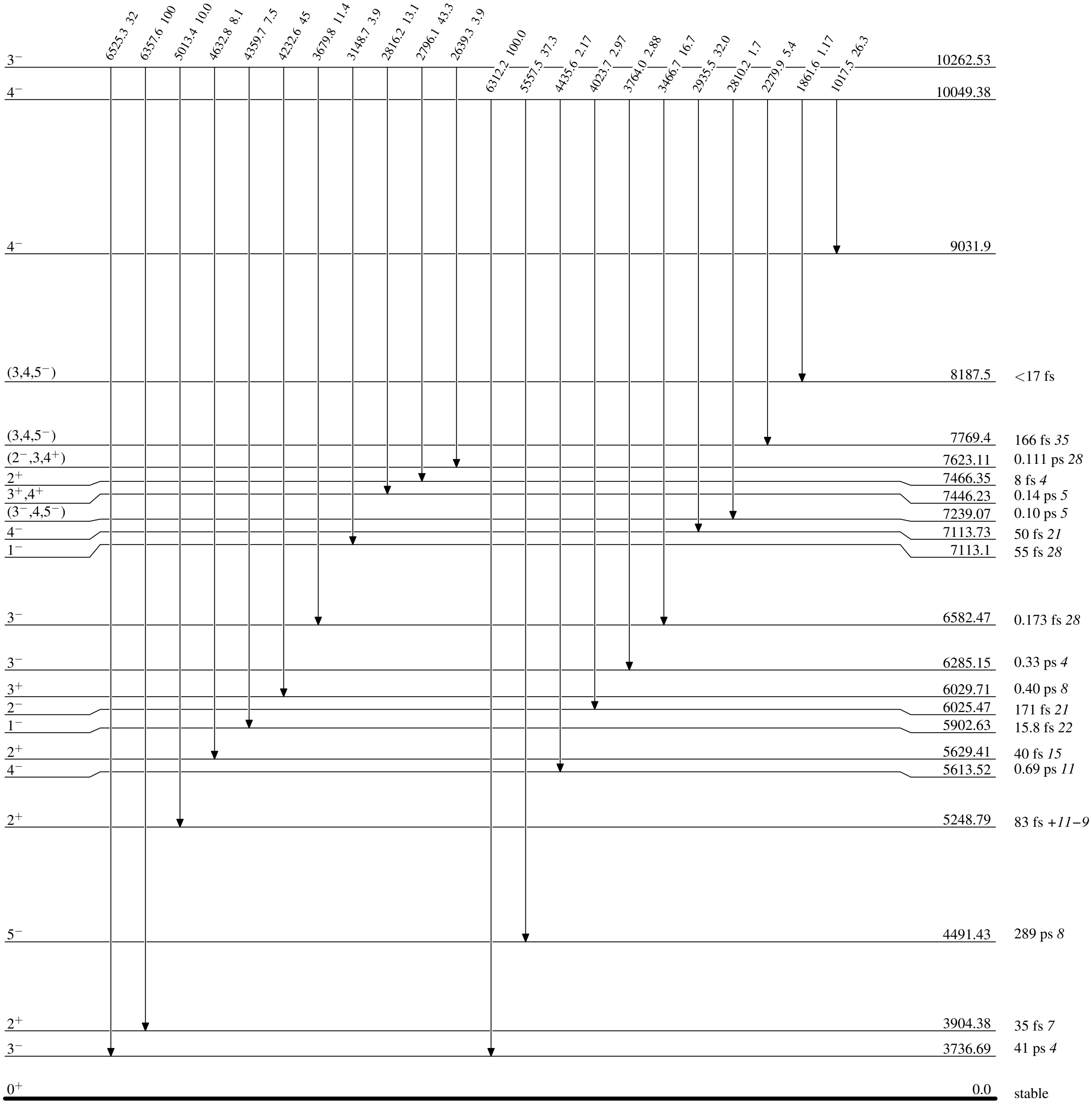
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

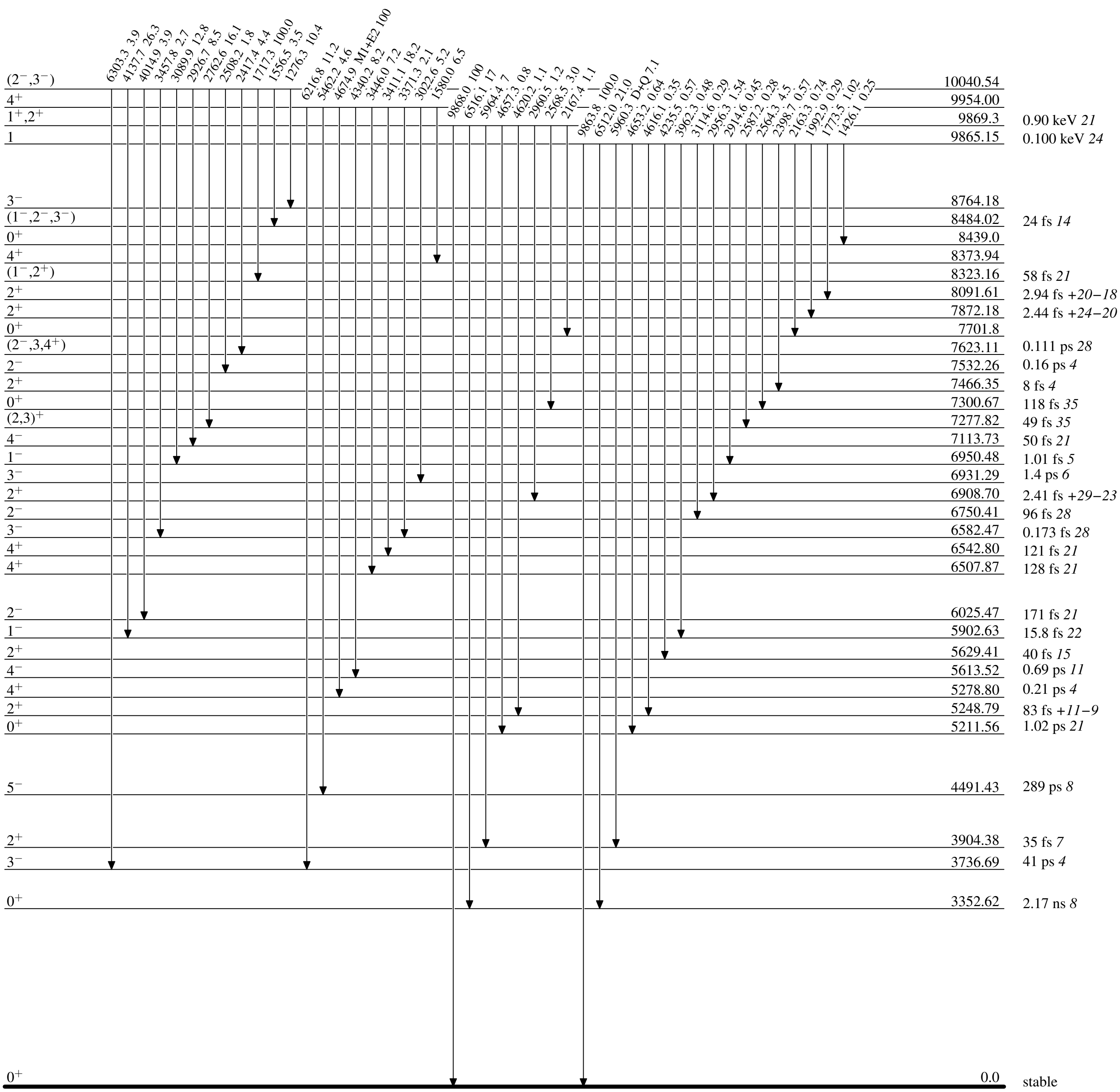


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

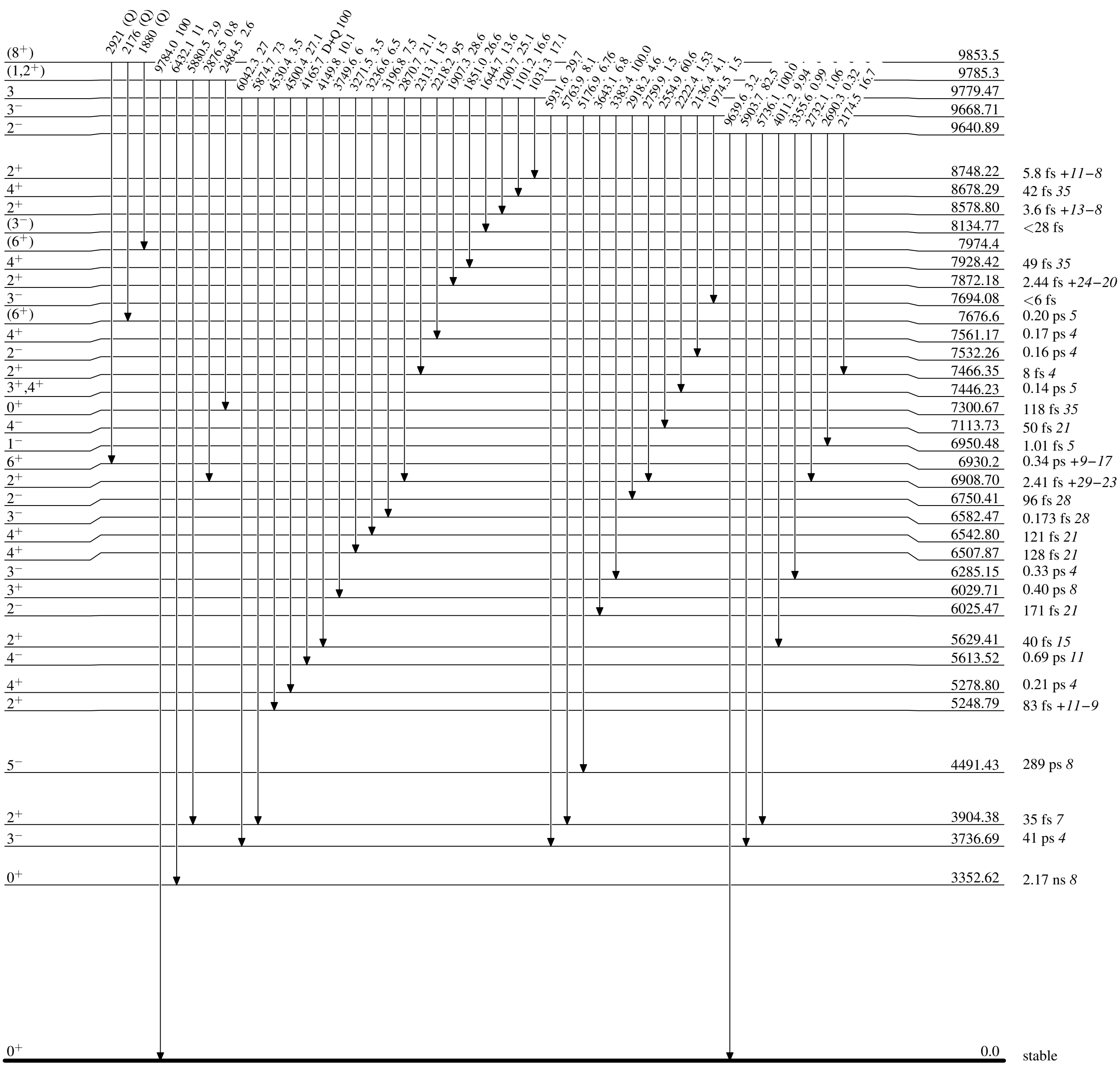


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

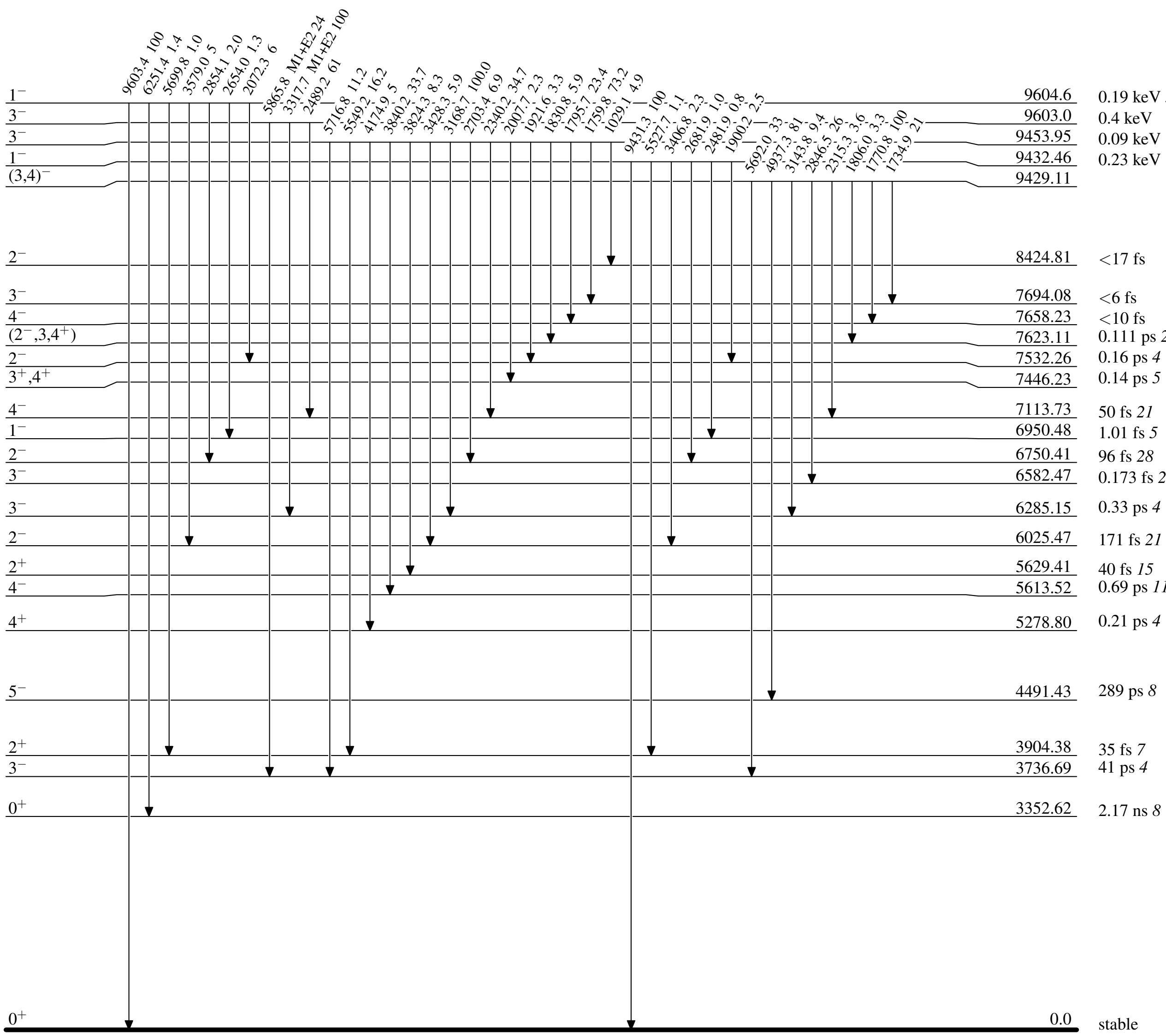


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

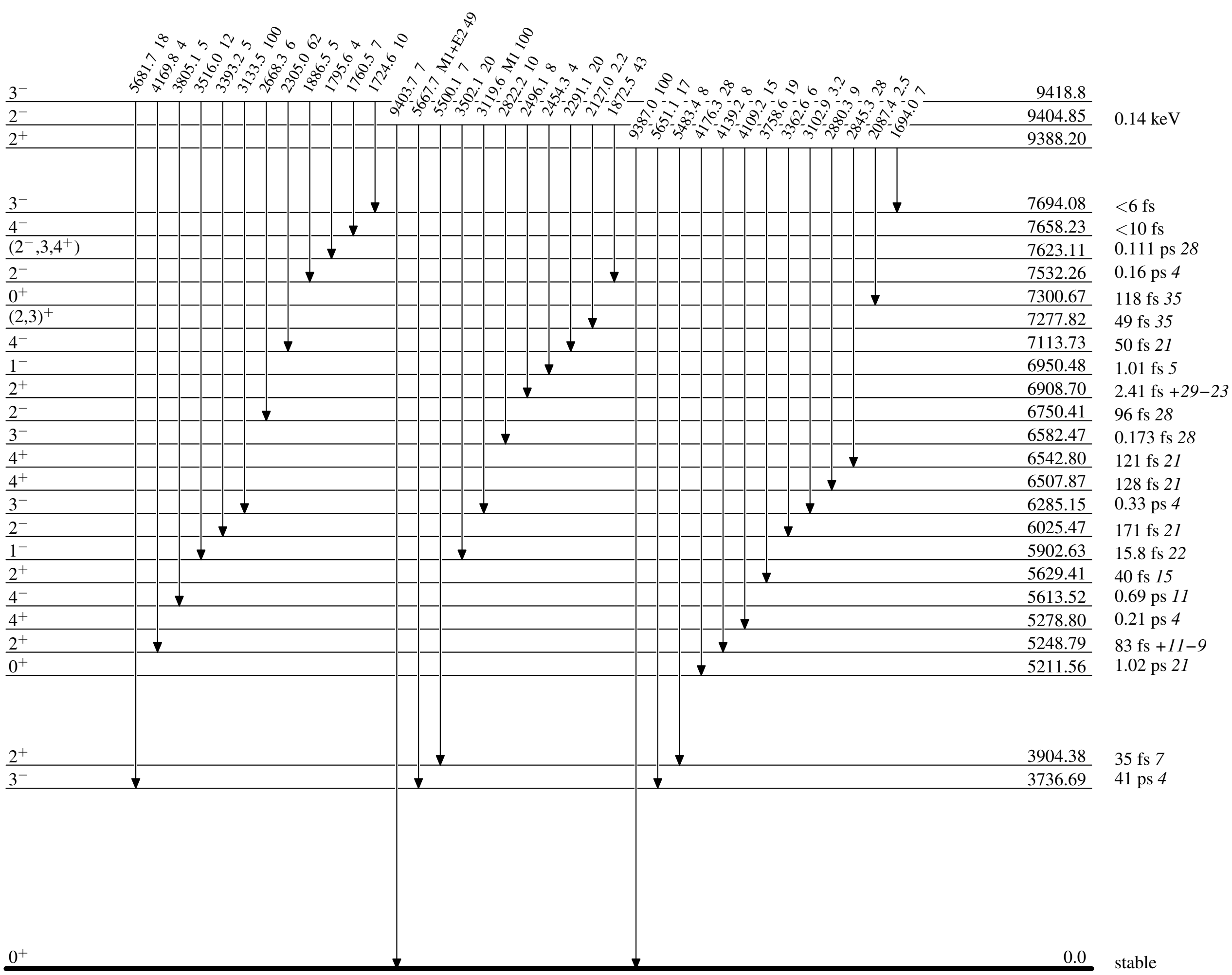


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

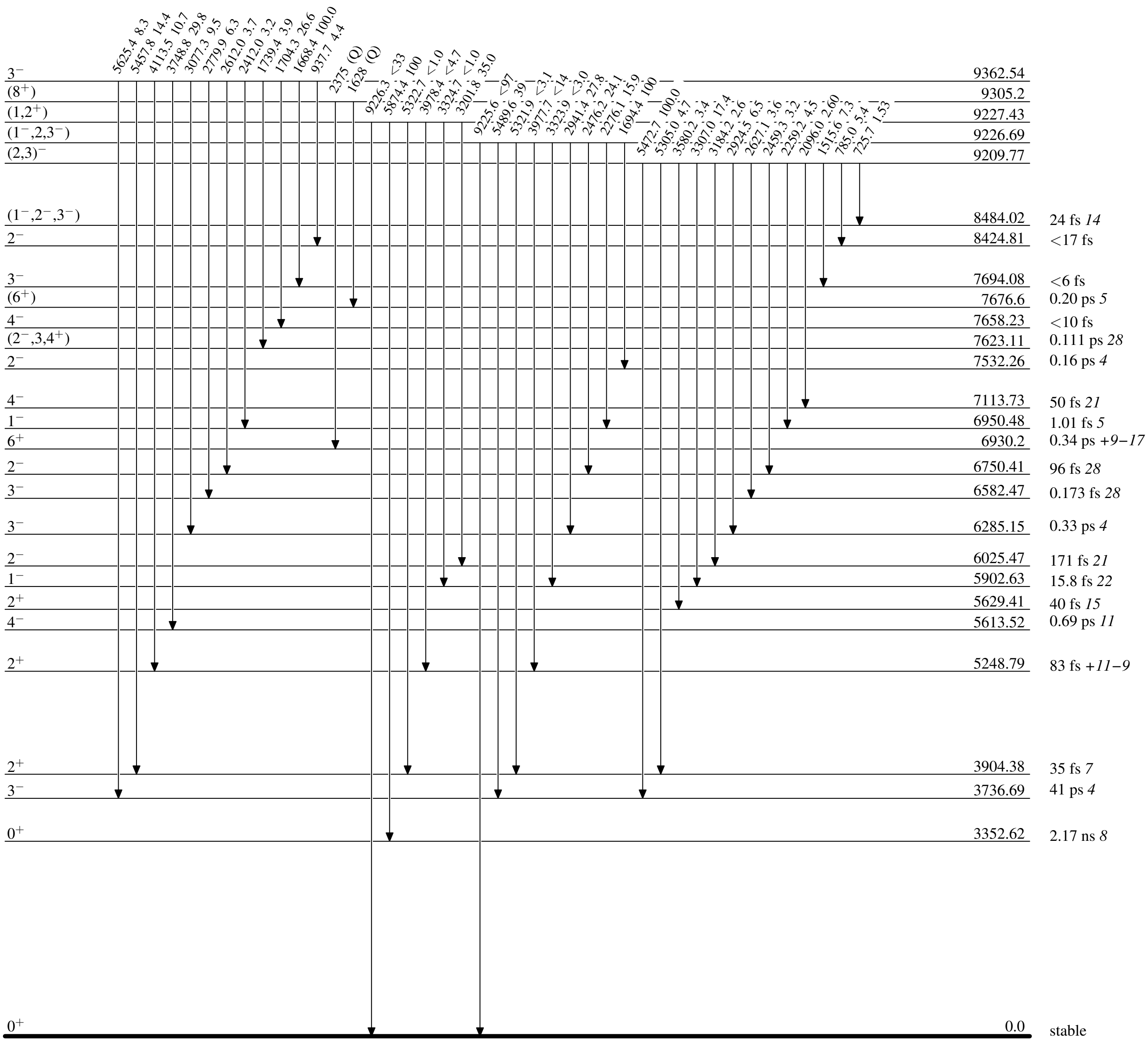


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



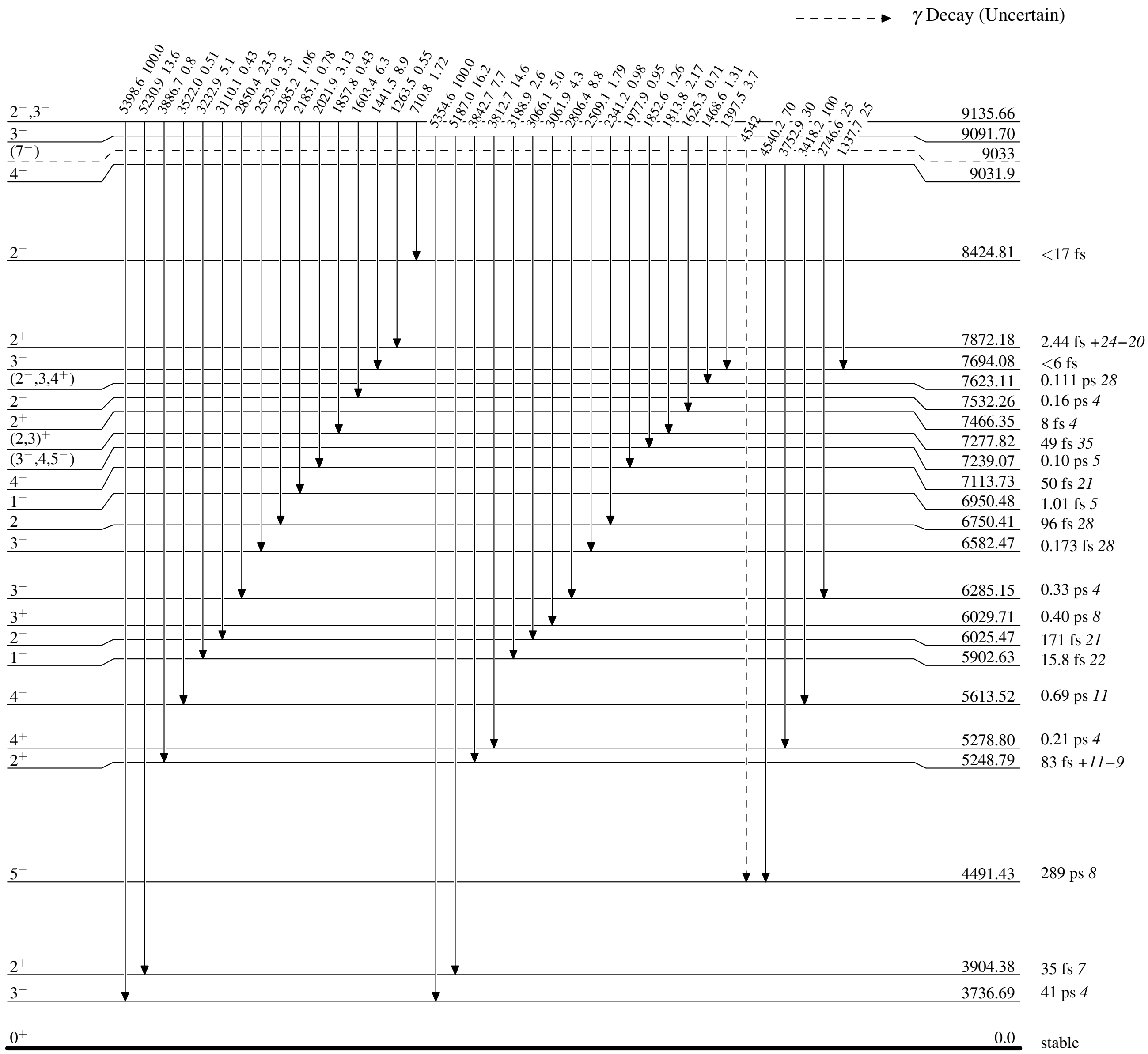
$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

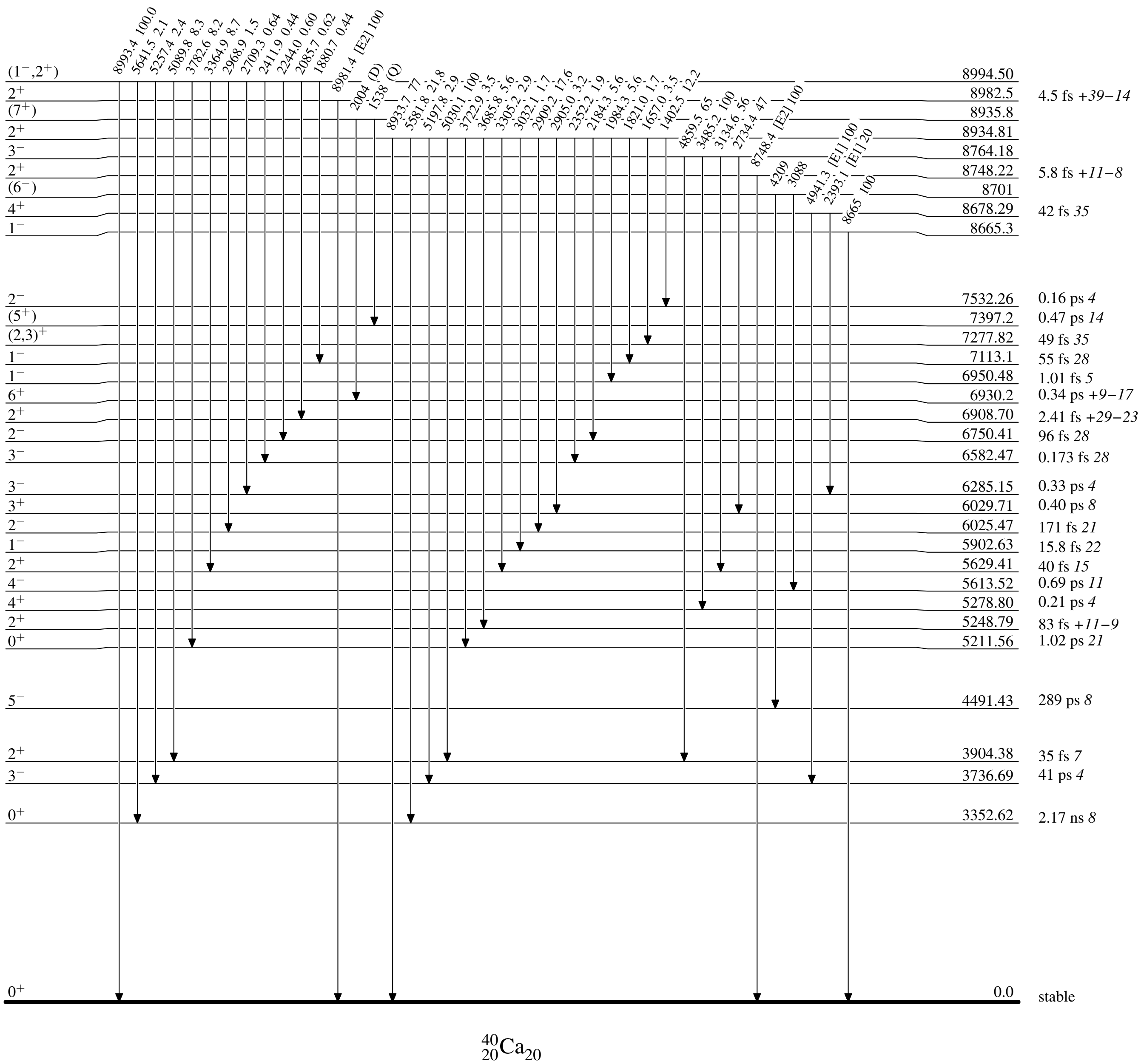


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



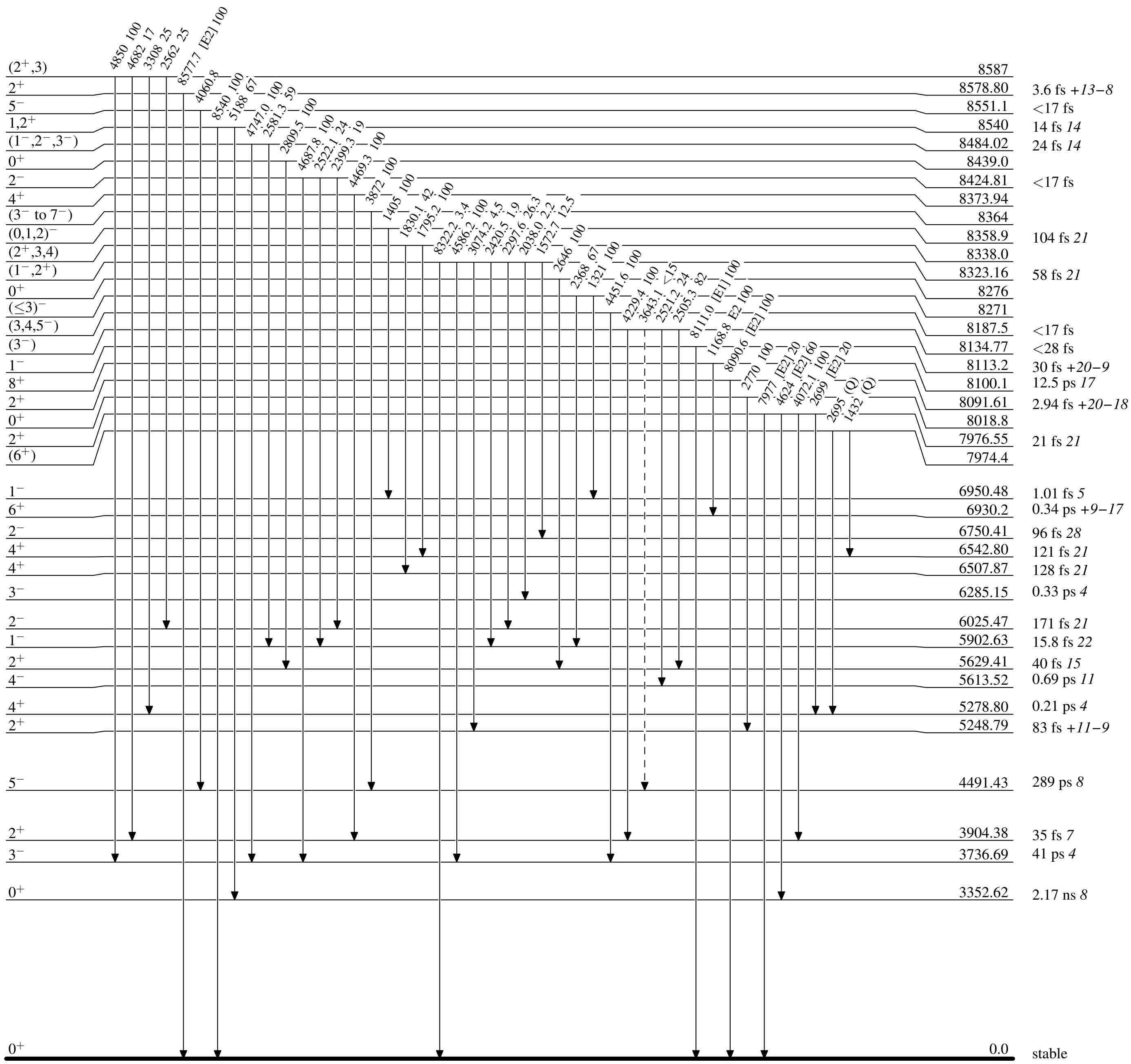
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

Legend

γ Decay (Uncertain)

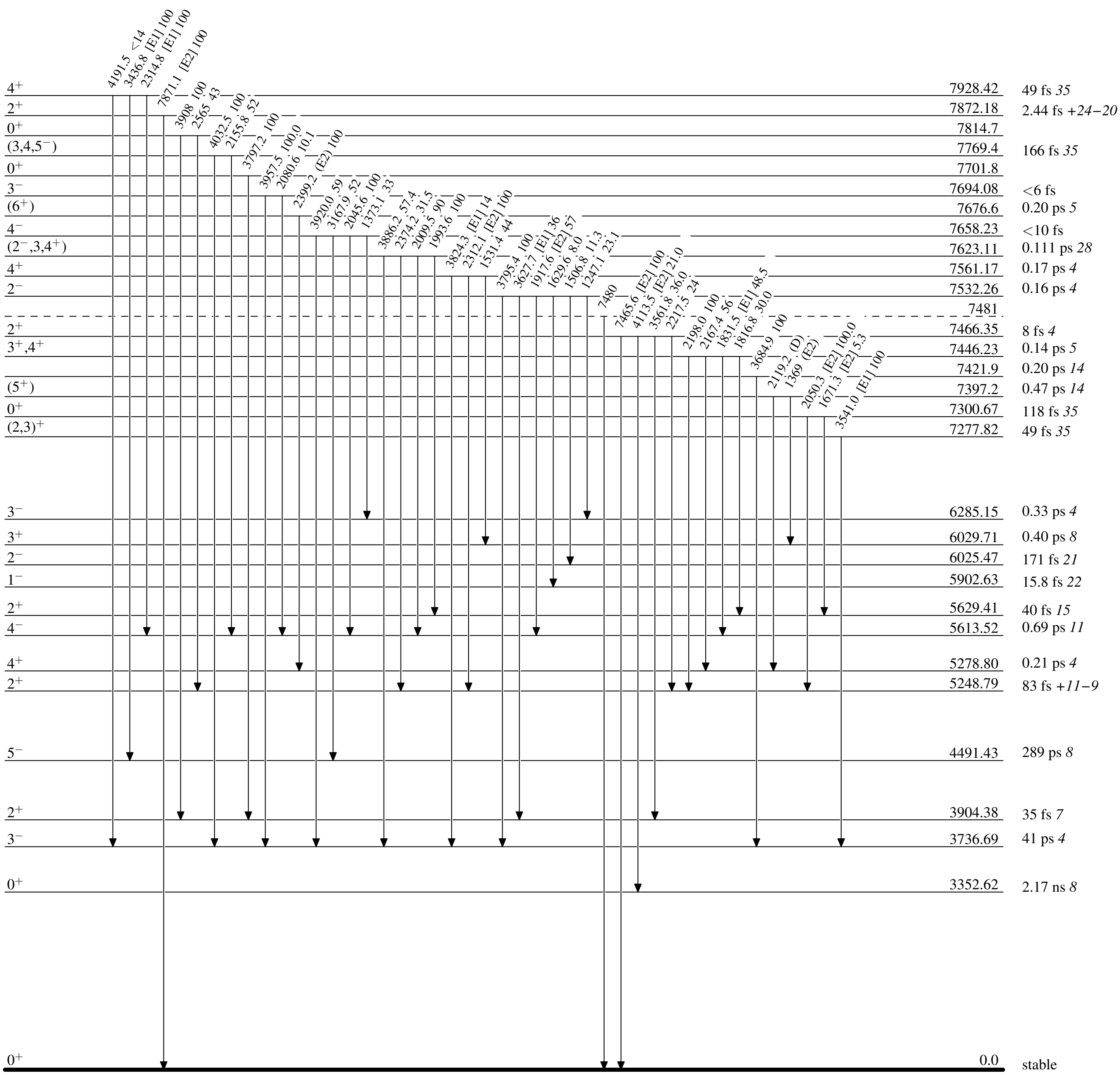


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



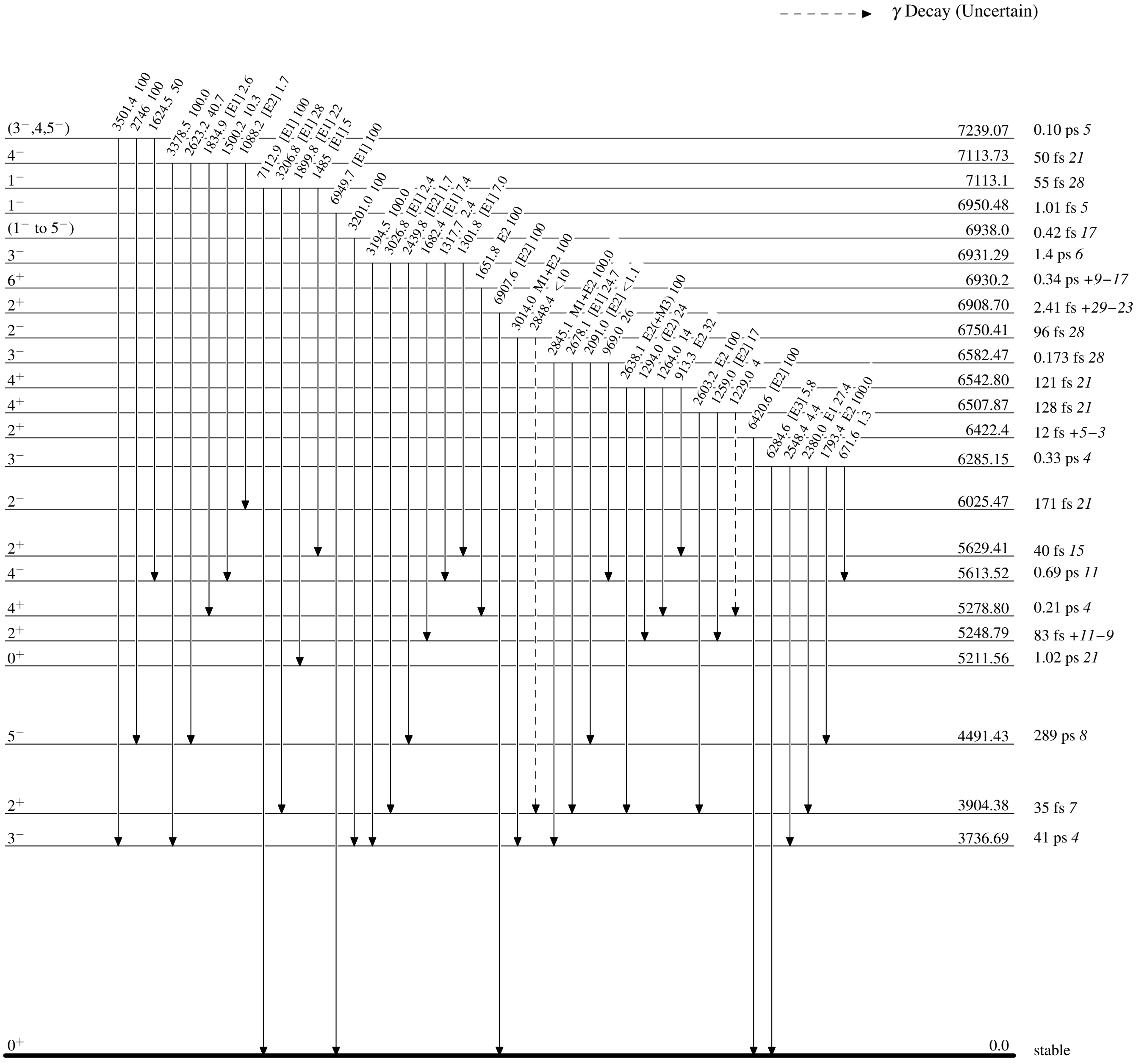
$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

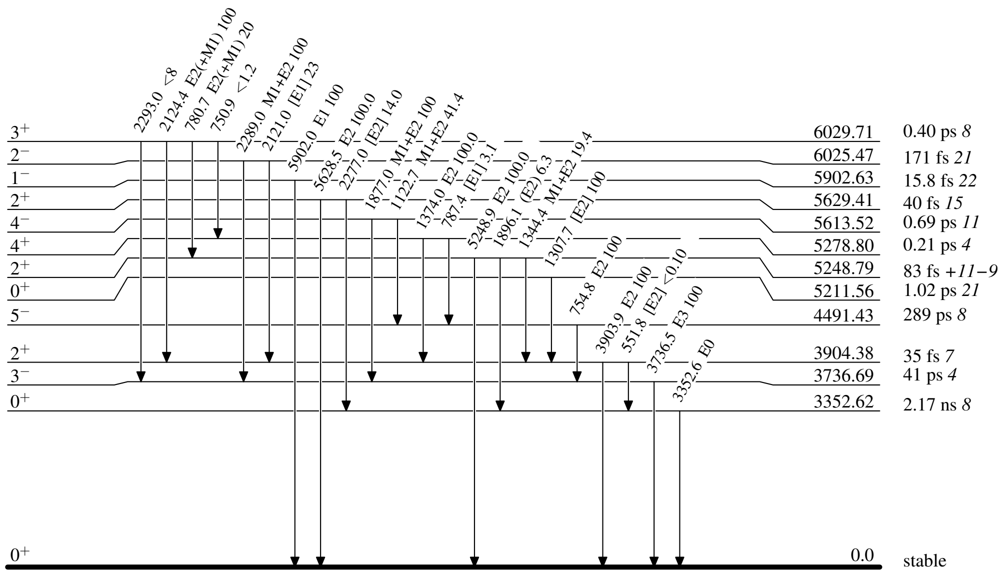


$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

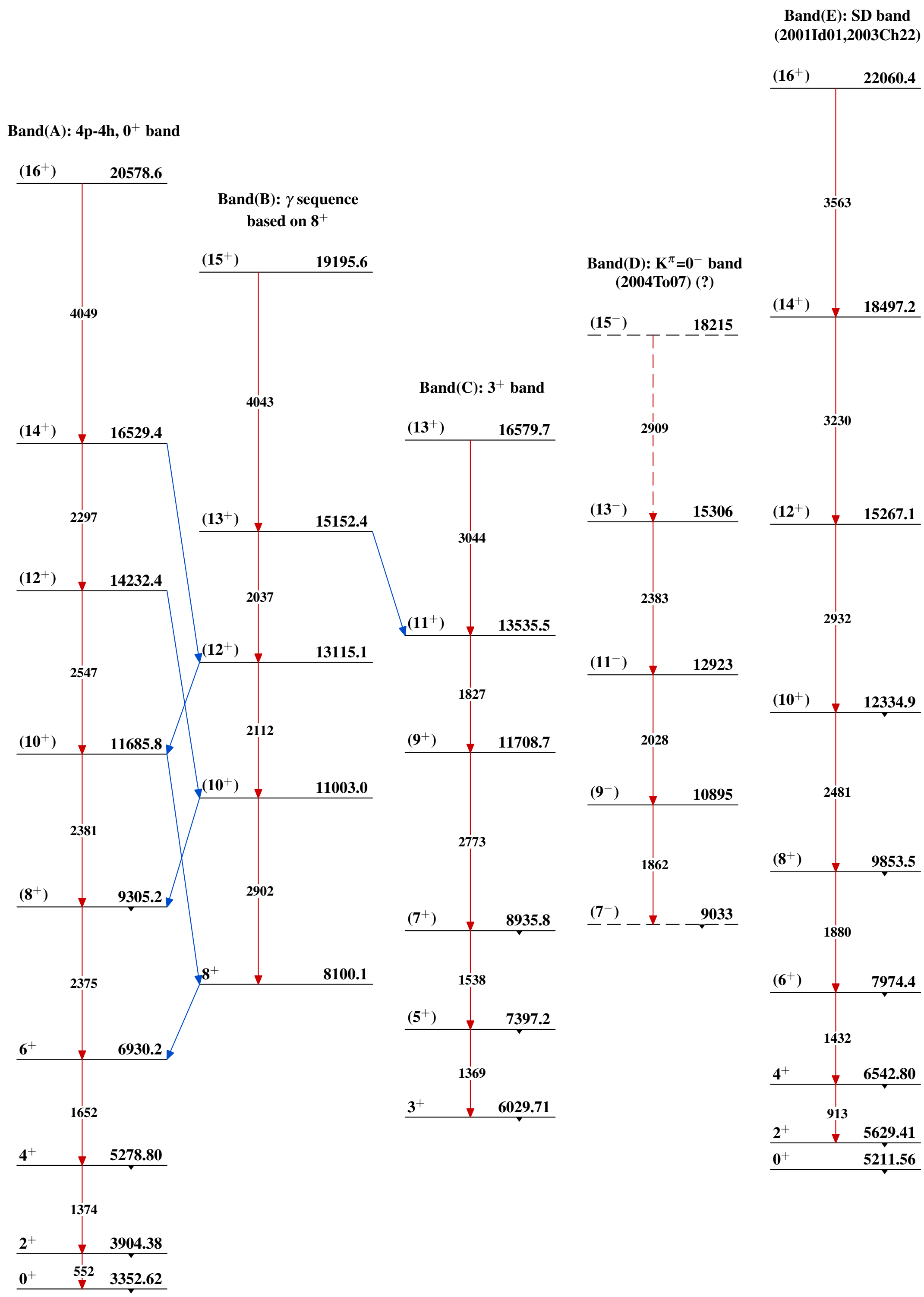
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas



$^{40}_{20}Ca_{20}$

Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen# and Balraj Singh	NDS 135, 1 (2016)	31-May-2016

Q(β^-)=−6426.10 *10*; S(n)=11480.67 *6*; S(p)=10276.67 *15*; Q(α)=−6257.34 *25* 2012Wa38
S(2n)=19843.49 *15*, S(2p)=18085.29 *15* (2012Wa38).
Identification of stable ^{42}Ca by F.W. Aston, Nature 133, 684 (1934) through mass spectrographic studies.
^{42}Ca(n,n): 1989Ra06: E=thermal. Measured Bragg diffraction patterns, deduced scattering lengths.
^{42}Ca(^{3}He,^{3}He): 1971Ra35: E=13.0 MeV; 1973Mo13: E=28 MeV. Measured $\sigma(\theta)$.
^{42}Ca(^{48}Ti,^{48}Ti): 1990Vo07, 1988Br02: E=240-725 MeV. Measured $\sigma(\theta)$, DWBA analysis.
Hyperfine structure and isotope-shift measurements: 2000Mu17, 2015Go24.
Some recent theoretical structure references (levels, B(E2), etc.): 2016Wo02 (shape coexistence), 2012Ca13, 2012Ca27, 2012Ha26.

```
--------------------------------------------------------------------
      Population of levels in decays/reactions labeled with XREF=Y

42K    β-     (12.355 h): 0, 1525, 1837, 2424, 2752, 3447
42Sc    ε  decay (680.79 ms): 0, 1525, 1837
42Sc    ε  decay (61.7 s): 0, 1525, 2424, 2752, 3189
38Ar(6Li,d):       0, 1525, 1837, 2424, 2752, 3300, 3654, 4443, 4448,  5866, 6016+6020, 6313+6390, 6516,
6716+6720
40Ar(3He,n):       0, 1525, 1837, 2424, 3300(?), 3392, 3654, 9270,     10205, 14700
40Ca(t,pγ):     0, 1520, 2420, 3890, 5850, 6020, 6520, 6700, 6820
40Ca(α,2He):        0, 1530, 2750, 3190, 3660, 4830, 5380, 7280, 8810, 9080, 9330, 9600, 9870, 10160
40Ca(14C,12C),(12C,10C),:                  0, 1700, 2800, 3500, 4800
40Ca(96Zr,94Zr):           0, 5866
41Ca(n,γ)     E=thermal: 0, 1524.7, 2424.2, 2752.4, 3253.9, 3446.9,    3954.4, 3999.7, 4690.1, 4759.7, 5017.1,
11480.7
42Ca(γ,γ):      0, 1525
42Ca(π+,π+'),(π-,π-'):        0, 1520, 2420, 3440, 4104, 4680, 6300
42Ca(d,d'):    0, 1524, 1835, 2423, 2749, 3445
42Ca(16O,16O'):          0, 1525, 1837, 2424, 2752, 3254, 3447, 4100,  4449, 4690, 4971
Coulomb excitation: 0, 1525
45Sc(p,α),(pol     p,α):  0, 1525, 1837, 2424, 2752, 3190, 3254, 3954,
4100, 4117
46Ti(d,6Li):       0, 1525, 1837
96Zr(40Ca,42Caγ):           0, 1525, 1837, 2424, 2752, 3189, 3254,
3447, 3654, 3954, 4443, 4760, 5017, 5866
--------------------------------------------------------------------
```

^{42}Ca Levels

Cross Reference (XREF) Flags

A	^{24}Mg(^{24}Mg,α2pγ)	P	^{41}Ca(d,p),(pol d,p)	AD	^{40}Ca(t,pγ)
B	^{27}Al(^{18}O,2npγ)	Q	^{42}Ca(e,e′)	AE	^{40}Ca(α,^{2}He)
C	^{27}Al(^{19}F,$\alpha\gamma$)	R	^{42}Ca(p,p′γ)	AF	^{40}Ca(^{14}C,^{12}C),(^{12}C,^{10}C),
D	^{28}Si(^{16}O,2pγ)	S	^{42}Ca(p,p′)	AG	^{40}Ca(^{96}Zr,^{94}Zr)
E	^{30}Si(^{18}O,α2nγ)	T	^{42}Ca(α,α′)	AH	^{41}Ca(n,γ) E=thermal
F	^{38}Ar(α,γ):resonances	U	^{43}Ca(p,d)	AI	^{42}Ca(γ,γ)
G	^{39}K(α,p)	V	^{43}Ca(d,t)	AJ	^{42}Ca(π^+,$\pi^{+\prime}$),(π^-,$\pi^{-\prime}$)
H	^{39}K(α,pγ)	W	^{43}Ca(^{3}He,α)	AK	^{42}Ca(d,d′)
I	^{40}Ca(t,p)	X	^{44}Ca(p,t)	AL	^{42}Ca(^{16}O,^{16}O′)
J	^{41}K(p,γ)	Y	^{42}K β^- decay (12.355 h)	AM	Coulomb excitation
K	^{41}K(p,n),(p,p):resonances	Z	^{42}Sc ε decay (680.79 ms)	AN	^{45}Sc(p,α),(pol p,α)
L	^{41}K(p,α):resonances	Others:		AO	^{46}Ti(d,^{6}Li)
M	^{41}K(^{3}He,dγ)	AA	^{42}Sc ε decay (61.7 s)	AP	^{96}Zr(^{40}Ca,^{42}Caγ)
N	^{41}K(^{3}He,d)	AB	^{38}Ar(^{6}Li,d)		
O	^{41}Ca(n,α):resonances	AC	^{40}Ar(^{3}He,n)		

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)†	J^{π}#	$T_{1/2}$‡	XREF	Comments
0.0[b]	0+	stable	ABC E GHIJ MN PQRSTUVWXYZ	XREF: Others: AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP The rms charge radius $(<r^2>)^{1/2}$: 3.5081 fm *21* (2013An02 evaluation). J^{π}: L(t,p)=L(p,t)=0 from 0+. Adopted (1977En02) neutron-stripping spectroscopic factor=1.6 *2* (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.58 *6* (L=3). Adopted (1977En02) proton-stripping spectroscopic factor=3.2 *4* (L=2).
1524.71[b] *3*	2+	0.83 ps *3*	ABCDE GHIJ N PQRSTUVWXYZ	XREF: Others: AA, AB, AC, AD, AE, AF, AH, AI, AJ, AK, AL, AM, AN, AO, AP μ=+0.08 *12* (2003Sc21,2014StZZ) Q=−0.19 *8* (1973To07,2014StZZ,2013StZZ) J^{π}: L(t,p)=L(p,t)=2 from 0+. $T_{1/2}$: weighted average of 0.62 ps *21* (α,pγ), 0.97 ps *22* (γ,γ), 1.11 ps *21* (p,p′γ) and 0.825 ps *28* (coulomb excitation). μ: from transient field integral perturbed angular correlation (2003Sc21). Q: reorientation method (1973To07). Adopted (1977En02) neutron-stripping spectroscopic factor=0.04 *2* (L=1), 0.48 *12* (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.18 *3* (L=3), small (L=1). Adopted (1977En02) proton-stripping spectroscopic factor=0.04 *3* (L=2).
1837.31[c] *18*	0+	387 ps *6*	E GHIJ N PQRSTUVWXYZ	XREF: Others: AB, AC, AF, AK, AL, AN, AO, AP J^{π}: L(t,p)=L(p,t)=0 from 0+. $T_{1/2}$: from (p,p′γ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.18 *5* (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.05 *2* (L=3). Adopted (1977En02) proton-stripping spectroscopic factor=0.3 *2* (L=2).
2424.15[c] *4*	2+	140 fs *40*	B E GH J MN PQRSTUVWXY	XREF: Others: AA, AB, AC, AD, AF, AH, AJ, AK, AL, AN, AP J^{π}: L(t,p)=L(p,t)=2 from 0+. $T_{1/2}$: weighted average of 114 fs *30* (α,pγ) and 210 fs *50* (p,p′γ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.56 *14* (L=3), small (L=1). Adopted (1977En02) neutron-pickup spectroscopic factor=0.16 *7* (L=3), (0.0) (L=1). Adopted (1977En02) proton-stripping spectroscopic factor=0.05 *5* (L=2).
2752.40[b] *4*	4+	2.8 ps *4*	ABCDE GHIJ M PQRSTUVWXY	XREF: Others: AA, AB, AE, AF, AH, AK, AL, AN, AP J^{π}: L(t,p)=L(p,t)=4 from 0+. $T_{1/2}$: weighted average of 3.5 ps *3* (^{18}O,2npγ), 2.63 ps *28* (^{16}O,2pγ) and 1.6 ps *7* (α,pγ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.03 *1* (L=1), 0.86 *22* (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.59 *10* (L=3), 0.01 (L=1).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[#]	T$_{1/2}$[‡]	XREF	Comments
3189.26[b] *10*	6$^+$	5.28 ns *15*	ABCDE GHIJ M P R TUVW	XREF: Others: AA, AE, AN, AP μ=−2.49 *9* (1975Yo02,2014StZZ) J$^{\pi}$: L(α,^{2}He)=L(α,α')=6 from 0$^+$. T$_{1/2}$: weighted average of 5.30 ns *16* (α,pγ) and 5.27 ns *14* (α,α'). μ: DPAD (1975Yo02). Adopted (1977En02) neutron-stripping spectroscopic factor=1.2 *3* (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.99 *18* (L=3) (L=3), 0.01 (L=1).
3253.89[c] *5*	4$^+$	123 fs *21*	B E gHIJ P R T V X	XREF: Others: AH, AL, AN, AP J$^{\pi}$: L(α,α')=L(p,t)=4 from 0$^+$. T$_{1/2}$: weighted average of 118 fs *21* (α,pγ) and 210 fs *+100−70* (p,p$'\gamma$). Adopted (1977En02) neutron-stripping spectroscopic factor=0.22 *6* (L=3), small (L=1). Adopted (1977En02) neutron-pickup spectroscopic factor=0.08 *2* (L=3), 0.00 (L=1).
3300.0 *4*	0$^+$	>0.9 ps	gHIJ N RST V X	XREF: Others: AB, AC, AF J$^{\pi}$: L(^{6}Li,d)=L(p,t)=0 from 0$^+$.
3392.01 *24*	2$^+$	135 fs *40*	HIJ P RST V X	XREF: Others: AC J$^{\pi}$: L(t,p)=L(α,α')=2 from 0$^+$. T$_{1/2}$: weighted average of 118 fs *21* in (α,pγ) and 230 fs *50* in (p,p$'\gamma$). Adopted (1977En02) neutron-stripping spectroscopic factor=0.01 *1* (L=1), 0.01 *1* (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.01 (L=3), 0.01 *1* (L=1).
3446.94[d] *5*	3$^-$	0.27 ps *9*	B E GHIJ MN PQRSTUVWXY	XREF: Others: AF, AH, AJ, AK, AL, AP B(E3)↑=0.0110 *18* (1971He08,1989It02) B(E3) from (e,e$'$). J$^{\pi}$: L(t,p)=L(p,t)=3 from 0$^+$. T$_{1/2}$: weighted average of 0.23 ps *7* (α,pγ) and 0.45 ps *14* (p,p$'\gamma$). Adopted (1977En02) neutron-stripping spectroscopic factor=small (L=0 and L=2). Adopted (1977En02) neutron-pickup spectroscopic factor=0.26 *17* (L=0), 0.12 *3* (L=2). Adopted (1977En02) proton-stripping spectroscopic factor=0.28 *4* (L=1+3).
3654.0 *3*	2$^+$	49 fs *35*	GHIJ P RSTUVWX	XREF: Others: AB, AC, AE, AP J$^{\pi}$: L(t,p)=L(p,t)=2 from 0$^+$. T$_{1/2}$: from (α,pγ). Other: 40 fs *+60−40* from (p,p$'\gamma$).
3780 *10*	(2$^+$,3$^-$)		S	J$^{\pi}$: L(p,p$'$)=2 or 3.
3885.0 *4*	1$^-$		HIJ N P RST V	XREF: Others: AD J$^{\pi}$: ΔJ=1 γ to 0$^+$ and L(α,α')=3, L(^{3}He,d)=1(+3).
3954.39[d] *6*	4$^-$	3.36 ps *21*	B E GHI MN P RS V	XREF: Others: AH, AN, AP J$^{\pi}$: γ(θ,lin pol) in (^{18}O,α2nγ) and (α,pγ); L(^{3}He,d)=3; L(^{3}He,α)=0(+2); σ(θ) and Ay(θ) in (pol p,α). T$_{1/2}$: from (α,pγ).
3999.66 *9*	4$^+$		E HIJ P RS	XREF: Others: AH J$^{\pi}$: γ(θ,lin pol) in (^{18}O,α2nγ) and gammas to 2$^+$ and 4$^+$.
4047.0 *4*	3$^-$	0.17 ps *5*	GHIJ N P RST V	J$^{\pi}$: L(^{3}He,d)=1+3 from 3/2$^+$, L(^{3}He,α)=0+2; γ to 2$^+$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J^{π}[#]	$T_{1/2}$[‡]	XREF	Comments
				$T_{1/2}$: from (α,pγ).
4099.65[d] *11*	5^-	0.45 ps *10*	ABCDE GHIJ MN pQRSTUVwX	XREF: Others: AJ, AL, AN J^{π}: L(p,t)=L(p,p′)=L(α,α′)=5 from 0^+; $\sigma(\theta)$ and Ay(θ) in (pol p,α); also γ(θ,lin pol). $T_{1/2}$: from (α,pγ). Adopted (1977En02) neutron-stripping spectroscopic factor=small (L=2). Adopted (1977En02) neutron-pickup spectroscopic factor=0.43 *13* (L=2). Adopted (1977En02) proton-stripping spectroscopic factor=0.46 *9* (L=3).
4117.1 *3*	3^-		H J N p R w	XREF: Others: AN J^{π}: γ(θ,lin pol) in (p,p′γ); $\sigma(\theta)$ and Ay(θ) in (pol p,α).
4180 *2*	0		W	Additional information 1.
4232.0 *4*	1		HIJ N P RS	J^{π}: γ(θ,lin pol).
4342.3 *6*	(0^+ to 4^+)		g iJ rs w	J^{π}: γ to 2^+. Additional information 2.
4354.0 *5*	4^-	0.47 ps *7*	gHi P rs Vw	J^{π}: γ(θ,lin pol) in (α,pγ); L(d,t)=2. $T_{1/2}$: from (α,pγ).
4418.0 *4*	3^-		GH J MN P UVWX	J^{π}: L(p,t)=3 from 0^+; also L(d,p)=0+2 from $7/2^-$, L(^{3}He,d)=1+3 from $3/2^+$.
4443.0 *6*	4^+		H QRST v	XREF: Others: AB, AL, AP XREF: S(4470). J^{π}: L(p,p′)=L(α,α′)=4 from 0^+.
4448.8 *4*	2^+		HIJ p R v	XREF: Others: AB, AL J^{π}: L(t,p)=2 from 0^+; gammas to 0^+ and 3^-.
4505.0 *5*	$(2,3,4)^+$		HI P S	J^{π}: L(d,p)=1+3 from $7/2^-$; and gammas to 2^+ and 4^+.
4566.9 *5*	($1,2^+$)		HIJ P S	J^{π}: gammas to 0^+ and 2^+.
4666 *10*	$(3,4)^-$		i P	XREF: Others: AF J^{π}: L(d,p)=0+2 from $7/2^-$ this level was not adopted by 1990En08 since the (d,p) cross section is small.
4690.06 *10*	3^-		GHi N PQ TuVwX	XREF: Others: AF, AH, AJ, AL J^{π}: L(t,p)=L(p,t)=3 from 0^+.
4717.53[c] *14*	6^+	83 fs *32*	A E Hi n	XREF: Others: AF J^{π}: $\gamma\gamma(\theta)$(DCO) and γ(lin pol) in (^{18}O,α2nγ). $T_{1/2}$: from (α,pγ).
4717.6 *4*	3^-		i n P S	XREF: Others: AF J^{π}: L(p,p′)=3 from 0^+; L(d,p)=0+2 from $7/2^-$.
4759.71 *16*	2^+		HIJ P T X	XREF: Others: AF, AH, AP J^{π}: L(t,p)=L(p,t)=2 from 0^+.
4866.0 *6*	2^+		HIJ P ST X	XREF: Others: AE, AF J^{π}: L(t,p)=L(α,α′)=L(p,p′)=2; but L(α,^{2}He)=4.
4897.0[d] *3*	5^-	47 fs *21*	E GHi uvwX	XREF: Others: AF J^{π}: γ(θ,lin pol). $T_{1/2}$: from (α,pγ).
4904.0 *5*	3^-		HiJ N P Tuvw	XREF: Others: AF J^{π}: L(α,α′)=3. This requires E3 to g.s. E(level): if $T_{1/2}$<50 fs then E3 50% to g.s. is unlikely. In that case another level of $J^{\pi}=2^+$ is required.
4946.9 *10*	$(1,2,3)^-$		Hi N P	XREF: Others: AF J^{π}: L(^{3}He,d)=1(+3) from $3/2^+$ and γ to 2^+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)†	J^{π}#	$T_{1/2}$‡	XREF	Comments
4971.0 *5*	3^-		GHiJ N PQ ST X	XREF: Others: AF, AL J^{π}: L(p,p′)=L(p,t)=3 from 0^+.
5017.14 *11*	4^+		HI P T V X	XREF: Others: AF, AH, AP J^{π}: L(t,p)=L(p,t)=4 from 0^+.
5075.0 *8*	$(1,2,3)^-$		GHI N P	J^{π}: L(^{3}He,d)=1(+3) from $3/2^+$ and γ to 3^-.
5158.0 *7*	3^-		GHI N T	J^{π}: L(α,α')=3 from 0^+.
5188.0 *11*	$(2,3,4)^+$		H Vw	J^{π}: γ to 3^-; L(d,t)=3.
5210.3 *7*	(2^+)		Hij N p T Vwx	J^{π}: γ to 4^+. L(t,p)=L(α,α')=2. It is assumed that the level at 5200 *5* in (t,p) and 5205 *5* in (α,α') is the same as 5210 *2* in (α,pγ).
5212.98 *19*	6		E	J^{π}: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
5214.1 *6*	(2^+)		H j p wx	J^{π}: gammas to 2^+ and 4^+; L(p,t)=2. It is assumed that the level at 5213 in (p,t) is the same as this level. See also comment for 5210 level. Additional information 3.
5320.0 *5*	$(3,4)^-$		GHI N P RS UVw	XREF: Others: AK XREF: U(5340). J^{π}: L(d,p)=0(+2) and L(d,t)=0+2 from $7/2^-$.
5345.0 *10*	0^+		H R wX	XREF: Others: AJ, AK XREF: X(5332). J^{π}: L(p,t)=0 and γ to 2^+.
5358.0 *6*	2^+		HIJ P X	J^{π}: γ to 0^+ and L(d,p)=1 from $7/2^-$.
5380.0 *6*	5^-		HI T V X	XREF: Others: AE J^{π}: gammas to 4^+ and 6^+; L(d,t)=2 from $7/2^-$. Inconsistent with L(α,^{2}He)=6.
5393.0 *7*	$(3)^-$		GHi N P t w	J^{π}: gammas to 2^+; L(^{3}He,d)=1(+3) from $3/2^+$ and L(d,p)=(0+2).
5407 *4*	3^-		i N P t Vw	J^{π}: L(^{3}He,d)=1+3; L(d,p)=0.
5439.0 *10*	$(3,4)^-$		Hi P V	J^{π}: L(d,p)=L(d,t)=0 from $7/2^-$.
5466 *5*	(1 to 5)$^-$		i N	J^{π}: L(^{3}He,d)=3.
5472.0 *6*	$(2,3,4)^+$		Hi P V X	J^{π}: γ to 2^+; L(d,p)=L(d,t)=1 from $7/2^-$; L(p,t)=(4) favors 4^+.
5490.77[d] *13*	6^-	59 fs *14*	ABCDE GH v x	J^{π}: from $\gamma(\theta$,lin pol,DCO). $T_{1/2}$: from (α,pγ).
5491.0 *8*	3^-		H N T v x	J^{π}: L(α,α')=3. But inconsistent with L(d,t)=3(+1) for a level at 5488 *5*.
5510.0 *8*	3^-		Hi N Q T	XREF: Others: AJ, AK, AL XREF: T(5527). J^{π}: L(e,e′)=L(α,α')=3.
5530.0 *7*	2^+		Hi P X	J^{π}: L(p,t)=2 and L(d,p)=1.
5578.0 *11*	(0^+ to 4^+)		HI	J^{π}: γ to 2^+.
5593.0 *5*	3^-		GHiJ N T V x	J^{π}: L(^{3}He,d)=1+3 from $3/2^+$; L(d,t)=0+2 from $7/2^-$.
5601.0 *8*	$(3^-,4^-)$		Hi Wx	J^{π}: L(^{3}He,α)=(0+2) from $7/2^-$. It is assumed that the level at 5610 *20* in (^{3}He,α) is the same as the level at 5601 *2* in (α,pγ).
5624.0 *7*	3^-		GHi N P T	J^{π}: L(^{3}He,d)=1(+3) from $3/2^+$; L(d,p)=0(+2) from $7/2^-$.
5665.0 *6*	(3^-)		gHi n q T w	J^{π}: L(α,α')=L(p,t)=3. It is assumed that the level at 5665 *2* in (α,pγ) is the same as 5667 *5* in (α,α') and 5664 in (p,t).
5670.0 *7*	(3^-)		gHi Pq w	J^{π}: gammas to 2^+ and 3^-; L(d,p)=0+2. It is assumed that the level at 5670 *2* in (α,pγ) is the same as 5669 *10* in (d,p).
5691.77 *17*	6^+		E Hi P T w	J^{π}: $\gamma(\theta$,DCO) in (^{18}O,α2nγ); gammas to 4^+ and 6^+. But L(α,α')=(4,5) gives ($4^+,5^-$).
5716.0 *10*	2^+		Hi n t X	J^{π}: L(p,t)=2.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[#]	$T_{1/2}$[‡]	XREF	Comments
5725.0 *10*	(2^+ to 6^+)		Hi n t	J$^{\pi}$: γ to 4^+.
5738.0 *5*	(2^+)		J S	J$^{\pi}$: gammas to 0^+ and 2^+; L(p,p′)=2,3.
5744.01[d] *11*	7^-	0.42 ps *10*	ABCDE GHi	J$^{\pi}$: ΔJ=2 γ to 5^-; γ to 6^+ from γ(θ,lin pol,DCO). $T_{1/2}$: from (α,pγ). Other: 10.5 ps *10* is reported in (^{16}O,2pγ) using RDM. It may suggest two closely spaced levels.
5769.0 *7*	3^-		Hi Vwx	J$^{\pi}$: gammas to 2^+ and 4^+; L(d,t)=2 from $7/2^-$.
5774.9 *7*	$(4,5)^+$		Hi P wx	J$^{\pi}$: gammas to 4^+ and 6^+; L(d,p)=1 from $7/2^-$.
5797.0 *6*	$(1,2)^+$		HI p V	XREF: Others: AK, AL XREF: I(5790). J$^{\pi}$: gammas to 0^+ and 2^+; L(d,t)=3 from $7/2^-$.
5802.0 *10*	3^-		GH N pQ STUVWx	XREF: Others: AK, AL XREF: G(5791)N(5795)T(5794)U(5790)W(5790). J$^{\pi}$: L(α,α')=3.
5822.0 *10*	$(1,2,3)^-$		H N x	J$^{\pi}$: γ to 2^+; L(^{3}He,d)=1 from $3/2^+$.
5860 *10*	0^+		I	J$^{\pi}$: L(t,p)=0.
5866.0 *8*	(1,2,3^-)		gH	XREF: Others: AB, AD, AG, AP J$^{\pi}$: gammas to 0^+ and 2^+. If this level is the same as 5860 in (t,p) with L=0, then placement of 4028.5γ is incorrect as it would be E0.
5875.0 *7*	2^+		gH N T	J$^{\pi}$: L(α,α')=2.
5924.0 *5*	$(3,4)^-$		GHI N P t V	XREF: Others: AJ, AK XREF: I(5920). J$^{\pi}$: gammas to 4^+, 4^- and 5^-; L(d,p)=0+2 from $7/2^-$.
5925.5 *3*	(5)		E HI st V	XREF: Others: AJ, AK XREF: I(5920). J$^{\pi}$: ΔJ=1, γ to 6^+ from DCO in (^{18}O,α2nγ); γ from 4^+.
5956 *10*	$(3,4)^-$		P	J$^{\pi}$: L(d,p)=0+2 from $7/2^-$.
5980 *5*	3^-		I N UV	XREF: Others: AK XREF: I(5980). J$^{\pi}$: L(^{3}He,d)=1 from $3/2^+$; L(d,t)=0(+2) from $7/2^-$.
5994.0 *8*	3^-		HI P UV	XREF: Others: AK XREF: I(5980). J$^{\pi}$: γ to 2^+; L(d,p)=0+2; L(d,t)=0+(2) from $7/2^-$.
6003.0 *10*	3^-,4^-		HI p UV	XREF: Others: AK XREF: I(5980). J$^{\pi}$: L(d,p)=0+2 from $7/2^-$.
6016 *5*	0^+		I n T	XREF: Others: AB J$^{\pi}$: L(t,p)=0. L(α,α')=2 is inconsistent. Additional information 4.
6020.0 *7*	(4^+,5,6^-)		H n	XREF: Others: AB J$^{\pi}$: gammas to 4^- and 6^+; 5^- or 6^- are supported by $11/2^-$ transfer in (α,p) from $3/2^+$. Additional information 5.
6028.0 *6*	$(3)^-$		H P tuvw	J$^{\pi}$: L(d,p)=0+2 from $7/2^-$; γ to 2^+.
6038.0 *7*	$(1,2,3)^-$		H N T v	XREF: Others: AD, AJ XREF: AD(6020). J$^{\pi}$: L(^{3}He,d)=(1+3) from $3/2^+$; L(d,t)=2(+0) from $7/2^-$; γ to 2^+. Additional information 6.
6080	0^+		X	J$^{\pi}$: L(p,t)=0.
6093.5 *8*	(3^- to 7^-)		H n q v	J$^{\pi}$: γ to 5^-.
6104.0 *7*	(0^+ to 4^+)		H n q v	J$^{\pi}$: γ to 2^+.
6113.0 *8*	4^+		GHI PQ T V	XREF: Others: AK XREF: G(6096)I(6105).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J^{π}[#]	$T_{1/2}$[‡]	XREF	Comments
				J^{π}: L(t,p)=4.
6140.8 *6*	6^-	49 fs +21−14	gHi p	J^{π}: $\gamma(\theta)$ to 6^- in (α,pγ); γ to $4^-,5^-$. $T_{1/2}$: from (α,pγ).
6144.72[d] *14*	7^-	<70 fs	ABCDE gHI p	J^{π}: from $\gamma(\theta$,lin pol,DCO). $T_{1/2}$: from (α,pγ).
6158 *5*	3^-		i N P T V	J^{π}: L(α,α')=3.
6182.0 *7*	(1,2,3^-)		Hi N T	J^{π}: E=6182 γ to 0^+.
6212.0 *10*	3^-		Hi P S Vw	J^{π}: L(d,p)=0+2 from $7/2^-$; L(p,p')=2 or 3 from 0^+.
6240 *5*	3^-		N P T V	J^{π}: L(α,α')=3.
6247.9 *6*	(4^+,5,6^-)		H	J^{π}: gammas to 4^- and 6^+.
6274 *7*	2^+		I P	J^{π}: L(t,p)=2.
6313 *7*	(2 to 5)$^+$		G I P T VW	XREF: Others: AB, AJ XREF: I(6290). J^{π}: L(d,p)=1 and Ay(θ).
6390 *10*	(3,4)$^-$		I P RST	XREF: Others: AB, AJ XREF: I(6400)AJ(6300). J^{π}: L(d,p)=0 from $7/2^-$; L($\pi^+,\pi^{+\prime}$)=(3).
6408.57[d] *12*	8^-	31.0 ps *25*	ABCDE GH w	J^{π}: ΔJ=2 E2 γ to 6^-; ΔJ=1 γ to 7^- from $\gamma(\theta$,lin pol,DCO). $T_{1/2}$: from (^{16}O,2pγ).
6426 *10*	(2 to 5)$^+$		i P w	J^{π}: L(d,p)=1 from $7/2^-$.
6462 *10*	(3,4)$^-$		i P	J^{π}: L(d,p)=0+2 from $7/2^-$.
6516.0 *6*			I P TU W	XREF: Others: AB, AD J^{π}: L(d,p)=1 from $7/2^-$. L(p,d)=0+2 from $7/2^-$ is incompatible. L(t,p)=(0) suggests (0^+) and L(^{3}He,α)=(4) suggests (4^+).
6541.8 *6*	5^+		H P	J^{π}: gammas to $5^-,6^+$, and 6^-; L(d,p)=1 from $7/2^-$.
6553.72[d] *12*	9^-	42 ps *3*	ABCDE GH	J^{π}: ΔJ=2 E2 γ to 7^-; ΔJ=1 γ to 8^- from $\gamma(\theta$,lin pol,DCO).
6572 *15*	(2 to 5)$^+$		i P w	J^{π}: L(d,p)=1 from $7/2^-$.
6584.7 *8*	(5^- to 8^-)		GHi w	J^{π}: gammas to 7^- and 6^-.
6614 *15*	(3,4)$^+$		i P T	J^{π}: L(d,p)=1 and analyzing power in (d,p).
6636.30[c] *15*	8^+	36 fs *15*	E HI P RST W	XREF: Others: AK XREF: I(6640)P(6653)W(6660). J^{π}: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ). $T_{1/2}$: from (α,pγ).
6674.8 *10*	(4^+ to 8^+)		H P T W	XREF: Others: AL XREF: P(6670)W(6660). J^{π}: γ to 6^+.
6715.9 *7*	(4^+)		H P	XREF: Others: AB J^{π}: γ to 6^+; γ to (2^+); L(d,p)=(1+3) from $7/2^-$.
6718.14 *17*	7		E	J^{π}: ΔJ=1 γ to 6^+ from $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
6720 *8*	0^+		I	XREF: Others: AB, AD XREF: AD(?). J^{π}: L(t,p)=0.
6746.5 *8*	4^+		GHI P T X	XREF: Others: AL XREF: P(6760). J^{π}: L(d,p)=1 from $7/2^-$; J_n=1/2+3/2 in (pol d,p); γ transitions to 5^- in (α,pγ). But $3/2^+$ transfer in (α,p) from $3/2^+$ favors 3^+.
6781 *7*			G I P TU W	XREF: I(6800).
6816.8 *10*	(4,5)$^+$		HI P	XREF: Others: AD

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[‡]	XREF	Comments
				Jπ: γ to 6+; L(d,p)=1 from 7/2−.
6895.8 *6*	4+		HI P	Jπ: gammas to 3− and 6+; L(d,p)=1 from 7/2−.
6920 *4*	(3,4)+		I P	Jπ: L(d,p)=1 from 7/2−; J_n=1/2 in (pol d,p).
6931 *7*	(2,3)+		G I P ST V	XREF: I(6940). Jπ: 3/2+ transfer in (α,p) from 3/2+ and L(d,p)=1+3 from 7/2−.
6940.2 *6*	(5−,6,7−)		Hi t	Jπ: gammas to 5− and 7−.
6961 *15*	(3,4)+		P	Jπ: L(d,p)=1 from 7/2−; J_n=1/2 in (pol d,p).
6975.5 *5*	(5+)		GH P	Jπ: gammas to 5−, 6+, and 6−; 13/2+ transfer in (α,p) from 3/2+.
7020 *12*	4+		G I PQ s w	XREF: Others: AL XREF: I(7010). Jπ: 11/2+ transfer in (α,p) from 3/2+; L(d,p)=1+3 from 7/2−; J_n=1/2+5/2 in (pol d,p).
7041 *15*	(3−,4−)		P s w	Jπ: L(d,p)=(0+2) from 7/2−.
7103 *7*	(1 to 4)−		G I Q	XREF: Others: AL XREF: I(7110). Jπ: 5/2− transfer in (α,p) from 3/2+.
7129.9 *10*	4+		Hi P	Jπ: L(d,p)=1 from 7/2−; J_n=1/2+3/2 in (pol d,p); γ to 6+.
7153 *7*	(3,4)+		G i P	Jπ: L(d,p)=1 from 7/2−; J_n=1/2 in (pol d,p); 11/2+ transfer in (α,p) favors 4+.
7180 *20*	2+		I	Jπ: L(t,p)=2.
7197.9 *10*			H P	Jπ: γ to 6+, but L(d,p)=(0+2) from 7/2− suggests (3−,4−).
7228 *7*	(3−,4−)		G P	Jπ: 5/2− transfer in (α,p) from 3/2+ gives (1 to 4)$^{(-)}$ and L(d,p)=(0+2) from 7/2− gives (3−,4−).
7273 *7*	(3,4)+		G I P	XREF: Others: AJ, AK, AL XREF: I(7257). Jπ: L(d,p)=1 from 7/2−; J_n=1/2 in (pol d,p); 3/2+ transfer in (α,p) from 3/2+ favors 3+.
7282.02 *14*	9−		A E HI U	XREF: Others: AE, AJ, AL XREF: I(7280). Jπ: gammas to 8− and 9−; γ(θ,DCO) in (^{18}O,α2nγ). But L(α,^{2}He)=(5,6,7) suggest (7−).
7344.7 *10*	(6− to 10−)		G I R	XREF: Others: AJ, AL XREF: I(7320). Jπ: γ to 8−.
7348 *15*	(3,4)+		P	Jπ: L(d,p)=1 from 7/2−; J_n=1/2 in (pol d,p).
7360.6 *10*	(5− to 9−)		H	Jπ: γ to 7−.
7368.46[d] *15*	10−	1.9 ps *8*	ABCDE H	Jπ: from γ(θ,lin pol,DCO). $T_{1/2}$: weighted average of 2.6 ps *11* in (^{18}O,2npγ) and 1.5 ps *8* in (^{16}O,2pγ).
7388.8 *10*	4+		HI PQ S	XREF: Others: AL XREF: P(7401). Jπ: γ to 6+; L(d,p)=1 from 7/2−; J_n=1/2+3/2 in (pol d,p).
7415.87 *15*	8+		E H P S w	XREF: Others: AJ, AL XREF: P(7422). Jπ: from γ(θ,DCO) in (^{18}O,α2nγ); γ to 6+.
7421.2 *8*	(4+ to 8+)		H P RS U w	XREF: Others: AL XREF: P(7438). Jπ: γ to 6+.
7468 *15*	(2 to 5)$^{(+)}$		P	Jπ: L(d,p)=(1+3) from 7/2−.
7520 *15*	(3,4)+		P	Jπ: L(d,p)=1 from 7/2−; J_n=1/2 in (pol d,p).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J^{π}[#]	$T_{1/2}$[‡]	XREF	Comments
7543.1 *6*	$(4^+$ to $7^-)$		H w	J^{π}: gammas to 5^- and 6^+.
7562.5 *10*	$(4^+,5^+)$		H PQ w	XREF: Others: AK, AL XREF: P(7571). J^{π}: γ to 6^+; L(d,p)=(1) from $7/2^-$.
7600 *15*	$(2^+$ to $5^+)$		P	J^{π}: L(d,p)=(1+3) from $7/2^-$.
7634.03 *23*	$(6,8^+)$		E H	J^{π}: γ to 6^+; $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
7643 *15*	$3^+,4^+$		P	J^{π}: L(d,p)=1 from $7/2^-$; J_n=1/2+3/2 in (pol d,p).
7696.8 *10*	4^+		H P	J^{π}: L(d,p)=1 from $7/2^-$; J_n=1/2+3/2 in (pol d,p); γ to 6^+.
7726.5 *10*	$(4^+$ to $8^+)$		H	J^{π}: γ to 6^+.
7750.66 *17*	$(11)^-$	<2.1 ps	CD	J^{π}: ΔJ=1 γ to 10^-; γ(lin pol). $T_{1/2}$: from (^{16}O,2pγ).
7758.0 *6*	$(6^-,7^-)$		H	J^{π}: gammas to 5^-, 6^-, 7^- and 8^-.
7760 *15*	$(3,4)^+$		P	J^{π}: L(d,p)=1 from $7/2^-$; J_n=(1/2) in (pol d,p).
7793 *15*	$(3,4)^+$		P	J^{π}: L(d,p)=1 from $7/2^-$; J_n=1/2 in (pol d,p).
7800.7 *10*	$(5^-$ to $9^-)$		H	J^{π}: γ to 7^-.
7838.9 *12*	$(2^+$ to $6^+)$		H	J^{π}: γ to (4^+).
7921.2 *8*	$(4^+$ to $8^+)$		H	J^{π}: γ to 6^+.
7939.8 *8*	$(4^+$ to $8^+)$		H	J^{π}: gammas to 6^+.
8052.6 *10*	$(4^+$ to $8^+)$		H	J^{π}: γ to 6^+.
8059.7 *8*	$(6^-$ to $9^-)$		H	J^{π}: gammas to 7^- and 8^-.
8082.7 *10*	$(7^-$ to $11^-)$		H	J^{π}: γ to 9^-.
8103.2 *8*	$(4^+$ to $8^+)$		H	J^{π}: gammas to 6^+.
8170 *20*			W	
8297.46[d] *15*	11^-	<1.7 ps	ABCDE H TU W	XREF: Others: AJ XREF: W(8260). J^{π}: ΔJ=1 M1 γ to 10^-; γ to 9^-; $\gamma(\theta$,pol,DCO). $T_{1/2}$: from (^{18}O,2npγ).
8364.8 *8*	$(6^-,7,8^+)$		H R U W	XREF: W(8330). J^{π}: gammas to 6^+ and 8^-.
8449.7 *6*	$(7,8)^-$		H Q S U W	XREF: W(8410). J^{π}: gammas to 6^- and 9^-.
8450	0^+		X	J^{π}: L(p,t)=0 from 0^+.
8511.7 *8*	$(6^-$ to $9^-)$		U	XREF: Others: AB, AJ, AK XREF: AK(8520). J^{π}: gammas to 7^- and 8^-.
8517.0 *11*	(3 to 9)		H U W	XREF: Others: AJ, AK XREF: W(8520). J^{π}: γ to (5,7).
8522.3 *3*	(10)		C U W	XREF: Others: AJ, AK XREF: W(8520). J^{π}: ΔJ=1 γ to $(11)^-$; $\gamma(\theta)$ in (^{19}F,$\alpha\gamma$).
8580.9 *12*	$(2^+$ to $6^+)$		H TU W	XREF: W(8600). J^{π}: γ to (4^+).
8611.9 *12*	$(2^+$ to $6^+)$		H TU W	XREF: W(8600). J^{π}: γ to (4^+).
8615.13 *15*	9		E	J^{π}: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
8722.30 *15*	9		E	J^{π}: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
8744.9 *11*	$(8^-$ to $12^-)$		H	J^{π}: γ to 10^-.
8773.7 *8*	(5,6,7)		H Q U	XREF: Others: AE XREF: AE(8810). J^{π}: gammas to 6^- and 6^+.
8847.97[c] *20*	(10^+)		E H Q U W	XREF: Others: AE XREF: AE(8810). J^{π}: gammas to 8^+; $\gamma(\theta$,DCO) in (^{18}O,α2nγ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)†	J$^{\pi}$#	XREF	Comments
8951.3 *11*	(6$^+$ to 10$^+$)	H	J$^{\pi}$: γ to 8$^+$.
9015.01 *14*	10$^+$	A E	J$^{\pi}$: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ); gammas to 8$^+$, 9$^-$ and 11$^-$.
9036.9 *11*	(8$^-$ to 12$^-$)	H UV	XREF: Others: AE XREF: AE(9080). J$^{\pi}$: γ to 10$^-$.
9115 *5*		F	
9191 *5*		F	
9205.9 *8*	(7$^-$ to 9$^-$)	H UV	XREF: Others: AE XREF: AE(9080). J$^{\pi}$: gammas to 7$^-$ and 9$^-$.
9241.9? *9*		E	J$^{\pi}$: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
9270			XREF: Others: AC
9280 *5*	1$^-$@	F	
9311.08 *16*	(8,10$^+$)	E	J$^{\pi}$: ΔJ=(0,2) γ to (6,8$^+$); γ to 8$^+$; $\gamma(\theta$,DCO) in (^{18}O,α2nγ).
9330 *50*			XREF: Others: AE
9367 *5*		F	
9377.7 *10*	(5$^-$ to 9$^-$)	H	J$^{\pi}$: γ to 7$^-$.
9426 *5*		F	
9470 *5*		F	
9561 *5*		F	
9600 *50*	(5$^-$,6$^+$)		XREF: Others: AE J$^{\pi}$: L(α,^{2}He)=(5,6).
9635 *5*		F	
9672 *5*		F	
9699 *5*		F	
9723 *5*		F	
9750 *10*	(2$^-$)	M Q S UVW	XREF: Others: AL T=2 XREF: W(9740). J$^{\pi}$: M2 excitation in (e,e′); g.s. analog of ^{42}Ca.
9757 *5*		F	
9759.7 *10*	(7$^-$ to 11$^-$)	H	J$^{\pi}$: γ to 9$^-$.
9770	(2$^+$)	Q	J$^{\pi}$: E2 excitation in (e,e′).
9784 *5*		F	
9786.29 *14*	(9$^-$,11)	A E	J$^{\pi}$: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ); gammas to 9, 10$^+$, 10$^-$ and 11$^-$.
9841.6 *10*	(5,6)$^-$	H UVW	XREF: Others: AE, AL XREF: AE(9870). J$^{\pi}$: γ to 7$^-$; L(p,d)=L(^{3}He,α)=2 from 7/2$^-$.
9850 *10*	(3$^-$)	M X	T=2 J$^{\pi}$: possible IAS of ^{42}Ca at 107 keV.
9947 *5*		F	
10000 *10*	(4)$^-$	M u w	T=2 J$^{\pi}$: possible IAS of ^{42}Ca at 258 keV; L(^{3}He,d)=3 from 3/2$^+$.
10035.6 *10*	(5$^-$ to 9$^-$)	H u w	J$^{\pi}$: γ to 7$^-$.
10038 *5*		F	
10160 *50*			XREF: Others: AE
10168.69 *16*	(10,12$^+$)	A E	J$^{\pi}$: from $\gamma(\theta$,DCO) in (^{18}O,α2nγ); gammas to 10$^+$ and 11$^-$.
10205 *5*		F	XREF: Others: AC
10231 *5*		F	
10282 *5*	1$^-$@	F	
10314 *5*		F	
10358 *5*	1$^-$@	F	
10389 *5*		F	
10450.0 *10*	(5)$^-$	M QRS U W	T=2

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)†	Jπ#	XREF	Comments
			XREF: U(10430)W(10430). Jπ: possible IAS of ^{42}Ca at 699. L(^{3}He,d)=3 from 3/2+.
10453 *5*		F	
10500 *5*	1− @	F	
10510 *20*		W	T=2
10527 *5*		F	
10561 *5*		F	
10588 *5*		F	
10610 *20*		W	T=2
10612 *5*		F	
10633 *5*		F	
10652 *5*		F	
10673 *5*	1− @	F	
10700 *5*	@	F	
10726 *5*	1− @	F	
10783 *5*	1− @	F	
10805 *5*	1− @	F	
10842 *5*	1− @	F	
10884 *5*	1− @	F	
10905 *5*	1− @	F	
10916 *5*	1− @	F	
10968 *5*		F	
10970 *20*	3−	U WX	T=2 Jπ: L(p,t)=3 from 0+ and L(p,d)=0 from 7/2−.
10985 *5*		F	
11013 *5*	1− @	F	
11048 *5*		F	
11076 *5*	1− @	F	
11108 *5*	1− @	F	
11149 *5*	1− @	F	
11165.7 *9*	(10,12)	E	Jπ: γ(θ,DCO) in (^{18}O,α2nγ).
11185 *5*	1− @	F	
11223 *5*	1− @	F	
11235 *5*	(1+)	Q	T=2 Jπ: M1 excitation in (e,e′).
11279 *5*		F	
11303.7 *10*		F J	
11309.5 *10*		J	
11319.3 *10*		J	
11326.1 *10*		J	
11331.0 *10*		J	
11335.9 *10*	1− @	F J	
11343.7 *10*		J	
11361.3 *7*	(1,2+)	J	Jπ: γ(θ) in (p,γ).
11363.2 *10*		J	
11380.8 *10*	1− @	F J	
11398.4 *10*		J	
11401.3 *10*		F J	
11405.1c *11*	(12+)	E	Jπ: γ(θ,DCO) in (^{18}O,α2nγ).
11409.1 *10*		J	
11412.0 *10*		J	
11416.9 *10*		J	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[#]	XREF	Comments
11426.0 *10*		J L	
11429.6 *15*	(0$^+$,1$^-$,2$^+$)[&]	L	
11432.3 *10*		J L	
11436.1 *10*	(1$^-$,2$^+$)[&]	J L	
11439.7 *10*	1$^-$[@]	F J L	
11440 *20*	3$^-$,4$^-$	U WX	T=2 J$^{\pi}$: L(p,d)=L(^{3}He,α)=0 from 7/2$^-$.
11445.6 *10*		J L	
11447.7 *15*	(0$^+$,1$^-$,2$^+$)[&]	L	
11449.0 *15*		L	
11450.5 *15*		L	
11453.1 *15*		L	
11464.7 *15*		L	
11468.1 *15*		L	
11469.3 *15*	(1$^-$,2$^+$)[&]	L	
11473.5 *15*	(1$^-$,2$^+$)[&]	L	
11475.8 *15*		L	
11477.7 *15*		L	
(11480.64 *7*)	3$^-$,4$^-$		XREF: Others: AH J$^{\pi}$: s-wave capture in ^{41}Ca g.s. (J$^{\pi}$=7/2$^-$).
11481.77 *9*		O	
11485.20 *6*	(2$^+$)[&]	L O	
11486.86 *6*		O	
11488.7 *15*	1$^-$[@]	F L	
11490.40 *9*		L O	
11493.6 *15*		L	
11495.41 *6*		O	
11499.0 *1*		L O	
11500.20 *6*		L O	
11503.70 *11*		L O	
11507.10 *15*	(0$^+$,1$^-$,2$^+$)[&]	L O	
11508.8 *15*		L	
11510.34 *16*	(1$^-$)[&]	L O	
11512.5 *15*		L	
11514.36 *15*		O	
11516.6 *15*	(1$^-$)[&]	L	
11519.5 *3*		F L O	
11523.3 *15*	(1$^-$,2$^+$)[&]	L O	
11525.4 *15*		L	
11527.4 *15*	(1$^-$,2$^+$)[&]	L	
11529.3 *15*	(0$^+$,1$^-$,2$^+$)[&]	L	
11530.7 *3*		L O	
11532.6 *15*		L	
11537.12 *25*		O	
11540.0 *15*	(1$^-$)[&]	L	
11542.3 *15*	(0$^+$,1$^-$,2$^+$)[&]	L	
11543.6 *15*		L	
11544.4 *15*	1$^-$[@]	F L	
11550.0 *15*	(0$^+$,1$^-$,2$^+$)[&]	L	
11551.5 *15*		L	
11555.4 *15*	(1$^-$)[&]	L	
11556.3 *15*		L	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J^{π}[#]	XREF	Comments
11558.1 *15*		L	
11562.8 *15*		L	
11569.2 *15*	1^{-}[&]	L	
11571.7 *15*	$(0^{+},1^{-},2^{+})$[&]	L	
11572.8 *15*	$(1^{-},3^{-},4^{+})$[&]	L	
11575.2 *15*	$(3^{-},4^{+})$[&]	L	
11576.2 *15*		L	
11589.8 *15*	(1^{-})[&]	L	
11591.1 *15*		L	
11592.6 *15*		L	
11594.6 *15*		L	
11596.7 *15*	1^{-}[&]	L	
11599.4 *15*	$(1^{-},2^{+})$[&]	L	
11601.8 *15*	1^{-}[&]	L	
11603.5 *15*		L	
11612.5 *15*	1^{-}[&]	F KL	
11614.0 *15*		L	
11616.0 *15*	1^{-}[&]	L	
11621.0 *15*	$(1^{-},2^{+})$[&]	L	
11632.8 *15*		L	
11634.5 *15*	$(1^{-},2^{+})$[&]	L	
11636.1 *15*	$(1^{-},2^{+})$[&]	L	
11637.4 *15*	$(1^{-},2^{+})$[&]	L	
11639.4 *15*	1^{-}[&]	KL	E(level): possible analog of 1927 level in ^{42}Ca.
11641.1 *15*		L	
11643.5 *15*		L	
11644.1 *4*	$(1^{-},2^{+})$[&]	JKL	
11646.2 *15*	(4^{+})[&]	L	
11651.2 *15*	$(1^{-},2^{+})$[&]	J L	
11653.4 *15*		JKL	
11654.2 *15*	(1^{-})[&]	L	
11656.8 *15*	(1^{-})[&]	L	
11658		JK	
11662.2 *15*	$(1^{-},2^{+})$[&]	F JKL	
11664.9 *15*		L	
11670.9 *4*	2^{+}[&]	JKL	
11674.0 *5*	$(1^{-},2^{+})$[a]	JK	
11680		J	
11685		JK	
11689.2 *15*	$(1^{-},2^{+})$[&]	L	
11693.0 *4*	$(1^{-},2^{+})$[a]	JK	
11695.0 *15*	(3^{-})[&]	L	
11697.3 *15*		J L	
11699.7 *15*		J L	
11707.5 *4*	2^{+}[&]	J L	
11709.2 *15*	$(1^{-},2^{+})$[&]	JKL	
11710.1 *15*		JKL	
11718.3 *15*		JKL	
11725.7 *9*	$(8^{-}$ to $11)$	E	J^{π}: γ to 9 and 10^{-}.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[#]	XREF
11727.1 *3*	2^+[&]	JKL
11728.2 *15*		L
11729.3 *15*		L
11733.0 *15*		JKL
11737.4 *15*	$(0^+,1^-,2^+)$[&]	L
11738.4 *4*	1^-[&]	JKL
11743.4 *5*	$(1^-,2^+)$[a]	JKL
11748.0 *15*		L
11752.3 *15*		JKL
11756.6 *15*	(1^-)[&]	JKL
11758		J
11760		JK
11763		JK
11768		JK
11772.7 *15*	$(1^-,2^+)$[&]	J L
11775.0 *4*	$(1^-,2^+)$[a]	JK
11777.2 *15*		L
11778.5 *15*	$(0^+,1^-,2^+)$[&]	JKL
11783.0 *15*	$(1^-,2^+)$[&]	L
11784.7 *15*	$(1^-),2^+$[&]	L
11786.1 *15*		JKL
11787.5 *15*		L
11789.8 *15*		L
11792		J
11795.2 *4*	$(1^-,2^+)$[a]	J L
11798.3 *15*	$(1^-,2^+)$[&]	JKL
11805.4 *4*	$(1^-,2^+)$[&]	JKL
11809.7 *15*	$(1^-,2^+)$[&]	JKL
11811.1 *15*	$(1^-,2^+)$[&]	L
11814		JK
11818.0 *15*		L
11821.1 *4*		E
11822.4 *4*	(1^-)[&]	JKL
11824.0 *15*	$(1^-,2^+)$[&]	L
11829.0 *15*	$(1^-,2^+)$[&]	JKL
11830.2 *15*	(2^+)[&]	L
11831.8 *15*		JKL
11836.4 *15*	(4^+)[&]	JKL
11843.3 *5*	$(1^-,2^+)$[&]	JKL
11844.9 *15*	$(1^-,2^+)$[&]	L
11846.8 *15*		L
11850		JK
11852.6 *15*	1^-[&]	JKL
11856.4 *15*		JKL
11865.6 *15*	$(0^+,1^-,2^+)$[&]	KL
11868.0 *4*	$(1^-,2^+)$[a]	JK
11871.5 *4*	$(1^-,2^+)$[a]	JKL
11872.8 *15*		L
11873.7 *4*	$(1^-,2^+)$[a]	JKL
11881		JK
11885.2 *15*	$(1^-,2^+,3^-)$[&]	JKL

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[#]	XREF	Comments
11887		JK	
11895.3 *15*	(1$^-$,2$^+$)[&]	JKL	
11902.0 *15*	(1$^-$,2$^+$)[&]	JKL	
11906.3 *15*	(1$^-$,3$^-$)[&]	JKL	
11910.6 *15*	(1$^-$,2$^+$)[&]	JKL	
11916		JK	
11921		JK	
11923.3 *15*	(1$^-$,2$^+$)[&]	L	
11925.6 *5*	(1$^-$,2$^+$)[a]	JKL	
11929		K	
11933.1 *15*	(1$^-$,2$^+$)[&]	KL	
11937		JK	
11941.9 *15*	2$^+$[&]	L	
11944.4 *15*	1$^-$[&]	J L	
11950.1 *15*		JKL	
11953		JK	
11959.2 *5*	(1$^-$)	J L	
11962.8 *15*	(1$^-$,2$^+$)[&]	JKL	
11967		JK	
11970.2 *15*	1$^-$[&]	KL	
11976.8 *15*	(2$^+$)[&]	L	
11980.3 *4*	1$^-$[&]	JKL	
11989.0 *15*	(2$^+$,3$^-$)[&]	L	
11992.1 *15*	(1$^-$,2$^+$)[&]	L	
12000.2 *15*	2$^+$[&]	L	
12005.0 *15*	(1$^-$,2$^+$)[&]	L	
12006.3 *15*		L	
12012.0 *15*	(2$^+$)[&]	L	
12013.6 *15*		L	
12020.4 *15*	(1$^-$,2$^+$)[&]	L	
12029.5 *15*	(0$^+$,1$^-$,2$^+$)[&]	L	
12032.5 *15*	(3$^-$)[&]	L	
12039.8 *15*	1$^-$[&]	L	
12041.8 *15*		L	
12042.8 *15*		L	
12050.9 *15*	(1$^-$,2$^+$)[&]	L	
12052.0 *15*		L	
12061.8 *15*		L	
12066.2 *15*	(1$^-$,2$^+$)[&]	L	
12070.1 *15*	(2$^+$)[&]	L	
12071.4 *15*		L	
12082.8 *15*		L	
12085.2 *15*		L	
12091.9 *15*		L	
12099		L	
12101.3 *15*	1$^-$[&]	JKL	E(level): possible analog of 2356 level in ^{42}Ca.
12105.1 *15*		J L	
12109		JK	
12112.2 *15*	1$^-$[&]	JKL	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)[†]	Jπ[#]	XREF	Comments
12116.5 15	(2+)[&]	KL	
12123.8 15	(1−,2+)[&]	JKL	
12127.6 15		JKL	
12130		J	
12135.2 15		JKL	
12137.9 15		L	
12142		JK	
12144.7 15		JKL	
12146.8 15		L	
12148.5 15		J L	
12153.7 15	2+[&]	JKL	
12156		J	
12158.6 15	1−[&]	KL	
12160		JK	
12163.1 15	1−[&]	JKL	
12168 3	(1−)[&]	JKL	
12172.0 5	(1,2+)[a]	JK	
12175.7 15	1−[&]	KL	
12180		JK	
12182.8 15	1−[&]	KL	
12185		JK	
12187.7 15		JKL	
12198		JK	
12198.1 11		E	
12203.0 15	(1−,3−)[&]	JKL	
12204.1 15		JKL	
12207.9 15	(0+,1−,2+)[&]	JKL	
12210.4 15		L	
12212.2 15		JKL	
12216		JK	
12221.0 15		L	
12222.7 15		J L	
12226.3 15		JKL	
12230.5 15	(1−,2+,3−)[&]	JKL	
12236		JK	
12238.4 15	(1−,3−)[&]	JKL	
12239.4 15		J L	
12246.4 15	(1−,2+)[&]	L	
12247.6 15		L	
12251.8 15	(1−)[&]	L	
12255		JK	
12260.2 15	(2+,3−)[&]	L	
12263		JK	
12265.2 15	1−[&]	L	
12268.1 15	3−[&]	L	
12270		JK	
12271.8 15	(1−,2+)[&]	L	
12277.2 15	(0+,1−,2+,3−,4+)[&]	JKL	
12278.7 15		JKL	
12280	0+	J X	Jπ: L(p,t)=0 from 0+.
12285.7 15	(1−,2+)[&]	J L	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

E(level)†	Jπ#	XREF	Comments
12287.7 *15*		JKL	
12291.3 *15*		JKL	
12294.9 *15*		L	
12298.6 *15*	$(1^-,2^+,3^-)$&	JKL	
12300.6 *15*		JKL	
12304.9 *15*		JKL	
12308.2 *15*		KL	
12310.9 *15*		JKL	
12314		JK	
12316		J	
12320.6 *15*	$(0^+,1^-,2^+)$&	L	
12323.2 *15*	$(1^-,2^+)$&	JKL	
12327.0 *15*		JKL	
12330		JK	
12336		JKL	
12340		KL	
12344		JK	
12348		JKL	
12351		JKL	
12358		J L	
12362		JKL	
12369		JKL	
12374		JKL	
12377		L	
12381		JKL	
12383		L	
12386		JKL	
12390		J	
12397		J L	
12701.4 *4*		E	
12814.7 *8*		E	
13712.8 *11*		E	
13762.8 *13*		E	
14700 *50*	0^+		XREF: Others: AC J^π: L(^{3}He,n)=0.
15251.7 *13*		E	
17.4×10^3 *1*	1^-	J	Γ=3.3 MeV *5* (1973Di03) J^π: GDR, T=1 (p,γ).
20.4×10^3 *1*	1^-	J	Γ=4.4 MeV *1* (1973Di03) J^π: GDR, T=2 (p,γ).

† From least-squares adjustment to measured Eγ data when such data are available. Otherwise weighted averages of available level energies from different reactions are taken.

‡ Primarily from (α,pγ) and (p,p′γ) by Doppler Shift Attenuation Method (DSAM) or Recoil Distance Method (RDM), unless otherwise noted.

\# When L-transfer arguments are used, the target spin-parity is $J^\pi=3/2^+$ for ^{41}K; $J^\pi=0^+$ for ^{40}Ca, ^{42}Ca and ^{44}Ca; $J^\pi=7/2^-$ for ^{43}Ca. When assigning J^π to a level based on γ transitions from this level to a level of known J^π, evaluators use the following rules: if Eγ<4 MeV, transitions are considered to be E1, M1 or E2; if Eγ>4 MeV, M2 and E3 are also considered as possible.

@ From angular distributions of the ground-state γ-rays from resonant states in (α,γ).

& From comparison of experimental data of angular distributions with theoretical predictions in (p,α):resonance.

a From γ(θ) and analysis of proton-resonance data in (p,γ).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{42}Ca Levels (continued)

[b] Band(A): g.s., Yrast band.
[c] Band(B): Excited 0^+ band.
[d] Band(C): Negative-parity structure.

$\gamma(^{42}Ca)$

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	α#	$I_{(\gamma+ce)}$	Comments
1524.71	2^+	1524.67 *3*	100	0.0	0^+	E2				B(E2)(W.u.)=9.5 *4*
1837.31	0^+	312.60 *25*	100 *6*	1524.71	2^+	E2		0.00349		B(E2)(W.u.)=55 *5* I_γ: represents 97.95% *17* decay branching for level.
		1837.3		0.0	0^+	E0			2.05 *17*	ρ^2(E0)=0.140 *12*, q^2_K(E0/E2)=0.92 *8*, X(E0/E2)=0.089 *8* (2005Ki02 evaluation). Decay takes place by pair formation. Γ (pair production)=1.6×10^{-8} eV *2* from (e,e′) (1978Gr02). $I_{(\gamma+ce)}$: from (p,p′γ).
2424.15	2^+	586.9@	<1.5	1837.31	0^+					
		899.41 *4*	100 *2*	1524.71	2^+	M1+E2	−0.17 *2*			B(M1)(W.u.)=0.15 *5*; B(E2)(W.u.)=15 *6*
		2424.16 *7*	43 *2*	0.0	0^+	E2				B(E2)(W.u.)=1.7 *5*
2752.40	4^+	328.2	1.0 *4*	2424.15	2^+	[E2]				B(E2)(W.u.)=60 *30*
		1227.65 *3*	100.0 *4*	1524.71	2^+	E2				B(E2)(W.u.)=8.3 *12*
3189.26	6^+	436.84 *12*	100	2752.40	4^+	E2				B(E2)(W.u.)=0.777 *22*
3253.89	4^+	501.46 *3*	64 *7*	2752.40	4^+	[M1]				B(M1)(W.u.)=0.50 *11*
		829.7	18 *9*	2424.15	2^+	[E2]				B(E2)(W.u.)=1.3×10^2 *8*
		1729.19 *5*	100 *7*	1524.71	2^+	E2(+M3)	+0.05 *4*			B(E2)(W.u.)=19 *4*
3300.0	0^+	875.8	100 *1*	2424.15	2^+	E2				B(E2)(W.u.)<1.3×10^2
		1775.3	8 *4*	1524.71	2^+	E2				B(E2)(W.u.)<0.31
3392.01	2^+	967.8	45 *10*	2424.15	2^+					
		1554.7	15 *3*	1837.31	0^+	[E2]				B(E2)(W.u.)=3.2 *+14−7*
		1867.3	100 *4*	1524.71	2^+	M1+E2	+1.7 *4*			B(M1)(W.u.)=0.0026 *+11−6*; B(E2)(W.u.)=6.4 *+27−15*
		3391.9	87 *8*	0.0	0^+	E2				B(E2)(W.u.)=0.43 *9*
3446.94	3^-	692.0 *8*	6.6 *18*	2752.40	4^+	[E1]				B(E1)(W.u.)=0.00025 *11*
		1022.77 *4*	57 *2*	2424.15	2^+	[E1]				B(E1)(W.u.)=0.00068 *23*
		1922.18 *7*	100 *3*	1524.71	2^+	E1(+M2)	+0.02 *7*			B(E1)(W.u.)=0.00018 *6*; B(M2)(W.u.)<0.7
3654.0	2^+	1229.8	4.2 *10*	2424.15	2^+					
		1816.7	7 *4*	1837.31	0^+	[E2]				B(E2)(W.u.)=4 *+18−3*
		2129.2	100 *3*	1524.71	2^+	M1(+E2)	−0.06 *17*			B(M1)(W.u.)=0.035 *25*; B(E2)(W.u.)<0.55
		3653.8	22.2 *10*	0.0	0^+	E2				B(E2)(W.u.)=0.34 *25*
3885.0	1^-	1460.8	4 *2*	2424.15	2^+					
		2047.6	93 *3*	1837.31	0^+	E1				
		3884.8	100 *4*	0.0	0^+	E1				
3954.39	4^-	507.45 *3*	100 *4*	3446.94	3^-	M1+E2	+0.11 *5*			B(M1)(W.u.)=0.042 *4*; B(E2)(W.u.)=6 *+6−4*
		1202.0	18 *4*	2752.40	4^+	E1				B(E1)(W.u.)=1.5×10^{-5} *4*
3999.66	4^+	1247.2	7 *4*	2752.40	4^+					
		1575.5	49 *5*	2424.15	2^+					
		2474.80 *10*	100 *5*	1524.71	2^+					
4047.0	3^-	600.1	22 *5*	3446.94	3^-	M1+E2	+0.21 *12*			B(M1)(W.u.)=0.07 *3*; B(E2)(W.u.)=30 *+70−25*
		1294.6	29 *8*	2752.40	4^+	[E1]				B(E1)(W.u.)=0.00024 *11*
		1622.8	29 *10*	2424.15	2^+	[E1]				B(E1)(W.u.)=0.00012 *6*
		2522.2	100 *11*	1524.71	2^+	[E1]				B(E1)(W.u.)=0.00011 *4*

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
4099.65	5^-	652.8		3446.94	3^-			
		910.37 *15*	100 *3*	3189.26	6^+	E1(+M2)	+0.04 *2*	B(E1)(W.u.)=0.00102 *24*
		1347.26 *14*	61 *3*	2752.40	4^+	E1+M2	−0.09 *4*	B(E1)(W.u.)=0.00019 *5*
4117.1	3^-	670.1	61 *11*	3446.94	3^-			
		1692.8	21 *6*	2424.15	2^+			
		2592.2	100 *7*	1524.71	2^+			
4232.0	1	1807.8	27 *5*	2424.15	2^+			
		4231.8	100 *5*	0.0	0^+			
4342.3	(0^+ to 4^+)	1918.1	100	2424.15	2^+			
4354.0	4^-	399.6	9 *2*	3954.39	4^-	M1+E2	>0.09	B(M1)(W.u.)<0.046; B(E2)(W.u.)>3.9 δ: also,<−0.09.
		907.0	53 *9*	3446.94	3^-			
		1100.1	20 *5*	3253.89	4^+	[E1]		B(E1)(W.u.)=0.00010 *3*
		1601.6	100 *9*	2752.40	4^+	E1		B(E1)(W.u.)=0.00016 *3*
4418.0	3^-	971.0	67 *12*	3446.94	3^-			
		1993.8	25 *8*	2424.15	2^+			
		2893.2	100 *13*	1524.71	2^+			
4443.0	4^+	1189.1	10 *3*	3253.89	4^+			
		1690.6	100 *5*	2752.40	4^+			
		2018.8	16 *4*	2424.15	2^+			
4448.8	2^+	794.8	34 *6*	3654.0	2^+			
		1001.8	37 *9*	3446.94	3^-			
		2611.4	49 *11*	1837.31	0^+			
		2924.0	100 *17*	1524.71	2^+			
		4448.5	66 *14*	0.0	0^+			
4505.0	$(2,3,4)^+$	1113.0	34 *6*	3392.01	2^+			
		1251.1	15 *4*	3253.89	4^+			
		1752.6	64 *11*	2752.40	4^+			
		2980.2	100 *13*	1524.71	2^+			
4566.9	$(1,2^+)$	682.0	47 *9*	3885.0	1^-			
		2142.8	100 *9*	2424.15	2^+			
		3042.2	100 *9*	1524.71	2^+			I_γ: Iγ(3043)/Iγ(2143)=78/44 in (p,γ).
		4566		0.0	0^+			I_γ: Iγ(4566)/Iγ(2143)=100/44 in (p,γ).
4690.06	3^-	2265.8	22 *6*	2424.15	2^+			
		3165.24 *11*	100 *6*	1524.71	2^+			
4717.53	6^+	1463.7 *3*	95 *5*	3253.89	4^+	[E2]		B(E2)(W.u.)=48 *+30−13*
		1525.5	35 *7*	3189.26	6^+			
		1965.2 *4*	100 *3*	2752.40	4^+	[E2]		B(E2)(W.u.)=12 *+7−3*
4759.71	2^+	2335.70 *30*	57 *29*	2424.15	2^+			
		2922.5	43 *14*	1837.31	0^+			
		3235.1	86 *29*	1524.71	2^+			
		4759.6	100 *29*	0.0	0^+			
4866.0	2^+	2441.8	100 *9*	2424.15	2^+			

$^{42}_{20}Ca_{22}$-20

γ(^{42}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
4866.0	2^+	3341.2	22 *9*	1524.71	2^+			
		4865.7	22 *9*	0.0	0^+			I_γ: $I\gamma(4866)/I\gamma(3341)$=100/100 in (p,$\gamma$).
4897.0	5^-	779.0	8 *1*	4117.1	3^-	[E2]		B(E2)(W.u.)=3.1×10^2 *15* I_γ: branching most likely incorrect.
		797.8 *3*	100 *4*	4099.65	5^-	M1+E2	+0.14 *8*	B(M1)(W.u.)=0.7 *4*; B(E2)(W.u.)=70 *+230−60*
		1449.0	18 *4*	3446.94	3^-	E2		B(E2)(W.u.)=31 *16*
4904.0	3^-	2151.5	36 *9*	2752.40	4^+			
		2479.8	45 *9*	2424.15	2^+			
		4903.7	100 *18*	0.0	0^+	[E3]		
4946.9	$(1,2,3)^-$	2522.7	100	2424.15	2^+			
4971.0	3^-	1016.6	91 *14*	3954.39	4^-			
		2546.7	100 *17*	2424.15	2^+			
		3446.1	94 *17*	1524.71	2^+			E_γ: (p,γ) reported 1526, 2281 and 4968 γ transitions instead of the three transition given here from (α,pγ).
5017.14	4^+	1763.12 *12*	100 *7*	3253.89	4^+			
		3492.2	21 *7*	1524.71	2^+			
5075.0	$(1,2,3)^-$	657.0	47 *10*	4418.0	3^-			
		1628.0	100 *10*	3446.94	3^-			
5158.0	3^-	2733.7	85 *17*	2424.15	2^+			
		3633.1	100 *17*	1524.71	2^+			
5188.0	$(2,3,4)^+$	770.0	100	4418.0	3^-			
5210.3	(2^+)	1956.1	100 *5*	3253.89	4^+			
		2457.5	14 *5*	2752.40	4^+			
5212.98	6	1213.2 *3*	100 *10*	3999.66	4^+			
		1959.1 *4*	75 *9*	3253.89	4^+			
5214.1	(2^+)	1217 *3*	100 *8*	3999.66	4^+			
		2789.7	25 *7*	2424.15	2^+			
		3689.1	39 *8*	1524.71	2^+			
		5213.7@		0.0	0^+			γ reported in (p,γ) only.
5320.0	$(3,4)^-$	902.0	61 *11*	4418.0	3^-			
		1220.3	61 *11*	4099.65	5^-			
		1273.0	26 *5*	4047.0	3^-			
		1365.6	100 *13*	3954.39	4^-			
		2066.1	16 *5*	3253.89	4^+			
5345.0	0^+	3820.1	100	1524.71	2^+			
5358.0	2^+	2933.7	33 *20*	2424.15	2^+			
		5357.6	100 *20*	0.0	0^+			
5380.0	5^-	2126.1	52 *10*	3253.89	4^+			
		2190.5	86 *12*	3189.26	6^+			
		2627.5	100 *14*	2752.40	4^+			
5393.0	$(3)^-$	2968.7	33 *12*	2424.15	2^+			
		3868.1	100 *12*	1524.71	2^+			
5439.0	$(3,4)^-$	1339.3	100	4099.65	5^-			

$^{42}_{20}$Ca$_{22}$-21

Adopted Levels, Gammas (continued)

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
5472.0	$(2,3,4)^+$	2218.1	100 *10*	3253.89	4^+			
		2719.5	43 *8*	2752.40	4^+			
		3947.1	16 *10*	1524.71	2^+			
5490.77	6^-	2301.6 *2*	100	3189.26	6^+	E1(+M2)	+0.10 *8*	B(E1)(W.u.)=0.00077 *19*
5491.0	3^-	1374.0	100 *13*	4117.1	3^-			
		3966.1	45 *13*	1524.71	2^+			
5510.0	3^-	1463.0	47 *12*	4047.0	3^-			
		2063.0	100 *12*	3446.94	3^-			
5530.0	2^+	3105.7	100 *13*	2424.15	2^+			
		4005.1	43 *13*	1524.71	2^+			
5578.0	$(0^+$ to $4^+)$	2185.9	100	3392.01	2^+			
5593.0	3^-	1638.6	100 *15*	3954.39	4^-			
		3168.7	56 *8*	2424.15	2^+			
		4068.1	52 *15*	1524.71	2^+			
		5592.6	52 *15*	0.0	0^+	[E3]		E_γ: reported only in (p,γ).
5601.0	$(3^-,4^-)$	1096.0	49 *15*	4505.0	$(2,3,4)^+$			
		1601.3	100 *15*	3999.66	4^+			
5624.0	3^-	1624.3	100 *15*	3999.66	4^+			
		5623.6	60 *15*	0.0	0^+	[E3]		
5665.0	(3^-)	1247.0	51 *11*	4418.0	3^-			
		1710.6	100 *16*	3954.39	4^-			
		3240.7	71 *13*	2424.15	2^+			
5670.0	(3^-)	2223.0	100 *16*	3446.94	3^-			
		4145.1	79 *16*	1524.71	2^+			
5691.77	6^+	974.1 *2*	100 *13*	4717.53	6^+			
		2437.8 *3*	83 *13*	3253.89	4^+			
		2502.4	30 *9*	3189.26	6^+			
5716.0	2^+	2462.0	100	3253.89	4^+			
5725.0	$(2^+$ to $6^+)$	2972.5	100	2752.40	4^+			
5738.0	(2^+)	3313.7	33 *17*	2424.15	2^+			
		4213.1	33 *17*	1524.71	2^+			
		5737.6	100 *33*	0.0	0^+			
5744.01	7^-	253.3 *1*	2.6 *2*	5490.77	6^-			
		1026.3 *2*	4.0 *4*	4717.53	6^+			
		1644.29 *11*	100 *3*	4099.65	5^-	E2(+M3)	−0.02 *3*	B(E2)(W.u.)=7.2 *18*
		2554.75 *21*	73 *3*	3189.26	6^+	E1+M2	−0.04 *2*	B(E1)(W.u.)=3.2×10^{-5} *8*; B(M2)(W.u.)<0.12
5769.0	3^-	3016.5	100 *11*	2752.40	4^+			
		3344.7	59 *11*	2424.15	2^+			
5774.9	$(4,5)^+$	2521.0	100 *3*	3253.89	4^+			
		2585.5	12 *3*	3189.26	6^+			
5797.0	$(1,2)^+$	3372.7	100 *18*	2424.15	2^+			
		4272.1	72 *15*	1524.71	2^+			
		5796.6	85 *18*	0.0	0^+			

From ENSDF

$^{42}_{20}Ca_{22}$-22

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
5802.0	3^-	1802.3	100	3999.66	4^+			
5822.0	$(1,2,3)^-$	3397.7	100	2424.15	2^+			
5866.0	$(1,2,3^-)$	4028.5	122 *22*	1837.31	0^+			
		4341.1	100 *22*	1524.71	2^+			
5875.0	2^+	3122.5	41 *11*	2752.40	4^+			
		3450.7	100 *11*	2424.15	2^+			
5924.0	$(3,4)^-$	1419.0	27 *8*	4505.0	$(2,3,4)^+$			
		1570.0	32 *8*	4354.0	4^-			
		1824.2	100 *14*	4099.65	5^-			
		1969.6	57 *11*	3954.39	4^-			
		3171.5	54 *11*	2752.40	4^+			
5925.5	(5)	2736.2 *4*	100	3189.26	6^+			
5994.0	3^-	1023.0	20 *6*	4971.0	3^-			
		3569.7	100 *6*	2424.15	2^+			
6003.0	$3^-,4^-$	3250.5	100	2752.40	4^+			
6020.0	$(4^+,5,6^-)$	2065.6	23 *7*	3954.39	4^-			
		2830.5	100 *7*	3189.26	6^+			
6028.0	$(3)^-$	2073.6	91 *16*	3954.39	4^-			
		3275.5	100 *16*	2752.40	4^+			
		4503.0	36 *11*	1524.71	2^+			
6038.0	$(1,2,3)^-$	3613.7	33 *8*	2424.15	2^+			Additional information 7.
		4513.0	100 *8*	1524.71	2^+			Additional information 8.
6093.5	(3^- to 7^-)	1197.0	100 *8*	4897.0	5^-			
		1993.2	47 *8*	4099.65	5^-			
6104.0	(0^+ to 4^+)	3679.7	100 *14*	2424.15	2^+			
		4579.0	79 *14*	1524.71	2^+			
6113.0	4^+	1695.0	16 *5*	4418.0	3^-			
		2859.0	100 *5*	3253.89	4^+			
6140.8	6^-	649.8	16 *6*	5490.77	6^-	(M1+E2)	−0.25 *+25−10*	B(M1)(W.u.)=0.16 *+8−10*; B(E2)(W.u.)<210
		1787.0	17 *3*	4354.0	4^-	[E2]		B(E2)(W.u.)=8 *+3−4*
		2041.2@	26 *5*	4099.65	5^-	[M1]		B(M1)(W.u.)=0.009 *+3−5* Placement possibly incorrect.
		2186.5	100 *9*	3954.39	4^-	E2(+M3)	≈0	B(E2)(W.u.)=13 *5*
6144.72	7^-	2955.42 *20*	100	3189.26	6^+	E1(+M2)	+0.02 *2*	B(E1)(W.u.)>0.00031
6182.0	$(1,2,3^-)$	4657.0	100 *13*	1524.71	2^+			
		6181.5	47 *13*	0.0	0^+			
6212.0	3^-	3459.4	100	2752.40	4^+			
6247.9	$(4^+,5,6^-)$	2293.5	74 *13*	3954.39	4^-			
		3058.4	100 *15*	3189.26	6^+			
		3495.4	82 *13*	2752.40	4^+			
6408.57	8^-	263.84 *8*	20.3 *9*	6144.72	7^-	M1(+E2)	0.00 *2*	B(M1)(W.u.)=0.0055 *6*
		664.6 *2*	5.0 *7*	5744.01	7^-			
		917.77 *12*	100 *3*	5490.77	6^-	E2(+M3)	+0.03 *2*	B(E2)(W.u.)=2.28 *21*

$^{42}_{20}Ca_{22}$-23

γ(^{42}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
6408.57	8^-	3219.2 *3*	16.3 *17*	3189.26	6^+	M2+E3	+0.85 *23*	B(M2)(W.u.)=0.016 *5*; B(E3)(W.u.)=5.0 *18* δ: weighted average of +0.8 *2* in (^{16}O,2pγ) and +2.0 *10* in (α,pγ).
6516.0		2630.9		3885.0	1^-			E_γ: from (^{14}C,^{12}C) only.
		4091.6		2424.15	2^+			E_γ: from (^{14}C,^{12}C) only.
		4991.0		1524.71	2^+			E_γ: from (^{14}C,^{12}C) only.
6541.8	5^+	1050.8	43 *7*	5490.77	6^-			
		2442.2	29 *7*	4099.65	5^-			
		3352.4	100 *10*	3189.26	6^+			
6553.72	9^-	145.12 *10*	36.8 *17*	6408.57	8^-	M1(+E2)	0.00 *2*	B(M1)(W.u.)=0.042 *4*
		409.1 *2*	3.0 *5*	6144.72	7^-			E_γ: reported only in (^{18}O,α2nγ).
		809.73 *10*	100 *2*	5744.01	7^-	E2(+M3)	−0.03 *2*	B(E2)(W.u.)=2.96 *23*
		3364.4 *3*	11 *1*	3189.26	6^+	[E3]		B(E3)(W.u.)=4.1 *5* E_γ: reported only in (^{18}O,α2nγ).
6584.7	(5^- to 8^-)	840.7	100 *11*	5744.01	7^-			
		1093.8	85 *11*	5490.77	6^-			
6636.30	8^+	1918.6 *2*	100 *4*	4717.53	6^+			
		3447.1 *4*	100 *3*	3189.26	6^+			
6674.8	(4^+ to 8^+)	3485.4	100	3189.26	6^+			
6715.9	(4^+)	1505.0	100 *13*	5210.3	(2^+)			
		1999.9	83 *13*	4717.53	6^+			
		3525.4	68 *13*	3189.26	6^+			
6718.14	7	1505.1 *2*	100 *9*	5212.98	6			
		2000.4 *3*	64 *7*	4717.53	6^+			
		3528.8 *5*	52 *5*	3189.26	6^+			
6746.5	4^+	1850.0	100 *18*	4897.0	5^-			
		2646.2	96 *18*	4099.65	5^-			
6816.8	$(4,5)^+$	3627.4	100	3189.26	6^+			
6895.8	4^+	970.5	32 *6*	5925.5	(5)			
		1404.8	8 *3*	5490.77	6^-			
		3706.4	100 *6*	3189.26	6^+			
6940.2	(5^-,6,7^-)	1195.7	43 *9*	5744.01	7^-			
		2043.9	100 *13*	4897.0	5^-			
		2840.2	74 *11*	4099.65	5^-			
6975.5	(5^+)	1483.8	36 *7*	5490.77	6^-			
		2259.9	27 *7*	4717.53	6^+			
		2875.2	60 *9*	4099.65	5^-			
		3785.4	100 *11*	3189.26	6^+			
7129.9	4^+	3940.4	100	3189.26	6^+			
7197.9		4008.4	100	3189.26	6^+			
7282.02	9^-	728.3 *1*	30 *3*	6553.72	9^-			
		873.5 *2*	100 *5*	6408.57	8^-			
7344.7	(6^- to 10^-)	936.1	100	6408.57	8^-			
7360.6	(5^- to 9^-)	1215.9	100	6144.72	7^-			

$^{42}_{20}Ca_{22}$-24

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ †	I_γ †	E_f	J^π_f	Mult. ‡	δ ‡	Comments
7368.46	10^-	814.70 *19*	100 *3*	6553.72	9^-	M1+E2		
		959.9 *2*	3.5 *6*	6408.57	8^-	[E2]		B(E2)(W.u.)=1.4 +*10*−*4*
7388.8	4^+	4199.3	100	3189.26	6^+			
7415.87	8^+	779.6 *2*	35 *3*	6636.30	8^+			
		1723.9 *3*	30 *5*	5691.77	6^+			
		2699.9	4.0 *12*	4717.53	6^+			
		4225.3	100 *5*	3189.26	6^+			
7421.2	(4^+ to 8^+)	2704.9	33 *5*	4717.53	6^+			
		4230.3	100 *5*	3189.26	6^+			
7543.1	(4^+ to 7^-)	2645.9	100 *19*	4897.0	5^-			
		2826.9	100 *19*	4717.53	6^+			
		4352.3	63 *19*	3189.26	6^+			
7562.5	(4^+,5^+)	2844.9	100	4717.53	6^+			
7634.03	(6,8^+)	1708.5 *4*	51 *9*	5925.5	(5)			
		1942.2 *3*	54 *9*	5691.77	6^+			
		2916.3 *3*	100 *14*	4717.53	6^+			
		4444.3	80 *11*	3189.26	6^+			
7696.8	4^+	4507.3	100	3189.26	6^+			
7726.5	(4^+ to 8^+)	3008.9	100	4717.53	6^+			
7750.66	$(11)^-$	382.20 *8*	100	7368.46	10^-	M1(+E2)	+0.02 *7*	
7758.0	(6^-,7^-)	1349.1	56 *9*	6408.57	8^-			
		2013.6	75 *13*	5744.01	7^-			
		2266.7	100 *13*	5490.77	6^-			
		2861.9	81 *13*	4897.0	5^-			
7800.7	(5^- to 9^-)	1655.9	100	6144.72	7^-			
7838.9	(2^+ to 6^+)	1123.0	100	6715.9	(4^+)			
7921.2	(4^+ to 8^+)	3204.9	100 *13*	4717.53	6^+			
		4730.3	61 *13*	3189.26	6^+			
7939.8	(4^+ to 8^+)	2248.0	75 *12*	5691.77	6^+			
		4750.3	100 *12*	3189.26	6^+			
8052.6	(4^+ to 8^+)	3334.9	100	4717.53	6^+			
8059.7	(6^- to 9^-)	1651.1	100 *2*	6408.57	8^-			
		2315.6	6 *2*	5744.01	7^-			
8082.7	(7^- to 11^-)	1529.0	100	6553.72	9^-			
8103.2	(4^+ to 8^+)	2410.0	49 *8*	5691.77	6^+			
		3386.9	100 *8*	4717.53	6^+			
8297.46	11^-	928.98 *10*	100 *4*	7368.46	10^-	M1+E2	−0.11 *5*	B(M1)(W.u.)>0.0095; B(E2)(W.u.)>0.040
		1743.8 *2*	67 *4*	6553.72	9^-	[E2]		
8364.8	(6^-,7,8^+)	1956.1	100 *18*	6408.57	8^-			
		5175.2	75 *18*	3189.26	6^+			
8449.7	$(7,8)^-$	1896.0	69 *12*	6553.72	9^-			
		2041.0	69 *12*	6408.57	8^-			
		2958.7	100 *12*	5490.77	6^-			

$^{42}_{20}Ca_{22}$-25

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡
8511.7	(6^- to 9^-)	2103.0	89 *13*	6408.57	8^-		
		2767.6	100 *13*	5744.01	7^-		
8517.0	(3 to 9)	2591.4	100	5925.5	(5)		
8522.3	(10)	771.61 *20*	100	7750.66	$(11)^-$	D(+Q)	0.00 *4*
8580.9	(2^+ to 6^+)	1865.0		6715.9	(4^+)		
8611.9	(2^+ to 6^+)	1896.0	100	6715.9	(4^+)		
8615.13	9	1199.3 *3*	34 *4*	7415.87	8^+		
		1896.9 *2*	100 *8*	6718.14	7		
		1978.7 *3*	54 *7*	6636.30	8^+		
		2061.1	9 *2*	6553.72	9^-		
8722.30	9	1306.4 *2*	90 *9*	7415.87	8^+		
		1440.3 *3*	30 *5*	7282.02	9^-		
		2004.0 *3*	86 *15*	6718.14	7		
		2085.9 *2*	100 *10*	6636.30	8^+		
		2168.6 *3*	36 *6*	6553.72	9^-		
8744.9	(8^- to 12^-)	1376.4		7368.46	10^-		
8773.7	(5,6,7)	3282.7	100 *11*	5490.77	6^-		
		5584.2	41 *11*	3189.26	6^+		
8847.97	(10^+)	2211.6 *2*	100	6636.30	8^+		
8951.3	(6^+ to 10^+)	2314.9	100	6636.30	8^+		
9015.01	10^+	292.7 *2*	11 *2*	8722.30	9		
		399.9 *1*	26 *2*	8615.13	9		
		717.6 *3*	5 *1*	8297.46	11^-		
		1599.1 *1*	100 *4*	7415.87	8^+		
		1733.0 *2*	67 *10*	7282.02	9^-		
		2378.6 *3*	13 *2*	6636.30	8^+		
		2461.3 *3*	15 *2*	6553.72	9^-		
9036.9	(8^- to 12^-)	1668.4	100	7368.46	10^-		
9205.9	(7^- to 9^-)	1924.0	92 *13*	7282.02	9^-		
		3060.8	100 *13*	6144.72	7^-		
9241.9?		1959.9		7282.02	9^-		
9311.08	(8,10^+)	1677.0 *3*	90 *6*	7634.03	(6,8^+)		
		2674.7 *3*	100 *12*	6636.30	8^+		
9377.7	(5^- to 9^-)	3633.5	100	5744.01	7^-		
9759.7	(7^- to 11^-)	3205.9	100	6553.72	9^-		
9786.29	(9^-,11)	475.2 *1*	14 *1*	9311.08	(8,10^+)		
		771.3 *1*	100 *3*	9015.01	10^+		
		938.3 *2*	16 *1*	8847.97	(10^+)		
		1063.9 *3*	24.0 *14*	8722.30	9		
		1171.0 *2*	16.0 *15*	8615.13	9		
		1488.8 *1*	44 *2*	8297.46	11^-		
		2417.8 *2*	28 *2*	7368.46	10^-		
9841.6	$(5,6)^-$	3696.7	100	6144.72	7^-		

$^{42}_{20}Ca_{22}$-26

γ(^{42}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Comments
10035.6	(5^- to 9^-)	3890.7	100	6144.72	7^-	
10168.69	(10,12^+)	382.4 *1*	100 *3*	9786.29	(9^-,11)	
		1153.6 *3*	29 *2*	9015.01	10^+	
		1871.2 *2*	11 *1*	8297.46	11^-	
10450.0	$(5)^-$	6349.8	100	4099.65	5^-	I_γ: represents>60% decay branching for level.
11165.7	(10,12)	2868.1 *8*	100	8297.46	11^-	
11361.3	(1,2^+)	9835.4		1524.71	2^+	
		11359.6		0.0	0^+	
11405.1	(12^+)	2557.0	100	8847.97	(10^+)	
(11480.64)	3^-,4^-	6462.79 *17*		5017.14	4^+	
		6720.46 *18*		4759.71	2^+	
		6790.05 *17*		4690.06	3^-	
		7480.07 *18*		3999.66	4^+	
		7525.47 *10*		3954.39	4^-	
		8033.03 *18*		3446.94	3^-	
		8225.86 *13*		3253.89	4^+	
		8727.42 *14*		2752.40	4^+	
11644.1	(1^-,2^+)	7194.6	6	4448.8	2^+	
		7411.4	50	4232.0	1	
		7526.4	19	4117.1	3^-	
		7596.4	19	4047.0	3^-	
		7758.3	19	3885.0	1^-	
		7989.3	19	3654.0	2^+	
		8251.2	9	3392.01	2^+	
		9218.8	16	2424.15	2^+	
		9805.6	12	1837.31	0^+	
		10118.1	100	1524.71	2^+	
		11642.4	44	0.0	0^+	
11670.9	2^+	7221.4	38	4448.8	2^+	
		7553.2	34	4117.1	3^-	
		8016.1	28	3654.0	2^+	
		8278.0	31	3392.01	2^+	
		9245.6	59	2424.15	2^+	
		9832.4	100	1837.31	0^+	
		10144.9	55	1524.71	2^+	
11674.0	(1^-,2^+)	7556.3	100	4117.1	3^-	
		8281.1	59	3392.01	2^+	
		9248.7	48	2424.15	2^+	
		9835.5	48	1837.31	0^+	
		10148.0	90	1524.71	2^+	
11693.0	(1^-,2^+)	6932.5	90	4759.71	2^+	
		7460.3	62	4232.0	1	
		7575.3	33	4117.1	3^-	

$^{42}_{20}$Ca$_{22}$-27

γ(^{42}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	Comments
11693.0	(1⁻,2⁺)	8038.2	71	3654.0	2⁺			
		8300.1	62	3392.01	2⁺			
		8392.1	14	3300.0	0⁺			
		9267.7	100	2424.15	2⁺			
		10167.0	43	1524.71	2⁺			
11707.5	2⁺	6114.0	32	5593.0	3⁻			
		7364.5	20	4342.3	(0⁺ to 4⁺)			
		7474.8	36	4232.0	1			
		7821.7	20	3885.0	1⁻			
		8052.7	32	3654.0	2⁺			
		8314.6	24	3392.01	2⁺			
		8406.6	12	3300.0	0⁺			
		9282.2	32	2424.15	2⁺			
		9869.0	100	1837.31	0⁺			
		10181.5	56	1524.71	2⁺			
11725.7	(8⁻ to 11)	2483.8		9241.9?				
		4357.0		7368.46	10⁻			
11727.1	2⁺	6966.6	27	4759.71	2⁺	D(+Q)	+0.02 *4*	δ: or +3.0 *10*.
		7277.6	67	4448.8	2⁺	(D+Q)	+0.70 *10*	
		7308.4	27	4418.0	3⁻			
		7494.4	47	4232.0	1	(D+Q)	+0.30 *15*	δ: or +2.0 *10*.
		7609.4	47	4117.1	3⁻			
		8072.3	20	3654.0	2⁺			
		8334.2	40	3392.01	2⁺	D+Q	+3.7 *1*	
		8426.2	40	3300.0	0⁺			
		9301.8	93	2424.15	2⁺	D+Q	+0.65 *5*	
		9888.5	67	1837.31	0⁺			
		10201.1	93	1524.71	2⁺	D+Q	−0.20 *5*	
		11725.3	100	0.0	0⁺			
11738.4	1⁻	6523.9	45	5214.1	(2⁺)			
		6833.8	82	4904.0	3⁻			
		7288.9	18	4448.8	2⁺			
		7505.7	32	4232.0	1			
		7620.7	100	4117.1	3⁻			
		7852.6	45	3885.0	1⁻			
		8083.6	27	3654.0	2⁺			
		8345.5	50	3392.01	2⁺			
		9899.8	9	1837.31	0⁺			
		10212.4	23	1524.71	2⁺			
		11736.6	23	0.0	0⁺			
11743.4	(1⁻,2⁺)	7510.7	35	4232.0	1			
		7625.7	29	4117.1	3⁻			
		8350.5	79	3392.01	2⁺			

$^{42}_{20}$Ca$_{22}$-28

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f
11743.4	$(1^-,2^+)$	9904.8	26	1837.31	0^+
		10217.4	100	1524.71	2^+
		11741.6	24	0.0	0^+
11775.0	$(1^-,2^+)$	7207.3	33	4566.9	$(1,2^+)$
		7542.3	29	4232.0	1
		7657.3	19	4117.1	3^-
		7774.6	76	3999.66	4^+
		7889.2	29	3885.0	1^-
		8327.2	100	3446.94	3^-
		8382.1	62	3392.01	2^+
		9349.7	76	2424.15	2^+
		10249.0	24	1524.71	2^+
		11773.2	29	0.0	0^+
11795.2	$(1^-,2^+)$	7677.4	50	4117.1	3^-
		8347.4	25	3446.94	3^-
		8402.3	100	3392.01	2^+
		9369.9	92	2424.15	2^+
		9956.6	46	1837.31	0^+
		10269.2	33	1524.71	2^+
		11793.4	71	0.0	0^+
11805.4	$(1^-,2^+)$	6211.9	86	5593.0	3^-
		7355.9	38	4448.8	2^+
		7386.7	52	4418.0	3^-
		7462.4	100	4342.3	$(0^+$ to $4^+)$
		7757.6	71	4047.0	3^-
		8357.6	24	3446.94	3^-
		8412.5	52	3392.01	2^+
		9380.1	14	2424.15	2^+
		10279.3	19	1524.71	2^+
		11803.6	19	0.0	0^+
11821.1		1652.3 *4*	83 *11*	10168.69	$(10,12^+)$
		2034.6 *8*	100 *7*	9786.29	$(9^-,11)$
11822.4	(1^-)	7589.7	100	4232.0	1
		8167.5	56	3654.0	2^+
		8429.5	52	3392.01	2^+
		9397.1	48	2424.15	2^+
		9983.8	36	1837.31	0^+
		10296.3	92	1524.71	2^+
		11820.6	16	0.0	0^+
11843.3	$(1^-,2^+)$	6871.7	68	4971.0	3^-
		6976.7	100	4866.0	2^+
		8188.4	39	3654.0	2^+
		8542.4	26	3300.0	0^+
11843.3	$(1^-,2^+)$	9418.0	29	2424.15	2^+
		10317.2	61	1524.71	2^+
11868.0	$(1^-,2^+)$	6963.4	87	4904.0	3^-
		7750.2	87	4117.1	3^-
		7820.2	87	4047.0	3^-
		8213.1	73	3654.0	2^+
		8475.1	87	3392.01	2^+
		9442.7	100	2424.15	2^+
		10029.4	33	1837.31	0^+
		10341.9	53	1524.71	2^+
		11866.2	60	0.0	0^+
11871.5	$(1^-,2^+)$	6133.0	59	5738.0	(2^+)
		6513.0	59	5358.0	2^+
		7753.7	82	4117.1	3^-
		7823.7	47	4047.0	3^-
		7985.7	71	3885.0	1^-
		8478.6	29	3392.01	2^+
		9446.2	100	2424.15	2^+
		10032.9	29	1837.31	0^+
		10345.4	47	1524.71	2^+
		11869.7	55	0.0	0^+
11873.7	$(1^-,2^+)$	7641.0	100	4232.0	1
		7755.9	28	4117.1	3^-
		7825.9	28	4047.0	3^-
		7987.9	34	3885.0	1^-
		8480.8	19	3392.01	2^+
		9448.4	25	2424.15	2^+
		10035.1	16	1837.31	0^+
		10347.6	56	1524.71	2^+
		11871.9	6	0.0	0^+
11925.6	$(1^-,2^+)$	8270.7	42	3654.0	2^+
		8477.7	53	3446.94	3^-
		9500.3	40	2424.15	2^+
		10399.5	63	1524.71	2^+
		11923.8	100	0.0	0^+
11959.2	(1^-)	8511.3	25	3446.94	3^-
		9533.9		2424.15	2^+
		10433.1	50	1524.71	2^+
		11957.4	100	0.0	0^+
11980.3	1^-	7530.8	23	4448.8	2^+
		8325.4	18	3654.0	2^+
		8532.4	5	3446.94	3^-
		8587.4	8	3392.01	2^+

$^{42}_{20}Ca_{22}$-29

Adopted Levels, Gammas (continued)

$\gamma(^{42}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	E_i(level)	J^π_i	E_γ†	E_f	J^π_f
11980.3	1^-	8679.3	21	3300.0	0^+	12198.1		3350.0	8847.97	(10^+)
		9555.0	21	2424.15	2^+	12701.4		880.3 *2*	11821.1	
		10454.2	100	1524.71	2^+			2533 *1*	10168.69	$(10,12^+)$
		11978.5	62	0.0	0^+	12814.7		2646.0	10168.69	$(10,12^+)$
12172.0	$(1,2^+)$	8779.0	72	3392.01	2^+			4517.0	8297.46	11^-
		9746.6	83	2424.15	2^+	13712.8		5415.0	8297.46	11^-
		10645.8	60	1524.71	2^+	13762.8		2037.0	11725.7	$(8^-$ to $11)$
		12170.1	100	0.0	0^+	15251.7		2436.9	12814.7	

† Primarily from $(\alpha,p\gamma)$, (p,γ), $(p,p'\gamma)$ and $(^{18}O,\alpha 2n\gamma)$. Weighted averages are taken of all available values with uncertainties. Values of γ-energies without uncertainties are deduced from level-energy difference.

‡ From $\gamma(\theta,pol)$ in $(\alpha,p\gamma)$, $(p,p'\gamma)$ and $(^{19}F,\alpha\gamma)$. If $T_{1/2}$ is unknown and parity is determined not by polarization measurements, evaluators use D and Q, instead of M1 and E2, or, E1 and M2.

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.

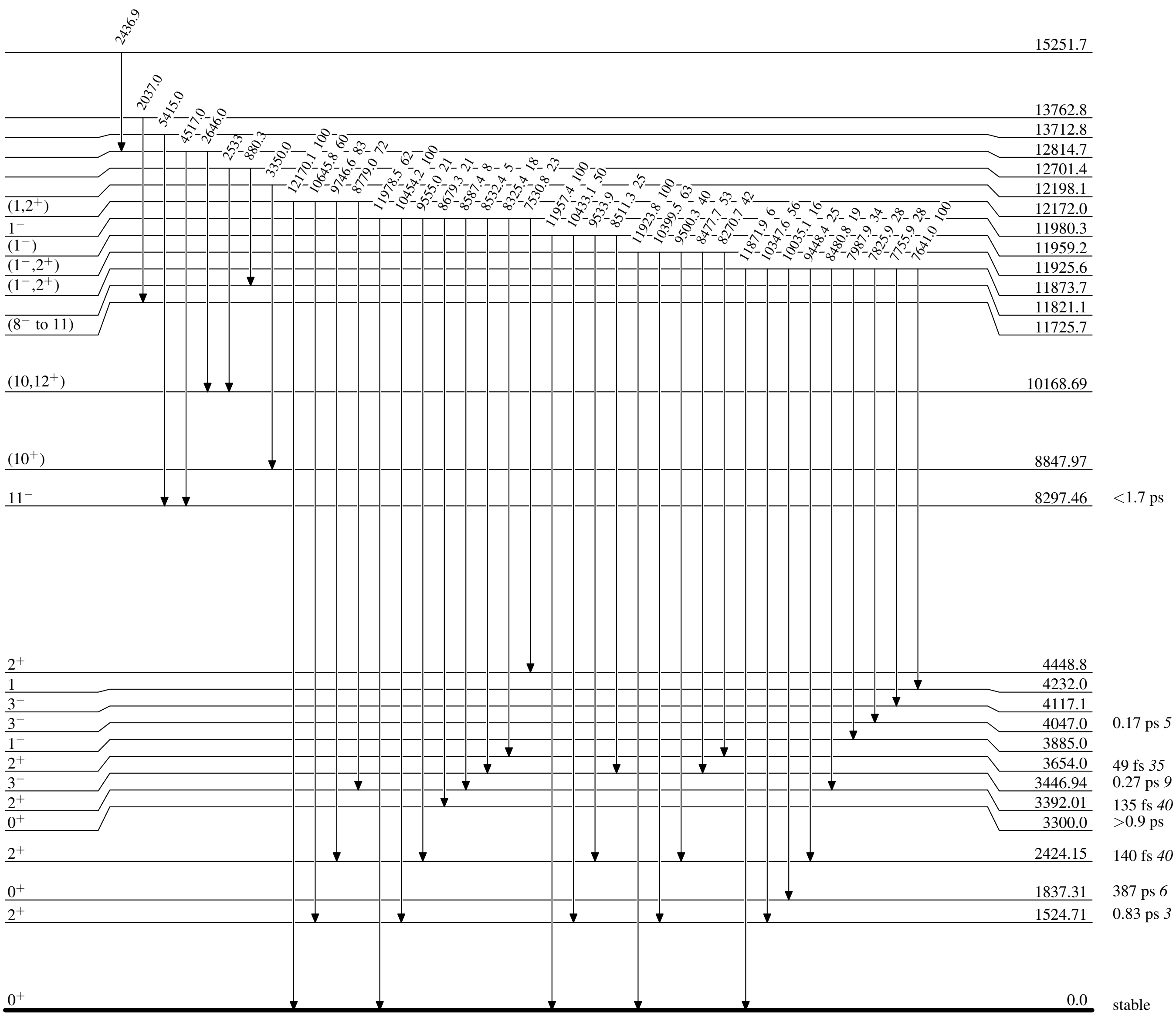
@ Placement of transition in the level scheme is uncertain.

$^{42}_{20}Ca_{22}$-30

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

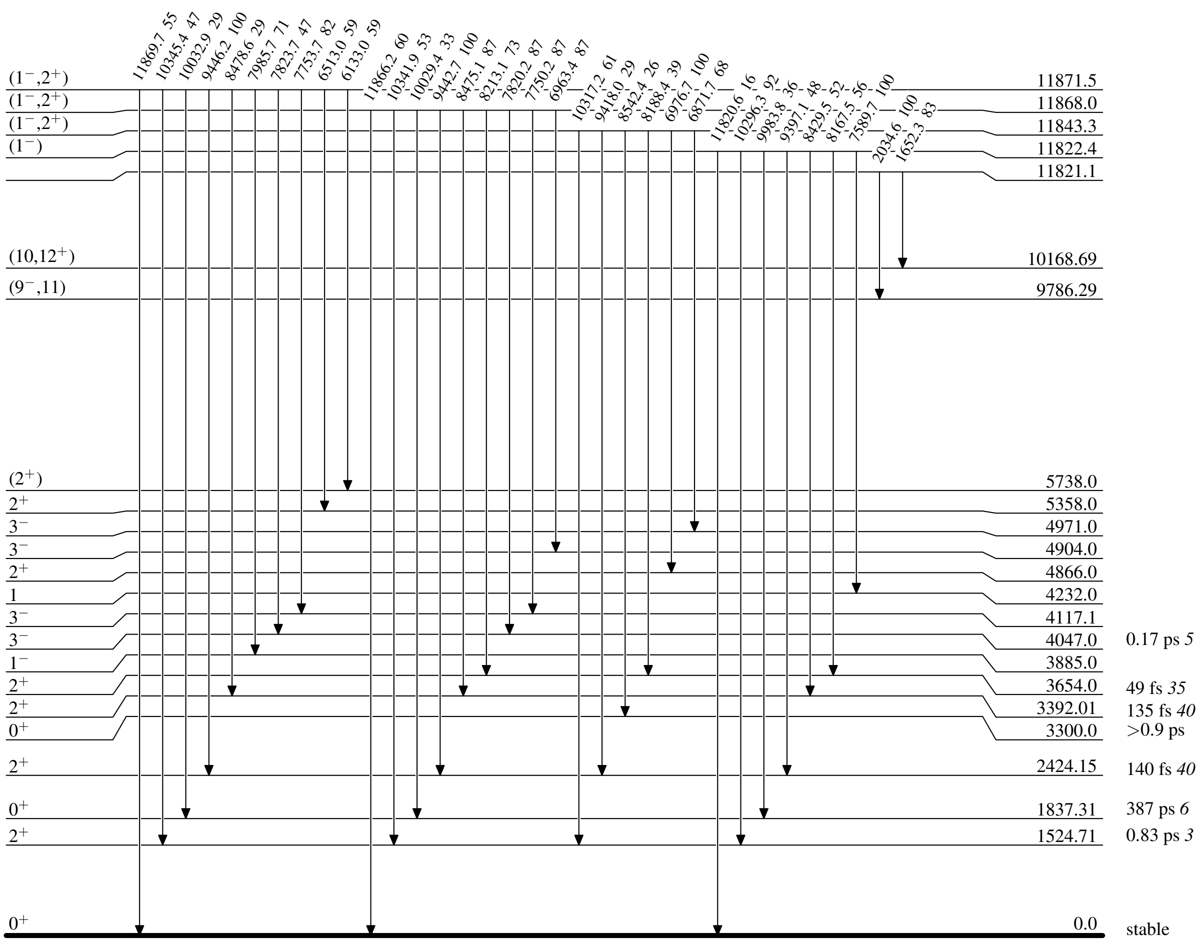


$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

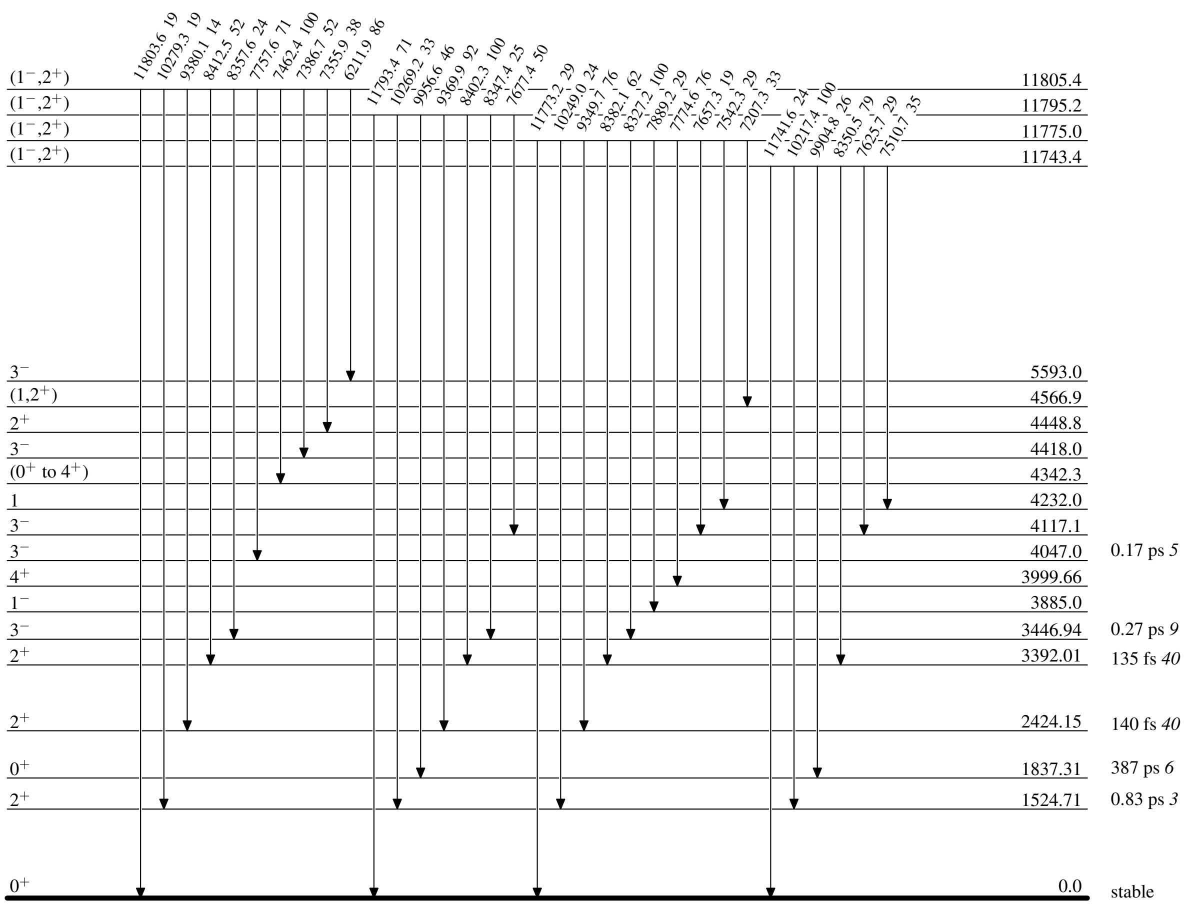


$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

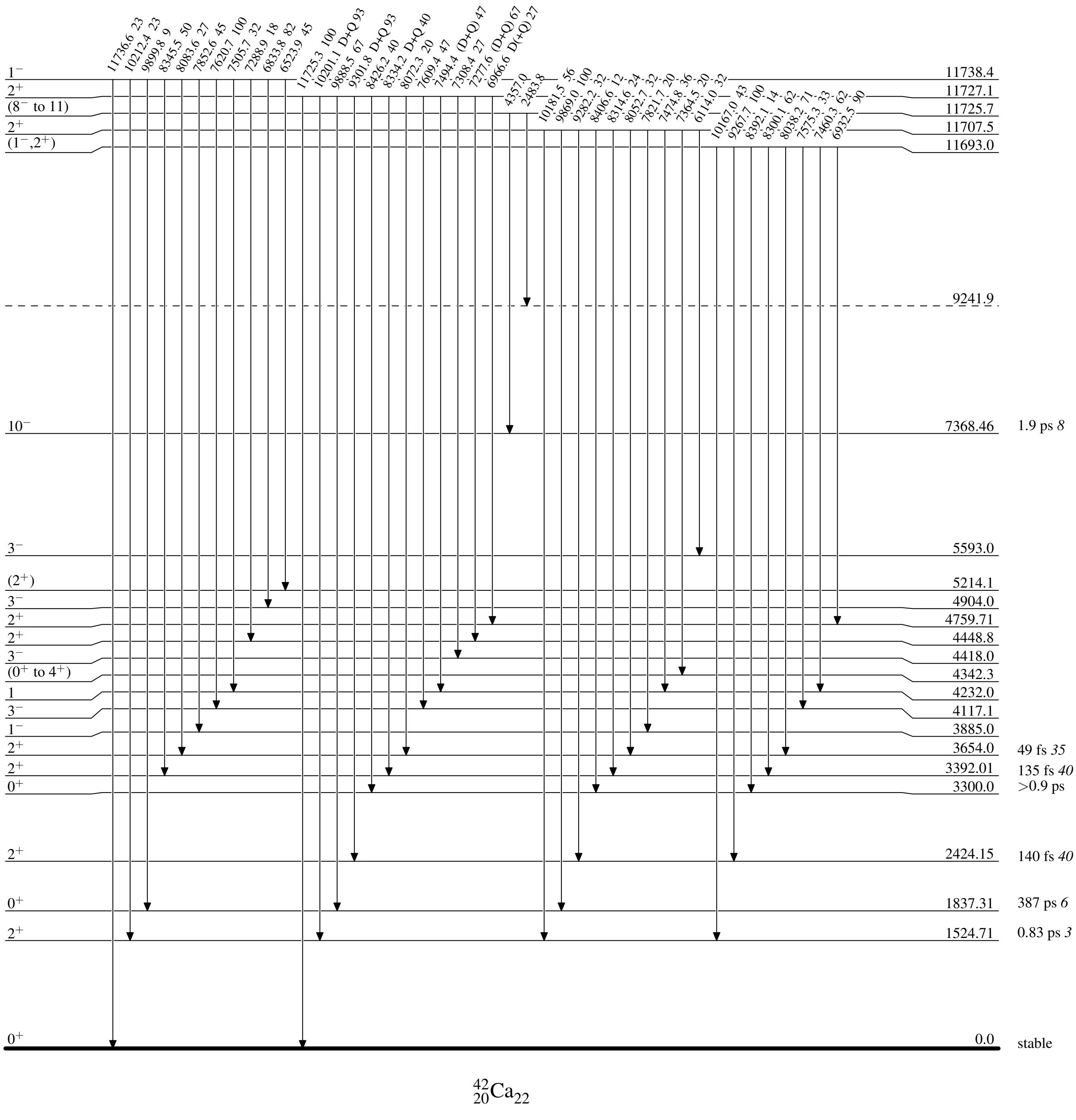


$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

Level Scheme (continued)

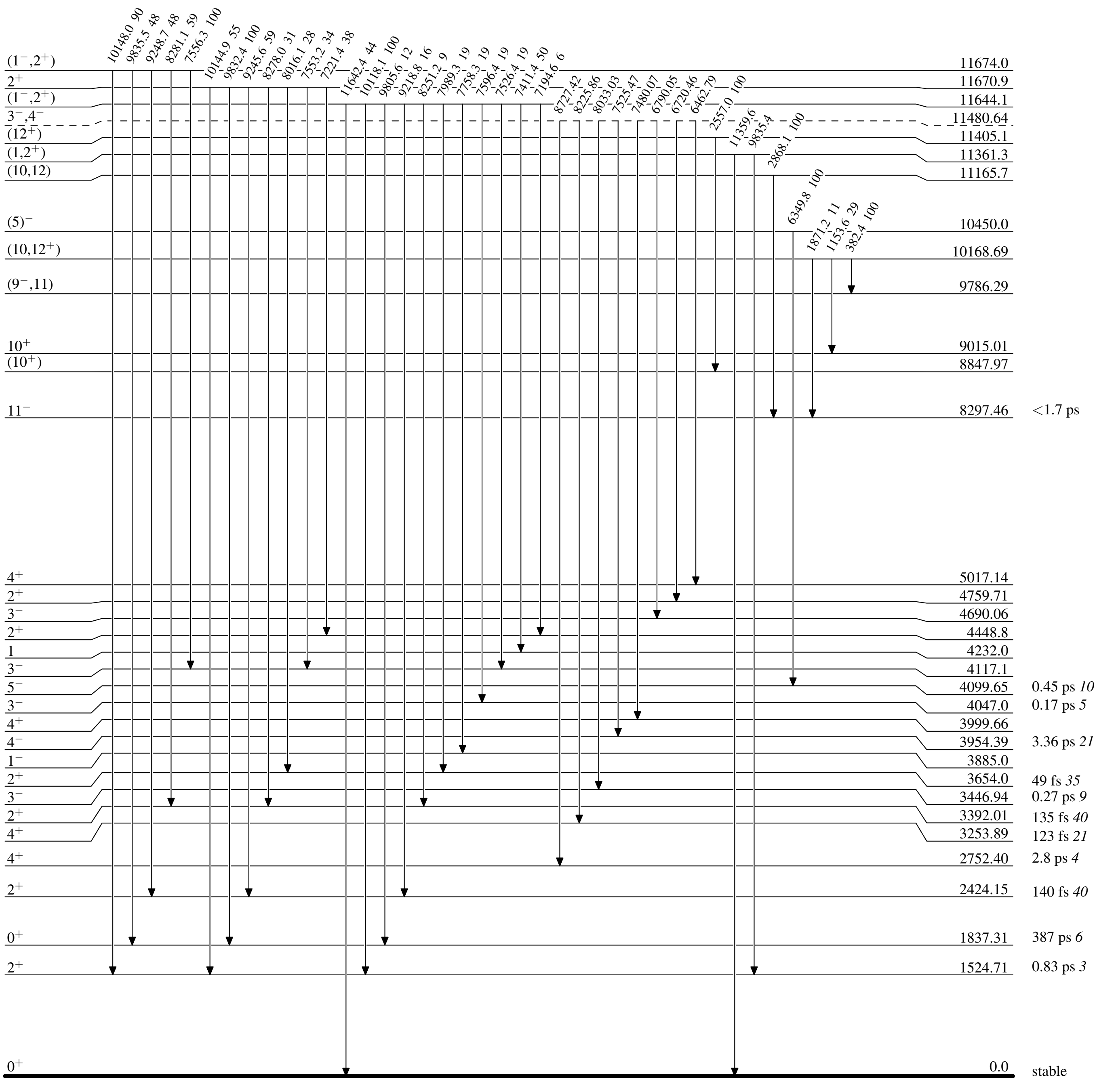
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

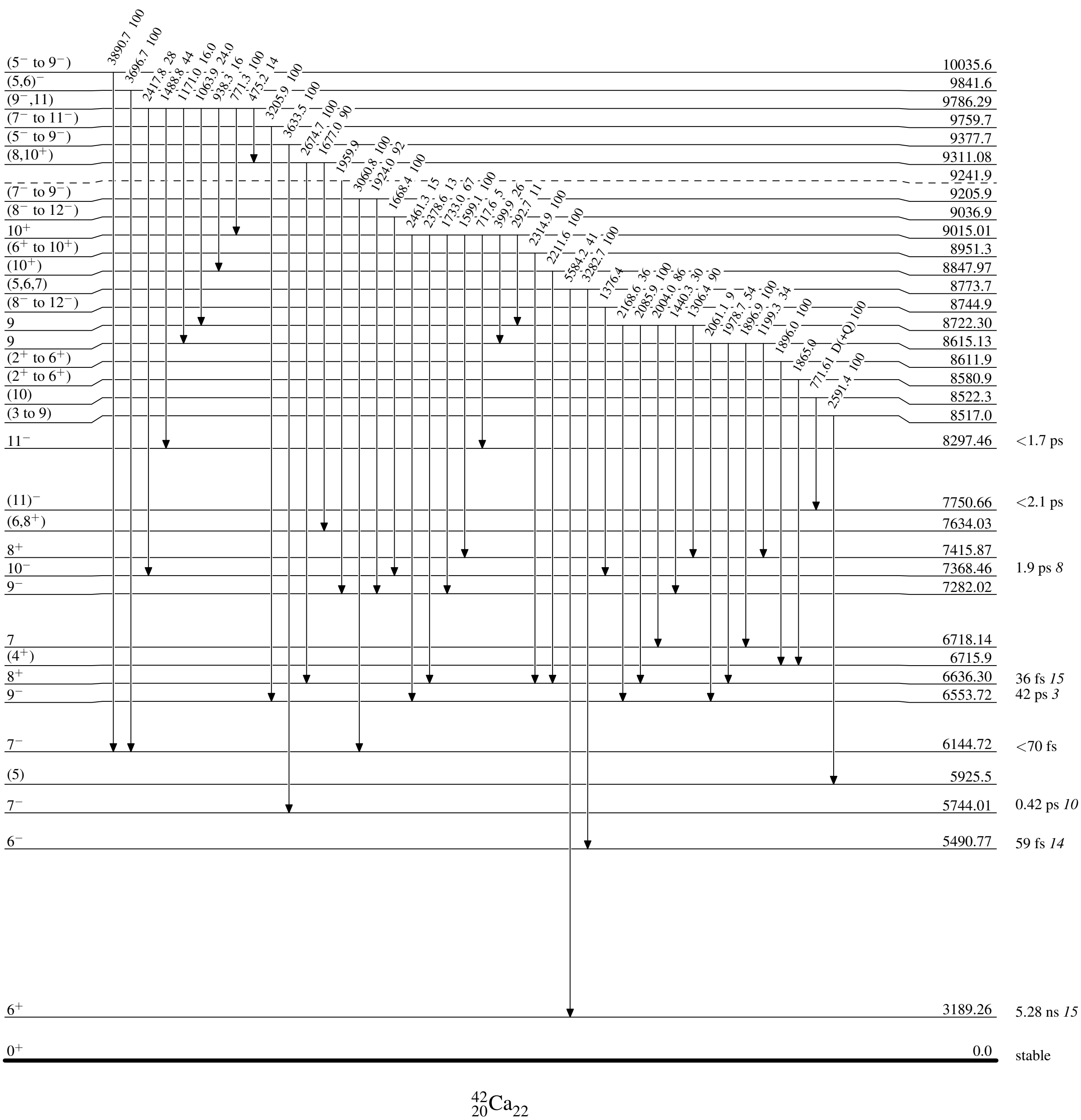
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

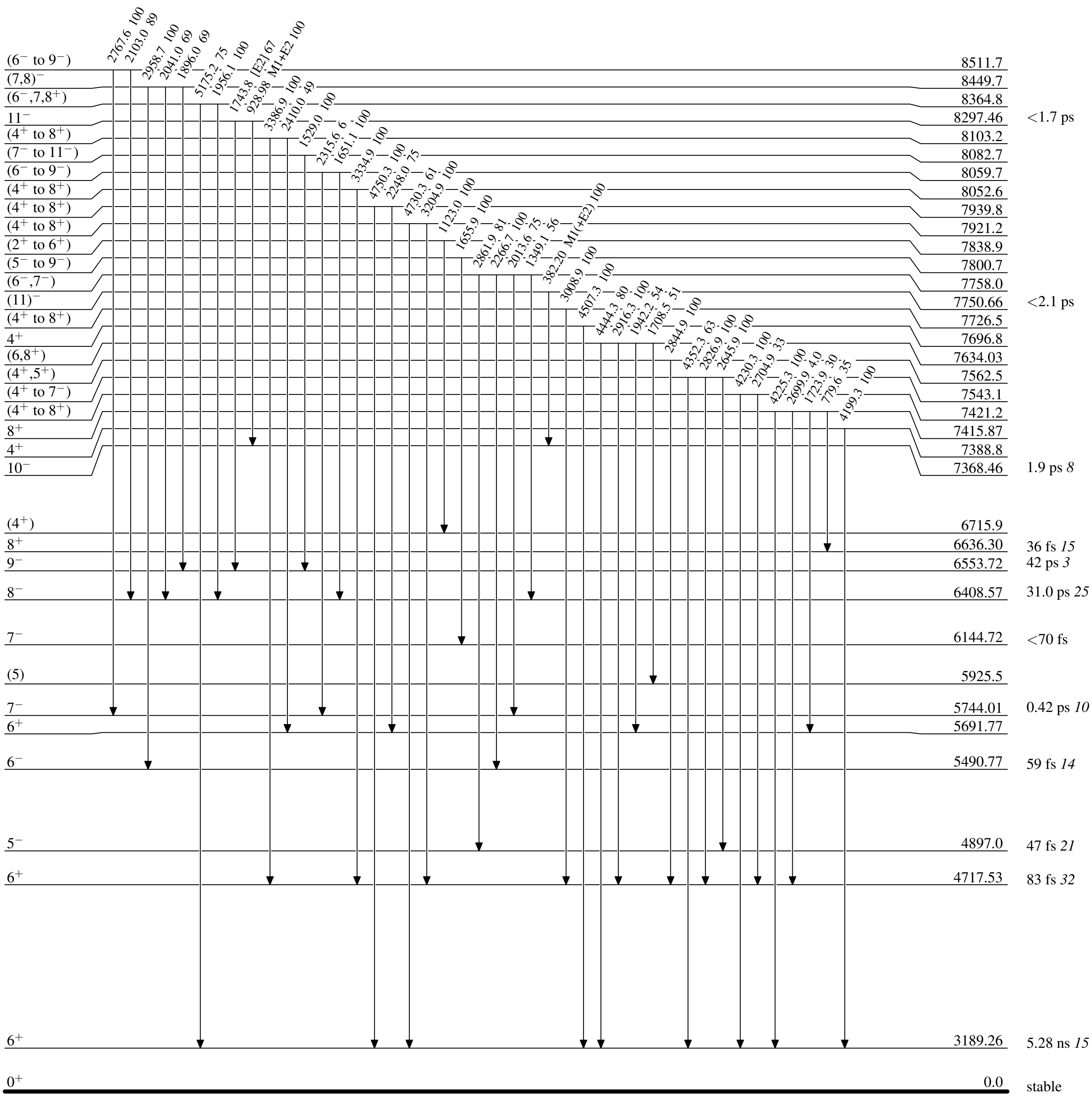
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

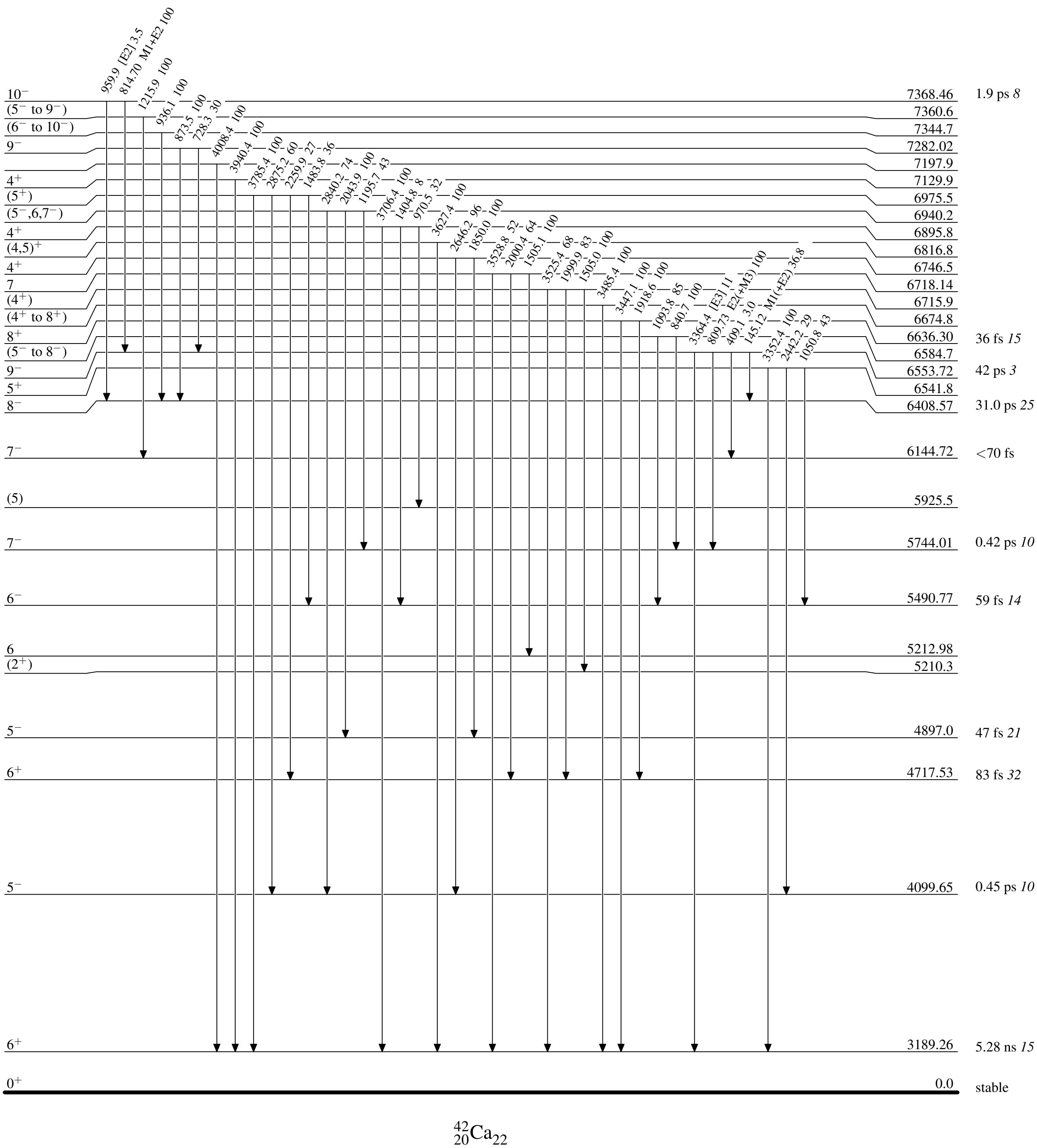
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



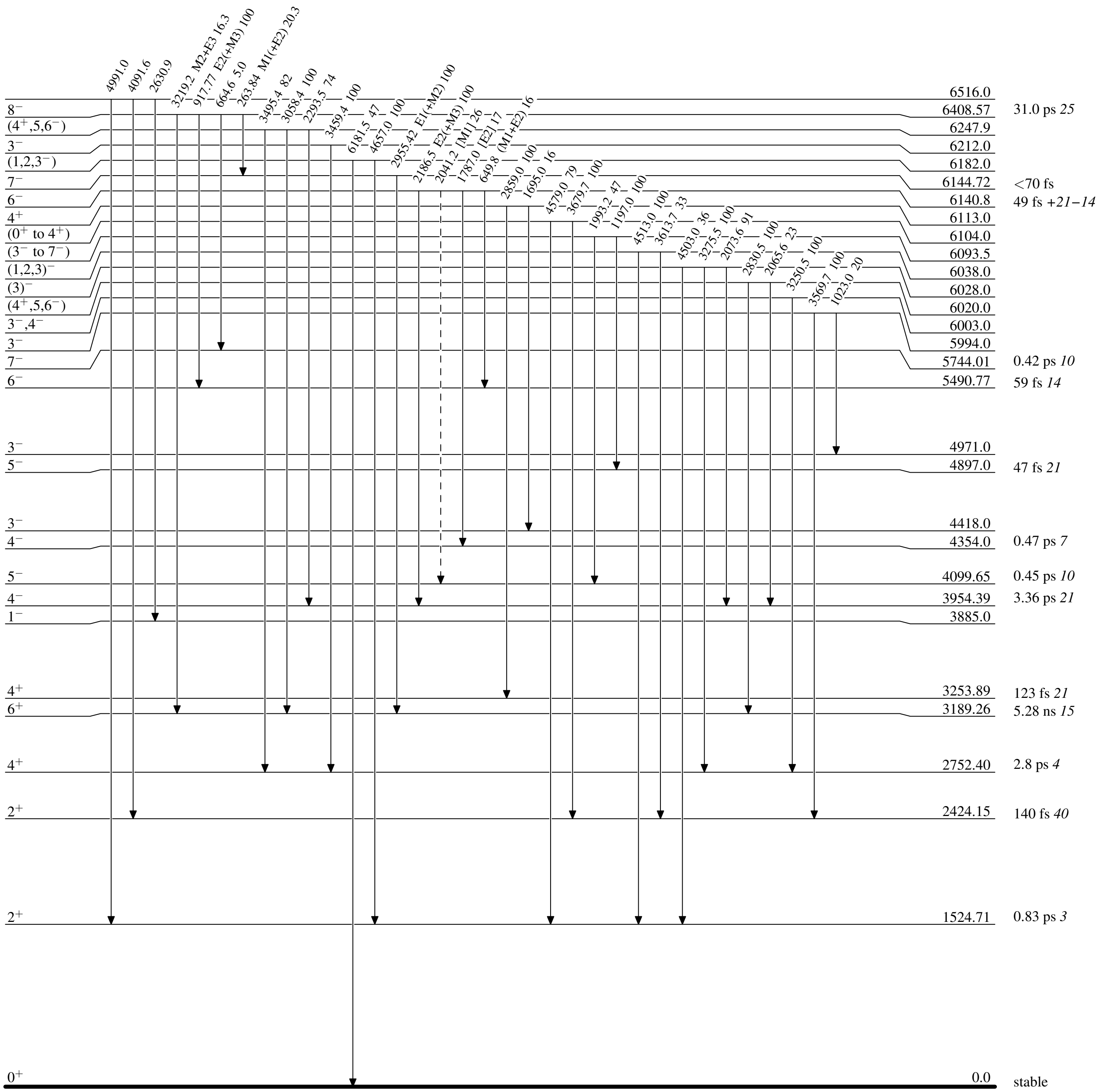
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

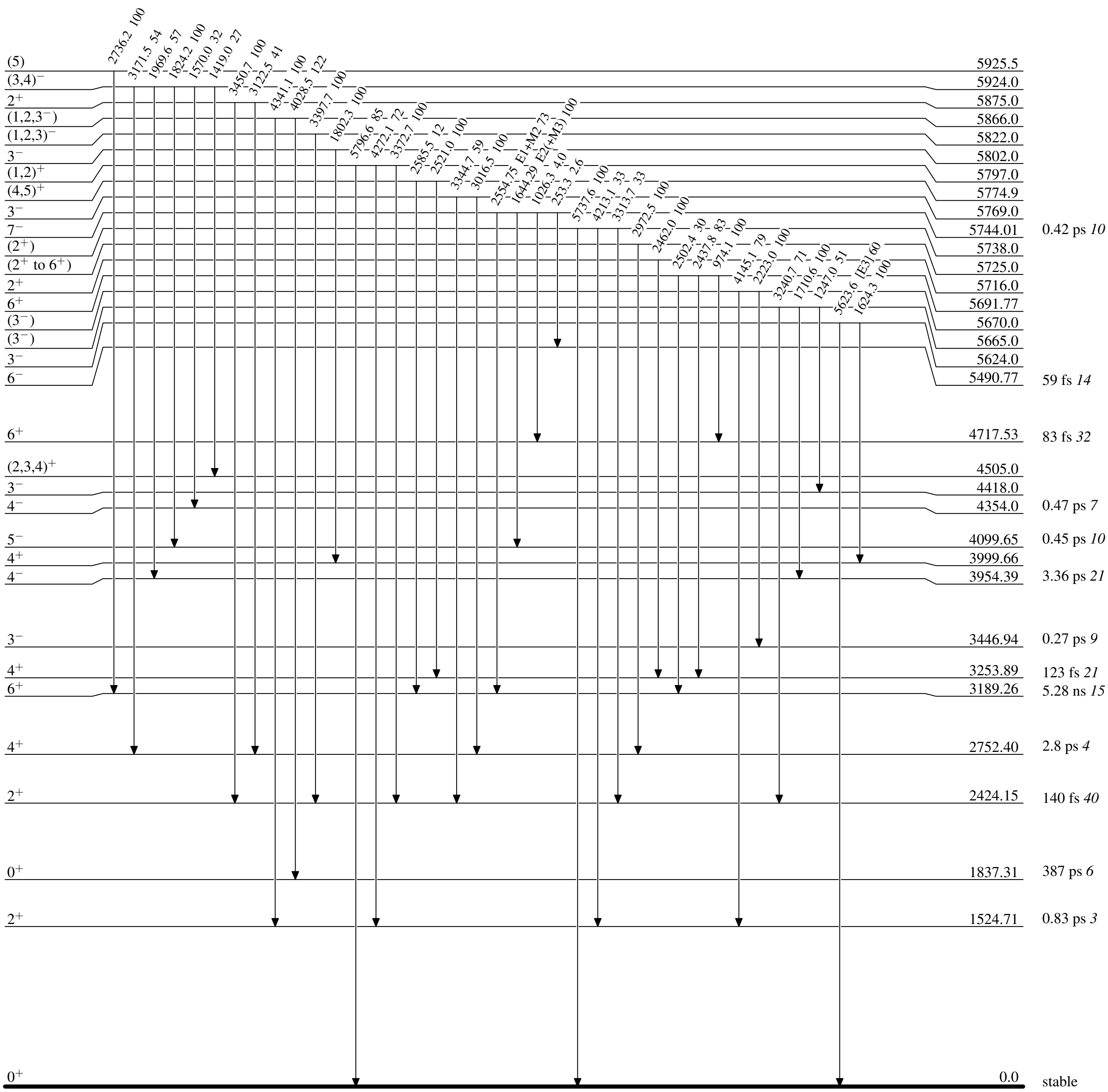


$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

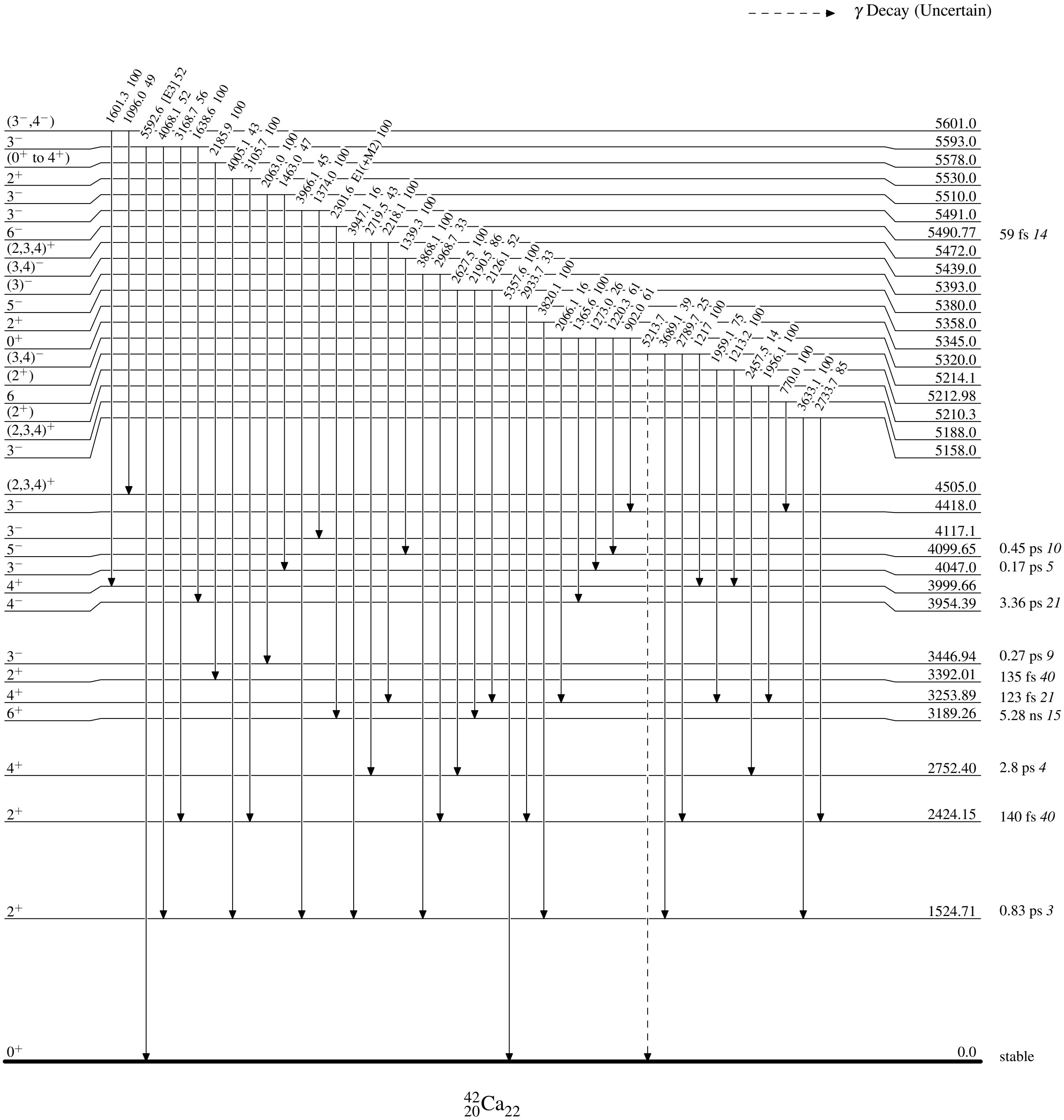


$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

Level Scheme (continued)

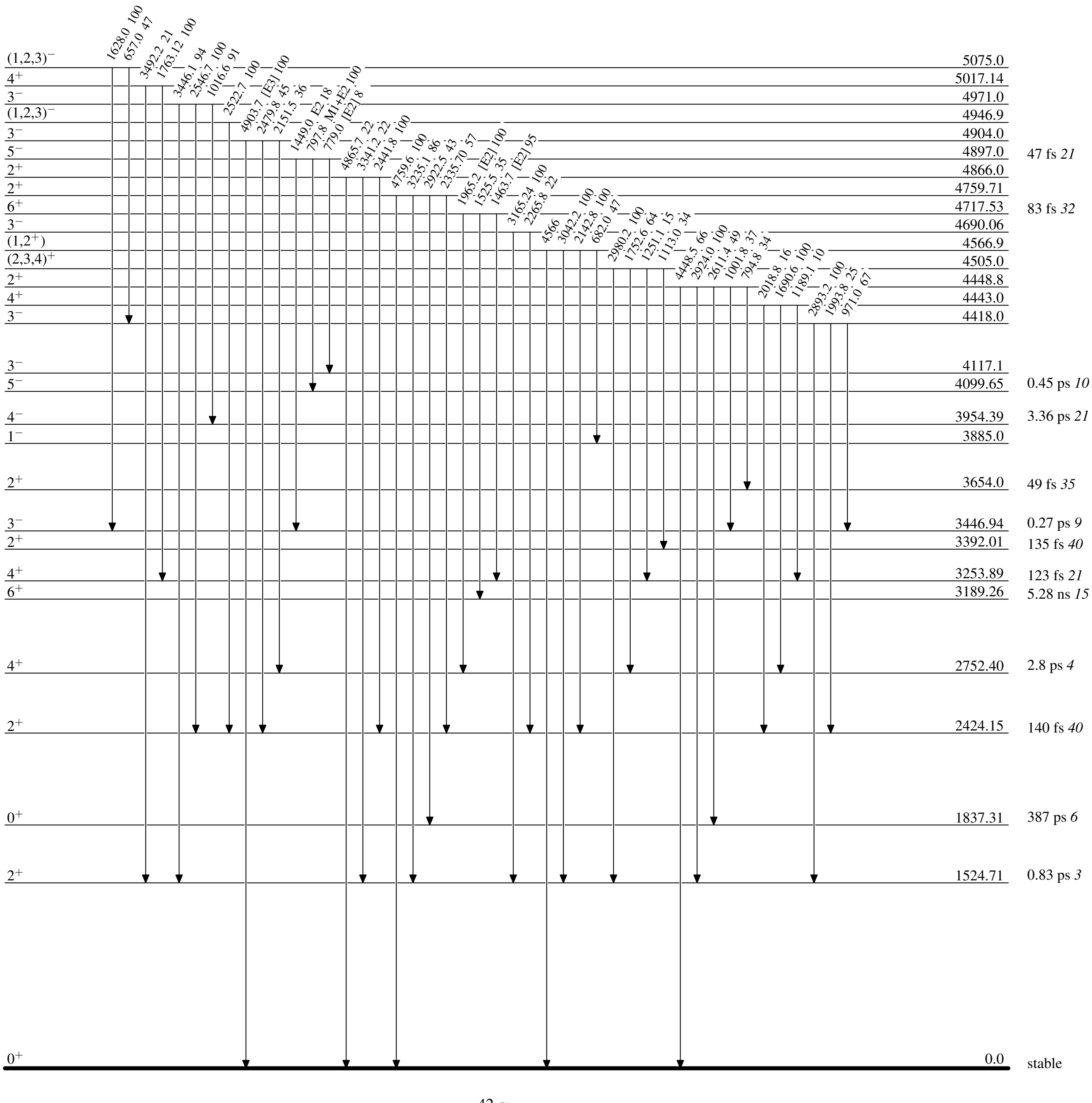
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

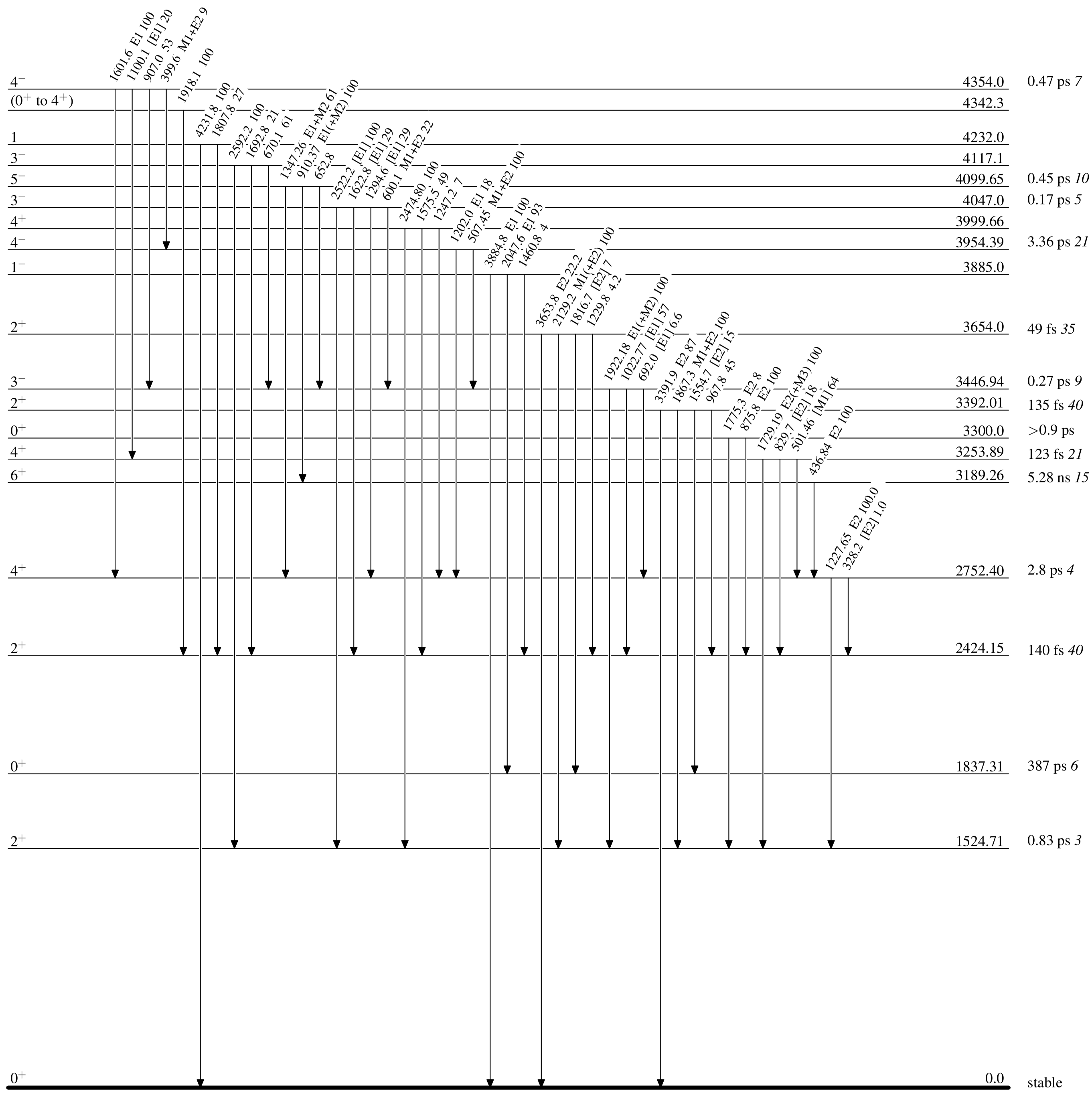
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



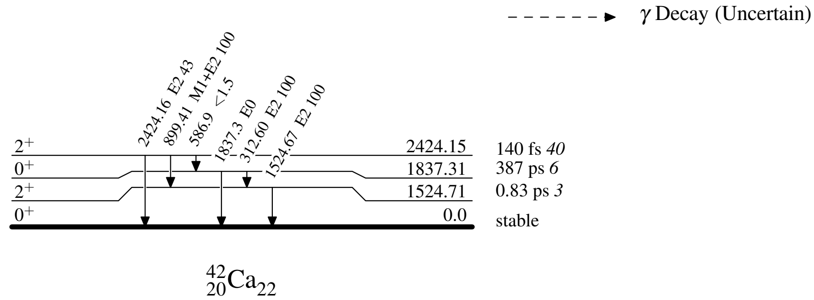
$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

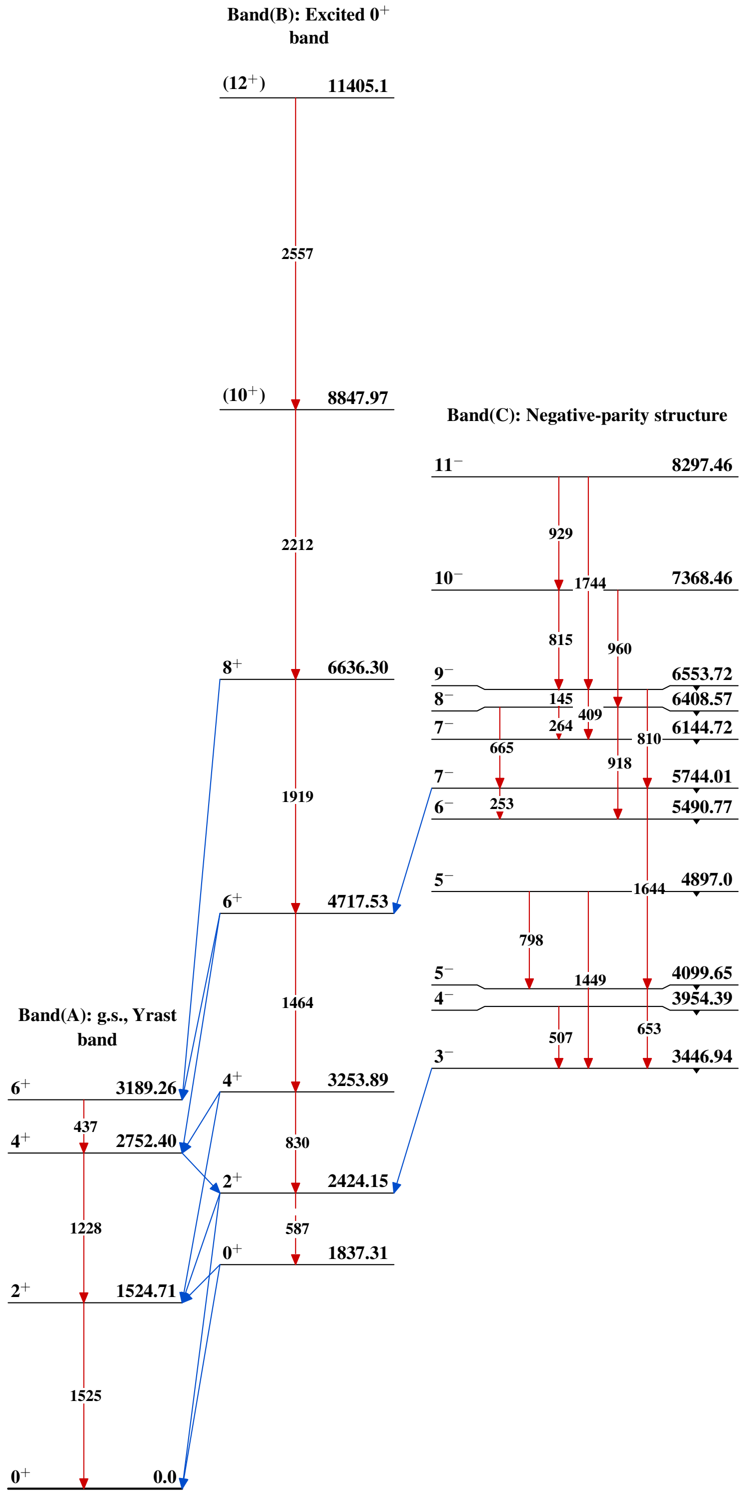
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level



Adopted Levels, Gammas



$^{42}_{20}Ca_{22}$

Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 190,1 (2023)	20-Jun-2023

Q(β^-)=−3652.7 *18*; S(n)=11131.18 *23*; S(p)=12182.3 *5*; Q(α)=−8853.7 *3* 2021Wa16
S(2n)=19064.07 *29*, S(2p)=21624 *6* (2021Wa16).
^{44}Ca identification: 1923As04, 1925As02, 1935As01, 1938Ni04 using mass-spectrographic technique.
Other measurements and reactions:
Mesic atoms (pionic x rays): 1970Ku03, 1970Ma26, 1979Ba07, 1980Po01, 1983Ku10.
Mesic atoms (muonic x rays): 1966Co02, 1981Wo02.
Mesic atoms (kaonic x rays): 1971Ku08.
Isotope shifts: 2015Go24, 1976Ne08, 1978Br31, 1978Wo03, 1980Be13, 1982An15, 1982Ay02, 1983Lo13, 1984Pa12, 1986We08, 1991As06, 1992Ma20, 1998No10.
^{26}Mg(^{18}O,X) E=130 MeV: 1995Co22.
^{40}Ar(α,n): 1938Fu01: resonances.
Additional information 1.
^{26}Mg(^{18}O,xn): 1995Co22.
^{40}Ar(α,γ): 1976Fo04,1974Fo04.
^{42}Ca(^{48}Ti,^{46}Ti): 1986Br06,1988Br02; measured σ(E,θ).
1977Mu02,1993Mo10,1966Go38,1964Go13: ^{43}Ca(n,γ),(n,X) resonance. ≈50 ^{43}Ca+n resonances between 11133 and 11172 keV.
^{45}Sc(γ,p): 1995Is07,1993Is07,1982Ry01,1977Oi01,1975We11.
^{48}Ti(p,pα): 1981Ca02,1984Ca09.
^{42}Ca(^{48}Ti,^{46}Ti) E=385 MeV: 1986Br06.
^{45}Sc(p,2p): 1967Ru03 (E=156 MeV); 1969Ja12 (E=385 MeV).
Theoretical structure calculations:
2023Ha06: calculated levels, J^π using shell model with OXBASH code.
2022Wa13: calculated levels, J^π of the low-lying spectra in Bayesian neural network (BNN) approach.
2021Fu11: calculated energy levels, J^π, S(2n) using realistic shell model.
2019Wa31, 2015Wa37: calculated binding energy, S(2n), levels, J^π, yrast states, spectroscopic factors using shell model with CD-Bonn and Kuo-Brown (KB) interactions.
2017Va30: calculated levels, J^π using IBM, p-IBM and shell-model with KB3G interaction.
2016Im01: calculated low-lying levels, J^π using g.s. multiplets with seniority 2, 3 and 4 for pairing of nucleons in $1f_{7/2}$ shell.
2014Ho12: calculated ground-state energy in pf and $pfg_{9/2}$ shells, levels, J^π, B(E2), B(M1) using Chiral two- and three-nucleon interactions, and many-body perturbation theory (MBPT).
2012Ca13: calculated levels, J^π, orbital occupations, quadrupole moments, B(E2), magnetic moment using shell model with realistic interactions.
2012Ca27: calculated levels, J^π, B(E2), B(E3), two-quasi particle components for the first 2^+ and 3^- states using QRPA with iterative non-Hermitian Arnoldi diagonalization procedures.
2012Ut01: calculated energy levels, J^π, spectroscopic factors using large-scale shell-Model.
2010Le16: calculated levels, J^π, B(E2), wave function overlaps using shell Model with GXPF1A interaction.
1981Co09: calculated levels, J^π, spectroscopic factors using shell model with modified Kuo-Brown interaction.
1974Sk03: calculated levels, J^π, B(E2), spectroscopic factors, γ-branching ratios using an extended model for the mixing between 4p spherical and 6p-2h deformed configurations.
1973Ba23: calculated binding energy, levels, J^π, spectroscopic factors using shell model with a pairing-plus-surface-tensor interaction.
1973Mc10: calculated levels, J^π, spectroscopic factors, B(E2), B(M1) using shell model.
1972Fu02: calculated levels, J^π, B(E2), spectroscopic factors using shell model with Hamada-Johnston, and Tabakin interactions.
1970Fe06: calculated levels, J^π, binding energy, spectroscopic factors using shell model with effective interactions.
Theoretical calculations: about 343 primary references for structure calculations from 1970 to 2023, and six references for double-β decay can be retrieved from the NSR database at www.nndc.bnl.gov/nsr/.

Adopted Levels, Gammas (continued)

^{44}Ca Levels

Cross Reference (XREF) Flags

A	^{44}K β^- decay (22.13 min)	M	^{43}Ca(n,γ) E=thermal	Y	^{44}Ca(^{6}Li,^{6}Li′)
B	^{44}Sc ε decay (4.0420 h)	N	^{43}Ca(n,γ),(n,n):resonances	Z	^{44}Ca(^{7}Li,^{7}Li)
C	^{44}Sc ε decay (58.61 h)	O	^{43}Ca(d,p)	Others:	
D	^{27}Al(^{19}F,2pγ)	P	^{44}Ca(γ,γ'),(pol γ,γ')	AA	^{44}Ca(^{9}Be,^{9}Be′)
E	^{30}Si(^{16}O,2pγ)	Q	^{44}Ca(e,e′)	AB	^{44}Ca(^{16}O,^{16}O′)
F	^{30}Si(^{18}O,2p2nγ)	R	^{44}Ca(π^+,$\pi^{+\prime}$),(π^-,$\pi^{-\prime}$)	AC	^{44}Ca(^{18}O,^{18}O′)
G	^{36}S(^{14}C,α2nγ)	S	^{44}Ca(n,n′γ)	AD	^{45}Sc(μ^-,nγ)
H	^{40}Ar(^{6}Li,d)	T	^{44}Ca(p,p′),(pol p,p′)	AE	^{45}Sc(d,^{3}He),(pol d,^{3}He)
I	^{41}K(α,pγ),(α,p)	U	^{44}Ca(p,p′γ)	AF	^{45}Sc(t,α)
J	^{42}Ca(t,p)	V	^{44}Ca(d,d′)	AG	^{46}Ti(^{14}C,^{16}O)
K	^{42}Ca(α,^{2}He)	W	^{44}Ca(^{3}He,^{3}He′),(pol ^{3}He,^{3}He′)	AH	^{48}Ti(d,^{6}Li)
L	^{42}Ca(^{48}Ti,^{46}Ti)	X	^{44}Ca(α,α')	AI	Coulomb excitation

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	XREF	Comments
0.0[c]	0$^+$	stable	ABCDEFGHIJK M OPQRSTUVWXYZ	XREF: Others: AA, AB, AC, AD, AE, AF, AG, AH, AI The rms charge radius $<r^2>^{1/2}$=3.5179 fm *21* (2013An02 evaluation). Evaluated change in charge radius $\delta<r^2>$(^{44}Ca−^{40}Ca)=+0.283 fm^2 *6* (2013An02). $\delta<r^2>$(^{40}Ca−^{44}Ca)=0.288 fm^2 *2*(stat)*6*(syst) (2016Ga34), 0.2904 fm^2 *10* (1998No10). $\delta\nu$(^{40}Ca-^{44}Ca)=851.1 MHz *6*(stat)*21*(syst) (2016Ga34). J$^\pi$: L(t,p)=L(α,^{2}He)=L(^{6}Li,d)=L(d,^{6}Li)=0 from 0$^+$. Adopted (1977En02) spectroscopic factors S: 3.1 *3* (L=3) (neutron stripping); 0.50 *13* (L=3) (proton pickup).
1157.0208[c] *30*	2$^+$	2.94 ps *12*	ABCDEFGHIJ M OPQRSTUVWXY	XREF: Others: AA, AB, AC, AD, AE, AF, AG, AH, AI μ=+0.34 *6* (2003Sc21,2020StZV) Q=−0.14 *7* (1973To07,2021StZZ) B(E2)↑=0.0475 *20* J$^\pi$: L(t,p)=L(^{6}Li,d)=L(α,α')=L(d,d′)=L(p,p′)=L(e,e′)=2 from 0$^+$. T$_{1/2}$: weighted average of 3.5 ps *7* from DSAM in (α,pγ); 2.0 ps *+8−5* from DSAM in (p,p′γ); 3.05 ps *28* from DSAM in Coul. ex. (2003Sc21); 3.19 ps *27* from DSAM in Coul. ex. (1973Fi15); and 2.88 ps *12* from adopted B(E2)↑=0.0475 *20* in Coulomb excitation. μ: from transient field method in 2003Sc21. Q: from Coulomb excitation in 1973To07. B(E2)↑: weighted average of 0.0550 *20* (1989It02) and 0.048 *3* (1971He08) in (e,e′), 0.0475 *36* (2016Ca17), 0.0473 *20* (1973To07) and 0.049 *5* (1972Bi17) in Coulomb excitation. Adopted (1977En02) spectroscopic factors S: 0.41 *11* (L=3) and 0.08 *2* (L=1) (neutron stripping); 0.18 *3* (L=3) (proton pickup).
1570?	2$^+$		W	E(level): from (pol ^{3}He,^{3}He′) only; this level is not seen in other studies.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$[#]	XREF	Comments
				J$^{\pi}$: from analyzing power in (pol ^{3}He,^{3}He′).
1883.516 *13*	0$^+$	13.9 ps *42*	A HIJ M OPQR TUVWX	XREF: Others: AB, AE, AF, AG, AH XREF: J(1903)X(1890?). J$^{\pi}$: L(^{6}Li,d)=L(d,^{6}Li)=0 from 0$^+$; p-1883$\gamma(\theta)$ is isotropic in (p,p′γ). $T_{1/2}$: other: >1.4 ps from DSAM in (p,p′γ). Adopted (1977En02) spectroscopic factors S: 0.39 *10* (L=3) (neutron stripping); 0.12 *3* (L=3) (proton pickup).
2030?	2$^+$		K	E(level): from (α,^{2}He) only; this level is not seen in other studies. J$^{\pi}$: L(α,^{2}He)=2 from 0$^+$.
2283.119[c] *10*	4$^+$	1.9 ps *7*	A CDEFGHIJ M O QR TUV X	XREF: Others: AB, AD, AE, AF, AG, AH, AI J$^{\pi}$: L(^{6}Li,d)=L(e,e′)=L(p,p′)=L(α,α′)=4 from 0$^+$. $T_{1/2}$: others: 2.6 ps from B(E2)↑(from 2$^+$,1157)=0.021 in (^{16}O,^{16}O′); 16 ps *5* from RDM in (^{19}F,2pγ) is discrepant. Adopted (1977En02) spectroscopic factors S: 0.14 *4* (L=3) and 0.01 *1* (L=1) (neutron stripping); 0.09 *3* (L=3) (proton pickup).
2656.509 *11*	2$^+$	30 fs *3*	AB F HIJ M OPQR TUV X	XREF: Others: AB, AD, AE, AF, AG, AH, AI B(E2)↑=0.0079 *7* (1989It02) XREF: AI(2657?). J$^{\pi}$: L(^{6}Li,d)=L(t,p)=L(p,p′)=L(α,α′)=2 from 0$^+$. $T_{1/2}$: from B(E2) in (e,e′) in 1989It02. B(E2)↑: from 1989It02 in (e,e′). Adopted (1977En02) spectroscopic factors S: 0.51 *13* (L=3) and <0.02 (L=1) (neutron stripping); 0.19 *3* (L=3) (proton pickup).
3044.292 *33*	4$^+$	4.6 ps *+13−10*	A FGHIJ M O TU X	XREF: Others: AB, AF, AG, AH J$^{\pi}$: L(t,p)=L(α,α′)=4 from 0$^+$. Adopted (1977En02) spectroscopic factors S: 0.91 *23* (L=3) (neutron stripping); <0.04 (L=3) (proton pickup).
3285.004[c] *22*	6$^+$	13.3 ps *12*	CDEFG IjK M T	XREF: Others: AH XREF: j(3298)K(3290)ah(3300). J$^{\pi}$: L(α,^{2}He)=6 from 0$^+$; 1001.869γ, ΔJ=2 to 4$^+$. $T_{1/2}$: other: <17 ps from RDM in (^{19}F,2pγ), <0.76 ns from $\gamma\gamma$(t) in (n,γ) E=thermal.
3301.36 *4*	2$^+$	35 fs *18*	AB Ij M OP TU	XREF: Others: AH XREF: j(3298)ah(3300). J$^{\pi}$: 3301.33γ E2 0$^+$.
3307.872 *10*	3$^-$	0.15 ps *6*	AB F j M OPQR TUV X	XREF: Others: AB, AF, AG, AH B(E3)↑=0.0072 *12* XREF: j(3298)ah(3300). J$^{\pi}$: L(e,e′)=L(p,p′)=L(d,d′)=L(α,α′)=3 from 0$^+$. $T_{1/2}$: from adopted B(E3)↑=0.0072 *12* and γ-branching ratios. Other: <0.35 ns from $\gamma\gamma$(t) in (n,γ) E=thermal. B(E3)↑: unweighted average 0.0095 *9* (1989It02) and 0.00559 *23* (1971He08) in (e,e′), 0.0065 *9* (1969BeYW) in (α,α′).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
3357.29 *11*	(2$^+$,3,4$^+$)	<28 fs	A IJ M O TU X	XREF: Others: AE, AF XREF: AE(3370). J^{π}: 1074γ to 4$^+$, 2200γ to 2$^+$. L(d,^{2}He)=2 from 0$^+$ for a 3370 group suggest π=−, but L(t,α)=3 from 7/2$^-$ for a 3360 group suggests π=+.
3581.3 *10*	0$^+$		A H J O TU	XREF: Others: AH XREF: J(3592). J^{π}: L(d,^{6}Li)=L(^{6}Li,d)=0$^+$ from 0$^+$.
3661.527 *10*	1$^-$[&]		A j OP TU X	XREF: Others: AF XREF: j(3671)af(3670). J^{π}: 3661γ D to 0$^+$; 353.67γ to 3$^-$ is not M2 since it would require a $T_{1/2}$>0.3 ns or width Γ<1.5×10$_6$ eV which is significantly smaller than observed Γ_γ=0.08 eV in (γ,γ′). $T_{1/2}$: 5.8 fs from Γ_γ=0.08 eV in (γ,γ′), but it would require a B(E2)(W.u.)(354γ)=3800 exceeding RUL=100, which constrains $T_{1/2}$>0.22 ps or a width Γ<0.0021 eV.
3676.092 *14*	(2$^+$)		A j M O TU	XREF: Others: AF XREF: j(3671)af(3670). J^{π}: 3676.7γ to 0$^+$, 368.2γ to 3$^-$; L(p,p′)=(2) from 0$^+$.
3691.7 *4*	1[&]	46[@] fs *+30−13*	P	
3711.96[d] *9*	4$^-$	<0.42 ns	A F M O T	XREF: Others: AF XREF: O(3729). J^{π}: L(t,α)=2 from 7/2$^-$; 404.26γ D, ΔJ=1 to 3$^-$; 1428.67γ ΔJ=0 to to 4$^+$.
3776.27 *11*	2$^-$	<0.69 ns	A M O TU	XREF: Others: AE, AF XREF: O(3792)AF(3770?). J^{π}: spin=2 from pγ(θ) in (p,p′γ); L(d,^{3}He)=2 from 7/2$^-$.
3880 *10*			O	
3913.80[e] *8*	5$^-$	>2 ps	FG M Q T X	XREF: Others: AB, AF, AH B(E5)↑=0.000083 *15* XREF: af(3915)ah(3920). J^{π}: L(e,e′)=L(α,α′)=5 from 0$^+$. $T_{1/2}$: from DSAM in (^{14}C,α2nγ). B(E5)↑: unweighted average of 0.000096 *8* (1989It02) and 0.000053 *5* (1971He08) in (e,e′), and 0.000101 *16* (1969BeYW) in (α,α′).
3922.71 *10*	5$^-$	<0.56 ns	F M T	XREF: Others: AF, AH XREF: F(?)af(3915)ah(3920). J^{π}: L(p,p′)=5 from 0$^+$; and γ′s to 4$^+$ and 6$^+$.
3934? *10*	(2$^+$,3$^+$,4$^+$,5$^+$)		O	J^{π}: L(d,p)=(1) from 7/2$^-$.
4011.4 *4*			M O T	XREF: Others: AF XREF: O(4026)AF(4022).
4092.04 *13*	(6$^+$)		F M o x	XREF: Others: AF XREF: o(4104)x(4091)af(4099). J^{π}: 1809γ (Q), ΔJ=(2) to 4$^+$.
4093.7 *4*	(2$^+$,3,4$^+$)		A o x	XREF: Others: AF

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)†	J$^{\pi}$‡	T$_{1/2}$#	XREF	Comments
				XREF: o(4104)x(4091)af(4099). E(level): this level is probably different from 4092 level (see discussion in 1976Co06 in ^{44}K β^- decay). J$^{\pi}$: 1810.4γ to 4$^+$, 2937.8γ to 2$^+$.
4170 *5*	(2$^+$)		T X	XREF: Others: AH XREF: X(4169?)AH(4170). E(level): from (p,p′). J$^{\pi}$: L(α,α')=(2) from 0$^+$.
4196.10 *22*	2$^+$	50 fs *+13−8*	M OP TU	XREF: O(4207). J$^{\pi}$: L(d,p)=1 from 7/2$^-$; ΔJ=2 to 0$^+$ from pγ(θ) in (p,p′γ). But J=1 is expected from population in (γ,γ'), although, a 2$^+$ level could also be populated weakly either directly or from deexcitation of a higher J=1 level. T$_{1/2}$: from 30 fs $^{8-5}$ deduced from $\Gamma_{\gamma 0}$ for J=1 in (γ,γ') with a correcting factor of 5/3 due to the change of spin from 1 to 2, since (2J+1)Γ_{g0} is proportional to measured γ-ray yield (2011Is01). Other: <0.69 ns from $\gamma\gamma$(t) in (n,γ) E=thermal.
4260.27 *35*	(2$^+$,3)		A	J$^{\pi}$: (2$^+$,3,4$^+$) from γ′s to 2$^+$ and 4$^+$; 4$^+$ excluded by β-decay from 2$^-$.
4315.22 *14*	(1,2,3)		A	XREF: Others: AF XREF: AF(4310?). J$^{\pi}$: from β-decay from 2$^-$, log *ft*=7.04.
4358.440 *30*	3$^-$		A J M Q T X	XREF: Others: AF J$^{\pi}$: L(α,α')=3 from 0$^+$.
4399.2 *5*	3$^-$		A j M O qr T X	XREF: Others: AB, AF, AH XREF: j(4396)O(4410)q(4390)r(4400)ab(4399)af(4400)ah(4400). J$^{\pi}$: L(p,p′)=L(α,α')=3 from 0$^+$.
4409.176 *14*	(1)$^-$		A j qr T	XREF: Others: AB, AF, AH XREF: j(4396)q(4390)r(4400)ab(4399)af(4400)ah(4400). J$^{\pi}$: allowed β-decay from 2$^-$, log *ft*=5.63; 4408.9γ to 0$^+$.
4436.7 *5*	(1,2$^+$)		A	J$^{\pi}$: 4437γ to 0$^+$.
4479.9 *5*	2$^+$		J M O T X	XREF: Others: AE, AF XREF: O(4491?). J$^{\pi}$: L(t,p)=L(α,α')=2 from 0$^+$. But 3$^-$,4$^-$ from L(d,^{3}He)=0 from 7/2$^-$ for a group at 4480 is inconsistent.
4552.644 *23*	(3)$^-$		A j T	XREF: Others: AH XREF: j(4562)ah(4550). J$^{\pi}$: allowed β-decay from 2$^-$, log *ft*=5.63; 2268.5γ to 4$^+$.
4561.8? *6*			A	XREF: A(?).
4564.87 *14*	(5$^-$)		F jK M o Q T X	XREF: Others: AF, AH XREF: F(?)j(4562)K(4550)o(4569)af(4565)ah(4550). J$^{\pi}$: L(α,α')=L(p,p′)=(5) from 0$^+$. L(α,^{2}He)=7 for a 4550 group.
4572.6 *5*	(1,2,3)		A j o	XREF: Others: AF, AH XREF: j(4562)o(4569)af(4565)ah(4550). J$^{\pi}$: β-decay from 2$^-$ parent, log *ft*=7.0 *3*.
4584.08 *18*	(2$^+$,3,4$^+$)	<3.5 ns	M O T X	XREF: O(4598). J$^{\pi}$: 3427.5γ to 2$^+$ and 1539.4γ to 4$^+$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
4616 *10*			O	
4649.46 *10*	1[&]	7.4[@] fs *+16−11*	P	XREF: Others: AF XREF: af(4660).
4650.3 *4*	2^+		A J M O T X	XREF: Others: AB, AF XREF: O(4662)af(4660). J^{π}: L(t,p)=L(α,α')=2 from 0^+.
4690.0 *5*	$(1^-,2,3,4^+)$		M O	J^{π}: 3332.9γ to 2^+; primary γ from $3^-,4^-$ rejects 0^+, 1^+.
4803.6 *4*	$(1^-,2,3,4^+)$		M T	J^{π}: 3647.2γ to 2^+; primary γ from $3^-,4^-$ rejects 0^+, 1^+.
4824.4 *6*	(1,2,3)		A O	J^{π}: β-decay from 2^- parent, log *ft*=6.9 *+3−2*.
4848.39 *20*	1[&]	17[@] fs *+5−3*	P	
4866.09 *8*	1[&]	4.3[@] fs *+14−9*	A P	
4884.02 *8*	(1,2,3)		A j t	XREF: j(4898)t(4889). J^{π}: β-decay from 2^- parent, log *ft*=5.86 *8*.
4892.6? *8*			A	XREF: A(?).
4904.58 *35*	3^-		A j M Q t X	XREF: Others: AB, AF XREF: A(?)j(4898)Q(4900)t(4889)AB(4905)AF(4912). J^{π}: L(α,α')=3 from 0^+; L(t,α)=2 from $7/2^-$. But 2^+ from (^{16}O,^{16}O$'$) is in disagreement.
4914 *10*	$2^+,3^+,4^+,5^+$		j O	XREF: j(4898). J^{π}: L(d,p)=1 from $7/2^-$.
4930.74[d] *16*	(6^-)		F	J^{π}: 1016.9γ D, ΔJ=1 to 5^- and member of a 4^- band in (^{18}O,2p2nγ).
4992 *10*	$2^+,3^+,4^+,5^+$		J O	XREF: Others: AF XREF: J(4991). E(level): from (d,p). Other: 4991 *15* from (t,p). J^{π}: L(d,p)=1 from $7/2^-$.
5005.69 *22*	4^+		j M O T X	XREF: Others: AB XREF: j(5015)O(5016)T(5031)AB(5006?). J^{π}: L(α,α')=4 from 0^+.
5025.73 *21*	3^-		A j R	XREF: Others: AF XREF: j(5015). J^{π}: L(π,π')=3 from 0^+.
5087.62[c] *8*	8^+	0.53 ps *14*	EFG	J^{π}: 1802.59γ E2, ΔJ=2 6^+ and member of g.s. band in (^{18}O,2p2nγ). $T_{1/2}$: from DSAM in (^{14}C,α2nγ).
5096.87 *34*	$3^-,4^-$		M T	XREF: Others: AE, AF XREF: AE(5070). J^{π}: L(t,α)=0 from $7/2^-$.
5130.22 *21*	$(2,3)^+$		A M O T	XREF: Others: AF XREF: O(5143)AF(5120?). J^{π}: L(d,p)=1 from $7/2^-$; β-decay from 2^- parent, log *ft*=6.7 *+4−2*.
5161.8 *5*	1[&]	2.6[@] fs *3*	A OP	XREF: O(5172).
5201.13 *30*	$(1,2,3)^-$		A j	XREF: j(5222). J^{π}: allowed β-decay from 2^- parent, log *ft*=5.9 *+4−2*.
5210.0 *5*	1^+[&]	2.0 fs *+4−3*	k P T	XREF: k(5210). $T_{1/2}$: deduced from Γ=0.228 eV *40* in (γ,γ').

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
				J^{π}: parity from 4053γ M1+E2 to 2^+. L(α,^{2}He)=4+5 from 0^+ for a 5210 group is inconsistent.
5222 *5*	(3^-)		Jk T X	XREF: Others: AF XREF: k(5210)af(5235). E(level): from (α,α'). J^{π}: L(α,α')=(3) from 0^+. L(α,^{2}He)=4+5 for a 5210 group.
5230.33 *20*	2^+,3^+,4^+,5^+	<4.2 ns	Jk M O T	XREF: Others: AF XREF: J(5245)k(5210)O(5243)T(5235)af(5235) . J^{π}: L(d,p)=1 from $7/2^-$ for a group at 5343 *10*. Other: 3^- for a group at 5235 *5* in (p,p′) is inconsistent.
5245.19[e] *12*	7^-		F	J^{π}: 1331.3γ ΔJ=2 to 5^-, 1960.2γ ΔJ=1 to 6^+; band assignment.
5289.25 *32*			M o T	XREF: o(5296). J^{π}: L(d,p)=1 for a group at 5296 *10*, probably a doublet of 5289+5301.
5300.5 *4*			M o T	XREF: Others: AF XREF: o(5296)AF(5306). J^{π}: see comment for 5289 level.
5325.0 *6*	(1,2,3)		A j	XREF: j(5333). J^{π}: β-decay from 2^- parent, log *ft*=6.5 *+4−2*.
5342.2 *5*	$(2)^+$		j M O X	XREF: Others: AF XREF: j(5333)O(5351). J^{π}: L(α,α')=(2) from 0^+; L(d,p)=1 from $7/2^-$.
5367.5 *7*	(1,2,3)		A j	XREF: j(5361). J^{π}: β-decay from 2^- parent, log *ft*=5.9 *+8−3*.
5375.0 *5*	$(2,3,4)^+$		j M O	XREF: j(5361)O(5385). J^{π}: L(d,p)=1 from $7/2^-$; 4217.9γ to 2^+.
5406 *5*	3^-,4^-		O X	XREF: Others: AE, AF XREF: AE(5430). E(level): weighted average of 5405 *10* from (d,p), 5407 *5* from (α,α'), and 5404 *12* from (t,α). J^{π}: L(t,α)=L(d,^{3}He)=0 from $7/2^-$.
5458.9 *4*	$(2,3,4)^+$		M O	J^{π}: L(d,p)=1 from $7/2^-$; 4301.7γ to 2^+.
5512.3 *10*			A X	XREF: Others: AF XREF: A(5512?)AF(5518).
5548.68 *22*	$(2,3,4)^+$		M O	J^{π}: L(d,p)=1 from $7/2^-$; 4391.5γ to 2^+.
5561.0 *5*	3^-		A	XREF: Others: AF XREF: AF(5579). J^{π}: L(t,α)=0 from $7/2^-$; allowed β feeding from spin=2 parent; 4403.6γ to 2^+.
5611.56 *28*	1[&]	1.4[@] fs *+7−4*	P	
5646.79 *14*	$8^{(+)}$		F	J^{π}: ΔJ=0 (M1) to 8^+ in (^{18}O,2p2nγ).
5656 *5*	(1 to $6)^-$		J O X	XREF: Others: AF XREF: J(5646)O(5666). E(level): weighted average of 5646 *20* in (t,p), 5666 *10* in (d,p), 5654 *5* from (α,α'), and 5660 *12* from (t,α). J^{π}: L(t,α)=2 from $7/2^-$.
5733.30 *22*	$(4,5)^+$	<3.5 ns	J M O X	XREF: Others: AF J^{π}: L(d,p)=1 from $7/2^-$; 1640.7γ to (6^+).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	XREF	Comments
5775.76 *22*	$(2,3,4)^+$		M O	J^π: L(d,p)=1 and γ to 2^+.
5800.61 *20*	1[&]	11[@] fs *+5−3*	P	XREF: Others: AF XREF: af(5810).
5806.31 *10*	1^-[&]	2.3[@] fs *3*	P	XREF: Others: AF XREF: af(5810). J^π: from γ(pol) in (γ,γ') (2016De05).
5832 *10*			O X	XREF: X(5830).
5864 *20*	0^+		H JK	XREF: H(5850)J(5864)K(5860). E(level): from (t,p). J^π: L(t,p)=L(^{6}Li,d)=L(α,^{2}He)=0 from 0^+.
5866.82 *30*	$(4^+,5^+)$		M O	XREF: O(5873?). J^π: L(d,p)=(1) from $7/2^-$; 1773.3γ to 6^+.
5875.82 *20*	1^-[&]	4.2[@] fs *+8−5*	P X	XREF: Others: AF XREF: X(5880)AF(5891). J^π: from γ(pol) in (γ,γ') (2016De05).
5911.13 *20*	1[&]	1.9[@] fs *+6−4*	P X	XREF: X(5940?).
5971.30[d] *14*	$8^{(-)}$		F	J^π: 1040.5γ Q, ΔJ=2 to 6^-, 726.1γ (M1), ΔJ=1 to 7^-.
5975 *10*			O X	XREF: X(5970).
6014 *20*			J X	XREF: X(6020).
6040.0 *5*	$2^+,3^+,4^+,5^+$		M O	XREF: O(6050). J^π: L(d,p)=1 from $7/2^-$.
6082.9 *4*	1^+[&]	2.1[@] fs *+4−3*	P	
6136.59 *26*	1^-[&]	1.27[@] fs *+20−15*	P	XREF: Others: AE XREF: AE(6100).
6146.14 *31*	$(4,5)^+$		M O	J^π: L(d,p)=1 from $7/2^-$; 2053.9γ to (6^+).
6211.4 *5*			K M	XREF: K(6210). J^π: L(α,^{2}He)=2 for a 6210 group suggests π=+.
6245.48 *30*	1[&]	9[@] fs *+3−2*	k P	XREF: k(6210).
6422.12 *10*	1^-[&]	0.21[@] fs *2*	J P	XREF: J(6438).
6446.5 *7*	1^+[&]	5.9[@] fs *+16−11*	P	
6507.1 *5*	1[&]	3.3[@] fs *+9−6*	P	
6578 *20*			J	
6657.65[e] *17*	$9^{(-)}$		F	J^π: 1412.4γ (E2), ΔJ=2 to 7^-, 1570γ (E1), ΔJ=1 to 8^+.
6672.92 *31*			M	
6675.44 *20*	1[&]	4.5[@] fs *+9−6*	P	
6744 *20*			J	
6778 *20*			J	
6913 *20*			J	
6960.7 *6*	1[&]	5.6[@] fs *+13−9*	P	
6972.14 *19*	1[&]	0.47[@] fs *+14−9*	j P	XREF: j(6996).
6996 *20*			J	
7065.9 *9*	1[&]	2.7[@] fs *+6−4*	P	
7092.76 *15*	(9^-)		F	J^π: 2005.1γ (E1), ΔJ=1 to 8^+, (E1) to 8^+.
7226.04 *30*	1[&]	2.8[@] fs *+6−4*	P	
7275.2 *9*	1[&]	1.9[@] fs *+4−3*	P	
7403.0 *8*	1[&]	3.7[@] fs *+9−6*	P	
7470.92 *20*	(10^+)		F	J^π: 1824.1γ Q, ΔJ=2 to (8^+).
7556.58 *22*	(9)		F	J^π: 2468.9γ D, ΔJ=(1) to 8^+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
7572.0 *5*	$1^{(+)}$[&]	2.6[@] fs *+8−5*	P	
7578.90 *30*	1^-[&]	0.51[@] fs *+7−6*	P	
7662.1 *6*	1^-[&]	4.7[@] fs *+21−11*	P	
7783.3 *10*	1^-[&]	4.2[@] fs *+19−11*	P	
7808.9 *16*	1^-[&]	8[@] fs *+4−2*	P	
7828.9 *12*	1[&]	6[@] fs *+3−2*	P	
7834.8 *8*	1^-[&]	3.0[@] fs *+9−6*	P	
7844 *20*			J	
7879.97[d] *19*	(10^-)		F	J^{π}: 1908.6γ Q, ΔJ=2 to 8^-, 787.2γ (M1), ΔJ=1 to (9^-).
7953.1 *5*	1[&]	1.7[@] fs *+7−4*	P	
8050			K	J^{π}: L(α,^{2}He)=3 from 0^+ suggests π=−.
8070.2 *7*	1[&]	2.2[@] fs *+5−3*	P	
8086.0 *7*	1[&]	2.1[@] fs *+5−3*	P	
8286.28[e] *26*	(11^-)		F	J^{π}: 1628.6γ (E2), ΔJ=2 to 9^-; band assignment.
8290			K	J^{π}: L(α,^{2}He)=5 from 0^+ suggests π=−.
8321.5 *16*	1[&]	9.5[@] fs *+7−3*	P	
8395.3 *4*	1[&]	1.6[@] fs *+5−3*	P	
8405.4 *17*	1[&]	0.42[@] fs *+7−5*	P	
8556.7 *8*	1^-[&]	2.4[@] fs *+16−7*	P	
8615.2 *12*	1^-[&]	2.3[@] fs *+10−5*	P	
8801.9 *29*	1^-[&]	11[@] fs *+13−4*	P	
8828.0 *11*	1^-[&]	0.8[@] fs *+3−2*	P	
8851.5 *7*	1^-[&]	0.70[@] fs *+17−12*	P	
8860			K	J^{π}: L(α,^{2}He)=(5,6,7) from 0^+.
8908.8 *7*	1^-[&]	0.33[@] fs *+7−5*	P	
9024.1 *20*	1^-[&]		P	
9148.4 *24*	1^-[&]		P	
9273.6 *8*	1^-[&]	1.1[@] fs *+3−2*	P	
9317.2 *10*	1^-[&]		P	
9460			K	J^{π}: L(α,^{2}He)=3 from 0^+ suggests π=−.
9664.9 *7*	1^-[&]		P	
9750			K	J^{π}: L(α,^{2}He)=(7,8) from 0^+.
9788.6 *6*			F	J^{π}: 2317.6γ to (10^+).
9814.1 *11*	1^-[&]		P	
9859.5[d] *4*	(12^-)		F	J^{π}: 1979.5γ (E2), ΔJ=2 to (10^-); band assignment.
9898.2 *10*	1^-[&]		P	
10567.8[e] *5*	(13^-)		F	J^{π}: 2281.5γ Q, ΔJ=2 to (11^-); band assignment.
(11131.60 *12*)	$3^-,4^-$		M	J^{π}: s-wave capture in $7/2^-$ g.s. of ^{43}Ca. E(level): S(n)=11131.16 *23* (2021Wa16).
11132.73 *30*	4^-[a]	1.13 eV	N	
11134.44 *23*	+[a]		N	
11134.52 *23*	$(4)^-$[a]	0.67 eV	N	
11135.49 *23*	4^-[a]	0.522 eV *7*	N	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	XREF	Comments
11135.72 *23*	+[a]		N	
11136.33 *23*	3⁻[a]	1.23 eV *10*	N	
11136.35 *23*	4⁻[a]		N	
11138.07 *23*	3⁻[a]	0.69 eV *7*	N	
11139.93 *23*	4⁻[a]	0.68 eV *7*	N	
11141.00 *23*	+[a]		N	
11141.22 *23*	+[a]		N	
11141.52 *23*	(4)⁻[a]	0.76 eV *10*	N	
11143.08 *23*			N	
11143.31 *23*			N	
11143.77 *23*	+[a]		N	
11144.39 *23*			N	
11144.9 *5*	4⁻[a]	1.0 eV *1*	N	
11145.29 *23*	(3)⁻[a]	0.8 eV *9*	N	
11145.65 *23*	+[a]		N	
11146.04 *23*	+[a]		N	
11146.19 *23*	+[a]		N	
11147.53 *23*	3⁻,4⁻[a]		N	
11149.99 *24*	4⁻[a]	0.66 eV *7*	N	
11150.62 *23*	+[a]		N	
11151.10 *23*	(3)⁻[a]	0.80 eV *12*	N	
11152.19 *23*	(3)⁻[a]	0.79 eV *10*	N	
11152.71 *23*	(3)[a]	0.5 eV	N	
11153.68 *23*	(4)⁻[a]	0.57 eV *9*	N	
11154.10 *23*	+[a]		N	
11154.90 *23*	(2)⁺[a]	0.92 eV *12*	N	
11155.07 *23*	(3)⁻[a]	0.81 eV *12*	N	
11155.29 *23*	+[a]		N	
11155.41 *23*	(2)⁺[a]	0.74 eV *11*	N	
11157.59 *23*			N	
11157.71 *23*	(4)⁻[a]	0.60 eV *8*	N	
11157.99 *23*	3⁻,4⁻[a]		N	
11158.69 *23*	+[a]		N	
11158.84 *23*	+[a]		N	
11160.27 *23*	(4)⁻[a]	0.66 eV *8*	N	
11160.40 *23*	(4)⁻[a]	0.75 eV *10*	N	
11161.47 *23*	+[a]		N	
11161.65 *23*	(4)⁻[a]	0.66 eV *7*	N	
11161.86 *23*	+[a]		N	
11162.06 *23*	(4)⁻[a]	0.75 eV *9*	N	
11162.89 *23*			N	
11164.00 *23*			N	
11165.39 *23*			N	
11165.91 *23*			N	
11166.61 *23*			N	
11166.74 *23*			N	
11167.34 *23*			N	
11167.58 *23*	(4)⁻[a]	1.4 eV *2*	N	
11170.05 *23*			N	
11850 *10*			Q	T=3
12188.1 *10*			F	Additional information 2.
16.5×10^3[b] *15*		4.9[b] MeV *+21−24*	X	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{44}Ca Levels (continued)

E(level)[†]	$T_{1/2}$[#]	XREF
17.13×10^3[b] *11*	9.40[b] MeV *14*	X
19.5×10^3[b] *4*	5.8[b] MeV *+9−7*	X
34.9×10^3[b] *15*	16.3[b] MeV *23*	X

[†] From a least-squares fit to γ-ray energies for levels populated in γ-ray studies, and from different reactions as noted for others, unless otherwise noted.

[‡] When assigning J^π to a level based on γ transitions from this level to a level of known J^π, evaluators use the following rules: if Eγ<4 MeV, transitions are only considered to be E1, M1 or E2; if Eγ>4 MeV, M2 and E3 are considered to be possible.

[#] From DSAM in (α,pγ), unless otherwise stated. Values quoted in nanoseconds are from $\gamma\gamma$(t) in (n,γ).

[@] Deduced by the evaluators from Γ_γ in (γ,γ'). Actual $T_{1/2}$ could be smaller for levels from which only the g.s. transitions are reported, with the possibility that competing transitions to the low-lying 2^+ and 0^+ excited states in ^{44}Ca might have missed observation, making Γ_γ underestimated, thus $T_{1/2}$ overestimated.

[&] From ΔJ=1 excitation and γ(linear polarization) in (γ,γ') and (polarized γ,γ').

[a] From analysis of neutron resonance.

[b] From (α,α') for giant resonance.

[c] Band(A): Yrast g.s. band.

[d] Band(B): Band based on 4^-, α=0.

[e] Band(b): Band based on 5^-, α=1.

$\gamma(^{44}Ca)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	δ	$I_{(\gamma+ce)}$	Comments
1157.0208	2^+	1157.004 *3*	100	0.0	0^+	E2			B(E2)(W.u.)=10.06 *+42−40* E_γ: weighted average of 1157.002 *3* from ^{44}K β^- decay, 1157.022 *15* from ^{44}Sc ε decay (4.0420 h), 1157.002 *15* from ^{44}Sc ε decay (58.61 h), 1157 *1* from (^{16}O,2pγ), 1157.0 *2* from (^{18}O,2p2nγ), 1157.031 *15* from (^{14}C,α2nγ), 1156.89 *15* from (n,γ) E=thermal, 1158 *1* from (p,p$'\gamma$), and 1155.9 *5* from (μ^-,nγ). Mult.: ΔJ=2, Q γ from DCO in (^{18}O,2p2nγ); M2 rejected by RUL.
1883.516	0^+	726.490 *16*	100	1157.0208	2^+	E2			B(E2)(W.u.)=22 *+9−5* Mult.: Q from p$\gamma(\theta)$ in (p,p$'\gamma$); M2 ruled out by RUL.
		(1883.47)		0.0	0^+	E0		≈0.012	$I_{(\gamma+ce)}$: branching deduced by the evaluators from q_K^2(E0/E2)=I_K(E0)/I_K(E2)=0.54 *9* and assuming 80% K-shell conversion of E0 transition. q_K^2(E0/E2)=0.54 *9*, X(E0/E2)=0.23 *4*, ρ^2(E0)=0.14 *5* (2005Ki02 evaluation). Γ(pair formation)/Γ=8.8×10^{-4} *14* from (p,p$'$) (1976Ul01); Γ(pair formation)=2.1×10^{-8} eV *3* from (e,e$'$) (1978Gr02).
2283.119	4^+	1126.078 *10*	100	1157.0208	2^+	E2			B(E2)(W.u.)=18 *+10−5* E_γ: weighted average of 1126.076 *10* from ^{44}K β^- decay, 1126.084 *20* from ^{44}Sc ε decay (58.61 h), and 1126.092 *40* from (^{14}C,α2nγ). Others: 1126 *1* from (^{16}O,2pγ), 1126.1 *2* from (^{18}O,2p2nγ), 1126.03 *15* from (n,γ) E=thermal, 1127 *1* from (p,p$'\gamma$), and 1124.1 *7* from (μ^-,nγ). Mult.,δ: δ(O/Q)=−0.05 *+4−3* from p$\gamma(\theta)$ in (p,p$'\gamma$); M2, M3 ruled out by RUL.
2656.509	2^+	1499.449 *15*	100.0 *17*	1157.0208	2^+	M1+E2	−0.123 *17*		B(M1)(W.u.)=0.191 *+22−17*; B(E2)(W.u.)=3.6 *+12−9* E_γ: from ^{44}Sc ε decay (4.0420 h). Others: 1499.45 *4* from ^{44}K β^- decay, 1499.4 *3* from (^{18}O,2p2nγ), 1499.30 *18* from (n,γ) E=thermal, 1501 *2* from (p,p$'\gamma$), and 1510 *10* from (μ^-,nγ). I_γ: from ^{44}Sc ε decay (4.0420 h). Others: 100.0 *37* from ^{44}K β^- decay and 100.0 *25* from (p,p$'\gamma$). Mult.,δ: δ(Q/D) is weighted average of −0.15 *+4−9* (1970La09) and −0.14 *7* (1966Ma31) in (p,p$'\gamma$), −0.137 *17* (1968Wa21), and −0.07 *3* (1971Ok03) in ^{44}Sc ε decay (4.0420 h); E1+M2 ruled out by RUL.
		2656.44 *3*	12.39 *33*	0.0	0^+	E2			B(E2)(W.u.)=1.70 *+20−16* E_γ: weighted average of 2656.41 *3* from ^{44}K β^- decay, 2656.48 *4*

$^{44}_{20}Ca_{24}$-12

γ(^{44}Ca) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.	δ	α@	Comments
									from ^{44}Sc ε decay (4.0420 h), 2656.2 *5* from (n,γ) E=thermal, and 2656 *3* from (p,p$'\gamma$). I_γ: weighted average of 12.52 *59* from ^{44}K β^- decay, 12.31 *33* from ^{44}Sc ε decay (4.0420 h), and 17.0 *38* from (p,p$'\gamma$). Mult.: Q from p$\gamma(\theta)$ in (p,p$'\gamma$); M2 ruled out by RUL.
3044.292	4+	761.12 *4*	100 *5*	2283.119	4+	M1+E2	−0.18 *8*		B(M1)(W.u.)=0.0055 *+15−13*; B(E2)(W.u.)=0.9 *+10−6* E_γ: weighted average of 761.10 *3* from ^{44}K β^- decay, 761.3 *1* from (^{18}O,2p2nγ), and 761.19 *10* from (n,γ) E=thermal. Others: 761.19 *20* from (^{14}C,α2nγ) and 764 *1* from (p,p$'\gamma$). I_γ: from (^{14}C,α2nγ). Others: 100 *50* from ^{44}K β^- decay, 100.0 *52* from (^{18}O,2p2nγ), and 100.0 *79* from (p,p$'\gamma$). Mult.,δ: δ(Q/D) from weighted average of −0.18 *8* from (^{14}C,α2nγ) and −0.25 *+9−31* from (p,p$'\gamma$); E1+M2 ruled out by RUL.
		1887.34 *20*	92.5 *30*	1157.0208	2+	E2			B(E2)(W.u.)=0.27 *+7−6* E_γ: weighted average of 1887.21 *28* from ^{44}K β^- decay, 1887.3 *2* from (^{18}O,2p2nγ), 1887.45 *20* from (^{14}C,α2nγ), and 1887.3 *3* from (n,γ) E=thermal. Other: 1890 *2* from (p,p$'\gamma$). I_γ: weighted average of 100 *50* from ^{44}K β^- decay, 93.1 *69* from (^{18}O,2p2nγ), 85.4 *42* from (^{14}C,α2nγ), and 95.9 *30* from (p,p$'\gamma$). Mult.,δ: δ(O/Q)=−0.08 *+3−6* from (p,p$'\gamma$); M2,M3 ruled out by RUL.
3285.004	6+	1001.869 *20*	100	2283.119	4+	E2			B(E2)(W.u.)=4.57 *+46−37* E_γ: weighted average of 1001.876 *20* from ^{44}Sc ε decay (58.61 h), 1001.9 *1* from (^{18}O,2p2nγ), and 1001.850 *31* from (^{14}C,α2nγ). Others: 1001 *1* from (^{16}O,2pγ) and 1001.85 *15* from (n,γ) E=thermal. Mult.: Q, ΔJ=2 from DCO in (^{18}O,2p2nγ); M2 ruled out by RUL.
3301.36	2+	2144.27 *8*	100 *6*	1157.0208	2+	[M1,E2]			E_γ: weighted average of 2144.23 *8* from ^{44}K β^- decay, 2144.33 *10* from ^{44}Sc ε decay (4.0420 h), 2144.5 *5* from (n,γ) E=thermal, and 2144 *2* from (p,p$'\gamma$). I_γ: others: 100 *19* from ^{44}Sc ε decay (4.0420 h) and 100.0 *90* from (p,p$'\gamma$). B(M1)(W.u.)=0.044 *+40−16* if M1, B(E2)(W.u.)=27 *+24−10* if E2.
		3301.33 *6*	44 *7*	0.0	0+	E2			B(E2)(W.u.)=1.4 *+12−5* E_γ: weighted average of 3301.21 *14* from ^{44}K β^- decay, 3301.35 *6* from ^{44}Sc ε decay (4.0420 h), 3301.5 *6* from (n,γ) E=thermal, and 3304 *4* from (p,p$'\gamma$). I_γ: weighted average of 42.6 *70* from ^{44}K β^- decay, 38 *11* from ^{44}Sc ε decay (4.0420 h), and 49.3 *75* from (p,p$'\gamma$). Mult.: Q from p$\gamma(\theta)$ in (p,p$'\gamma$); M2 ruled out by RUL.

$^{44}_{20}$Ca$_{24}$-13

Adopted Levels, Gammas (continued)

γ(^{44}Ca) (continued)

E$_i$(level)	J$^\pi_i$	E$_\gamma$†	I$_\gamma$†	E$_f$	J$^\pi_f$	Mult.	α@	Comments
3307.872	3$^-$	263.53 *6*	0.49 *13*	3044.292	4$^+$	[E1]	1.13×10^{-3} *2*	B(E1)(W.u.)=0.00068 *+49−25*
		651.353 *16*	13.2 *8*	2656.509	2$^+$	[E1]		B(E1)(W.u.)=0.0012 *+8−4*
								E$_\gamma$: weighted average of 651.355 *9* from ^{44}K β^- decay, 651.07 *12* from (n,γ) E=thermal, and 652 *1* from (p,p′γ).
								I$_\gamma$: weighted average of 13.30 *51* from ^{44}K β^- decay and 6.8 *41* from (p,p′γ).
		1024.738 *17*	29.4 *5*	2283.119	4$^+$	[E1]		B(E1)(W.u.)=0.00069 *+44−20*
								E$_\gamma$: others: 1024.4 *3* from (^{18}O,2p2nγ), 1024.66 *20* from (n,γ) E=thermal, and 1026 *1* from (p,p′γ).
								I$_\gamma$: other: 28.4 *68* from (p,p′γ).
		2150.805 *17*	100.0 *21*	1157.0208	2$^+$	[E1]		B(E1)(W.u.)=0.00025 *+16−7*
								E$_\gamma$: weighted average of 2150.786 *17* from ^{44}K β^- decay, 2150.840 *22* from ^{44}Sc ε decay (4.0420 h), 2150.5 *2* from (^{18}O,2p2nγ), 2150.9 *3* from (n,γ) E=thermal, and 2150 *2* from (p,p′γ).
								I$_\gamma$: others: 100.0 *74* from (^{18}O,2p2nγ) and 100.0 *81* from (p,p′γ).
		3307.7 *5*	0.077 *26*	0.0	0$^+$	(E3)		B(E3)(W.u.)=9 *+7−4*
								Mult.: E3 excitation in (e,e′).
3357.29	(2$^+$,3,4$^+$)	1074.13‡ *15*	100 *60*	2283.119	4$^+$			E$_\gamma$: others: 1074.1 *4* from ^{44}K β^- decay and 1074 *1* from (p,p′γ).
		2200.1 *3*	13 *13*	1157.0208	2$^+$			
3581.3	0$^+$	2426.2 *29*	100	1157.0208	2$^+$	(E2)		E$_\gamma$: unweighted average of 2423.3 *6* from ^{44}K β^- decay and 2429 *2* from (p,p′γ).
								Mult.: (Q) from p$\gamma(\theta)$ in (p,p′γ); $\Delta\pi$=no from level scheme.
3661.527	1$^-$	353.67 *25*	0.29 *19*	3307.872	3$^-$	[E2]	2.18×10^{-3} *3*	E$_\gamma$: from (pol γ,γ').
		1005.0 *9*	0.48	2656.509	2$^+$	[E1]		E$_\gamma$: from (pol γ,γ').
		1777.973 *20*	34.8 *8*	1883.516	0$^+$	(E1)		E$_\gamma$: from (pol γ,γ'). Other: 1780 *2* from (p,p′γ).
								Mult.: D from p$\gamma(\theta)$ in (p,p′γ); $\Delta\pi$=yes from level scheme.
		2504.39 *6*	10.7 *9*	1157.0208	2$^+$	[E1]		E$_\gamma$: from (pol γ,γ'). Other: 2508 *3* from (p,p′γ).
		3661.363 *11*	100.0 *19*	0.0	0$^+$	(E1)	1.55×10^{-3} *2*	E$_\gamma$: others: 3661.3 *2* from (pol γ,γ') and 3659 *4* from (p,p′γ).
								Mult.: D from p$\gamma(\theta)$ in (p,p′γ); $\Delta\pi$=yes from level scheme.
3676.092	(2$^+$)	368.208 *23*	23.2 *4*	3307.872	3$^-$			E$_\gamma$: weighted average of 368.207 *14* from ^{44}K β^- decay, 368.8 *3* from (n,γ) E=thermal, and 367 *1* from (p,p′γ).
		374.82 *11*	2.0 *5*	3301.36	2$^+$			E$_\gamma$: weighted average of 374.85 *10* from ^{44}K β^- decay and 374.4 *4* from (n,γ) E=thermal.
		1017.5 *13*	8.7 *4*	2656.509	2$^+$			E$_\gamma$: unweighted average of 1019.55 *7* from ^{44}K β^- decay, 1017.8 *7* from (n,γ) E=thermal, and 1015 *1* from (p,p′γ).
		2518.991 *18*	100.0 *18*	1157.0208	2$^+$			E$_\gamma$: others: 2518.9 *5* from (n,γ) E=thermal and 2520 *3* from (p,p′γ).
		3676.7 *6*	0.15 *7*	0.0	0$^+$			
3691.7	1	3691.5 *4*	100	0.0	0$^+$			E$_\gamma$: from (γ,γ').
3711.96	4$^-$	404.26 *13*	100 *8*	3307.872	3$^-$	(M1)		B(M1)(W.u.)>5.2×10^{-4}
								E$_\gamma$: weighted average of 403.86 *20* from ^{44}K β^- decay, 404.4 *3* from

$\gamma(^{44}Ca)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.	δ	α@	Comments
									(^{18}O,2p2nγ), and 404.34 *10* from (n,γ) E=thermal. I_γ: from (^{18}O,2p2nγ). Other: 100 *27* from ^{44}K β^- decay. Mult.: D, ΔJ=1 from DCO in (^{18}O,2p2nγ); $\Delta\pi$=no from level scheme.
3711.96	4^-	1428.67 *25*	44 *4*	2283.119	4^+	[E1]			B(E1)(W.u.)>1.2×10^{-7} E_γ: weighted average of 1428.7 *4* from ^{44}K β^- decay, 1428.8 *3* from (^{18}O,2p2nγ), and 1428.56 *25* from (n,γ) E=thermal. I_γ: from (^{18}O,2p2nγ). Other: 36 *18* from ^{44}K β^- decay.
3776.27	2^-	1119.7 *4*	7.9 *38*	2656.509	2^+	[E1]			B(E1)(W.u.)>2.1×10^{-8} I_γ: weighted average of 8.3 *56* from ^{44}K β^- decay and 7.7 *38* from (p,p$'\gamma$).
		2619.16 *12*	100 *4*	1157.0208	2^+	(E1+M2)	−0.62 *+7−8*		B(E1)(W.u.)>2.6×10^{-8}; B(M2)(W.u.)>0.0061 E_γ: others: 2619.1 *5* from (n,γ) E=thermal and 2617 *4* from (p,p$'\gamma$). I_γ: from (p,p$'\gamma$). Other: 100 *20* from ^{44}K β^- decay. Mult.: D+Q from (p,p$'\gamma$); $\Delta\pi$=yes from level scheme.
3913.80	5^-	202.1 *2*	4.8	3711.96	4^-	[M1,E2]		0.010 *8*	E_γ,I_γ: from (^{18}O,2p2nγ) require a $T_{1/2}$>44 ps. B(M1)(W.u.)<0.041 if M1. B(E2)(W.u.)<2767 upper limit exceeds RUL=100 if E2.
		628.71 *11*	92.7 *32*	3285.004	6^+	(E1+M2)	−0.30 *14*		B(E1)(W.u.)<5.3×10^{-4} B(M2)(W.u.)<1013 upper limit exceeds RUL=3 *14*, RUL=3 would require a $T_{1/2}$>0.11 ns. E_γ: unweighted average of 628.9 *1* from (^{18}O,2p2nγ), 628.53 *9* from (^{14}C,α2nγ), and 628.69 *10* from (n,γ) E=thermal. I_γ: weighted average of 92.1 *32* from (^{18}O,2p2nγ) and 100 *11* from (^{14}C,α2nγ). Mult.,δ: D+Q from $\gamma(\theta)$ in (^{14}C,α2nγ); $\Delta\pi$=yes from level scheme. ΔJ=1 from DCO in (^{18}O,2p2nγ).
		869.47 *15*	100 *5*	3044.292	4^+	(E1)			B(E1)(W.u.)<2.2×10^{-4} E_γ: weighted average of 869.5 *2* from (^{18}O,2p2nγ) and 869.45 *15* from (n,γ) E=thermal. I_γ: from (^{18}O,2p2nγ). Mult.: D, ΔJ=1 from DCO in (^{18}O,2p2nγ); $\Delta\pi$=yes from level scheme.
3922.71	5^-	637.68 *12*	100‡	3285.004	6^+	[E1]			B(E1)(W.u.)>1.5×10^{-6} E_γ: weighted average of 637.8 *2* from (^{18}O,2p2nγ) and 637.63 *12* from (n,γ) E=thermal.
		878.25 *20*	91‡	3044.292	4^+	[E1]			B(E1)(W.u.)>4.8×10^{-7} E_γ: weighted average of 878.4 *2* from (^{18}O,2p2nγ) and 878.10 *20* from (n,γ) E=thermal.

γ(^{44}Ca) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	Comments
3922.71	5^-	1640.7[&‡] *5*	<46[&‡]	2283.119	4^+	[E1]	
4011.4		299.5[‡] *4*	100	3711.96	4^-		
4092.04	(6^+)	806.95[‡] *15*	100 *11*	3285.004	6^+	(E2)	E_γ: other: 807.0 *3* from (^{18}O,2p2nγ). I_γ: from (^{18}O,2p2nγ). Mult.: from DCO in (^{18}O,2p2nγ).
		1809.0 *4*	53 *7*	2283.119	4^+	(E2)	E_γ: weighted average of 1809.1 *4* from (^{18}O,2p2nγ) and 1808.9 *5* from (n,γ) E=thermal. I_γ: from (^{18}O,2p2nγ). Other: 48 from (n,γ) E=thermal. Mult.: from DCO in (^{18}O,2p2nγ).
4093.7	$(2^+,3,4^+)$	1810.4 *7*	100 *67*	2283.119	4^+		
		2937.8 *10*	67 *25*	1157.0208	2^+		
4196.10	2^+	3038.7[‡] *4*	30 *7*	1157.0208	2^+	[M1,E2]	E_γ: other: 3040 from (p,p′γ); not seen in (γ,γ'). I_γ: from (p,p′γ). B(M1)(W.u.)=0.0036 *+9−11* if M1, B(E2)(W.u.)=1.09 *+28−31* if E2.
		4196.1 *3*	100 *4*	0.0	0^+	(E2)	B(E2)(W.u.)=0.73 *15* E_γ: from (γ,γ'), also seen in (p,p′γ). but this γ is not seen in (n,γ) E=thermal. It is likely a different level is populated in (n,γ) E=thermal. I_γ: from (p,p′γ). Mult.: Q from p$\gamma(\theta)$ in (p,p′γ); $\Delta\pi$=no from level scheme.
4260.27	$(2^+,3)$	1976.9 *7*	82 *64*	2283.119	4^+		
		3103.2 *4*	100 *36*	1157.0208	2^+		
4315.22	(1,2,3)	1658.69 *18*	100 *24*	2656.509	2^+		
		3158.07 *20*	70 *11*	1157.0208	2^+		
4358.440	3^-	646.5 *3*	12 *4*	3711.96	4^-		
		682.34 *3*	11 *6*	3676.092	(2^+)		
		696.9[a]	≤0.8	3661.527	1^-		
		1050.60 *10*	79 *12*	3307.872	3^-		E_γ: other: 1050.54 *20* from (n,γ) E=thermal.
		1701.9 *3*	14 *6*	2656.509	2^+		
		3201.26 *12*	100 *8*	1157.0208	2^+		E_γ: weighted average of 3201.27 *7* from ^{44}K β^- decay and 3200.1 *7* from (n,γ) E=thermal.
4399.2	3^-	3242.0 *6*	100	1157.0208	2^+		E_γ: other: 3242.1 *7* from (n,γ) E=thermal.
4409.176	$(1)^-$	733.0 *4*	4.0 *17*	3676.092	(2^+)		
		747.63 *3*	51.4 *29*	3661.527	1^-		
		1101.3 *5*	0.29 *29*	3307.872	3^-		
		1107.98 *10*	16.4 *12*	3301.36	2^+		
		1752.629 *10*	100.0 *14*	2656.509	2^+		
		3252.07 *13*	3.9 *6*	1157.0208	2^+		
		4408.91 *19*	1.31 *22*	0.0	0^+		
4436.7	$(1,2^+)$	3279.0 *7*	100 *67*	1157.0208	2^+		
		4437.0 *7*	40 *27*	0.0	0^+		

$^{44}_{20}$Ca$_{24}$-16

Adopted Levels, Gammas (continued)

γ(^{44}Ca) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Comments
4479.9	2^+	3322.8[‡] *6*	100	1157.0208	2^+	
4552.644	$(3)^-$	876.53 *3*	100 *2*	3676.092	(2^+)	
		891.10 *12*	5.4 *20*	3661.527	1^-	
		1195.4	2.7 *24*	3357.29	$(2^+,3,4^+)$	
		1244.75 *5*	48.0 *17*	3307.872	3^-	
		1896.0 *9*	6.4 *47*	2656.509	2^+	
		2268.5 *10*	1.7 *14*	2283.119	4^+	
		3395.51 *4*	96.3 *27*	1157.0208	2^+	
4561.8?		3404.6[a] *6*	100	1157.0208	2^+	
4564.87	(5^-)	651.07 *12*	<420	3913.80	5^-	E_γ: other: 651.0 *3* from (^{18}O,2p2nγ). I_γ: from (n,γ) E=thermal, where the 651.07γ is a doubly placed with intensity not divided.
		2281.7[‡] *5*	100[‡]	2283.119	4^+	
		4565.1[a] *8*	98	0.0	0^+	Placement of this transition in (n,γ) E=thermal is considered unlikely by evaluators from the implied high mult=E5.
4572.6	(1,2,3)	1916.0 *8*	100 *52*	2656.509	2^+	
		3415.5 *7*	44 *18*	1157.0208	2^+	
4584.08	$(2^+,3,4^+)$	1276.0[‡] *8*	9.2[‡]	3307.872	3^-	
		1539.40[‡] *25*	39[‡]	3044.292	4^+	
		2300.6[‡] *5*	40[‡]	2283.119	4^+	
		3427.5[‡] *4*	100[‡]	1157.0208	2^+	
4649.46	1	4649.2 *1*	100	0.0	0^+	E_γ: from (γ,γ').
4650.3	2^+	1992.8 *7*	100 *67*	2656.509	2^+	E_γ: weighted average of 1992.4 *5* from ^{44}K β^- decay and 1994.2 *10* from (n,γ) E=thermal.
		4650.1[‡] *9*	12 *7*	0.0	0^+	I_γ: from ^{44}K β^- decay. In (n,γ), Iγ(4651)/Iγ(1993)=1.43.
4690.0	$(1^-,2,3,4^+)$	3532.9[‡] *6*	100	1157.0208	2^+	
4803.6	$(1^-,2,3,4^+)$	3647.2[‡] *6*	100	1157.0208	2^+	
4824.4	(1,2,3)	2167.8 *6*	100	2656.509	2^+	
4848.39	1	4848.1 *2*	100	0.0	0^+	E_γ: from (γ,γ').
4866.09	1	1285.0[a] *10*	≤10.7	3581.3	0^+	
		2982.44 *15*	79 *11*	1883.516	0^+	E_γ: weighted average of 2982.47 *15* from ^{44}K β^- decay and 2982.3 *3* from (pol γ,γ'). I_γ: other: 79 *27* from (pol γ,γ').
		3708.90[a] *13*	≤29	1157.0208	2^+	
		4865.81 *15*	100 *4*	0.0	0^+	E_γ: other: 4865.7 *4* from (pol γ,γ'). I_γ: other: 100 *27* from (pol γ,γ').
4884.02	(1,2,3)	1222.50 *8*	100 *10*	3661.527	1^-	
		1575.9 *3*	36 *11*	3307.872	3^-	
		3726.6 *4*	6.0 *12*	1157.0208	2^+	

γ(^{44}Ca) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	δ	α[@]	Comments
4892.6?		4892.3[a] 8	100	0.0	0^+				
4904.58	3^-	2248.2[‡] 5	63[‡]	2656.509	2^+				
		3747.2[‡] 6	100[‡]	1157.0208	2^+				
4930.74	(6^-)	1016.9 2	100 7	3913.80	5^-	D			
		1218.8 3	48 7	3711.96	4^-				
5005.69	4^+	1092.2[‡] 7	6.7[‡]	3913.80	5^-				
		1648.1[‡] 5	69[‡]	3357.29	$(2^+,3,4^+)$				
		2722.4[‡] 3	100[‡]	2283.119	4^+				
		3848.9[‡] 7	12.2[‡]	1157.0208	2^+				
5025.73	3^-	1363.7 8	18 18	3661.527	1^-				
		3868.56 22	100 27	1157.0208	2^+				
		5025.4 8	2.7 18	0.0	0^+				
5087.62	8^+	1802.59 8	100	3285.004	6^+	E2			B(E2)(W.u.)=6.1 +22−13 E_γ: from (^{14}C,α2nγ). Others: 1802 1 from (^{16}O,2pγ) and 1802.6 2 from (^{18}O,2p2nγ). Mult.: Q, ΔJ=2 from DCO in (^{18}O,2p2nγ); M2 ruled out by RUL.
5096.87	$3^-,4^-$	1183.1[‡] 4	100	3913.80	5^-				
5130.22	$(2,3)^+$	1773.3[‡] 5	34[‡]	3357.29	$(2^+,3,4^+)$				
		2846.9 3	100[‡]	2283.119	4^+				E_γ: weighted average of 2847.6 7 from ^{44}K β^- decay and 2846.8 3 from (n,γ) E=thermal.
		3973.1[‡] 4	83[‡]	1157.0208	2^+				
5161.8	1	4005	1.8 18	1157.0208	2^+				
		5161.33 63	100 6	0.0	0^+				E_γ: unweighted average of 5161.96 10 from ^{44}K β^- decay and 5160.7 3 from (pol γ,γ').
5201.13	$(1,2,3)^-$	1525.0[a]		3676.092	(2^+)				
		1893.2 4	100 47	3307.872	3^-				
		4044[a]	≤2.6	1157.0208	2^+				
5210.0	1^+	1909	33 15	3301.36	2^+	[M1,E2]			E_γ,I_γ: from (γ,γ'). B(M1)(W.u.)=0.19 8 if M1, B(E2)(W.u.)=1.4×10^2 6 if E2.
		2553	4 4	2656.509	2^+	[M1,E2]			E_γ,I_γ: from (γ,γ'). B(M1)(W.u.)<0.023 if M1, B(E2)(W.u.)<10 if E2.
		3326	80 2	1883.516	0^+	M1			B(M1)(W.u.)=0.085 +16−15 E_γ,I_γ,Mult.: from (γ,γ').
		4053	65 2	1157.0208	2^+	M1+E2	+0.27 8	1.07×10^{-3} 2	B(M1)(W.u.)=0.036 7; B(E2)(W.u.)=0.44 +27−23 E_γ,I_γ,Mult.,δ: from (γ,γ').

From ENSDF

$^{44}_{20}$Ca$_{24}$-18

γ(^{44}Ca) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	α[@]	Comments
5210.0	1^+	5210	100 *1*	0.0	0^+	M1[#]	1.41×10^{-3} *2*	B(M1)(W.u.)=0.028 *5* E_γ,I_γ: from (γ,γ').
5230.33	2^+,3^+,4^+,5^+	1872.7[&‡] *3*	<74[&‡]	3357.29	(2^+,3,4^+)			
		2186.2[‡] *10*	6.9[‡]	3044.292	4^+			
		2947.4[‡] *3*	100[‡]	2283.119	4^+			
5245.19	7^-	1331.3 *2*	100 *5*	3913.80	5^-	(E2)		E_γ,I_γ: from (^{18}O,2p2nγ). Mult.: ΔJ=2 from DCO in (^{18}O,2p2nγ).
		1960.2 *2*	97 *7*	3285.004	6^+	(E1)		E_γ,I_γ: from (^{18}O,2p2nγ). Mult.: ΔJ=1 from DCO in (^{18}O,2p2nγ).
5289.25		3006.0[‡] *4*	100	2283.119	4^+			
5300.5		1588.7[‡] *4*	100	3711.96	4^-			
5325.0	(1,2,3)	4167.8 *6*	100 *50*	1157.0208	2^+			
5342.2	$(2)^+$	4185.6[‡] *8*	100	1157.0208	2^+			
5367.5	(1,2,3)	2711	1.0×10^2 *10*	2656.509	2^+			
		4210.1 *10*	30 *27*	1157.0208	2^+			
5375.0	$(2,3,4)^+$	4217.9[‡] *8*	100	1157.0208	2^+			
5458.9	$(2,3,4)^+$	3176.2[‡] *7*	100[‡]	2283.119	4^+			
		4301.7[‡] *7*	50[‡]	1157.0208	2^+			
5512.3		4355[a]	100	1157.0208	2^+			
5548.68	$(2,3,4)^+$	1872.7[&‡] *3*	<540[&‡]	3676.092	(2^+)			
		2891.2[‡a] *6*	63[‡]	2656.509	2^+			
		3265.4[‡] *7*	100[‡]	2283.119	4^+			
		4391.5[‡] *7*	72[‡]	1157.0208	2^+			
5561.0	3^-	1884.5 *10*	100 *75*	3676.092	(2^+)			
		4403.6 *6*	15 *10*	1157.0208	2^+			
		5561.3[a] *10*	13 *10*	0.0	0^+			
5611.56	1	4454.1 *8*	100 *21*	1157.0208	2^+			
		5611.2 *3*	47 *21*	0.0	0^+			
5646.79	$8^{(+)}$	559.2 *2*	100 *11*	5087.62	8^+	(M1)		E_γ,I_γ: from (^{18}O,2p2nγ). ΔJ=0 from DCO in (^{18}O,2p2nγ).
		1554.7 *3*	70 *7*	4092.04	(6^+)	(E2)		E_γ,I_γ: from (^{18}O,2p2nγ).
		2361.6 *4*	75 *7*	3285.004	6^+	(E2)		E_γ,I_γ: from (^{18}O,2p2nγ).
5733.30	$(4,5)^+$	1640.7[&‡] *5*	<42[&‡]	4092.04	(6^+)			
		2376.1[‡] *5*	16.7[‡]	3357.29	(2^+,3,4^+)			
		2688.7[‡] *5*	21.3[‡]	3044.292	4^+			

$^{44}_{20}Ca_{24}$-19

$\gamma(^{44}Ca)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	Comments
5733.30	$(4,5)^+$	3450.3[‡] *4*	100[‡]	2283.119	4^+		
5775.76	$(2,3,4)^+$	2099.3[‡] *5*	49[‡]	3676.092	(2^+)		
		2474.9[‡a] *6*	24.8[‡]	3301.36	2^+		
		2730.7[‡] *6*	33[‡]	3044.292	4^+		
		3120.5[‡a] *15*	12.8[‡]	2656.509	2^+		
		3492.9[‡] *4*	100[‡]	2283.119	4^+		
		4618.0[‡] *8*	37[‡]	1157.0208	2^+		
5800.61	1	5800.2 *2*	100	0.0	0^+		
5806.31	1^-	5805.9 *1*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=1.2×10^{-3} *2*
5866.82	$(4^+,5^+)$	1773.3[‡] *5*	100[‡]	4093.7	$(2^+,3,4^+)$		
		2509.2[‡] *6*	23.1[‡]	3357.29	$(2^+,3,4^+)$		
		3583.4[‡] *6*	100[‡]	2283.119	4^+		
5875.82	1^-	5875.4 *2*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=6.4×10^{-4} *10*
5911.13	1	5910.7 *2*	100	0.0	0^+		
5971.30	$8^{(-)}$	726.1 *2*	100 *6*	5245.19	7^-	(M1)	E_γ,I_γ: from (^{18}O,2p2nγ). ΔJ=1 from DCO in (^{18}O,2p2nγ).
		883.7 *2*	71 *6*	5087.62	8^+		E_γ,I_γ: from (^{18}O,2p2nγ).
		1040.5 *3*	42.9 *29*	4930.74	(6^-)	Q	E_γ,I_γ: from (^{18}O,2p2nγ). ΔJ=2 from DCO in (^{18}O,2p2nγ).
6040.0	$2^+,3^+,4^+,5^+$	2682.8[‡] *6*	100	3357.29	$(2^+,3,4^+)$		
6082.9	1^+	4199.5 *5*	62 *12*	1883.516	0^+	M1[#]	B(M1)(W.u.)=0.043 *10*
		4925.3 *8*	41 *7*	1157.0208	2^+	[M1,E2]	B(M1)(W.u.)=0.018 *4* if M1, B(E2)(W.u.)=2.0 *5* if E2.
		6080.1 *14*	100 *7*	0.0	0^+	M1[#]	B(M1)(W.u.)=0.023 *4*
6136.59	1^-	4978.5 *5*	46 *7*	1157.0208	2^+	[E1]	B(E1)(W.u.)=0.00109 *19*
		6136.4 *3*	100 *5*	0.0	0^+	E1[#]	B(E1)(W.u.)=0.00127 *18*
6146.14	$(4,5)^+$	2053.9[‡] *5*	86[‡]	4092.04	(6^+)		
		2223.3[‡] *20*		3922.71	5^-		
		3861.7[‡] *7*	100[‡]	2283.119	4^+		
6211.4		2297.5[‡] *6*	100	3913.80	5^-		
6245.48	1	6245.0 *3*	100	0.0	0^+		
6422.12	1^-	4539.9 *7*	5.2 *7*	1883.516	0^+	E1[#]	B(E1)(W.u.)=0.0013 *2*
		5263.8 *7*	5.5 *7*	1157.0208	2^+	E1[#]	B(E1)(W.u.)=8.8×10^{-4} *14*
		6421.6 *1*	100 *1*	0.0	0^+	E1[#]	B(E1)(W.u.)=0.0088 *+9−8*
6446.5	1^+	5288.0 *17*	50 *14*	1157.0208	2^+	[M1,E2]	B(M1)(W.u.)=0.0084 *+24−26* if M1, B(E2)(W.u.)=0.84 *+24−26* if E2.
		6446.3 *8*	100 *10*	0.0	0^+	M1[#]	B(M1)(W.u.)=0.0093 *+24−22*

From ENSDF

$^{44}_{20}Ca_{24}$-20

Adopted Levels, Gammas (continued)

$\gamma(^{44}Ca)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	Comments
6507.1	1	6506.6 *5*	100	0.0	0^+		
6657.65	$9^{(-)}$	1412.4 *3*	59 *4*	5245.19	7^-	(E2)	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=2$ from DCO in $(^{18}O,2p2n\gamma)$.
		1570.0 *2*	100 *6*	5087.62	8^+	(E1)	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=1$ from DCO in $(^{18}O,2p2n\gamma)$.
6672.92		2088.2[‡] *5*	100[‡]	4584.08	$(2^+,3,4^+)$		
		2896.7[‡a] *6*	18.4[‡]	3776.27	2^-		
		3628.9[‡] *7*	34.5[‡]	3044.292	4^+		
6675.44	1	6674.9 *2*	100	0.0	0^+		
6960.7	1	6960.1 *6*	100	0.0	0^+		
6972.14	1	5815.0 *5*	100 *15*	1157.0208	2^+		
		6971.5 *2*	52 *15*	0.0	0^+		
7065.9	1	7065.3 *9*	100	0.0	0^+		
7092.76	(9^-)	435.1 *3*	39	6657.65	$9^{(-)}$		E_γ,I_γ: from $(^{18}O,2p2n\gamma)$.
		1121.5 *4*	78	5971.30	$8^{(-)}$		E_γ,I_γ: from $(^{18}O,2p2n\gamma)$.
		1445.9 *3*	100 *11*	5646.79	$8^{(+)}$	D	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=1$ from DCO in $(^{18}O,2p2n\gamma)$.
		2005.1 *2*	67 *6*	5087.62	8^+	(E1)	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=1$ from DCO in $(^{18}O,2p2n\gamma)$.
7226.04	1	7225.4 *3*	100	0.0	0^+		
7275.2	1	7274.5 *9*	100	0.0	0^+		
7403.0	1	7402.3 *8*	100	0.0	0^+		
7470.92	(10^+)	1824.1 *2*	100 *8*	5646.79	$8^{(+)}$	Q	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=2$ from DCO in $(^{18}O,2p2n\gamma)$.
		2383.2 *3*	55 *6*	5087.62	8^+	Q	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=2$ from DCO in $(^{18}O,2p2n\gamma)$.
7556.58	(9)	2468.9 *3*	100	5087.62	8^+	(D)	E_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=(1)$ from DCO in $(^{18}O,2p2n\gamma)$.
7572.0	$1^{(+)}$	7571.3 *5*	100	0.0	0^+	(M1)[#]	B(M1)(W.u.)=0.020 *5*
7578.90	1^-	7578.2 *3*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=0.0025 *3*
7662.1	1^-	7661.4 *6*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=2.6×10^{-4} *8*
7783.3	1^-	7782.6 *10*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=2.7×10^{-4} *+10−8*
7808.9	1^-	7808.2 *16*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=1.4×10^{-4} *5*
7828.9	1	7828.1 *12*	100	0.0	0^+		
7834.8	1^-	7834.0 *8*	100	0.0	0^+	E1[#]	B(E1)(W.u.)=3.8×10^{-4} *+10−9*
7879.97	(10^-)	323.4 *2*	33.3	7556.58	(9)	D	E_γ,I_γ: from $(^{18}O,2p2n\gamma)$. $\Delta J=1$ from DCO in $(^{18}O,2p2n\gamma)$.

$^{44}_{20}Ca_{24}$-21

$\gamma(^{44}Ca)$ (continued)

E_i(level)	J^π_i	E_γ †	I_γ †	E_f	J^π_f	Mult.	Comments
7879.97	(10⁻)	787.2 *2*	100 *8*	7092.76	(9⁻)	(M1)	E_γ,I_γ: from (^{18}O,2p2nγ). ΔJ=1 from DCO in (^{18}O,2p2nγ).
		1908.6 *3*	74 *8*	5971.30	$8^{(-)}$	Q	E_γ,I_γ: from (^{18}O,2p2nγ). ΔJ=2 from DCO in (^{18}O,2p2nγ).
7953.1	1	5293.8 *14*	100	2656.509	2⁺		
		7952.6 *5*	100	0.0	0⁺		
8070.2	1	8069.4 *7*	100	0.0	0⁺		
8086.0	1	8085.2 *7*	100	0.0	0⁺		
8286.28	(11⁻)	1628.6 *2*	100.0 *63*	6657.65	$9^{(-)}$	(E2)	E_γ,I_γ: from (^{18}O,2p2nγ). ΔJ=2 from DCO in (^{18}O,2p2nγ).
8321.5	1	8320.7 *16*	100	0.0	0⁺		
8395.3	1	8394.4 *4*	100	0.0	0⁺		
8405.4	1	8404.5 *17*	100	0.0	0⁺		
8556.7	1⁻	8555.8 *8*	100	0.0	0⁺	E1#	B(E1)(W.u.)=3.6×10^{-4} *+15−13*
8615.2	1⁻	8614.3 *12*	100	0.0	0⁺	E1#	B(E1)(W.u.)=3.7×10^{-4} *11*
8801.9	1⁻	8800.9 *29*	100	0.0	0⁺	E1#	B(E1)(W.u.)=7.2×10^{-5} *+4−3*
8828.0	1⁻	6944.6 *18*	100 *14*	1883.516	0⁺	E1#	B(E1)(W.u.)=0.0011 *+4−3*
		8826.6 *14*	89 *23*	0.0	0⁺	E1#	B(E1)(W.u.)=4.7×10^{-4} *+17−15*
8851.5	1⁻	7692.9 *18*	19 *8*	1157.0208	2⁺	E1#	B(E1)(W.u.)=2.7×10^{-4} *11*
		8850.7 *7*	100 *6*	0.0	0⁺	E1#	B(E1)(W.u.)=9.4×10^{-4} *+21−19*
8908.8	1⁻	8907.8 *7*	100	0.0	0⁺	E1#	B(E1)(W.u.)=0.0023 *4*
9024.1	1⁻	9023.1 *20*	100	0.0	0⁺	E1#	
9148.4	1⁻	9147.4 *24*	100	0.0	0⁺	E1#	
9273.6	1⁻	9272.5 *8*	100	0.0	0⁺	E1#	B(E1)(W.u.)=6.2×10^{-4} *14*
9317.2	1⁻	9316.1 *10*	100	0.0	0⁺	E1#	
9664.9	1⁻	8508.5 *33*	17 *8*	1157.0208	2⁺		
		9663.7 *7*	100 *6*	0.0	0⁺	E1#	
9788.6		2317.6 *6*	100	7470.92	(10⁺)		E_γ: from (^{18}O,2p2nγ).
9814.1	1⁻	9812.9 *11*	100	0.0	0⁺	E1#	
9859.5	(12⁻)	1979.5 *3*	100	7879.97	(10⁻)	(E2)	E_γ: from (^{18}O,2p2nγ). ΔJ=2 from DCO in (^{18}O,2p2nγ).
9898.2	1⁻	9897.0 *10*	100	0.0	0⁺	E1#	
10567.8	(13⁻)	2281.5 *4*	100	8286.28	(11⁻)	Q	
(11131.60)	3⁻,4⁻	4457.9‡ *7*	27.3‡	6672.92			
		4919.9‡ *7*	12.9‡	6211.4			
		4984.4‡ *5*	16.1‡	6146.14	(4,5)⁺		

From ENSDF

$^{44}_{20}Ca_{24}$-22

Adopted Levels, Gammas (continued)

$\gamma(^{44}\mathrm{Ca})$ (continued)

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π
(11131.60)	$3^-,4^-$	5091.6‡ *8*	5.7‡	6040.0	$2^+,3^+,4^+,5^+$
		5264.4‡ *5*	17.1‡	5866.82	$(4^+,5^+)$
		5355.7‡ *5*	41‡	5775.76	$(2,3,4)^+$
		5397.8‡ *5*	54‡	5733.30	$(4,5)^+$
		5582.4‡ *5*	14.2‡	5548.68	$(2,3,4)^+$
		5673.0‡ *7*	7.2‡	5458.9	$(2,3,4)^+$
		5756.3‡ *7*	12.2‡	5375.0	$(2,3,4)^+$
		5789.5‡ *7*	5‡	5342.2	$(2)^+$
		5831.4‡ *7*	14.4‡	5300.5	
		5841.9‡ *5*	16.8‡	5289.25	
		5900.9‡ *5*	100‡	5230.33	$2^+,3^+,4^+,5^+$
		6001.3‡ *6*	49‡	5130.22	$(2,3)^+$
		6034.4‡ *6*	16.9‡	5096.87	$3^-,4^-$
		6125.3‡ *6*	53‡	5005.69	4^+
		6226.7‡ *8*	12.1‡	4904.58	3^-
		6328.3‡ *6*	8.5‡	4803.6	$(1^-,2,3,4^+)$
		6441.1‡ *8*	5.6‡	4690.0	$(1^-,2,3,4^+)$
		6480.2‡ *6*	33‡	4650.3	2^+
		6546.6‡ *6*	33.9‡	4584.08	$(2^+,3,4^+)$
		6566.4‡ *6*	8‡	4564.87	(5^-)
		6651.3‡ *8*	6‡	4479.9	2^+
		6731.9‡ *10*	2.01‡	4399.2	3^-
		6772.3‡ *6*	10.8‡	4358.440	3^-
		6935.2‡ *6*	12.6‡	4196.10	2^+
		7119.7‡ *10*	1.15‡	4011.4	
		7208.1‡ *6*	22.2‡	3922.71	5^-
		7354.2‡ *8*	7‡	3776.27	2^-
		7418.8‡ *6*	10.6‡	3711.96	4^-
		7454.4‡ *10*	1.15‡	3676.092	(2^+)
		7773.4‡ *6*	44‡	3357.29	$(2^+,3,4^+)$
		7822.3‡ *10*	2.44‡	3307.872	3^-
		7829.3‡ *8*	8.6‡	3301.36	2^+

$^{44}_{20}\mathrm{Ca}_{24}$-23

γ(^{44}Ca) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Comments
(11131.60)	$3^-,4^-$	8086.4[‡] *7*	9.6[‡]	3044.292	4^+	
		8474.3[‡] *10*	1[‡]	2656.509	2^+	
		8848.0[‡] *7*	5.3[‡]	2283.119	4^+	
		9974.3[‡] *8*	1.58[‡]	1157.0208	2^+	
12188.1		2399.5 *7*	100	9788.6		E_γ: from (^{18}O,2p2nγ).

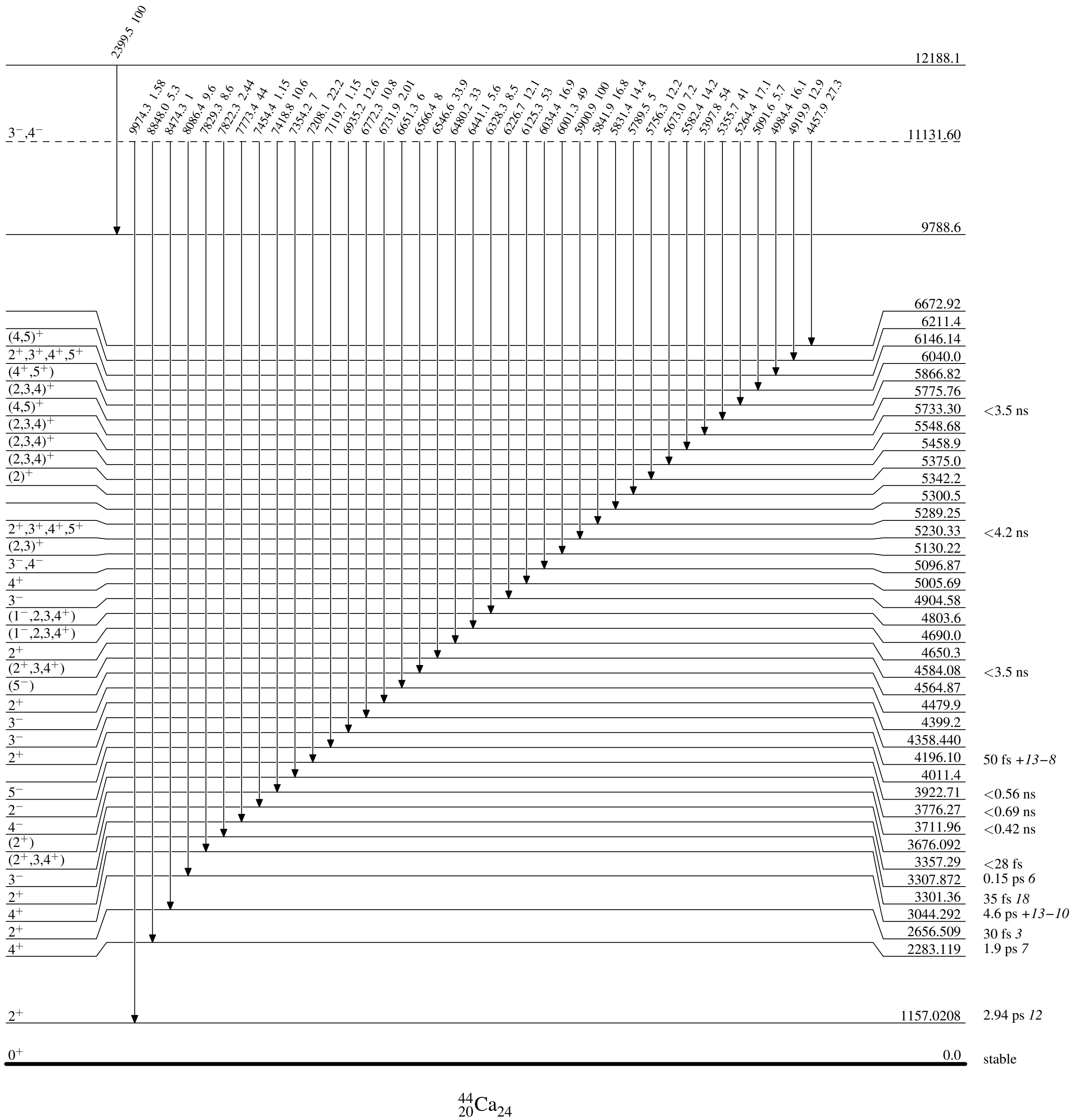
[†] From ^{44}K β^- decay up to 5561 level, and from (γ,γ'),(pol γ,γ') above that, unless otherwise noted.
[‡] From (n,γ) E=thermal.
[#] From γ(linear polarization) in (polarized γ,γ').
[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[&] Multiply placed with undivided intensity.
[a] Placement of transition in the level scheme is uncertain.

$^{44}_{20}$Ca$_{24}$-24

Adopted Levels, Gammas

Level Scheme

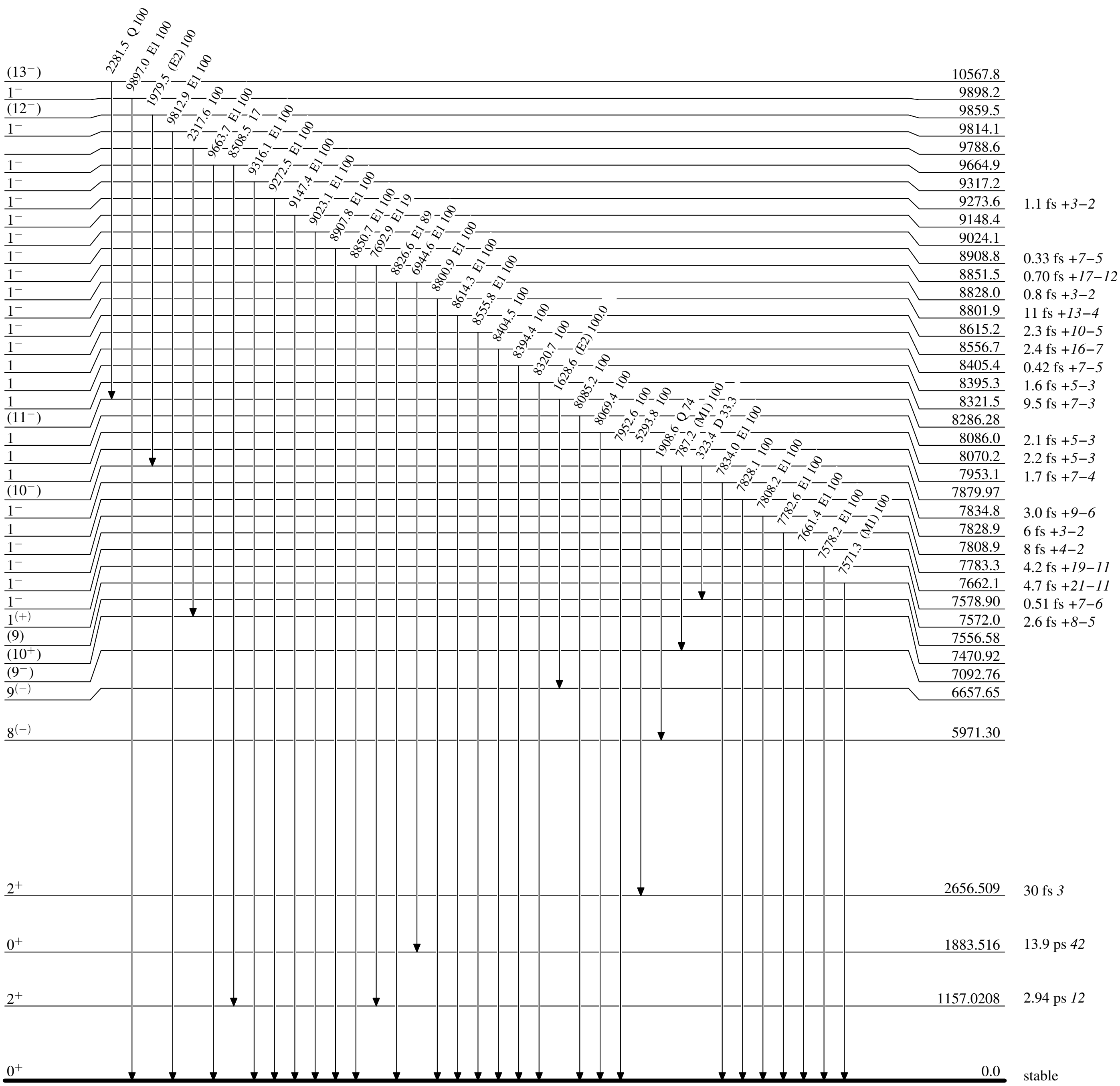
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



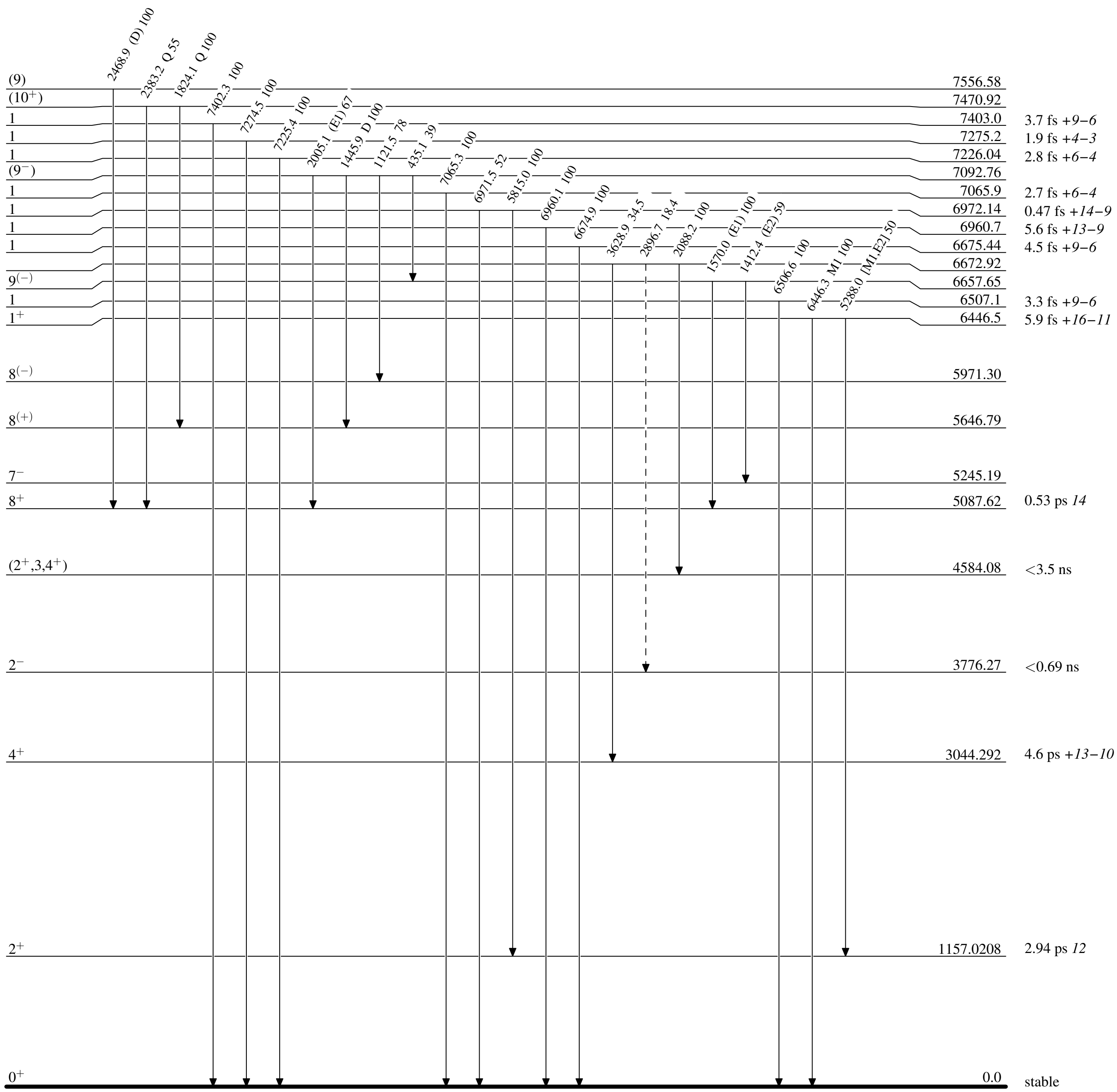
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

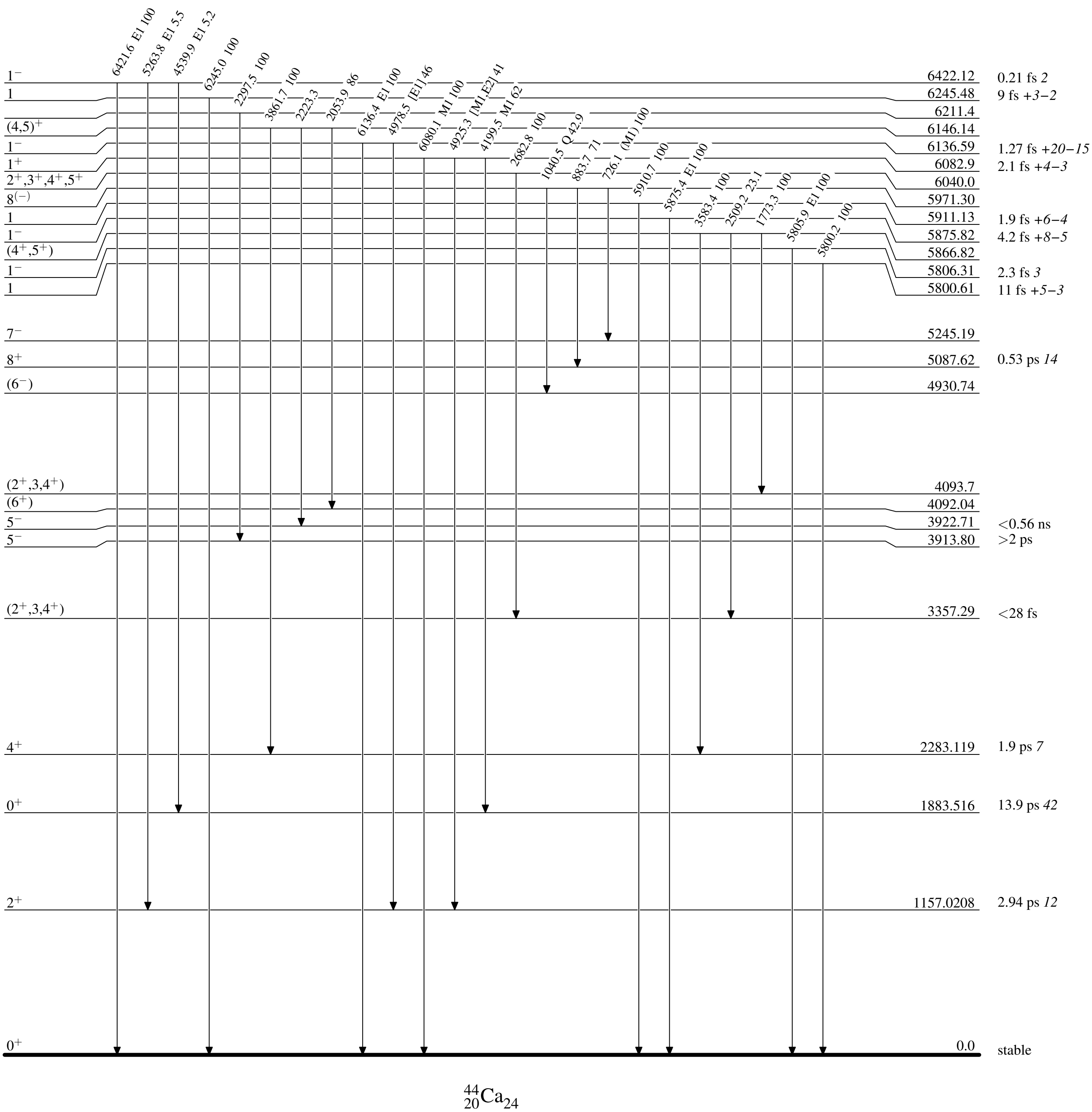


$^{44}_{20}$Ca$_{24}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



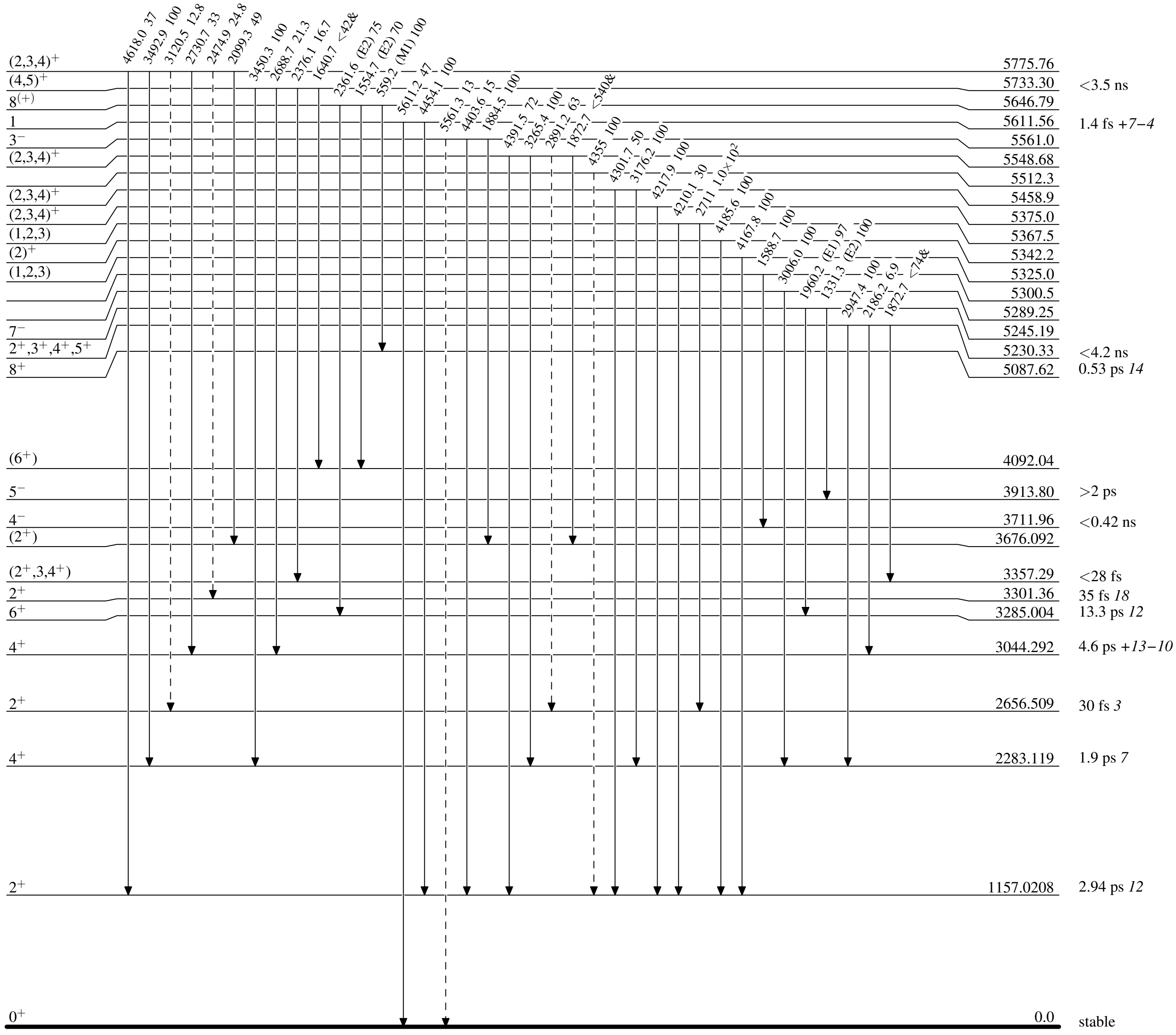
Adopted Levels, Gammas

Legend

Level Scheme (continued)

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

γ Decay (Uncertain)



$^{44}_{20}Ca_{24}$

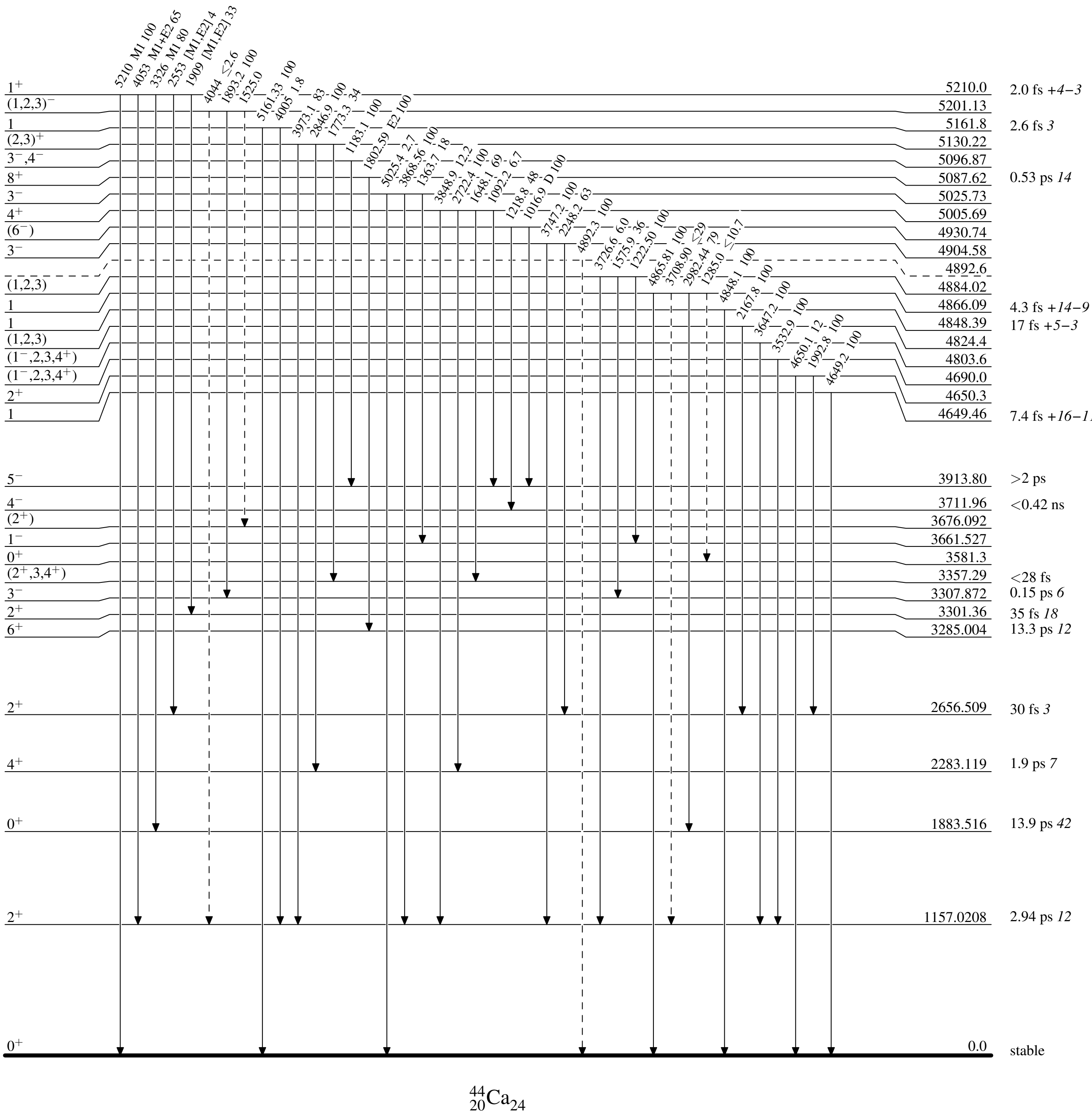
Adopted Levels, Gammas

Legend

Level Scheme (continued)

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

γ Decay (Uncertain)

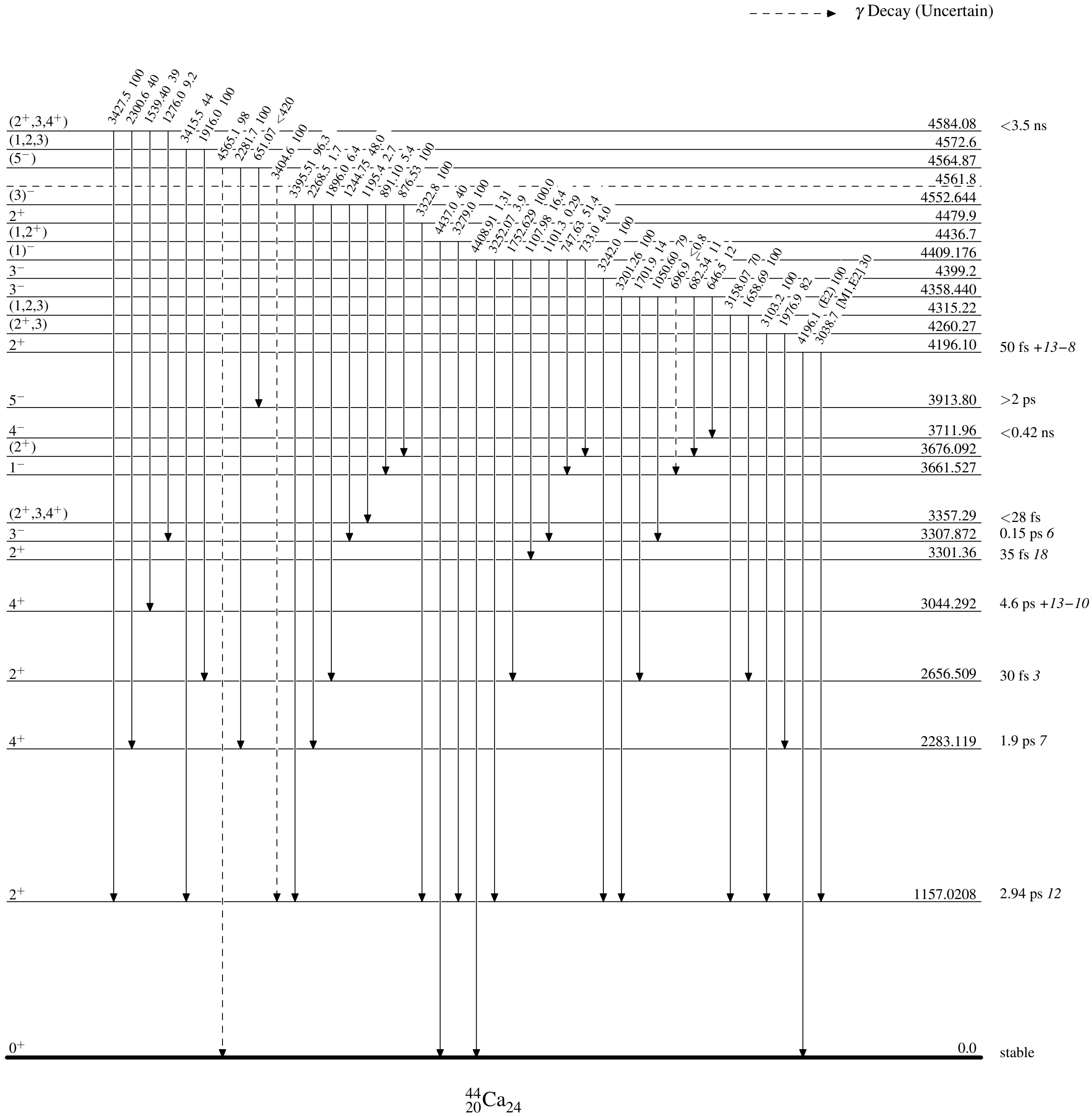


Adopted Levels, Gammas

Level Scheme (continued)

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

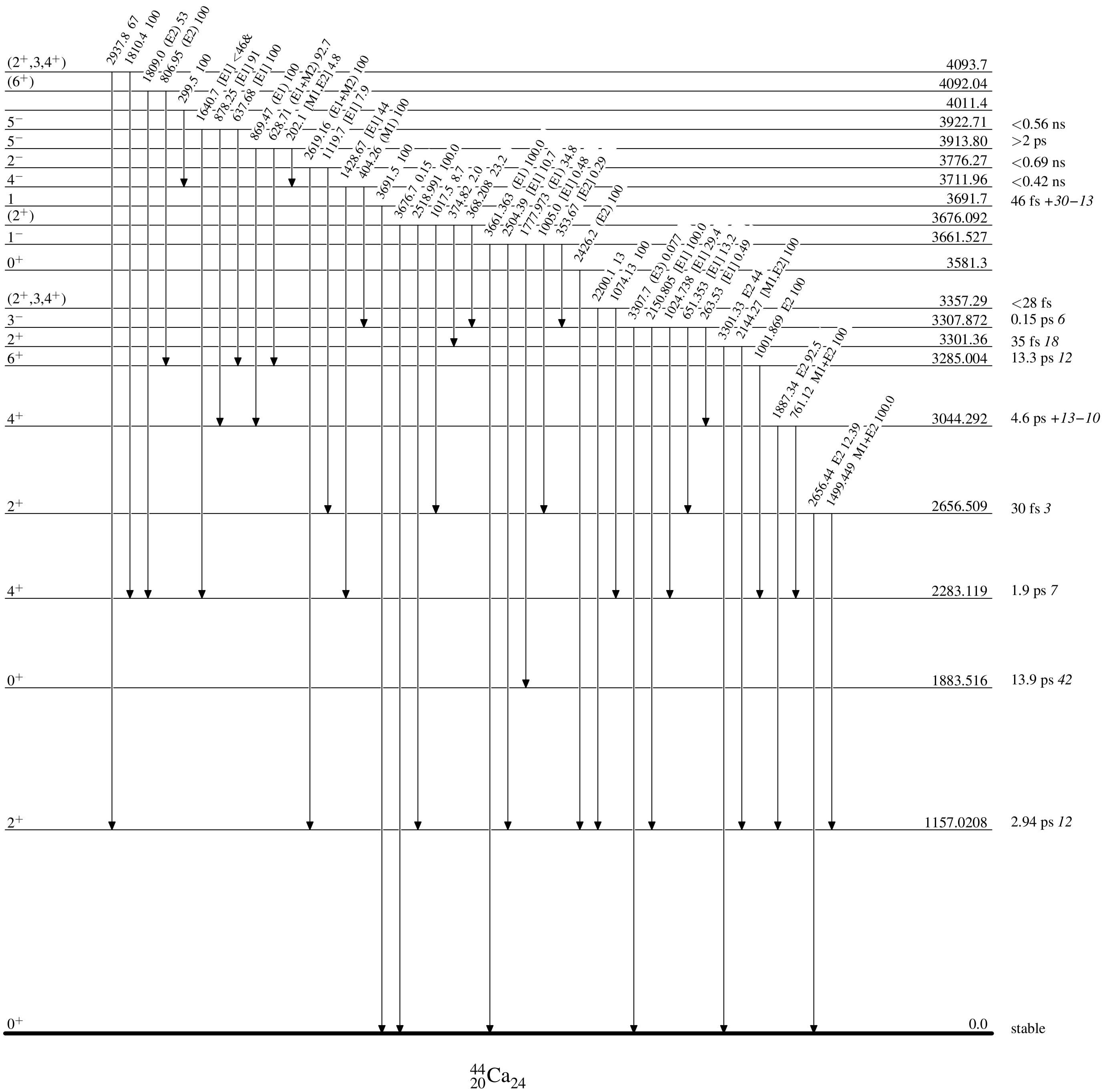
Legend



Adopted Levels, Gammas

Level Scheme (continued)

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



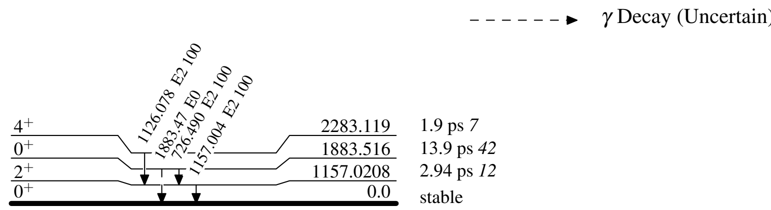
$^{44}_{20}Ca_{24}$

Adopted Levels, Gammas

Level Scheme (continued)

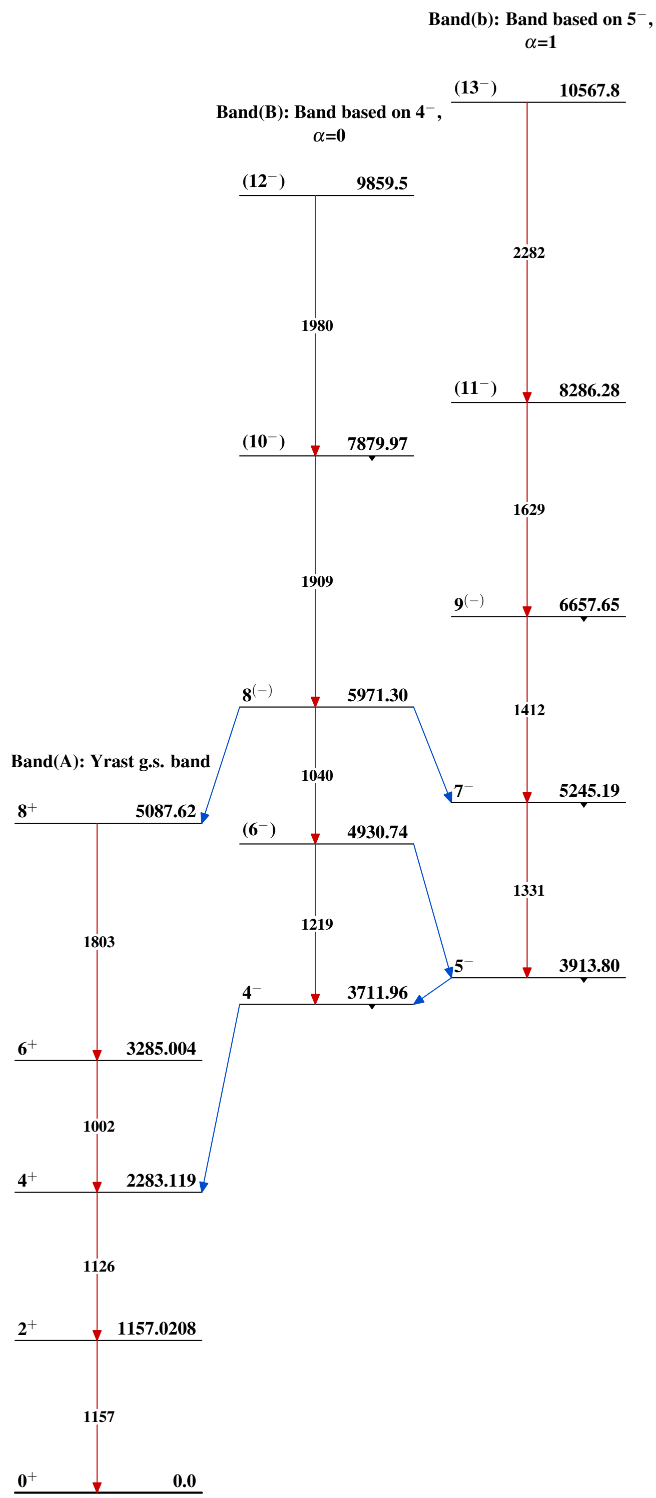
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

Legend



$^{44}_{20}Ca_{24}$

Adopted Levels, Gammas



$^{44}_{20}Ca_{24}$

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	S. -c. Wu	NDS 91,1 (2000)	15-Jul-2000

Q(β^-)=−1377.9 *24*; S(n)=10397.6 *23*; S(p)=13811.7 *24*; Q(α)=−11141 *7* 2012Wa38
Note: Current evaluation has used the following Q record \$ −1376.3 *24* 10393.724 *13816* 10 1995Au04.
Isotope shifts: 1993Si20.

^{46}Ca Levels

Cross Reference (XREF) Flags

A	^{46}K β^- decay: data set #1	F	^{46}Ca(e,e′)	K	^{48}Ca(p,t)
B	^{46}K β^- decay: data set #2	G	^{46}Ca(p,p′)	L	^{48}Ca(α,α2nγ)
C	^{44}Ca(t,p)	H	^{46}Ca(d,d′)	M	^{48}Ti(^{14}C,^{16}O)
D	^{44}Ca(t,pγ)	I	Coulomb excitation		
E	^{44}Ca(α,^{2}He)	J	^{48}Ca(p,p2nγ)		

E(level)	J$^{\pi}$[b]	T$_{1/2}$	XREF	Comments
0.0	0$^+$	stable	ABCDEFGHIJKLM	
1346.0[a] *3*	2$^+$	3.6 ps *3*	ABCDE GHIJKLM	J$^{\pi}$: L=2 in (t,p), (α,^{2}He) and (p,t). T$_{1/2}$: from Coul. ex. if B(E2)=0.0178 *13* (1975Ku17), T$_{1/2}$>5.5 ps from (t,pγ) (1974Be28).
2423.1 *8*	0$^+$	>4.5 ps	CD G K M	E(level): weighted average of values from (t,pγ) (Eγ plus adopted 1346.0 level), (p,p′), and (p,t). J$^{\pi}$: L=0 in (t,p) and (p,t). T$_{1/2}$: from (t,pγ) (1974Be28).
2574.7[a] *5*	4$^+$		A C E G JKLM	J$^{\pi}$: L=4 in (t,p), (α,^{2}He) and (p,t).
2973.9[a] *6*	6$^+$	10.4 ns *5*	C E G JKL	J$^{\pi}$: L=6 in (α,^{2}He) and (p,t). T$_{1/2}$: weighted average of 10.3 ns *10* (p,p2nγ) (1975Bi01) and 10.5 ns *6* (α,α2nγ) (1975Ku17).
3022.6 *10*	2$^+$		ABC GH K M	E(level): weighted average of values from ^{46}K β^- decay: data set #1, (t,p), (p,p′), (d,d′), and (p,t) (3020.5 *21* from ^{46}K β^- decay: data set #1 based on Eγ′s and 1346.0 *3* for first excited state (evaluator)). J$^{\pi}$: L=2 in (t,p) and (p,t).
3614.0 *9*	3$^-$		ABC GH K M	E(level): weighted average of values from (t,p), (p,p′), (d,d′), and (p,t). J$^{\pi}$: L=3 in (t,p) and (p,t).
3638.9[@] *12*	2$^+$		C G K	J$^{\pi}$: L=2 in (t,p) and (p,t).
3859.7[@] *13*	4$^+$		C G K	J$^{\pi}$: L=4 in (p,t).
3952? *2*			G	
3988[#] *3*	(3$^-$)		G K	J$^{\pi}$: L=(3) in (p,t).
4184.5[#] *15*	5$^-$		G K	J$^{\pi}$: L=5 in (p,t).
4261 *2*			C G	E(level): from (p,p′).
4407.0[#] *14*	3$^-$		G K	J$^{\pi}$: L=3 in (p,t).
4430.2 *9*	2$^+$		C GH K	E(level): weighted average of values from (t,p), (p,p′), (d,d′), and (p,t). J$^{\pi}$: L=2 in (t,p).
4489.4[#] *12*	(4$^+$)		G K	J$^{\pi}$: L=(4) in (p,t).
4728.8[#] *18*	5$^-$		E G K	J$^{\pi}$: L=5 in (p,t) and L=6,5 in (α,^{2}He).
4744.9[&] *24*	(4$^+$)		C G	J$^{\pi}$: L=(4) in (t,p).
4758 *3*	0$^+$		K	J$^{\pi}$: L=0 in (p,t).
4994.7[#] *20*	(4$^+$)		C G K	J$^{\pi}$: L=(2) in (t,p); L=(4) in (p,t).
5013.6 *20*			G	
5051 *3*	(4$^+$)		AB G K	E(level): weighted average of values from (p,p′) and (p,t). J$^{\pi}$: L=(4) in (p,t).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{46}Ca Levels (continued)

E(level)	$J^{\pi b}$	XREF	Comments
5151.6[#] *26*	(4$^+$)	G K	J$^\pi$: L=(4) in (p,t).
5218 *4*		G K	E(level): from (p,t); 5216 from (p,p′), ΔE not given.
5251.5[#] *28*	4$^+$	G K	J$^\pi$: L=4 in (p,t).
5317[@] *3*	0$^+$	C G K	J$^\pi$: L=0 in (t,p) and L=(0) in (p,t).
5379.6[#] *24*	(3$^-$)	G K	J$^\pi$: L=3 in (p,t).
5392[&] *4*		C G	
5416.7[#] *24*		G K	
5436.7[#] *24*	4$^+$	G K	J$^\pi$: L=4 in (p,t).
5474 *4*	(3$^-$)	K	J$^\pi$: L=(3) in (p,t).
5536.7[@] *23*	(4$^+$)	C G K	J$^\pi$: L=(4) in (p,t).
5600[‡] *4*	0$^+$	C K	J$^\pi$: L=0 in (t,p).
5628 *10*	0$^+$	C	J$^\pi$: L=0 in (t,p).
5638[#] *3*		G K	
5679		G	
5690 *4*		C G K	E(level): weighted average of values from (t,p) and (p,t).
5722[#] *3*		G K	
5781.6[@] *27*		C G K	
5821 *4*		K	
5850.9[@] *27*		C G K	
5863.0[#] *28*	(6$^+$)	G K	J$^\pi$: L=(6) in (p,t).
5958[‡] *4*	(2$^+$)	C K	J$^\pi$: L=(2) in (p,t).
5987 *4*	(6$^+$)	K	J$^\pi$: L=(6) in (p,t).
6010[#] *4*		G K	
6036[#] *4*	(4$^+$)	G K	J$^\pi$: L=(4) in (p,t).
6047 *15*	(0$^+$)	C	J$^\pi$: L=(0) in (t,p).
6077 *5*		K	
6116 *5*	(2$^+$)	K	J$^\pi$: L=(2) in (p,t).
6156 *5*		K	
6201 *5*		K	
6252 *5*	(4$^+$)	K	J$^\pi$: L=(4) in (p,t).
6267[‡] *5*	2$^+$	C K	J$^\pi$: L=2 in (t,p).
6309 *5*		K	
6372 *15*	2$^+$	C	J$^\pi$: L=2 in (t,p).
6555 *15*	(0$^+$)	C	J$^\pi$: L=(0) in (t,p).
6626 *15*	2$^+$	A C	J$^\pi$: L=2 in (t,p).
6745 *15*		C	
6836 *15*		C	
6964 *15*		C	
7025 *15*	(2$^+$)	C	J$^\pi$: L=(2) in (t,p).
7055 *7*	5$^-$,6$^+$[c]	E K	E(level): weighted average of values from (p,t) and (α,^{2}He).
7098 *15*		C	
7168 *15*		C	
7233 *15*	(0$^+$)	C	J$^\pi$: L=(0) in (t,p).
7267 *15*	(0$^+$)	C	
7311 *15*		C	
7380 *15*		C	
7438 *15*		C	
7490[‡] *6*	(2$^+$)	C K	J$^\pi$: L=(2) in (t,p) and (p,t).
7503 *15*		C	
7667 *14*	(2$^+$,5$^-$)[c]	C E	E(level): weighted average of values from (t,p) and (α,^{2}He). L=2 in (t,p) and L=5 in (α,^{2}He).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{46}Ca Levels (continued)

E(level)	J$^{\pi}$ [b]	$T_{1/2}$	XREF	Comments
7738 *15*			C	
≈7830	0^+		K	J$^{\pi}$: L=0 in (p,t).
7914 *8*			C	Possible doublet.
8382 *5*	7^- [c]		C E	Possible doublet.
8770 *50*	7^- [c]		E	
9070 *50*	5^- [c]		E	
9680 *50*	$5^-,6^+,8^+$ [c]		E	
12660 *50*	$6^+,8^+,7^-$ [c]		E	
13020 *40*	1^+	0.022 fs *7*	F	Observed and J^{π} assigned in ^{46}Ca(e,e′). $T_{1/2}$: from B(M1)↑=2.47 *77*.
13130 *50*	$6^+,8^+,7^-$ [c]		E	
13895 [†] *30*			K	
14488 [†] *30*	3^-		K	J$^{\pi}$: L=3 in (p,t).
14610 [†] *30*			K	
14795 [†] *30*	5^-		K	J$^{\pi}$: L=5 in (p,t).
15279 [†] *30*	3^-		K	J$^{\pi}$: L=3 in (p,t).
15847 [†] *30*			K	
16155 [†] *30*	(0^+)		K	J$^{\pi}$: L=(0) in (p,t).
16721 [†] *30*	(2^+)		K	J$^{\pi}$: L=(2) in (p,t).
≈17295 [†]			K	

[†] Proposed T=4 analog state from (p,t).
[‡] Weighted average of values from (t,p) and (p,t).
[#] Weighted average of values from (p,p′) and (p,t).
[@] Weighted average of values from (t,p), (p,p′), and (p,t).
[&] Weighted average of values from (t,p) and (p,p′).
[a] From least-squares fit to γ data.
[b] From (t,p) and/or (p,t), unless otherwise specified.
[c] Based on L-transfers in (α,^{2}He), and a comparison of experimental cross sections with theoretical DWBA values.

γ(^{46}Ca)

E_i(level)	J_i^{π}	E_{γ}	I_{γ}	E_f	J_f^{π}	Mult.	Comments
1346.0	2^+	1346.0 [†] *3*	100	0.0	0^+	[E2]	B(E2)(W.u.)=3.63 Mult.: based on J^{π} assignment.
2423.1	0^+	1077.5 *20*	100	1346.0	2^+		E_{γ}: from (t,pγ).
2574.7	4^+	1228.7 [†] *3*	100	1346.0	2^+		
2973.9	6^+	399.2 [†] *3*	100	2574.7	4^+	[E2]	B(E2)(W.u.)=0.55 Mult.: based on J, $T_{1/2}$, and decay modes in (p,p2nγ).
3022.6	2^+	1675 [‡] *3*	100 [‡]	1346.0	2^+		
		3020 [‡#] *3*	63 [‡] *29*	0.0	0^+		
3614.0	3^-	2274 *2*	100	1346.0	2^+		E_{γ}: from ^{46}K β^- decay: data set #2; 2285 *3* from ^{46}K β^- decay: data set #1 is inconsistent with 2268 separation of Adopted Levels levels.

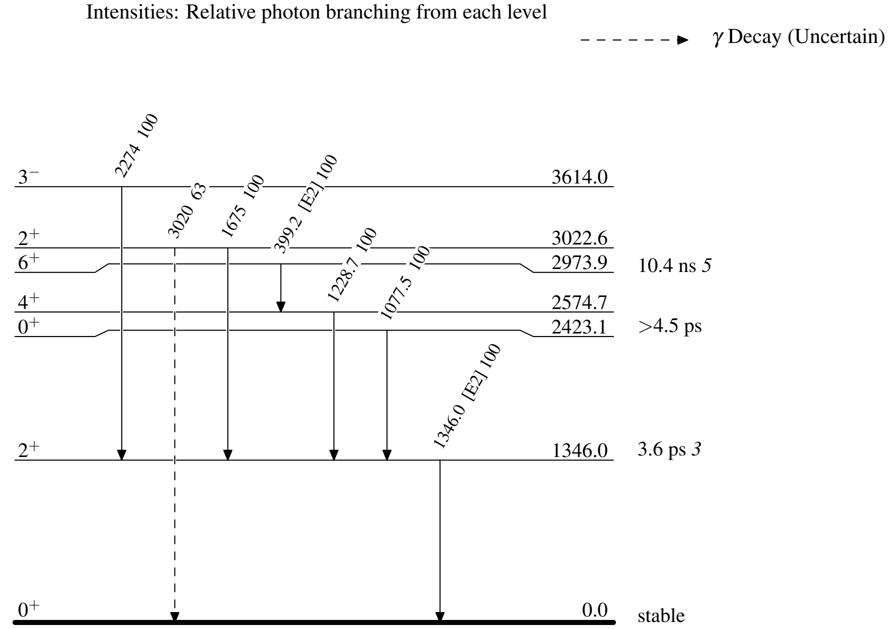
[†] From (p,p2nγ).
[‡] From ^{46}K β^- decay set #1.
[#] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

Legend



$^{46}_{20}Ca_{26}$

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 179, 1 (2022)	30-Nov-2021

Q(β^-)=279 *5*; S(n)=9951.5 *22*; S(p)=15801.9 *14*; Q(α)=−13976.5 *16* 2021Wa16
S(2n)=17227.9 *22*, S(2p)=29031.6 *23* (2021Wa16).
Mass measurements: 2016Ko45, 2014Kw04, 2013Bu12, 2012Re17, 2006Fr27.
Measurements of hyperfine structure and isotope shift: 2019Kn01, 2017Ga02, 2015Go24.
See ^{48}Ca(pol p,p′):GDR,GQR for information on the giant dipole, giant quadrupole, spin dipole, and spin quadrupole resonances.
See ^{48}Ca(e,e′n):GMR,GDR,GQR,IAR for information on the giant monopole, giant dipole, and giant quadrupole resonances.

^{48}Ca Levels

B(M1)↑ given under comments are from (p,p′), unless otherwise noted.
%β^-,%2β^- of g.s.: the small β^- decay probability together with the rather large phase space available for the 2β^- process have made ^{48}Ca a favorite for the study of the process. See the Nuclear Science References File for theoretical studies, compilations, and reviews. See 1990Al19 for a measurement of $\sigma(\theta)$ from the ^{48}Ti(n,p) reaction at E=198 MeV and its possible implications for ^{48}Ca 2β^- decay.

Cross Reference (XREF) Flags

A	^{48}K β^- decay	H	^{48}Ca(n,n′γ)	O	^{48}Ca(α,α′):giant resonance
B	^{49}K β^-n decay	I	^{48}Ca(p,p′),(pol p,p′)	P	^{48}Ca(α,α′γ)
C	^{46}Ca(t,p)	J	^{48}Ca(pol p,p′):GDR,GQR	Q	^{48}Ca(^{6}Li,^{6}Li′)
D	^{48}Ca(γ,γ′),(pol γ,γ′)	K	^{48}Ca(p,p′γ)	R	^{48}Ca(^{16}O,^{16}O′)
E	^{48}Ca(e,e′)	L	^{48}Ca(d,d′),(pol d,d′)	S	^{48}Ca(^{48}Ca,^{48}Ca′γ)
F	^{48}Ca(e,e′n):GMR,GDR,GQR,IAR	M	^{48}Ca(^{3}He,^{3}He′),(pol ^{3}He,^{3}He′)		
G	^{48}Ca(π^-,π^-′),(π^+,π^+′)	N	^{48}Ca(α,α′)		

E(level)[†]	J$^\pi$	T$_{1/2}$[d]	XREF	Comments
0.0	0$^+$	2.9×10^{19}[g] y *+42−11*	ABCDE GHI KLMN PQRS	%β^-=22 *+30−22*; %2β^-=78 *+22−30* %β^-,%2β^-: From T$_{1/2}$(2β^-)=3.7×10^{19} y *+33−12* and T$_{1/2}$=2.9×10^{19} y *+42−11*. See footnote comments for T$_{1/2}$. Nuclear rms charge radius=3.4771 fm *20* (2013An02).
3831.96 *22*	2$^+$	36 fs *3*	ABCDE GHI KLMNOPQRS	J$^\pi$: 3831.4γ E2 to 0$^+$. T$_{1/2}$: weighted average of 35 fs *3* from $\Gamma_{\gamma 0}$ in (γ,γ′) (2002Ha13), 42 fs *9* from DSAM in (n,n′γ) (1992Va06), and 37 fs *17* from DSAM in (p,p′γ) (1970Be39). B(E2)↑=0.0082 *5* from (e,e′) (1985Wi06), but it is discrepant with 0.0140 *15* from (α,α′):giant res (2011Lu07) and 0.0131 *12* from (^{6}Li,^{6}Li′) (2010Kr06).
4283.56 *24*	0$^+$	223 ps *11*	ABC E HI K N S	XREF: A(?). J$^\pi$: from observation of E0 e+/e- pair emission to g.s. in (p,p′γ); L(t,p)=0 from 0$^+$. T$_{1/2}$: from pγ(t) in (p,p′γ) (1970Be39).
4503.74 *24*	4$^+$	1.53 ns *3*	A c H K M S	XREF: M(?). J$^\pi$: 671.8γ E2 to 2$^+$; 1226γ from 5$^-$. T$_{1/2}$: from pγ(t) in (p,p′γ) (1972Ta23).
4507.05 *23*	3$^-$	6.1 ps *+38−20*	A c E GHI KLMNOPQRS	J$^\pi$: 4507.3γ E3 to 0$^+$. T$_{1/2}$: from DSAM in (p,p′γ) (1970Be39). Other: 7.2 ps *+26−20* from adopted B(E3)↑=0.0069 *10*. B(E3)↑=0.0069 *10*, unweighted average of 0.0065 *10* from (e,e′), 0.0054 *8* from (α,α′):giant res, 0.0087 *8* from (^{6}Li,^{6}Li′).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[d]	XREF	Comments
4612.24 *23*	$3^{(+)}$	2.5 ps *14*	A E HI K N S	XREF: N(?). J^π: spin=3 from $\gamma\gamma(\theta)$ in (p,p′γ) and $\gamma(\theta)$ in (n,n′γ); L(p,p′)=(4) from 0^+. $T_{1/2}$: unweighted average of 3.7 ps *+9−4* from (n,n′γ) (1992Va06) and 1.2 ps *4* from (p,p′γ) (1972Ta23).
4695.4 *3*	1	32.6[e] fs *+25−22*	D	J^π: from $\gamma(\theta)$ in (γ,γ′) .
5146.42 *25*	3,4,5	<0.69 ns	E HI K N RS	J^π: D γ to 4^+. Results are discrepant in the various experiments: 3,5 from $\gamma(\theta)$ in (n,n′γ); 5^+ from DWBA fit to Coulomb form factors and RPA calculation (unnatural π state from absence of longitudinal form factor) in (e,e′); 5^- from L(p,p′)=5 and observance of peak in (α,α′) (natural π state) (1988Fu01); (4) from comparison of $\sigma(\theta)$ and analyzing powers to those of known states in (p,p′) (1984Se10),(pol p,p′); 3^- from L(α,α′)=3. $T_{1/2}$: from direct timing in (p,p′γ) (1977Lo06).
5260.81 *23*	$4^{(-)}$	5.1 ps *+14−8*	A E HI K S	XREF: A(?). J^π: spin=4 from $\gamma(\theta)$ in (n,n′γ); 4^- from DWBA fit to the Coul. form factors and RPA calc. in (e,e′) (unnatural parity state from absence of longitudinal form factor). Other: (5^+) from (p,p′) for a group at 5257 *5* is discrepant.
5311 *6*	$(1)^-$[a]		I K n	XREF: K(5322). Additional information 1. E(level): from (p,p′). J^π: L(p,p′)=1 from 0^+.
5312.2 *3*	2	232 fs *+28−13*	H n	J^π: 5312.2γ Q to 0^+.
5369.90 *23*	3^-	1.80 ps *14*	A E HI K N	J^π: L(α,α′)=3 from 0^+.
5461 *7*	0^+		C I N	XREF: N(?). E(level): weighted average of 5459 *10* from (t,p) and 5462 *7* from (p,p′). J^π: L(t,p)=L(p,p′)=0 from 0^+.
5729.64 *24*	5^-	0.90 ps *+49−21*	E GHI K N S	J^π: L(α,α′)=L(p,p′)=5 from 0^+.
6105.00 *23*	(2^+)	139 fs *+17−28*	E HI K N	J^π: L(α,α′)=(2) from 0^+; 2273.1γ to 2^+, 1597.8γ to 3^-. Other: 4^- from DWBA fit to Coulomb form in (e,e′) (unnatural π state from absence of longitudinal form factor) and (4^-) from DWBA analysis in (p,p′) (unnatural π state since peak not observed in (α,α′)) are discrepant.
6336.8 *20*	2^+	191 fs *29*	C H	J^π: 6336.4γ E2 to 0^+.
6345.72 *24*	4^+	180 fs *+35−13*	E HI K N	XREF: K(6351). J^π: L(α,α′)=L(p,p′)=4 from 0^+.
6.48×10^3?			N	
6612.19 *10*	1^-	1.87[e] fs *14*	A D I K P	J^π: 6611.7γ E1 to 0^+.
6648.99 *24*	4^+	114 fs *+42−28*	C E HI K N	XREF: N(?). J^π: L(α,α′)=L(p,p′)=4 from 0^+.
6685.64 *23*	$2^{(-)}$[‡]	69 fs *+56−52*	A E HI K	
6755	2^+		I N	E(level): from (p,p′). J^π: L(α,α′)=2 from 0^+.
6791.5 *20*	1	<6.9 fs	e H	XREF: e(6796). J^π: 6791.0γ D to 0^+.
6805.7 *3*	2^+	83 fs *+44−38*	C e HI n P	XREF: C(6793)e(6796)I(6794)n(6820)P(6800). J^π: L(α,α′)=L(p,p′)=2 from 0^+.
6830.8 *6*	(3^-)		HI K n	XREF: n(6820). J^π: (3) from $\gamma(\theta)$ in (n,n′γ); L(p,p′)=(3) from 0^+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[d]	XREF	Comments
6895.87 *24*	(2$^-$)	55 fs +*83*−*55*	A e H k	J^π: 2,3,4 from $\gamma(\theta)$ in (n,n′γ); (2−&5$^+$) doublet from DWBA analysis in (p,p′) with unnatural π state since peak not observed in (α,α′) (1988Fu01).
6896 *7*	(5$^+$)		E I	E(level): weighted average of 6893 *9* from (e,e′) and 6898 *7* from (p,p′). J^π: the 5$^+$ member of (2−&5$^+$) doublet (see comment on J^π(6895.87)); J≥3 *1* from comparison of $\sigma(\theta)$ and analyzing power to those of known states in (p,p′) (1984Se10); .
7007.6 *6*	3$^-$[b]	69 fs +*18*−*14*	E HI	J^π: L(p,p′)=3 and L(α,α′)=(3) from 0$^+$; natural parity.
7019 *7*			e I	
7032.0 *6*	(3)$^-$[b]		e HI K N	XREF: N(7050). J^π: L(p,p′)=3+6 from 0$^+$; L(α,α′)=(3) from 0$^+$; (3,5) from $\gamma(\theta)$ in (n,n′γ); natural parity.
7.16×10^3?			N	
7296.1 *5*	(2$^+$)	<6.9 fs	H	J^π: 7298γ (E2) to 0$^+$.
7298.50 *20*	1$^-$	0.201[e] fs *14*	A DE I K P	J^π: 7297.9γ E1 to 0$^+$. Other: L(p,p′)=3 is discrepant.
7370.6 *20*	(1,2)		H	J^π: 7370γ to 0$^+$.
7385 *10*	3$^-$,(1$^-$)		I	E(level),J^π: from (p,p′), with J^π from analysis of $\sigma(\theta)$.
7401.22 *23*	(2$^-$)[‡#]		A E I K S	XREF: E(7397). J^π: (4$^-$) from DWBA fit to the Coulomb form factors and RPA calculations in (e,e′) (unnatural π state from absence of longitudinal form factor) discrepant. But L(p,p′)=(3) favors (3$^-$).
7407.3? *5*	(0,1,2,3$^-$)		A	Additional information 2. J^π: 793.11γ to 1$^-$.
7440.6 *20*	2,3$^-$	177.4 fs *70*	HI K	J^π: 7440γ Q,E3 to 0$^+$.
7471 *5*	4$^+$		E I	E(level): weighted average of 7476 *7* from (e,e′) and 7468 *5* from (p,p′). J^π: L(p,p′)=4 from 0$^+$ and natural parity due to presence in (α,α′) measured by 1988Fu01 in (p,p′).
7497.5 *3*	(3$^-$)		HI	J^π: (3) from analysis of $\sigma(\theta)$ in (p,p′) (1984Se10); 1767.8γ to 5$^-$.
7536.4 *4*	3$^-$[#b]		I N S	J^π: L(p,p′)=3 from 0$^+$ and natural parity.
7568.7 *6*			H	
7580 *7*			I	
7652 *10*	3$^-$[&]		A c E G i K	Additional information 3. E(level): from (p,p′). Other: 7658 from ^{48}K β^- decay, 7657 *10* from (e,e′). J^π: also from analysis of $\sigma(\theta)$ in (p,p′).
7655.66 *20*	1$^-$	1.87[e] fs *7*	cD P	B(M1)↑=0.008 *5* XREF: P(7651). J^π: 7655.0γ E1 to 0$^+$.
7659 *3*	3$^-$[b]		c e g I	E(level): from (p,p′). Others: 7650 *20* from (t,p) and 7657 *10* from (e,e′). J^π: L(p,p′)=3 from 0$^+$ and natural parity. B(E3)↑≈0.0014 from (e,e′).
7696	(1$^+$,2$^+$)[@]		E	B(M1)↑<0.05 from (e,e′). 15 additional states reported in (p,p′) by 1983Cr01 between 7.7 MeV and 12.7 MeV, seven of which appear to correspond to states observed in (e,e′).
7789 *7*	3$^-$		E K N	XREF: N(7760). Additional information 4.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[d]	XREF	Comments
				E(level): weighted average of 7791 *7* from (e,e′) and 7784 *10* from (p,p′). J^π: L(α,α')=3 from 0^+.
7797 *8*	4^+[b]		I	J^π: L(p,p′)=4 from 0^+ and natural parity.
7911 *7*	3^-[b]		I	J^π: L(p,p′)=3 from 0^+ and natural parity.
7915.4 *9*	2^+	22[e] fs *+4−3*	D	J^π: 7914.7γ E2 to 0^+.
7953? *15*	$(2^-,6^-)$[&]		E	
7957 *10*	$(4)^+$[a]		I K	Additional information 5. E(level): from (p,p′). J^π: L(p,p′)=4 from 0^+ and not clearly seen in α spectrum (1988Fu01).
8001 *8*			c I	J^π: natural parity state from presence in α spectra by 1988Fu01 in (p,p′).
8027.6 *4*	2^+	11.4[e] fs *12*	cDe I	J^π: 8026.9γ E2 to 0^+.
8045 *8*	(1)		c e I K	Additional information 6. E(level): from (p,p′). J^π: from analysis of $\sigma(\theta)$ in (p,p′); γ to 0^+. Other: $(1^-,2^+)$ from (e,e′) for a group at 8038 *15*.
8050	2		e P	Additional information 7. E(level): from (α,$\alpha'\gamma$). J^π: from $\alpha\gamma(\theta)$ in (α,$\alpha'\gamma$).
8065 *8*	5^-[b]		I	J^π: L(p,p′)=5 from 0^+ and natural parity.
8082 *10*			I	
8116 *8*	$1^+,2^+,3^+$		E I	E(level): weighted average of 8113 *9* from (e,e′) and 8119 *8* from (p,p′). J^π: L(p,p′)=2 from 0^+.
8150	$(1^+,2^+)$[@]		E	B(M1)↑<0.05 from (e,e′).
8178 *8*	4^+[b]		I	J^π: L(p,p′)=4 from 0^+ and natural parity.
8236 *8*	$4^-,5^-,6^-$		c I	XREF: c(8237). E(level): from (p,p′). Other: 8237 *20* from (t,p). J^π: L(p,p′)=5 from 0^+.
8248 *8*	4^+[b]		c I K	XREF: c(8237). Additional information 8. E(level): from (p,p′). J^π: L(p,p′)=4 from 0^+ and natural parity.
8276?	$(1^-,2,3)$		c K	XREF: c(8268). Additional information 9. E(level): reported by 1969Te03 as the same level at 8276 *10* seen in their (p,p′) measurement, however, while the level seen in thier (p,p′) could correspond to the 8283 *8* level with $J^\pi=4^+$ from 1988Fu01 in (p,p′) and the level seen in (p,p′γ) by 1969Te03 with a different J^π could be a separate level. J^π: 8275γ to 0^+, 1456γ to (3^-).
8279.1 *9*	4^+[#b]		c E I n S	XREF: c(8268)n(8330). J^π: L(p,p′)=4 from 0^+ and natural parity.
8356 *8*	5^-[b]		I n	XREF: n(8330). J^π: L(p,p′)=5 from 0^+ and natural parity.
8385? *18*	(3^-)		E	J^π: first maxima for Coul. Form factor at ≈1.0 fm^{-1}. in (e,e′).
8386 *8*	$(6)^+$		i P	E(level): from (p,p′). J^π: see comment on J^π(8386.1).
8386.1 *5*	1^-[a]	0.159[f] fs *21*	A D i K P	XREF: P(8400). J^π: 1−&$(6)^+$ doublet from L(p,p′)=1+6 and natural π state from presence of peak in (α,α') spectra; 8385.3γ E1 to 0^+.
8437 *5*	3^-[b]		E I	E(level): weighted average of 8435 *5* from (e,e′), and 8441 *8*

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J$^{\pi}$	T$_{1/2}$[d]	XREF	Comments
				from (p,p′). J$^{\pi}$: L(p,p′)=3 from 0^{+} and natural parity (1988Fu01).
8467?	(1,2)		A c	Additional information 10. E(level): from ^{48}K β^{-} decay. J$^{\pi}$: 4635γ to 2^{+}, 8466γ to 0^{+}.
8478 *8*	3^{+},4^{+},5^{+}		c E I K	Additional information 11. E(level): from (p,p′). Other: 8477 *15* from (e,e′). J$^{\pi}$: L(p,p′)=4 from 0^{+}.
8517.9 *8*	(1^{-},2^{+})		cD	J$^{\pi}$: 8517.1γ to 0^{+}; (1^{-},2^{+}) is most likely from γ excitation. T$_{1/2}$: 4.6 fs *8* if J^{π}=1^{-} or 11.4 fs *28* if J^{π}=2^{+} from $\Gamma_{\gamma0}$ in (γ,γ') assuming $\Gamma_{\gamma0}/\Gamma$=1.
8523 *5*	3^{-}[b]		c E I K	Additional information 12. E(level): from (p,p′). Other: 8518 *8* from (e,e′). J$^{\pi}$: L(p,p′)=3 from 0^{+} and natural parity.
8531?	(1,2^{+})		A c	Additional information 13. E(level): from ^{48}K β^{-} decay. J$^{\pi}$: possible 4247γ to 0^{+}.
8563 *7*	(6^{-})[&]		E I	E(level): weighted average of 8557 *14* from (e,e′), and 8565 *7* from (p,p′). J$^{\pi}$: other: (6) assigned by 1988Fu01 based on L(p,p′)=(6) from 0^{+} and uncertain existence of this state in the (α,α') spectra in 1988Fu01.
8586? *10*			I K	Additional information 14. E(level): from (p,p′).
8607 *6*	3^{-}[b]		C E I	E(level): weighted average of 8605 *6* from (e,e′) and 8609 *6* from (p,p′). J$^{\pi}$: L(p,p′)=3 from 0^{+} and natural parity.
8664.6 *11*	(3,4,5)[#]		S	J$^{\pi}$: 386γ to 4^{+} is most likely dipole.
8680 *7*	(3^{+})[‡]		c I K	Additional information 15. E(level): from (p,p′).
8698 *8*			c I	
8788 *8*			C I K	Additional information 16. E(level): from (p,p′).
8797 *8*	4^{+}&(6^{+})[b]		I	E(level): L(p,p′)=4+6 from 0^{+}, with L=4 more likely.
8805 *5*	5^{-}		E I	E(level): weighted average of 8804 *9* from (e,e′) and 8806 *5* from (p,p′). J$^{\pi}$: L(p,p′)=5 from 0^{+}; 5^{-} from DWBA analysis in (e,e′).
8831 *8*	2^{-},3^{-},4^{-}		I	J$^{\pi}$: L(p,p′)=3 from 0^{+}.
8866 *8*	4^{-},5^{-},6^{-}		I	J$^{\pi}$: L(p,p′)=5 from 0^{+}.
8883.3 *5*	1^{-}	0.42[f] fs *14*	De P	XREF: P(8900). J$^{\pi}$: 8882.6γ E1 to 0^{+}.
8886 *6*	2^{+}[b]		e I	E(level): from (p,p′). J$^{\pi}$: L(p,p′)=2 from 0^{+} and natural parity.
8890.7 *6*	>5[#]		S	J$^{\pi}$: 3160.8γ to 5^{-}.
8920 *8*			I	
8947 *8*			I	
8967?	(1,2,3)		A I	Additional information 17. E(level): from ^{48}K β^{-} decay. Other: 8964 *10* from (p,p′). J$^{\pi}$: 8966γ to 0^{+}.
8982 *8*	3^{-}[b]		I	J$^{\pi}$: L(p,p′)=3 from 0^{+} and natural parity.
9033.9 *4*	1^{-}	0.242[f] fs *14*	De I	J$^{\pi}$: 9033γ E1 to 0^{+}.
9047 *9*	2^{+}[b]		e I	J$^{\pi}$: L(p,p′)=2 from 0^{+} and natural parity.
9050	1		e P	Additional information 18.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J^{π}	$T_{1/2}$[d]	XREF	Comments
				E(level): from (α,$\alpha'\gamma$). J^{π}: 9050γ D to 0^+.
9079 *9*			I	
9094.6 *15*	[#]		S	
9123.1 *10*	$(1^+,2^+,3^+)$[#]		I S	J^{π}: L(p,p′)=2+(8) for the 9123 doublet. 9138 state appears to be the high-spin member.
9138 *22*			E	J^{π}: (8^-) from DWBA fit to the Coulomb form factors and RPA calculations in (e,e′); unnatural parity state from absence of longitudinal form factor; L(p,p′)=(8), $J^{\pi}=(7^-)$ from comparison to DWBA in (p,p′). See also J^{π} comment for 9123 level.
9158 *9*	$(4)^+$[a]		I	J^{π}: L(p,p′)=4 from 0^+ but not clearly seen in (α,α').
9176 *9*	2^+[b]		I	J^{π}: L(p,p′)=2^+ from 0^+ and natural parity.
9211 *9*	3^-[b]		I	J^{π}: L(p,p′)=3+(7) from 0^+ (natural π from presence of peak in (α,α')) in (p,p′) for the doublet. 9229 state appears to be the high-spin member.
9229	(7^-)		I	J^{π}: (7,8,9) from comparison of $\sigma(\theta)$ and analyzing power to those of known states in (p,p′),(pol p,p′); $(6^-,7^-)$ from comparison to DWBA in (p,p′),(α,α'). See comment on J^{π}(9211).
9232 *9*	$(0^-,1^-,2^-)$		I	J^{π}: L(p,p′)=(1) from 0^+.
9288 *9*	(2^+)[&]		E I	E(level): weighted average of 9290 *9* from (e,e′) and 9285 *10* from (p,p′).
9295.3 *5*	1^-[b]	0.236[e] fs *14*	A D i P	XREF: P(9300). J^{π}: 9294.3γ E1 to 0^+. L(p,p′)=1+(8) (natural π state from presence of peak in (α,α')) in (p,p′) for the doublet. 9296 state appears to be the L=8 member.
9295.7 *11*	(8^-)[#]		E i S	XREF: E(9276). J^{π}: (8^-) from DWBA fit to the Coulomb form factors and RPA calculations in (e,e′) unnatural π state from absence of longitudinal form factor; (7,8,9) from comparison of $\sigma(\theta)$ and analyzing power to those of known states and (8^-) from comparison to DWBA in (p,p′). See comment for J^{π}(9295.3).
9307	8		I	
9334 *9*			I	
9366 *9*	$5^+,6^+,7^+$		I	J^{π}: L(p,p′)=6 from 0^+.
9383 *10*	$(1^+,2^+)$[@]		E I	B(M1)↑=0.020 *2* E(level): from (p,p′). J^{π}: $1^+,2^+$ also from analysis of $\sigma(\theta)$ in (p,p′). B(M1)↑<0.07 from (e,e′).
9430 *9*	$2^-,3^-,4^-$		I	J^{π}: L(p,p′)=3 from 0^+.
9472.8 *8*	1^-[b]	0.250[e] fs *21*	D I P	J^{π}: 9471.8γ E1 to 0^+; L(p,p′)=1 from 0^+ and natural parity.
9496 *9*			I	
9545.72 *20*	1^-	0.139[e] fs *7*	D I P	J^{π}: 9544.7γ E1 to 0^+.
9550? *20*	(3^-)[&]		E	
9568 *9*	$(5^+,6^+,7^+)$		I	J^{π}: L(p,p′)=(6) from 0^+.
9621 *9*	4^+[b]		I	J^{π}: L(p,p′)=4 from 0^+ and natural parity.
9645 *9*	$2^-,3^-,4^-$		I	J^{π}: L(p,p′)=3 from 0^+.
9691 *9*	$(0^-,1^-,2^-)$		I	J^{π}: L(p,p′)=(1) from 0^+.
9728 *9*	$2^-,3^-,4^-$		I	J^{π}: L(p,p′)=3 from 0^+.
9765 *9*	3^-[b]		I	J^{π}: L(p,p′)=3 from 0^+ and natural parity.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J$^\pi$	XREF	Comments
9784 *9*	(3$^+$,4$^+$,5$^+$)	I	J$^\pi$: L(p,p′)=4 from 0$^+$.
9816 *9*	(1)$^-$ [a]	I	J$^\pi$: L(p,p′)=1 from 0$^+$ but not clearly seen in (α,α').
9862 *9*	3$^-$ [b]	I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
9885	(1$^+$,2$^+$)[@]	E	B(M1)↑<0.09 from (e,e′).
9894 *7*		I	J$^\pi$: L(p,p′)=3+(6) from 0$^+$.
9921 *9*	3$^-$ [b]	I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
9942 *9*	2$^-$,3$^-$,4$^-$	e I	J$^\pi$: L(p,p′)=3 from 0$^+$.
9.95×10^3 *3*	(8$^-$)[&]	E	
9954	(1$^+$,2$^+$)[@]	E	B(M1)↑<0.10 from (e,e′). J$^\pi$: from analysis of $\sigma(\theta)$ in (p,p′).
9973 *10*	1$^+$	I	B(M1)↑=0.037 *3*
9993 *9*	4$^+$ [b]	A I	XREF: A(9985). J$^\pi$: L(p,p′)=4 from 0$^+$ and natural parity.
10065 *10*	(4)$^+$ [a]	a I	J$^\pi$: L(p,p′)=4 from 0$^+$ but not clearly seen in (α,α').
10081 *10*	(3)$^-$ [a]	a I	J$^\pi$: L(p,p′)=3 from 0$^+$ but not clearly seen in (α,α').
10108 *10*	4$^+$ [b]	I	J$^\pi$: L(p,p′)=4 from 0$^+$ and natural parity.
10126 *10*	1$^-$ [b]	A I	J$^\pi$: L(p,p′)=1 from 0$^+$ and natural parity.
10138 *10*	(1$^+$,2$^+$)[@]	E I	B(M1)↑=0.148 *13* E(level): from (p,p′). B(M1)↑=0.12 *3* from (e,e′).
10151 *10*	3$^-$ [b]	e I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10178 *10*	3$^-$ [b]	A I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10191 *10*	3$^-$ [b]	I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10224 *7*	1$^+$	E G I	B(M1)↑=3.9 *3* from (e,e′). E(level): weighted average of 10227 *5* from (e,e′) and 10211 *10* from (p,p′). J$^\pi$: L(p,p′)=0 from 0$^+$; unnatural parity state from absence of peak in (α,α').
10240?		A	
10265 *10*	($^-$)	A I	E(level): from (p,p′). J$^\pi$: suggested in ^{48}K β^- decay.
10288 *10*		I	B(M1)↑=0.080 *8*
10319 *10*	3$^-$ [b]	I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10330? *10*	(1$^+$,2$^+$)[@]	E	B(M1)↑=0.09 *4* from (e,e′).
10345 *10*	3$^-$ [b]	I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10350 *10*	(1$^+$,2$^+$)[@]	A E I	B(M1)↑=0.040 *13* E(level): from (p,p′). B(M1)↑=0.08 *4* from (e,e′).
10370 *10*	(2)$^+$ [a]	A I	J$^\pi$: L(p,p′)=2 from 0$^+$ but not clearly seen in (α,α').
10390 *10*		I	B(M1)↑=0.023 *2*
10399 *10*	3$^+$,4$^+$,5$^+$	I	J$^\pi$: L(p,p′)=4 from 0$^+$.
10433 *10*	1$^+$,2$^+$,3$^+$	I	J$^\pi$: L(p,p′)=2 from 0$^+$.
10483 *10*	3$^-$ [b]	I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10521 *10*	(2)$^+$ [a]	I	J$^\pi$: L(p,p′)=2 from 0$^+$ but not clearly seen in (α,α').
10535 *10*	(0$^-$,1$^-$,2$^-$)	I	B(M1)↑=0.010 *3* J$^\pi$: L(p,p′)=(1) from 0$^+$.
10571 *10*		I	B(M1)↑=0.060 *8* J$^\pi$: L(p,p′)=1,2.
10586 *10*	(4)$^+$ [a]	I	J$^\pi$: L(p,p′)=4 from 0$^+$ but not clearly seen in (α,α') (1988Fu01).
10610 *10*		I	B(M1)↑=0.031 *4*
10611 *10*	3$^-$ [b]	A I	J$^\pi$: L(p,p′)=3 from 0$^+$ and natural parity.
10623 *10*		I	
10645 *10*		I	B(M1)↑=0.020 *4*
10648 *10*	(3)$^-$ [a]	a I	J$^\pi$: L(p,p′)=3 from 0$^+$ but not clearly seen in (α,α').

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J^π	XREF	Comments
10686 *10*	3^-[b]	a I	J^π: L(p,p′)=3 from 0^+ and natural parity.
10708 *10*		I	
10731 *10*	2^+[b]	I	J^π: L(p,p′)=2 from 0^+ and natural parity.
10764 *10*		I	B(M1)↑=0.059 *29*
10782 *10*	$(1^+,2^+)$[@]	E I	E(level): from (p,p′). B(M1)↑=0.12 *4* from (e,e′).
10803 *10*	(3^-)[b]	I	J^π: L(p,p′)=(3) from 0^+ and natural parity.
10822 *10*	3^-[b]	A I	J^π: L(p,p′)=3 from 0^+ and natural parity.
10857 *10*	2^+[b]	I	J^π: L(p,p′)=2 from 0^+ and natural parity.
10872 *10*	$5^+,6^+,7^+$	I	J^π: L(p,p′)=6 from 0^+.
10883 *10*	(2^+)[b]	I	J^π: L(p,p′)=(2) from 0^+ and natural parity.
10916 *10*	$(3)^-$[a]	A I	E(level): from (p,p′). J^π: L(p,p′)=3 from 0^+ but not clearly seen in (α,α').
10935 *10*	$(1^+,2^+)$[@]	e I	B(M1)↑=0.011 *8* E(level): from (p,p′). B(M1)↑=0.05 *2* from (e,e′).
10955 *10*	4^+[b]	I	J^π: L(p,p′)=4 from 0^+ and natural parity.
11013 *11*		a i	
11032?	$(^-)$	A	J^π: suggested in ^{48}K β^- decay.
11037 *11*	(2^+)[b]	I	J^π: L(p,p′)=(2) from 0^+ and natural parity.
11050 *11*	$(3^+,4^+,5^+)$	I	J^π: L(p,p′)=(4) from 0^+.
11098 *11*	$2^+\&4^+$[b]	I	J^π: L(p,p′)=2+4 from 0^+ and natural parity.
11125 *11*	$3^+,4^+,5^+$	I	J^π: L(p,p′)=4 from 0^+.
11153 *11*		I	
11183 *11*	(5^-)[b]	I	J^π: L(p,p′)=(5) from 0^+ and natural parity.
11219 *11*		I	
11227 *10*		I	B(M1)↑=0.012 *3*
11248 *11*	$(4)^+$[a]	I	J^π: L(p,p′)=4 from 0^+ but not clearly seen in (α,α').
11281 *11*	2^+[b]	I	J^π: L(p,p′)=2 from 0^+ and natural parity.
11329 *11*	3^-[b]	I	J^π: L(p,p′)=3 from 0^+ and natural parity.
11376 *11*	3^-[b]	I	J^π: L(p,p′)=3 from 0^+ and natural parity.
11383 *10*		I	B(M1)↑=0.003 *2*
11421 *11*	$(1^+,2^+)$[@]	E I	XREF: E(11410). B(M1)↑<0.09 from (e,e′).
11433 *11*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
11447 *11*	$2^-,3^-,4^-$	I	J^π: L(p,p′)=3 from 0^+.
11466 *11*		I	
11485 *11*	$(2^-,3^-,4^-)$	I	J^π: L(p,p′)=(3) from 0^+.
11490	$(1^+,2^+)$[@]	E	B(M1)↑=0.15 *3* from (e,e′).
11508 *11*	2^+[b]	I	J^π: L(p,p′)=2 from 0^+ and natural parity.
11513 *10*		I	B(M1)↑=0.021 *15*
11530 *11*	3^-[b]	I	J^π: L(p,p′)=3 from 0^+ and natural parity.
11550 *11*		I	
11563 *10*		I	B(M1)↑=0.039 *5*
11589 *11*	$0^-,1^-,2^-$	I	J^π: L(p,p′)=1 from 0^+.
11622 *11*	(4^+)[b]	I	J^π: L(p,p′)=(4) from 0^+ and natural parity.
11639 *11*	$(1^+,2^+,3^+)$	I	J^π: L(p,p′)=2 from 0^+.
11671 *11*	$(4^-,5^-,6^-)\&(8^-)$	I	J^π: L(p,p′)=(5)+(8,9) from 0^+.
11693 *11*	5^-[b]	I	J^π: L(p,p′)=5 from 0^+ and natural parity.
11695 *10*		I	B(M1)↑=0.025 *9*
11715 *11*	$(1^+,2^+,3^+)$	I	J^π: L(p,p′)=(2) from 0^+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J^π	XREF	Comments
11725 *10*	$(1^+,2^+)$[@]	E I	B(M1)↑=0.014 *9* B(M1)↑=0.12 *4* from (e,e′).
11752 *11*	$(2)^+$[a]	I	J^π: L(p,p′)=2 from 0^+ but not clearly seen in (α,α').
11773 *11*		I	
11816 *11*	$2^-,3^-,4^-$	I	J^π: L(p,p′)=3 from 0^+.
11828 *11*		I	
11843 *10*		I	B(M1)↑=0.030 *4*
11848 *11*		I	
11913 *11*	3^-[b]	I	J^π: L(p,p′)=3 from 0^+ and natural parity.
11945 *11*	$(0)^+$[c]	I	J^π: L(p,p′)=0 from 0^+ and $\sigma(\theta)$ fitted well assuming $J^\pi=0^+$.
11967 *11*	$(0)^+$[c]	I	J^π: L(p,p′)=0 from 0^+ and $\sigma(\theta)$ fitted well assuming $J^\pi=0^+$.
11990 *10*		I	B(M1)↑=0.047 *5*
12009 *12*	(3^-)[b]	I	J^π: L(p,p′)=(3) from 0^+ and natural parity.
12029 *12*	3^-[b]	I	J^π: L(p,p′)=3 from 0^+ and natural parity.
12051 *12*	$(0^-,1^-,2^-)$	I	J^π: L(p,p′)=(1) from 0^+.
12055	$(1^+,2^+)$[@]	E	B(M1)↑=0.08 *3* from (e,e′).
12090 *12*	$(2^-,3^-,4^-)$	I	J^π: L(p,p′)=(3) from 0^+.
12107 *12*	$4^-,5^-,6^-$	I	J^π: L(p,p′)=4 from 0^+.
12121 *10*	$0^-,1^-,2^-$	I	B(M1)↑=0.048 *6* J^π: L(p,p′)=1 from 0^+.
12162 *12*	$3^+,4^+,5^+$	I	J^π: L(p,p′)=4 from 0^+.
12176 *12*		I	
12216 *12*	$4^-,5^-,6^-$	I	J^π: L(p,p′)=5 from 0^+.
12271 *12*	$(3^+,4^+,5^+)$	e I	J^π: L(p,p′)=(4) from 0^+.
12275 *10*	$(1^+,2^+)$[@]	E I	B(M1)↑=0.035 *19* XREF: E(12270). B(M1)↑=0.10 *5* from (e,e′).
12318 *12*	$(0)^+$[c]	E I	XREF: E(12310). J^π: (M1) transition in (e,e′) is inconsistent. B(M1)↑=0.11 *3* from (e,e′).
12338 *10*	$(1,2)^+$	I	B(M1)↑=0.070 *9* J^π: L(p,p′)=2 from 0^+; (M1) transition with E2 not excluded due to weakness of this transition.
12369 *12*	$(3^+,4^+,5^+)$	I	J^π: L(p,p′)=(4) from 0^+.
12422 *12*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
12441 *12*	$2^-,3^-,4^-$	I	J^π: L(p,p′)=3 from 0^+.
12478 *10*		I	B(M1)↑=0.025 *13*
12499 *12*	$(1^+,2^+)$[@]	E I	B(M1)↑=0.09 *4* from (e,e′).
12540 *12*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
12565 *12*	$(0)^+$[c]	I	J^π: L(p,p′)=0 from 0^+.
12620 *12*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
12623 *10*		I	B(M1)↑=0.054 *20*
12659 *10*		I	B(M1)↑=0.077 *6*
12667 *12*		I	
12693 *10*	$(1^+,2^+)$[@]	E I	B(M1)↑=0.035 *5* B(M1)↑=0.10 *5* from (e,e′).
12704 *12*		I	
12757 *12*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
12798 *12*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
12846 *12*		I	
12869 *12*	(0^+)[c]	I	J^π: L(p,p′)=(0) from 0^+.
12918 *10*		I	B(M1)↑=0.048 *40*
12925 *12*	$1^+,2^+,3^+$	I	J^π: L(p,p′)=2 from 0^+.
12968 *12*	$(2^-,3^-,4^-)$	I	J^π: L(p,p′)=(3) from 0^+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{48}Ca Levels (continued)

E(level)[†]	J$^{\pi}$	$T_{1/2}$[d]	XREF	Comments
13030 *13*	4$^-$,5$^-$,6$^-$		I	J$^{\pi}$: L(p,p′)=5 from 0$^+$.
13065 *13*	(1$^+$,2$^+$,3$^+$)		I	J$^{\pi}$: L(p,p′)=(2) from 0$^+$.
13098 *13*	1$^+$,2$^+$,3$^+$		I	J$^{\pi}$: L(p,p′)=2 from 0$^+$.
13169 *13*	0$^-$,1$^-$,2$^-$		I	J$^{\pi}$: L(p,p′)=1 from 0$^+$.
13223 *13*			I	
13256 *13*	2$^-$,3$^-$,4$^-$		I	J$^{\pi}$: L(p,p′)=3 from 0$^+$.
13290 *13*			I	
13360 *13*	1$^+$,2$^+$,3$^+$		I	J$^{\pi}$: L(p,p′)=2 from 0$^+$.
13403 *13*	1$^+$,2$^+$,3$^+$		I	J$^{\pi}$: L(p,p′)=2 from 0$^+$.
13439 *13*			I	
13475 *13*	1$^+$,2$^+$,3$^+$		I	J$^{\pi}$: L(p,p′)=2 from 0$^+$.
13493 *13*			I	
16.69×10^3 *19*		6.2 MeV *+15−1*	O	E1 resonance.
16.79×10^3 *14*		6.95 MeV *+11−35*	O	E2 resonance.
19.88×10^3 *18*		6.68 MeV *+31−36*	O	E0 (ISGMR) resonance.
20.90×10^3 *14*		9.34 MeV *16*	O	E3+E4 resonance.
24.2×10^3	(1$^-$)		F	%n=100 T=(5) J$^{\pi}$,T: momentum transfer dependence favors an E1 excitation and small Γ implies an isobaric analog resonance in (e,e′n).
37.3×10^3 *20*		14.9 MeV *+35−1*	O	E1 resonance.

† From a least-squares fit to γ-ray energies for levels connected with γ transitions except for those from (p,p′γ), and from (p,p′) for other levels where available, unless otherwise noted. In the least-squares fit, where ΔEγ is not available, the following assumptions have been made: 0.05 keV for Eγ quoted to 100th keV, 0.5 keV for Eγ quoted to 10th keV and 1.0 keV for quoted to keV. The reduced χ^2 of the fitting is 2.65, compared to the critical χ^2=1.83, after adjustments of ΔEγ for some poor-fit Eγ values, as noted.

‡ From DWBA analysis in (p,p′) with unnatural parity due to peak not observed in (α,α′) spectra (1988Fu01). Natural parity is distinguished from unnatural parity based on observation of one-to-one correspondences of levels in (p,p′) and (α,α′) spectra (1988Fu01).

In (^{48}Ca,^{48}Ca′γ), 2001Br35 suggest that these states are near yrast states with J>5 and must involve two-particle two-hole core excitations, which is manifested by their large energy separation from lower lying states.

@ (M1) transition in (e,e′) gives (1$^+$); E2 giving 2$^+$ may not be excluded due to the weakness of the transition.

& From DWBA fit to the Coulomb form factors and RPA calculations in (e,e′); unnatural parity state from absence of longitudinal form factor.

a Likely spin but not clearly observed in (α,α′) spectra measured by 1988Fu01 in (p,p′).

b Natural parity state due to presence in the (α,α′) spectra measured by 1988Fu01 in (p,p′).

c σ(θ) in (p,p′) show oscillatory patterns and are well fitted by DWBA assuming 0$^+$.

d From DSAM in (n,n′γ) (1992Va06), unless otherwise noted.

e From $\Gamma_{\gamma0}$ in (γ,γ′) assuming $\Gamma_{\gamma0}/\Gamma$=1 (2002Ha13).

f From $\Gamma_{\gamma0}$ in (γ,γ′) (2002Ha13) and adopted $\Gamma_{\gamma0}/\Gamma$.

g Estimated by the evaluator from the following partial $T_{1/2}$ and limits: $T_{1/2}(\beta^-)>1.6\times10^{20}$ y, $>2.5\times10^{20}$ y, $>1.9\times10^{20}$ y for single β^- decay to g.s., 131 and 252 levels in ^{48}Sc, respectively (2002Bb03, 90% C.L.), $T_{1/2}(2\nu2\beta^-)=5.6\times10^{19}$ y *+14−11* (2016Ar19,2000Br63,1996Ba80) and $T_{1/2}(0\nu2\beta^-)>5.8\times10^{22}$ y (2008Um05, 90% C.L.), for $2\beta^-$ to g.s. in ^{48}Ti, and $T_{1/2}(2\beta^-)>1.8\times10^{20}$ y, $>1.5\times10^{20}$ y, and $>1.5\times10^{20}$ y (2002Bb03, 90% C.L.), for $(0\nu+2\nu)2\beta^-$ to 984, 2421, and 2997 levels in ^{48}Ti, respectively. Estimate was obtained by taking decay constant $\lambda=\lambda_{upper}/2$ with $\Delta\lambda=\lambda$ for partial $T_{1/2}$ given as lower limit (for λ_{upper}). See the ^{48}Ca β^- and ^{48}Ca $2\beta^-$ decay datasets for experimental details.

$\gamma(^{48}Ca)$

E_i(level)	J^{π}_i	E_{γ}[‡]	I_{γ}[#]	E_f	J^{π}_f	Mult.[e]	δ[e]	α[†]	$I_{(\gamma+ce)}$[b]	Comments
3831.96	2^+	3831.4 *3*	100	0.0	0^+	E2		1.12×10^{-3} *2*		B(E2)(W.u.)=1.84 *+17−14* α(K)=6.68×10^{-6} *9*; α(L)=5.71×10^{-7} *8*; α(M)=6.78×10^{-8} *9* α(N)=3.86×10^{-9} *5*; α(IPF)=0.001111 *16* E_{γ}: weighted average of 3831.3 *2* from (γ,γ') and 3832.2 *5* from (n,n$'\gamma$). Mult.: Q from p$\gamma(\theta)$ in (p,p$'\gamma$) and M2 ruled out by RUL.
4283.56	0^+	451.6 *1*	100.0[b] *10*	3831.96	2^+	[E2]		0.000934 *13*		B(E2)(W.u.)=10.1 *5* α=0.000934 *13*; α(K)=0.000851 *12*; α(L)=7.37×10^{-5} *10*; α(M)=8.73×10^{-6} *12* α(N)=4.89×10^{-7} *7* E_{γ}: from (n,n$'\gamma$). Other: 451.9 *5* from (p,p$'\gamma$). I_{γ}: from (p,p$'\gamma$). Other: 100 *13* from ^{49}K β^-n decay.
		(4283)		0.0	0^+	E0			29.0 *11*	Mult.: from observation of E0 e+/e- pair emission to g.s. q^2_K(E0/E2)=0.95 *4*; X(E0/E2)=0.0503 *19*; ρ^2(E0)=0.0145 *9* (2005Ki02,1970Be39). ω(E0)=4.817×10^{10}; ω(E0)(K)=1.342×10^{8}; ω(E0)(ipf)=4.817×10^{10}.
4503.74	4^+	671.8 *4*	100	3831.96	2^+	E2		0.000268 *4*		B(E2)(W.u.)=0.261 *5* α=0.000268 *4*; α(K)=0.0002441 *34*; α(L)=2.106×10^{-5} *30*; α(M)=2.498×10^{-6} *35* α(N)=1.408×10^{-7} *20* E_{γ}: unweighted average of 671.4 *1* from (n,n$'\gamma$) and 672.1 *2* from (p,p$'\gamma$). Mult.: Q from $\gamma(\theta)$ in (n,n$'\gamma$); M2 ruled out by RUL.
4507.05	3^-	675.1 *1*	100.0 *28*	3831.96	2^+	(E1(+M2))	0.00 *3*	9.18×10^{-5} *13*		B(E1)(W.u.)=0.00021 *+10−8* α=9.18×10^{-5} *13*; α(K)=8.37×10^{-5} *12*; α(L)=7.19×10^{-6} *10*; α(M)=8.53×10^{-7} *12* α(N)=4.83×10^{-8} *7* E_{γ}: from (n,n$'\gamma$). Other: 675.0 *1* from (p,p$'\gamma$). I_{γ}: from (p,p$'\gamma$). Others: 100 *4* from ^{48}K β^- decay and 100 *8* from (n,n$'\gamma$). Mult.,δ: D(+Q) and δ from p$\gamma(\theta)$ in (p,p$'\gamma$); $\Delta\pi$=yes from level scheme.
		4507.3 *5*	28 *5*	0.0	0^+	E3		1.05×10^{-3} *2*		B(E3)(W.u.)=8.4 *+43−35* α(K)=6.86×10^{-6} *10*; α(L)=5.87×10^{-7} *8*; α(M)=6.97×10^{-8} *10*

$^{48}_{20}Ca_{28}$-11

$\gamma(^{48}Ca)$ (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[e]	δ[e]	α[†]	Comments
									$\alpha(N)=3.97\times10^{-9}$ *6*; $\alpha(IPF)=0.001042$ *15* I_γ: unweighted average of 22 *6* from ^{48}K β^- decay, 25.0 *28* from (n,n′γ), and 37.0 *28* from (p,p′γ). I_γ: Iγ(4507γ)/Iγ(675γ)=0.37 *3* from (p,p′γ) discrepant, 0.22 *6* from β^- decay consistent. Mult.: O from pγ(θ) in (p,p′γ); M3 ruled out by RUL.
4612.24	$3^{(+)}$	780.2 *1*	100	3831.96	2^+	(M1)		0.0001108 *16*	B(M1)(W.u.)=0.019 *+17−7* $\alpha=0.0001108$ *16*; $\alpha(K)=0.0001010$ *14*; $\alpha(L)=8.68\times10^{-6}$ *12*; $\alpha(M)=1.031\times10^{-6}$ *14* $\alpha(N)=5.85\times10^{-8}$ *8* E_γ: weighted average of 780.1 *1* from (n,n′γ) and 780.4 *2* from (p,p′γ). Mult.: D from γγ(θ) in (p,p′γ) and γ(θ) in (n,n′γ); Δπ=(no) from level scheme.
4695.4	1	4695.2[@] *3*	100	0.0	0^+	D			E_γ,Mult.: from (γ,γ′), with Mult from γ(θ).
5146.42	3,4,5	642.7 *1*	100	4503.74	4^+	D			E_γ: other: 642.9 *2* from (p,p′γ).
5260.81	$4^{(-)}$	648.4 *1*	16.8 *17*	4612.24	$3^{(+)}$	(E1)		0.0001008 *14*	B(E1)(W.u.)=5.3×10^{-5} *+10−12* $\alpha=0.0001008$ *14*; $\alpha(K)=9.19\times10^{-5}$ *13*; $\alpha(L)=7.89\times10^{-6}$ *11*; $\alpha(M)=9.37\times10^{-7}$ *13* $\alpha(N)=5.30\times10^{-8}$ *7* I_γ: other: I(648γ)/I(754γ)=100 *20*/41 *20* from (p,p′γ) is discrepant. Mult.: D from γ(θ) in (n,n′γ); Δπ=(yes) from level scheme.
		753.8 *1*	100 *9*	4507.05	3^-	(M1)		0.0001188 *17*	B(M1)(W.u.)=0.0086 *+16−19* $\alpha=0.0001188$ *17*; $\alpha(K)=0.0001083$ *15*; $\alpha(L)=9.31\times10^{-6}$ *13*; $\alpha(M)=1.106\times10^{-6}$ *15* $\alpha(N)=6.28\times10^{-8}$ *9* E_γ: other: 753.9 from (^{48}Ca,$^{48}Ca'\gamma$). Mult.: D from γ(θ) in (n,n′γ); Δπ=(no) from level scheme.
		757.7[ag]		4503.74	4^+				E_γ: from (^{48}Ca,$^{48}Ca'\gamma$).
5311	$(1)^-$	804	25[b] *13*	4507.05	3^-				E_γ: original 810 from (p,p′γ).
		1479	100[b] *13*	3831.96	2^+				E_γ: original 1490 from (p,p′γ).
5312.2	2	803.9[c] *1*	5.7 *10*	4507.05	3^-	D			E_γ: level-energy difference=805.17.
		1480.2[d] *1*	100 *8*	3831.96	2^+	D+Q	+0.7 *6*		
		5312.2 *5*	15.4 *18*	0.0	0^+	Q			Mult.: M2 or E2 both allowed by RUL.
5369.90	3^-	757.5 *1*	29 *4*	4612.24	$3^{(+)}$	(E1)		7.10×10^{-5} *10*	B(E1)(W.u.)=0.000102 *15* $\alpha=7.10\times10^{-5}$ *10*; $\alpha(K)=6.47\times10^{-5}$ *9*; $\alpha(L)=5.56\times10^{-6}$ *8*; $\alpha(M)=6.59\times10^{-7}$ *9* $\alpha(N)=3.74\times10^{-8}$ *5* I_γ: other: 6.3 *4* from ^{48}K β^- decay is discrepant. Mult.: D from γ(θ) in (n,n′γ); Δπ=yes from level scheme.

$\gamma(^{48}\text{Ca})$ (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[#]	E_f	J_f^π	Mult.[e]	α[†]	Comments
5369.90	3^-	862.7 *1*	30 *4*	4507.05	3^-	[M1,E2]	0.000112 *22*	B(M1)(W.u.)=0.00308 *+46−43* (if pure M1); B(E2)(W.u.)=10.3 *+15−14* (if pure E2) α=0.000112 *22*; α(K)=0.000102 *20*; α(L)=8.8×10^{-6} *17*; α(M)=1.04×10^{-6} *20* α(N)=5.9×10^{-8} *11* I_γ: weighted average of 29 *4* from ^{48}K β^- decay and 30 *4* from (n,n′γ). Other: 67 *17* from (p,p′γ) is discrepant.
		866.9[d] *1*	26.4 *32*	4503.74	4^+	(E1)	5.33×10^{-5} *7*	B(E1)(W.u.)=6.2×10^{-5} *+9−8* α=5.33×10^{-5} *7*; α(K)=4.86×10^{-5} *7*; α(L)=4.17×10^{-6} *6*; α(M)=4.95×10^{-7} *7* α(N)=2.81×10^{-8} *4* E_γ: level-energy difference=866.16. I_γ: weighted average of 23 *4* from ^{48}K β^- decay and 28.6 *32* from (n,n′γ). Mult.: D from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=yes from level scheme.
		1537.8 *1*	100 *6*	3831.96	2^+	(E1)	0.000312 *4*	B(E1)(W.u.)=4.2×10^{-5} *4* α=0.000312 *4*; α(K)=1.715×10^{-5} *24*; α(L)=1.468×10^{-6} *21*; α(M)=1.743×10^{-7} *24* α(N)=9.91×10^{-9} *14*; α(IPF)=0.000293 *4* I_γ: from ^{48}K β^- decay. Others: 100 *9* from (n,n′γ) and 100 *17* from (p,p′γ). Mult.: D from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=yes from level scheme.
5729.64	5^-	468.7 *1*	100 *9*	5260.81	$4^{(-)}$	[M1]	0.000324 *5*	B(M1)(W.u.)=0.14 *5* α=0.000324 *5*; α(K)=0.000295 *4*; α(L)=2.55×10^{-5} *4*; α(M)=3.03×10^{-6} *4* α(N)=1.713×10^{-7} *24* I_γ: from (n,n′γ). Other: 100 *17* from (p,p′γ). Mult.: assumed based on comparions with RUL.
		1226.0 *1*	65 *14*	4503.74	4^+	[E1]	0.0001000 *14*	B(E1)(W.u.)=0.00012 *+4−5* α=0.0001000 *14*; α(K)=2.511×10^{-5} *35*; α(L)=2.151×10^{-6} *30*; α(M)=2.55×10^{-7} *4* α(N)=1.451×10^{-8} *20*; α(IPF)=7.25×10^{-5} *10* I_γ: weighted average of 63 *14* from (n,n′γ) and 67 *17* from (p,p′γ).
6105.00	(2^+)	1597.8 *1*	100 *10*	4507.05	3^-	[E1]	0.000359 *5*	B(E1)(W.u.)=0.00079 *+19−9* α=0.000359 *5*; α(K)=1.613×10^{-5} *23*; α(L)=1.381×10^{-6} *19*; α(M)=1.640×10^{-7} *23* α(N)=9.32×10^{-9} *13*; α(IPF)=0.000341 *5*
		2273.1 *1*	13.7 *20*	3831.96	2^+	[M1,E2]	0.00042 *4*	B(M1)(W.u.)=0.0016 *+5−3* (if pure M1); B(E2)(W.u.)=0.78 *+24−14* (if pure E2) α=0.00042 *4*; α(K)=1.49×10^{-5} *6*; α(L)=1.28×10^{-6} *5*; α(M)=1.52×10^{-7} *6* α(N)=8.63×10^{-9} *32*; α(IPF)=0.00041 *4*

$^{48}_{20}\text{Ca}_{28}$-13

Adopted Levels, Gammas (continued)

$\gamma(^{48}Ca)$ (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[e]	α[†]	Comments
6336.8	2^+	6336.4 20	100	0.0	0^+	E2		B(E2)(W.u.)=0.028 +5−4
6345.72	4^+	1199.3 1	17 8	5146.42	3,4,5			
		1733.5 1	20 5	4612.24	$3^{(+)}$			
		1841.2[d] 1	100 11	4503.74	4^+			E_γ: level-energy difference=1841.94.
6612.19	1^-	6611.7[@] 1	100	0.0	0^+	E1		B(E1)(W.u.)=0.00095 +8−7 Mult.: $\gamma(\theta)$ and γ asymmetry in (γ,γ').
6648.99	4^+	1278[g]		5369.90	3^-			
		1504.0[c] 1	68 8	5146.42	3,4,5	D		E_γ: level-energy difference=1502.54.
		2036.8 1	51 5	4612.24	$3^{(+)}$	(M1)	0.000283 4	B(M1)(W.u.)=0.0053 +19−15 α=0.000283 4; α(K)=1.724×10^{-5} 24; α(L)=1.476×10^{-6} 21; α(M)=1.753×10^{-7} 25 α(N)=9.98×10^{-9} 14; α(IPF)=0.000264 4 Mult.: D from $\gamma(\theta)$ in $(n,n'\gamma)$; $\Delta\pi$=no from level scheme.
		2145.1 1	100 16	4503.74	4^+	(M1)	0.000327 5	B(M1)(W.u.)=0.009 3 α=0.000327 5; α(K)=1.583×10^{-5} 22; α(L)=1.354×10^{-6} 19; α(M)=1.609×10^{-7} 23 α(N)=9.16×10^{-9} 13; α(IPF)=0.000310 4 Mult.: D from $\gamma(\theta)$ in $(n,n'\gamma)$; $\Delta\pi$=no from level scheme.
6685.64	$2^{(-)}$	1315.8 1	100 8	5369.90	3^-	[M1,E2]	7.3×10^{-5} 9	B(M1)(W.u.)=0.10 +13−5 (if pure M1); B(E2)(W.u.)=1.5×10^2 +19−7 (if pure E2) α=7.3×10^{-5} 9; α(K)=4.1×10^{-5} 4; α(L)=3.49×10^{-6} 33; α(M)=4.2×10^{-7} 4 α(N)=2.36×10^{-8} 22; α(IPF)=2.8×10^{-5} 5 I_γ: from ^{48}K β^- decay. Other: 100 10 from $(n,n'\gamma)$.
		2073.9[d] 1	17 4	4612.24	$3^{(+)}$	(E1)	0.000705 10	B(E1)(W.u.)=1.0×10^{-4} +13−5 α=0.000705 10; α(K)=1.089×10^{-5} 15; α(L)=9.31×10^{-7} 13; α(M)=1.106×10^{-7} 15 α(N)=6.29×10^{-9} 9; α(IPF)=0.000693 10 E_γ: level-energy difference=2073.35. I_γ: weighted average of 15 4 from ^{48}K β^- decay and 26 9 from $(n,n'\gamma)$. Mult.: D from comparison to RUL; $\Delta\pi$=yes from level scheme.
		2178.30[&g]	18[&] 4	4507.05	3^-	[M1,E2]	0.00038 4	B(M1)(W.u.)=0.0041 +52−21 (if pure M1); B(E2)(W.u.)=2.2 +28−11 (if pure E2) α=0.00038 4; α(K)=1.60×10^{-5} 6; α(L)=1.37×10^{-6} 5; α(M)=1.63×10^{-7} 7 α(N)=9.3×10^{-9} 4; α(IPF)=0.00036 4 E_γ,I_γ: from ^{48}K β^- decay. γ reported in $(p,p'\gamma)$ but not seen in $(n,n'\gamma)$.
6791.5	1	6791.0 20	100	0.0	0^+	D		
6805.7	2^+	2301.9 1	100 14	4503.74	4^+	[E2]	0.000478 7	B(E2)(W.u.)=5.9 +48−22 α=0.000478 7; α(K)=1.510×10^{-5} 21; α(L)=1.292×10^{-6} 18; α(M)=1.535×10^{-7} 21 α(N)=8.73×10^{-9} 12; α(IPF)=0.000462 6
		2974.8 5	72 24	3831.96	2^+	[M1,E2]	0.00073 6	B(M1)(W.u.)=0.0042 +36−17 (if pure M1); B(E2)(W.u.)=1.2 +10−5 (if

$\gamma(^{48}Ca)$ (continued)

E_i(level)	J^π_i	E_γ‡	I_γ#	E_f	J^π_f	Mult.[e]	α†	Comments
								pure E2) α=0.00073 *6*; α(K)=9.64×10^{-6} *26*; α(L)=8.24×10^{-7} *22*; α(M)=9.79×10^{-8} *26* α(N)=5.58×10^{-9} *15*; α(IPF)=0.00072 *6*
6830.8	(3$^-$)	2998.7 *5*	100	3831.96	2$^+$	D		
6895.87	(2$^-$)	1525.7 *1*	36 *6*	5369.90	3$^-$	(M1)	0.0001032 *14*	B(M1)(W.u.)>0.0065 α=0.0001032 *14*; α(K)=2.83×10^{-5} *4*; α(L)=2.426×10^{-6} *34*; α(M)=2.88×10^{-7} *4* α(N)=1.640×10^{-8} *23*; α(IPF)=7.21×10^{-5} *10* I_γ: from ^{48}K β^- decay. Other: 35 *8* from (n,n′γ). Mult.: D from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=(no) from level scheme.
		2283.15[&g]	23[&] *4*	4612.24	3$^{(+)}$	[E1]	0.000843 *12*	B(E1)(W.u.)>2.8×10^{-5} α=0.000843 *12*; α(K)=9.50×10^{-6} *13*; α(L)=8.12×10^{-7} *11*; α(M)=9.65×10^{-8} *14* α(N)=5.49×10^{-9} *8*; α(IPF)=0.000833 *12*
		2389.0 *1*	100 *7*	4507.05	3$^-$	(M1)	0.000428 *6*	B(M1)(W.u.)>0.0053 α=0.000428 *6*; α(K)=1.329×10^{-5} *19*; α(L)=1.137×10^{-6} *16*; α(M)=1.350×10^{-7} *19* α(N)=7.69×10^{-9} *11*; α(IPF)=0.000413 *6* I_γ: from ^{48}K β^- decay. Other: 100 *14* from (n,n′γ). Mult.: D from $\gamma(\theta)$ in (n,n′γ); $\Delta\pi$=(no) from level scheme.
		3063.27[&g]	35[&] *7*	3831.96	2$^+$			E_γ,I_γ: from ^{48}K β^- decay only.
7007.6	3$^-$	3175.5 *5*	100	3831.96	2$^+$	[E1]	1.33×10^{-3} *2*	B(E1)(W.u.)=0.00023 *+6−5* α(K)=6.12×10^{-6} *9*; α(L)=5.23×10^{-7} *7*; α(M)=6.21×10^{-8} *9* α(N)=3.54×10^{-9} *5*; α(IPF)=0.001328 *19*
7032.0	(3)$^-$	1771[g]		5260.81	4$^{(-)}$			E_γ: level-energy difference=1763 from (p,p′γ).
		2524.9 *5*	100	4507.05	3$^-$	D+Q		δ: large.
7296.1	(2$^+$)	3463.9 *5*	100 *11*	3831.96	2$^+$			
		7298 *2*	21 *4*	0.0	0$^+$	(E2)		B(E2)(W.u.)>0.051 Mult.: (Q) from $\gamma(\theta)$ in (n,n′γ); M2 ruled out by RUL.
7298.50	1$^-$	1929[&]	0.52[&]	5369.90	3$^-$			E_γ: 1932 from level-energy difference in ^{48}K β^- decay.
		2686[&]	0.52[&]	4612.24	3$^{(+)}$			E_γ: 2689 from level-energy difference in ^{48}K β^- decay.
		7297.9 *2*	100 *26*	0.0	0$^+$	E1		B(E1)(W.u.)=0.0065 *5* E_γ: from (γ,γ′). Other: 7300.9 from ^{48}K β^- decay. I_γ: from ^{48}K β^- decay. Mult.: from $\gamma(\theta)$ and γ asymmetry in (γ,γ′).
7370.6	(1,2)	7370 *2*	100	0.0	0$^+$			
7401.22	(2$^-$)	715.61[&]	8.2[&] *24*	6685.64	2$^{(-)}$			
		2031.23[&]	17.9[&] *24*	5369.90	3$^-$			
		2788.90[&]	100[&] *6*	4612.24	3$^{(+)}$			

$^{48}_{20}Ca_{28}$-15

$\gamma(^{48}$Ca) (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[e]	α[†]	Comments
7401.22	(2$^-$)	2894[&]	5.3[&]	4507.05	3$^-$			
		3569[&]	6.6[&]	3831.96	2$^+$			
		7400[&]	1.30[&]	0.0	0$^+$			
7407.3?	(0,1,2,3$^-$)	793.11[&g] *6*	100	6612.19	1$^-$			
7440.6	2,3$^-$	7440 *2*	100	0.0	0$^+$	Q,E3		B(E3)(W.u.)=39.7 *+17−15* (if pure E3)
7497.5	(3$^-$)	1767.8 *1*	100	5729.64	5$^-$			
7536.4	3$^-$	2389.8[a]		5146.42	3,4,5			
		3032.7[a]		4503.74	4$^+$			
7568.7		3736.6 *5*	100	3831.96	2$^+$			
7652	3$^-$	3146[fg]		4503.74	4$^+$			E_γ: level-energy difference=3140 from (p,p′γ).
		3146[fg]		4507.05	3$^-$			E_γ: level-energy difference=3140 from (p,p′γ).
		7651		0.0	0$^+$			
7655.66	1$^-$	7655.0[@] *2*	100	0.0	0$^+$	E1		B(E1)(W.u.)=6.11×10^{-4} *+24−23* Mult.: from $\gamma(\theta)$ and α asymmetry in (γ,γ').
7789	3$^-$	958		6830.8	(3$^-$)			E_γ: level-energy difference=964 from (p,p′γ).
7915.4	2$^+$	7914.7[@] *9*	100	0.0	0$^+$	E2		B(E2)(W.u.)=0.080 *+13−12*
7957	(4)$^+$	1126		6830.8	(3$^-$)			E_γ: level-energy difference=1137 from (p,p′γ).
8027.6	2$^+$	8026.9[@] *4*	100	0.0	0$^+$	E2		B(E2)(W.u.)=0.144 *+17−14* Mult.: Q from $\gamma(\theta)$ in (γ,γ'); M2 ruled out by RUL.
8045	(1)	3544[fg]		4503.74	4$^+$			E_γ: level-energy difference=3529 from (p,p′γ).
		3544[fg]		4507.05	3$^-$			E_γ: level-energy difference=3529 from (p,p′γ).
		8044[g]		0.0	0$^+$			E_γ: level-energy difference=8040 from (p,p′γ).
8050	2	8050		0.0	0$^+$			
8248	4$^+$	3740[fg]		4503.74	4$^+$			E_γ: level-energy difference=3735 from (p,p′γ).
		3740[fg]		4507.05	3$^-$			E_γ: level-energy difference=3735 from (p,p′γ).
8276?	(1$^-$,2,3)	1445		6830.8	(3$^-$)			E_γ: level-energy difference=1456 from (p,p′γ).
		3770[fg]		4507.05	3$^-$			E_γ: level-energy difference=3764 from (p,p′γ).
		3770[fg]		4503.74	4$^+$			E_γ: level-energy difference=3764 from (p,p′γ).
		8275		0.0	0$^+$			
8279.1	4$^+$	3133[a]		5146.42	3,4,5			
8386.1	1$^-$	1555[g]		6830.8	(3$^-$)			E_γ: level-energy difference=1564 from (p,p′γ).
		4554.2[@] *12*	9.9[@] *3*	3831.96	2$^+$	(E1)	1.88×10^{-3} *3*	B(E1)(W.u.)=0.0031 *+6−4* α(K)=3.93×10^{-6} *5*; α(L)=3.35×10^{-7} *5*; α(M)=3.98×10^{-8} *6* α(N)=2.269×10^{-9} *32*; α(IPF)=0.001876 *26* Mult.: D from $\gamma(\theta)$ in (γ,γ'); $\Delta\pi$=yes from level scheme.
		8385.3[@] *5*	100[@] *9*	0.0	0$^+$	E1		B(E1)(W.u.)=0.0050 *+8−6* Mult.: from $\gamma(\theta)$ and γ asymmetry in (γ,γ').
8467?	(1,2)	4635[&g]	100[&]	3831.96	2$^+$			
		8466[&g]	15.7[&]	0.0	0$^+$			

$^{48}_{20}$Ca$_{28}$-16

Adopted Levels, Gammas (continued)

$\gamma(^{48}Ca)$ (continued)

E_i(level)	J^π_i	E_γ[‡]	I_γ[#]	E_f	J^π_f	Mult.[e]	α[†]	Comments
8478	$3^+,4^+,5^+$	3972[fg]		4503.74	4^+			E_γ: level-energy difference=3976 from (p,p′γ).
		3972[fg]		4507.05	3^-			E_γ: level-energy difference=3976 from (p,p′γ).
8517.9	$(1^-,2^+)$	8517.1[@] *8*	100	0.0	0^+			
8523	3^-	4017[fg]		4503.74	4^+			E_γ: level-energy difference=4015 from (p,p′γ).
		4017[fg]		4507.05	3^-			E_γ: level-energy difference=4015 from (p,p′γ).
8531?	$(1,2^+)$	4247[&g]	39[&]	4283.56	0^+			
		4699[&g]	100[&]	3831.96	2^+			
		8530[&g]	61[&]	0.0	0^+			
8586?		4080[fg]		4503.74	4^+			E_γ: level-energy difference=4073 from (p,p′γ).
		4080[fg]		4507.05	3^-			E_γ: level-energy difference=4073 from (p,p′γ).
8664.6	(3,4,5)	386[a]		8279.1	4^+			
8680	(3^+)	4174[fg]		4503.74	4^+			E_γ: level-energy difference=4159 from (p,p′γ).
		4174[fg]		4507.05	3^-			E_γ: level-energy difference=4159 from (p,p′γ).
8788		4282[fg]		4503.74	4^+			E_γ: level-energy difference=4277 from (p,p′γ).
		4282[fg]		4507.05	3^-			E_γ: level-energy difference=4277 from (p,p′γ).
8883.3	1^-	5050.6 *9*	4.0 *10*	3831.96	2^+	(E1)	2.04×10^{-3} *3*	B(E1)(W.u.)=0.00036 *+30−14* α(K)=3.48×10^{-6} *5*; α(L)=2.97×10^{-7} *4*; α(M)=3.52×10^{-8} *5* α(N)=2.008×10^{-9} *28*; α(IPF)=0.002035 *28* E_γ,I_γ: from (γ,γ'). Mult.: D from $\gamma(\theta)$ in (γ,γ'); $\Delta\pi$=yes from level scheme.
		8882.6 *5*	100 *30*	0.0	0^+	E1		B(E1)(W.u.)=0.0017 *+9−4* E_γ,I_γ,Mult.: from (γ,γ') with Mult from $\gamma(\theta)$ and γ asymmetry.
8890.7	>5	3160.8[a]		5729.64	5^-			
8967?	(1,2,3)	8966[&g]	100	0.0	0^+			
9033.9	1^-	5200.9[@] *15*	2.2[@] *9*	3831.96	2^+	(E1)	2.08×10^{-3} *3*	B(E1)(W.u.)=0.00033 *13* α(K)=3.36×10^{-6} *5*; α(L)=2.87×10^{-7} *4*; α(M)=3.41×10^{-8} *5* α(N)=1.940×10^{-9} *27*; α(IPF)=0.002080 *29* Mult.: D from $\gamma(\theta)$ in (γ,γ'); $\Delta\pi$=yes from level scheme.
		9033.0[@] *4*	100[@] *4*	0.0	0^+	E1		B(E1)(W.u.)=0.0028 *2* Mult.: from $\gamma(\theta)$ and γ asymmetry in (γ,γ').
9050	1	9050		0.0	0^+	D		E_γ,Mult.: from (α,$\alpha'\gamma$), with Mult from $\alpha\gamma(\theta)$.
9094.6		430[a]		8664.6	(3,4,5)			
9123.1	$(1^+,2^+,3^+)$	232[a]		8890.7	>5			
		459[a]		8664.6	(3,4,5)			
9295.3	1^-	9294.3	100	0.0	0^+	E1		B(E1)(W.u.)=0.00270 *+17−15* E_γ: other: 9300 from (α,$\alpha'\gamma$) and ^{48}K β^- decay. Mult.: from $\gamma(\theta)$ and γ asymmetry in (γ,γ') and $\alpha\gamma(\theta)$ in (α,$\alpha'\gamma$).
9295.7	(8^-)	405[a]		8890.7	>5			
9472.8	1^-	9471.8[@] *8*	100	0.0	0^+	E1		B(E1)(W.u.)=0.00241 *+22−19* Mult.: from $\gamma(\theta)$ and γ asymmetry in (γ,γ').

$^{48}_{20}Ca_{28}$-17

Adopted Levels, Gammas (continued)

$\gamma(^{48}Ca)$ (continued)

E_i(level)	J_i^{π}	E_{γ}[‡]	I_{γ}[#]	E_f	J_f^{π}	Mult.[e]	Comments
9545.72	1^-	9544.7[@] 2	100	0.0	0^+	E1	B(E1)(W.u.)=0.00424 +23−21 Mult.: from $\gamma(\theta)$ and γ asymmetry in (γ,γ').

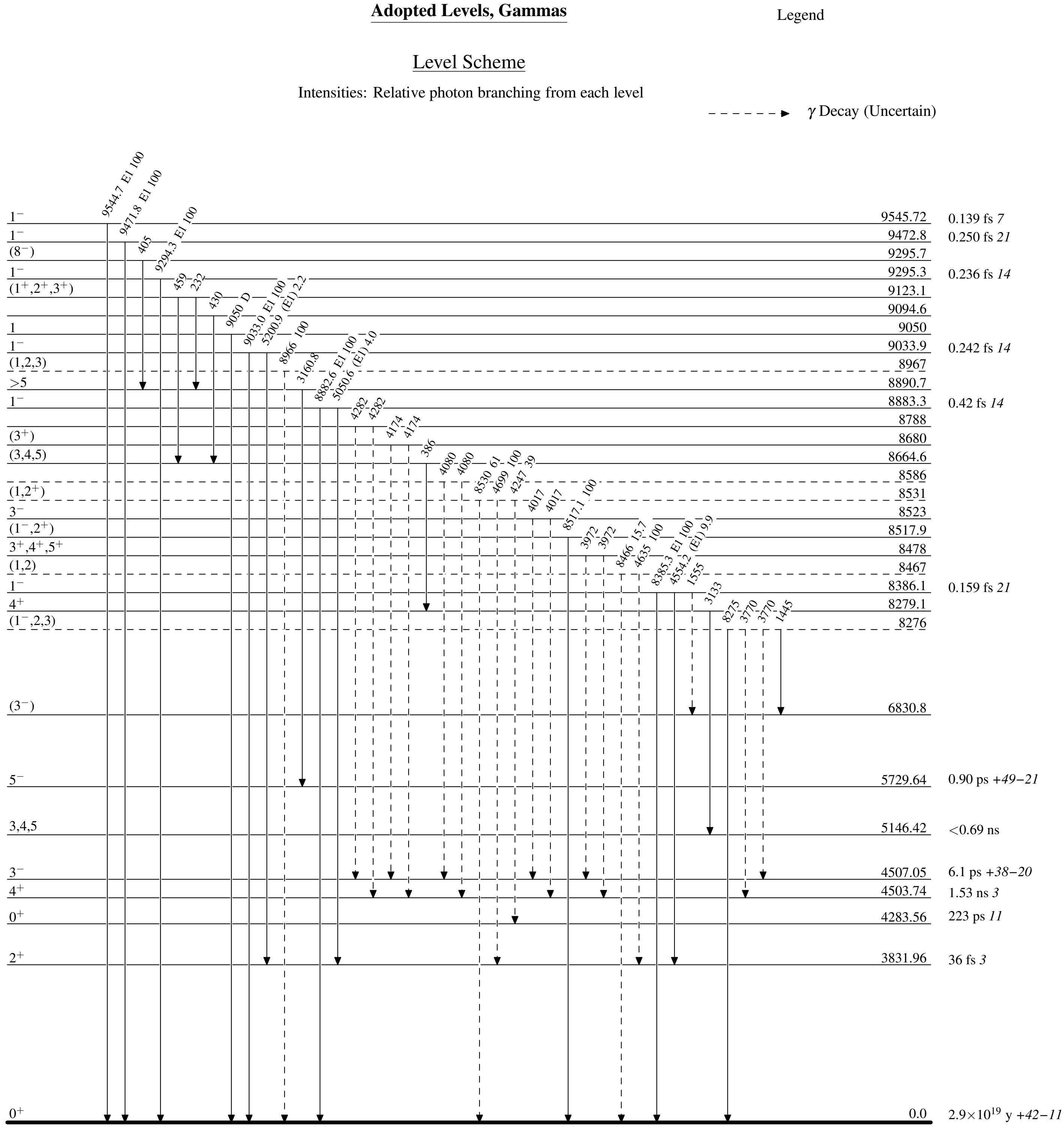
[†] Additional information 19.
[‡] Values with uncertainties are from (n,n′γ) and those without uncertainties are from level-energy differences for transitions reported in (p,p′γ) , unless otherwise noted. Note that values without uncertainties from (p,p′γ) are deduced from E(level) values reported in 1969Te03 only, while adopted E(level) values from (p,p′) are mostly from 1988Fu01 or average of all available measurements. Therefore, for those transitions, Eγ values quoted here have been re-deduced by the evaluator from the adopted level energies.
[#] From (n,n′γ), unless otherwise noted.
[@] From (γ,γ').
[&] From β^- decay.
[a] From (^{48}Ca,^{48}Ca′γ).
[b] From (p,p′γ), except as noted.
[c] Very poor-fit and omitted in the fitting.
[d] Poor-fit and uncertainty multiplied by a factor of 3 in the fitting.
[e] D,Q or D+Q with δ are from $\gamma(\theta)$ in (n,n′γ) and electric or magnetic nature is from comparison to RUL where $T_{1/2}$ is available, unless otherwise noted.
[f] Multiply placed.
[g] Placement of transition in the level scheme is uncertain.

$^{48}_{20}Ca_{28}$-18

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{48}_{20}Ca_{28}$

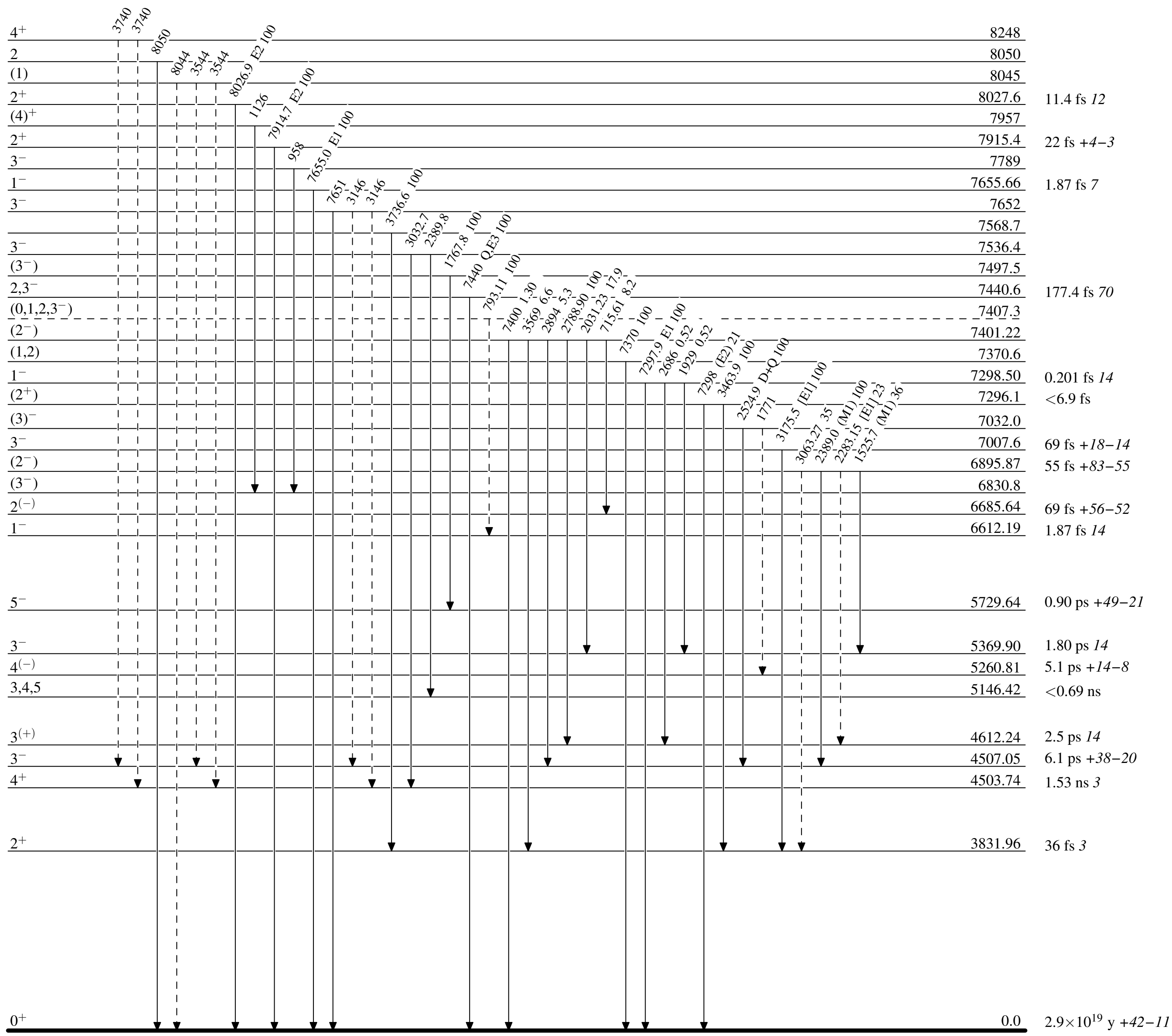
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

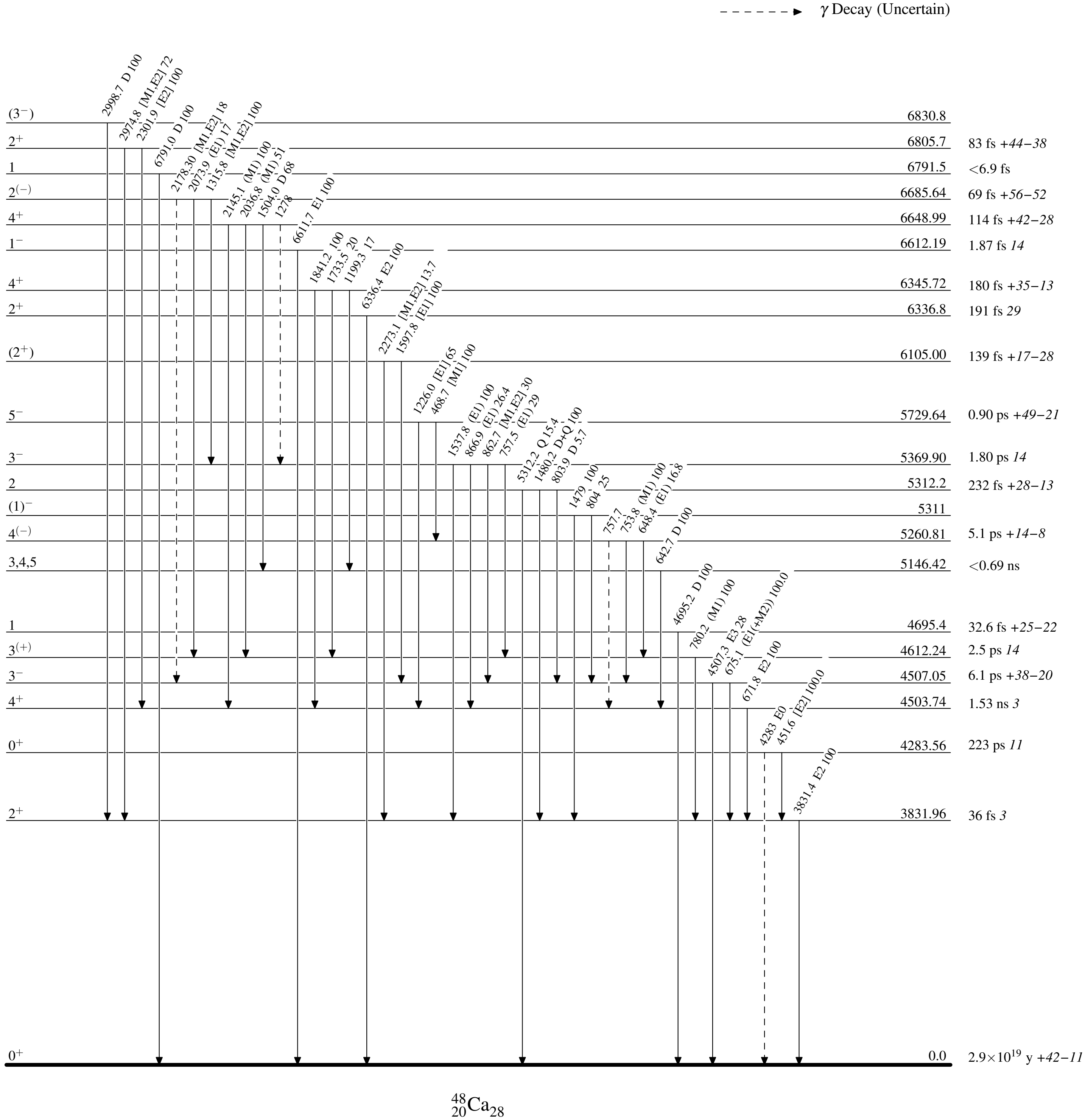


$^{48}_{20}Ca_{28}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 157, 1 (2019)	15-Apr-2019

Q(β^-)=4958 *15*; S(n)=6360.8 *16*; S(p)=17266.7 *18*; Q(α)=−12241.2 *19* 2017Wa10
S(2n)=11507.2 *16*, S(2p)=31890 *310* (2017Wa10).
Mass measurement: 2012La05 (TOF-ICR resonance frequency ratios using TITAN Penning trap spectrometer at TRIUMF-ISAC facility).
Theory references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 125 primary references for structure calculations.
Additional information 1.

^{50}Ca Levels

Cross Reference (XREF) Flags

A	^{50}K β^- decay (472 ms)	F	^{48}Ca(α,2p)
B	^{51}K β^-n decay (365 ms)	G	^{48}Ca(^{238}U,Xγ)
C	^{52}K β^-2n decay (110 ms)	H	^{208}Pb(^{48}Ca,Xγ)
D	^{1}H(^{50}Ca,P′γ)	I	^{238}U(^{48}Ca,Xγ)
E	^{48}Ca(t,p),(pol t,p)		

E(level)[†]	J^{π}[‡]	$T_{1/2}$[a]	XREF	Comments
0.0	0^+	13.45 s *5*	ABCDEFGHI	%β^-=100 $T_{1/2}$: measured by 2017Ga25 from fit to the decay curves of 1519- and 1591-keV γ transitions, ^{50}Ca beam produced in Ta(p,X),E=500 MeV at TRIUMF, and counted using GRIFFIN array of Ge detectors. Others: 13.9 s *6* (1970Wa29, from decay curve for 257γ); 14 s *3* (1968Ch11, from decay curve for all γ rays); 9 s *2* (1964Sh14, decay curves for 72γ and 258γ). Nuclear rms charge radius: $<r^2>^{1/2}$=3.517 fm *7* (2013An02, evaluation). Measured δr^2(^{40}Ca,^{50}Ca)=0.291 fm^2 *3*(stat) *12*(syst) (2016Ga34, using COLLAPS at ISOLDE-CERN; see also 2017Ne04 review article on measurements at this facility). Previous measurement: 0.276 fm^2 *34* (1992Ve02, online collinear laser spectroscopy). Measured isotope shift $\delta\nu$(^{40}Ca,^{50}Ca)=1969.2 MHz *9*(stat) *47*(syst) (2016Ga34, using COLLAPS at ISOLDE-CERN). Previous measurement: 1951 MHz *9*(stat) *20*(syst) (1992Ve02, online collinear laser spectroscopy). Measurement of isotope shift and rms radii: 1992Ve02, 2017Ne04.
1026.72 *10*	2^+	66.5 ps *21*	ABCDEFGHI	J^{π}: E2 1026.7γ to 0^+; L(t,p)=2 from 0^+. $T_{1/2}$: recoil-distance Doppler-shift method (2009Va06) in ^{208}Pb(^{48}Ca,Xγ). Other: 68.6 ps *55* from DSAM in (^{50}Ca,p′γ).
3002.1 *5*	(2^+)	<0.69 ps	AB DEFGH	J^{π}: L(t,p)=(2). L(t,p)=(4) and L(α,2p)=(4) are also proposed but in the latter case L=2 does not seem ruled out in figure 32 of 1990Fi07.
3531.7 *4*	$(1,2^+)$		AB E	XREF: E(3519). J^{π}: 3531.7γ to 0^+. Note that $J^{\pi}=0^+$ is suggested in 1968Br01, 1967Gl08 and 1966Ve06 in theoretical analyses of (t,p) results for a 3519 level observed by 1967Bj06. It is possible two separate levels are populated near this energy.
3997.22 *21*	(3^-)	<0.69 ps	DEFGHI	J^{π}: L(t,p)=(3). Inconsistent with L(α,2p)=4, but L=3 comparison of $\sigma(\theta)$ data was not shown in figure 32 of 1990Fi07.
4035.7 *4*	$(1,2^+)$		AB D	J^{π}: 4035.6γ to 0^+.
4475.8 *5*	(0^+)		A E	J^{π}: L(t,p)=(0).
4515.04 *14*	(4^+)	<1.04 ps	DE GHI	J^{π}: strong population in ^{238}U(^{48}Ca,Xγ) suggests yrast 4^+ level. L(t,p)=(3) for a 4517 *15* group is inconsistent.
4830.6 *3*	(4)	<0.69 ps	E GHI	J^{π}: L(t,p)=(4); (4^-) proposed in ^{238}U(^{48}Ca,Xγ) from γ to (3^-).
4870 *5*	(2^+)		G	J^{π}: 4870γ to 0^+. J=1 less likely to be populated in high-spin reaction.
4886.3 *5*	(1^-)		A E	J^{π}: L(t,p)=(1); 4886.0γ to 0^+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{50}Ca Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[a]	XREF	Comments
4.97×10^3 *5*	(4$^+$&5$^-$)[#]		F	J^{π},E(level): L(α,2p)=4+5 for a possible doublet.
5043 *15*	(1$^-$)		E	J^{π}: L(t,p)=(1).
5084.56 *25*	(4$^-$)[@]		I	
5109.88 *20*	(5$^-$)[@]	<0.69 ps	DE GHI	
5147.34 *17*	(5$^+$)[@]		I	
5168 *20*			E	
5281 *20*			E	
5362 *20*			E	
5434 *20*			E	
5516.92 *20*	(5$^-$)[@]		E I	J^{π}: L(t,p)=(4), but data were insufficient to get a reliable L value.
5576 *20*			E	J^{π}: L(t,p)=(4), but data were insufficient to get a reliable L value.
6519 *8*			A	%n≈100 Additional information 2.
6869.27 *25*	(7$^-$)[@]		I	
7039 *36*			A	%n≈100 Additional information 3.
7269 *46*			A	%n≈100 Additional information 4.
7309 *51*			A	%n≈100 Additional information 5.
7619 *66*			A	%n≈100 Additional information 6.
7999 *87*			A	%n≈100 Additional information 7.
8249 *97*			A	%n≈100 Additional information 8.
8.38×10^3 *5*	(7$^-$)[#]		F	
8.81×10^3 *12*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 9.
8.98×10^3 *5*	(7$^-$)[#]		F	
9239 *46*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 10.
9779 *72*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 11.
9.80×10^3 *5*	(6$^+$)[#]		F	J^{π}: 8$^+$ is not completely ruled out.
10.33×10^3 *5*	(8$^+$)[#]		F	J^{π}: 6$^+$ is not completely ruled out.
10430 *36*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 12.
1.055×10^4 *11*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 13.
11059 *36*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 14.
11479 *52*	(0$^-$,1$^-$)[&]		A	%n≈100 Additional information 15.

[†] For levels populated in γ-ray studies, values are from least-squares to γ-ray energies. For levels populated in particle-reaction studies, averages are taken when possible.
[‡] From DWBA analysis of σ(θ) in (t,p), except as noted. See (t,p) for additional tentative J^{π} assignments. For L(t,p) and L(α,2p) transfer reactions, target J^{π}=0$^+$. Most L(t,p) are considered by the evaluators as tentative values due either to disagreements with

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{50}Ca Levels (continued)

other reactions or to weak populations of levels.

From CCBA and DWBA analyses in (α,2p).

@ Tentative assignments in ^{238}U(^{48}Ca,Xγ) based on γ-decay pattern and possible model predictions. No supporting data are available for transition multipolarity assignments.

& From allowed β transition (log *ft*=4.1 to 4.9) from $0^{(-)}$ parent state.

a From RDDS method in ^{208}Pb(^{48}Ca,Xγ), unless otherwise stated.

γ(^{50}Ca)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.#	Comments
1026.72	2^+	1026.7 *1*	100	0.0	0^+	E2	B(E2)(W.u.)=0.68 *2* E_γ: weighted average of 1027.0 *5* from ^{50}K β^- decay (472 ms), 1026.2 *3* from (^{238}U,Xγ), and 1026.7 *1* from (^{48}Ca,Xγ). Others: 1027 *1* from ^{51}K β^-n decay (365 ms), 1027 *1* from ^{52}K β^-2n decay (110 ms), and 1028 *2* from (^{50}Ca,p′γ). Mult.: $\gamma(\theta)$ and linear polarization in ^{208}Pb(^{48}Ca,Xγ).
3002.1	(2^+)	1975.3 *5*	100	1026.72	2^+	(D)	E_γ: from β^- decay. Other: 1976 *1* from β^-n decay; 1978.2 *6* in ^{48}Ca(^{238}U,Xγ) is discrepant, possibly due to Doppler-shift effects. It is possible that 1978,2γ defined a level separate from 3002, (2^+), but there is no strong evidence for its existence.
3531.7	$(1,2^+)$	2504.5 *8*	100 *13*	1026.72	2^+		E_γ: weighted average of 2504.9 *5* from ^{50}K β^- decay (472 ms) and 2503 *1* from ^{51}K β^-n decay (365 ms). I_γ: from ^{50}K β^- decay . Other: 100 *17* from β^-n decay.
		3531.7 *4*	92 *13*	0.0	0^+		E_γ: weighted average of 3531.8 *5* from ^{50}K β^- decay (472 ms) and 3530 *2* from ^{51}K β^-n decay (365 ms). I_γ: from ^{50}K β^- decay . Other: 133 *17* from β^-n decay.
3997.22	(3^-)	2970.3 *3*	100	1026.72	2^+	D	E_γ: weighted average of 2964 *8* from (^{50}Ca,p′γ), 2971.4 *6* from (^{238}U,Xγ), and 2970.2 *2* from (^{48}Ca,Xγ).
4035.7	$(1,2^+)$	3008.8 *5*	60 *4*	1026.72	2^+		E_γ: weighted average of 3008.9 *5* from ^{50}K β^- decay and 3008 *2* from ^{51}K β^-n decay. I_γ: from ^{50}K β^- decay. Others: 60 *20* from ^{51}K β^-n decay and 75 *25* from (^{50}Ca,p′γ).
		4035.6‡ *5*	100 *6*	0.0	0^+		E_γ: weighted average of 4035.6 *5* from ^{50}K β^- decay and 4035 *2* from ^{51}K β^-n decay. Other: 4030 *18* from (^{50}Ca,p′γ). I_γ: from ^{50}K β^- decay. Others: 100 *20* from ^{51}K β^-n decay, and 100 *25* from (^{50}Ca,p′γ).
4475.8	(0^+)	3449.0‡ *5*	100	1026.72	2^+		
4515.04	(4^+)	518.4 *7*	2 *1*	3997.22	(3^-)		
		3488.2 *1*	100	1026.72	2^+	(E2)	E_γ: others: 3482 *14* from (^{50}Ca,p′γ) and 3488.4 *8* from (^{238}U,Xγ).
4830.6	(4)	833.4 *2*	100	3997.22	(3^-)	(D)	E_γ: weighted average of 833.9 *5* from (^{238}U,Xγ) and 833.3 *2* from (^{48}Ca,Xγ).
4870	(2^+)	4870 *5*		0.0	0^+		E_γ: from (^{238}U,Xγ) only.
4886.3	(1^-)	4886.0‡ *5*	100	0.0	0^+		
5084.56	(4^-)	1087.2 *3*	100	3997.22	(3^-)		
5109.88	(5^-)	594.9 *2*	100 *6*	4515.04	(4^+)	D	E_γ: weighted average of 603 *11* from (^{50}Ca,p′γ), 595.5 *3* from (^{238}U,Xγ), and 594.8 *1* from (^{48}Ca,Xγ).
		1112.6 *2*	6.8 *14*	3997.22	(3^-)		
5147.34	(5^+)	632.3 *1*	100	4515.04	(4^+)		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{50}Ca)$ (continued)

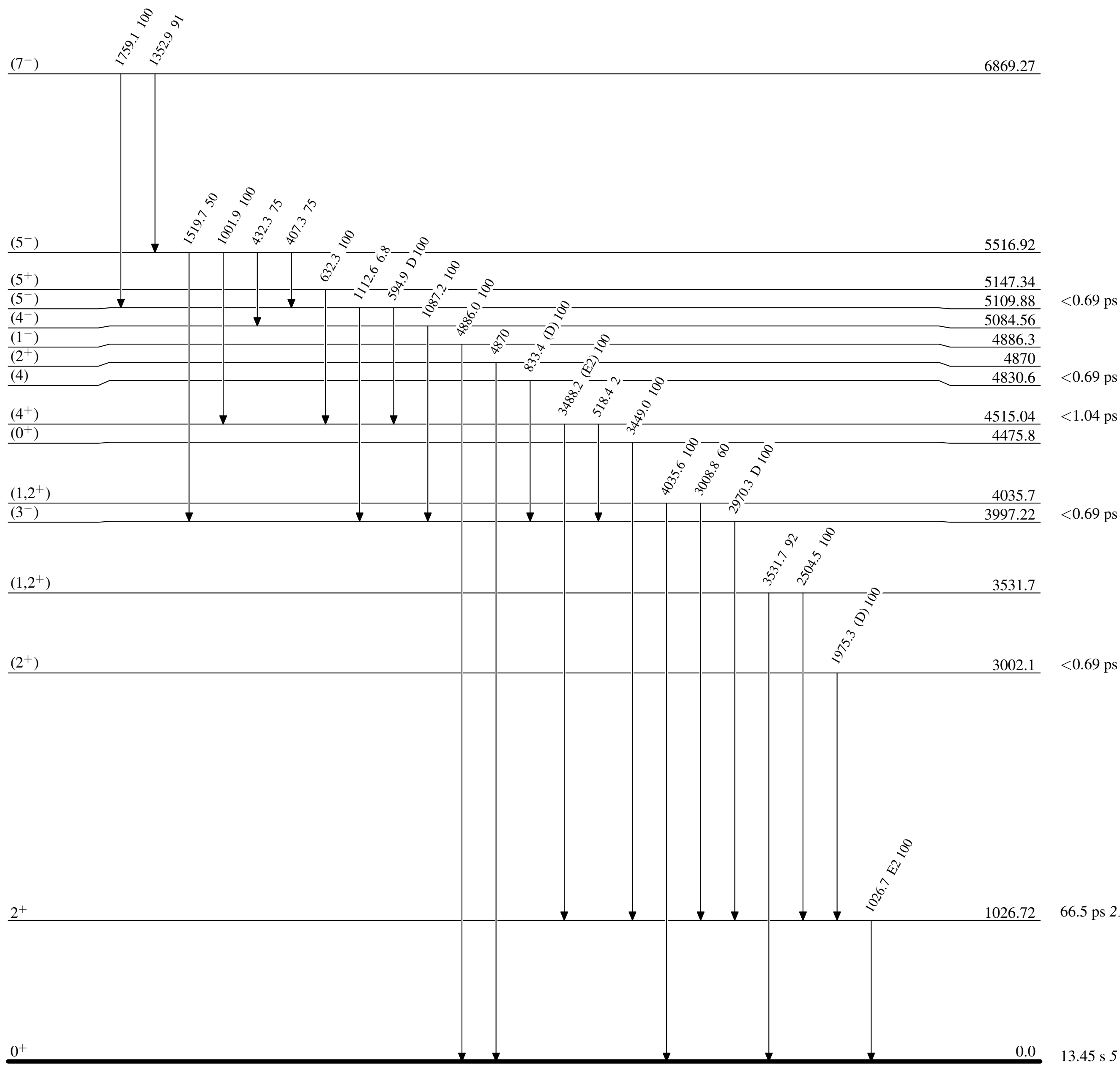
E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π
5516.92	(5⁻)	407.3 *2*	75 *13*	5109.88	(5⁻)
		432.3 *2*	75 *13*	5084.56	(4⁻)
		1001.9 *2*	100 *13*	4515.04	(4⁺)
		1519.7 *5*	50 *13*	3997.22	(3⁻)
6869.27	(7⁻)	1352.9 *3*	91 *18*	5516.92	(5⁻)
		1759.1 *2*	100 *9*	5109.88	(5⁻)

† From $^{238}U(^{48}Ca,X\gamma)$, unless stated otherwise.
‡ From β^- decay.
# From $\gamma(\theta)$ in $^{208}Pb(^{48}Ca,X\gamma)$, unless otherwise stated.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{50}_{20}Ca_{30}$

Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Yang Dong, Huo Junde	NDS 128, 185 (2015)	10-Jul-2015

Q(β^-)=5.90×10^3 *14*; S(n)=6.00×10^3 *6*; S(p)=1.904×10^4 *6*; Q(α)=−14250 *SY* 2012Wa38
ΔQ(α)=300 (2012Wa38).
All data are from ^{52}K β^- decay, except as noted.

^{52}Ca Levels

Cross Reference (XREF) Flags

A	^{52}K β^- decay
B	^{53}K β^-n decay:30 ms
C	^{9}Be(^{54}Ti,^{52}CaXγ)
D	^{48}Ca(^{238}U,Xγ)

E(level)	J$^\pi$	T$_{1/2}$	XREF	Comments
0	0$^+$	4.6 s *3*	ABCD	%β^-=100; %β^-n=? T$_{1/2}$: from n-β(t) (1985Hu03).
2563 *1*	2$^+$		ABCD	J$^\pi$: from systematics of even-even Ca isotopic chain.
3150 *2*			AB	
3990 *2*	(3$^-$)		A CD	J$^\pi$: from systematics of even-even Ca isotopic chain.
5190 *20*			A	
5550 *30*			A	
5760 *40*			A	
5950 *40*			A	
5951 *2*			A	
6700 *50*			A	
6940 *80*			A	
7160 *20*			A	
7410 *50*			A	
7570 *35*			A	
8090 *20*			A	
829×10^1 *12*			A	
8370 *80*			A	
8580 *50*			A	
8710 *80*			A	
895×10^1 *16*			A	
9130 *40*			A	
939×10^1 *12*			A	
963×10^1 *15*			A	
1014×10^1 *22*			A	
1050×10^1 *15*			A	
1110×10^1 *52*			A	

Adopted Levels, Gammas (continued)

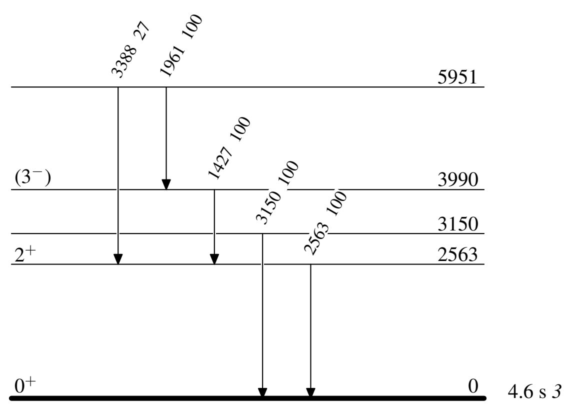
$\gamma(^{52}Ca)$

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f
2563	2^+	2563 *1*	100	0	0^+
3150		3150 *2*	100	0	0^+
3990	(3^-)	1427 *1*	100	2563	2^+
5951		1961 *1*	100 *13*	3990	(3^-)
		3388 *2*	27 *4*	2563	2^+

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{52}_{20}Ca_{32}$

Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Yang Dong, Huo Junde	NDS 121, 1 (2014)	20-Jun-2014

Q(β^-)=8820 *SY*; S(n)=4390 *SY*; S(p)=20390 *SY*; Q(α)=−14280 *SY* 2012Wa38
ΔQ(β^-): syst=620.
ΔS(n): syst=640.
ΔS(p): syst=710.
ΔQ(α): syst=710.
Additional information 1.
^{54}Ca was observed by 1997Be70, Be(^{238}U,X) E=750 MeV/nucleon, measured projectile fission fragment yield, fragment separator, tof techniques.

^{54}Ca Levels

Cross Reference (XREF) Flags

A ^{9}Be(^{76}Ge,X)
B Be(^{55}Sc,P),(^{56}Ti,2p)

E(level)	J$^{\pi}$†	T$_{1/2}$	XREF	Comments
0.0	0$^+$	107 ms *14*	AB	%β^-=100; %β^-n=?; %β^-2n=? (2012Au07) T$_{1/2}$: From ^{9}Be(^{76}Ge,X).
2043 *19*	(2$^+$)		B	
3699 *28*	(3$^-$)		B	

† From systematics of even-even nuclei.

γ(^{54}Ca)

E$_i$(level)	J$^{\pi}_i$	E$_\gamma$	E$_f$	J$^{\pi}_f$
2043	(2$^+$)	2043 *19*	0.0	0$^+$
3699	(3$^-$)	1656 *20*	2043	(2$^+$)

Adopted Levels, Gammas

Level Scheme