^{42}Ca(p,p′γ) 1970La22,1969Ko03

History

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

See also ^{42}Ca(p,p′).

1970La22: E=7.03 MeV proton beam was produced at the University of Liverpool EN tandem accelerator. A target of 200 μg/cm^2 thick enriched ^{42}Ca. Protons were detected in an annular silicon surface barrier detector and γ-rays were detected in NaI crystals. Measured Eγ, Iγ, E(p), pγ(θ). Deduced levels, J^π, branching ratios, mixing ratios.

1969Ko03: E=7.8 MeV proton beam was produced at the MIT cyclotron. A target of 1.19 mg/cm^2 enriched ^{42}Ca (93.7%). Scattered protons were detected by a solid state detector and γ-rays were detected with a Ge(Li) detector. Measured Eγ, Iγ, lifetimes by Doppler-shift attenuation method. Deduced levels, branching ratios, transition strengths.

1969Sc31: E=6.5 to 6.9 MeV. Measured pγ(θ) for γ rays from 2420 and 3666 levels.

1969Te05: E=12 MeV. Measured branching ratios from 3440, 3950, 4100 and 4420 levels.

1985Le17: E=5 MeV. Measured pγ coin, lifetime of 1836 level by electronic timing.

1976Ul01, 1961Be19 (also 1960Be07): E=4.4 MeV. Measured E0 electron-positron pairs and internal-conversion electrons corresponding to the g.s. E0 transition from 1840, 0^+ state.

1971RoYQ: measured γ rays.

1969Ho33: E=6.7, 7.7 MeV. Measured B(E1) ratios in decay of 3447, 3^- level.

Others: 1985Ki07, 1984Pa15, 1984Pa16, 1982Mi06.

^{42}Ca Levels

E(level)[†]	J^π[#]	$T_{1/2}$[@]	Comments
0	0^+		
1523	2^+	1.11 ps *21*	
1836	0^+	387[&] ps *6*	
2422	2^+	0.21 ps *5*	
2750	4^+	2.4 ps *+76−2*	
3191	6^+	>0.5 ps	
3250	4^+	0.21 ps *+10−7*	
3297	0^+	>1 ps	Measured upper limit of branching <1% for γ to g.s. and <2% for γ to 1836, 0^+ level.
3389	2^+	0.23 ps *5*	
3442	3^-	0.45 ps *14*	
3651	2^+	0.04 ps *+6−4*	
3883	1^-		
3950[‡]	4^-		
4000[a]	4^+		
4043	3^-		
4090	5^-		
4113	3^-		
4230	1		
4350			
4417[‡]	3^-		
4442[‡]	4^+		
4450[‡]	2^+		

[†] From 1969Ko03, unless otherwise stated.
[‡] From 1969Te05.
[#] From Adopted Levels.
[@] From Doppler-shift attenuation method (1969Ko03), except where noted.
[&] From pγ(t) (1985Le17).
[a] From 1970La22.

^{42}Ca(p,p′γ) 1970La22,1969Ko03 (continued)

γ(^{42}Ca)

A_2 and A_4 are from 1970La22.

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	$I_{(\gamma+ce)}$	Comments
1523	2+	1523	100	0	0+				
1836	0+	313	100	1523	2+				(1840p)(1523γ)(θ): A_2=+0.02 *4*, A_4=−0.03 *4*. Additional information 1.
		1836		0	0+	E0		2.05 *17*	ρ=0.34 *3* (1976Ul01). Other: 0.41 *4* (1961Be19). $I_{(\gamma+ce)}$: from 1976Ul01. Mult.: from the shape of the positron spectrum and the ratio I(e±)/I(ce(K))=9.0 *18* (1961Be19). Additional information 2.
2422	2+	585	≤1.5	1836	0+				
		899	100 *2*	1523	2+	M1+E2	−0.17 *2*		A_2=+0.21 *3*; A_4=+0.01 *3* δ: weighted average of −0.09 *8* (1970La22) and −0.18 *2* (1969Sc31).
		2422	44 *2*	0	0+	E2			A_2=+0.48 *6*; A_4=+0.01 *8* (2420p)(1523γ)(θ): A_2=+0.29 *2*, A_4=+0.06 *3*.
2750	4+	328	2.6[&] *16*	2422	2+				
		1227	100.0 *4*	1523	2+	E2			A_2=+0.55 *8*; A_4=−0.28 *11* (2750p)(1523γ)(θ): A_2=+0.46 *3*, A_4=−0.23 *4*.
3191	6+	440	100	2750	4+				
3250	4+	500	64 *7*	2750	4+				A_2=+0.50 *3*; A_4=−0.20 *4* δ: −0.3 to +2.0.
		828	18[&] *9*	2422	2+				
		1727	100 *7*	1523	2+				A_2=+0.38 *1*; A_4=0.00 *2* δ(O/Q)=+0.05 *14*. (3250p)(1227γ)(θ): A_2=+0.40 *18*, A_4=−0.14 *22*.
3297	0+	875	100 *1*	2422	2+				
		1774	8[&] *4*	1523	2+				(3300p)(899γ)(θ): A_2=−0.04 *4*, A_4=−0.12 *8*. (3300p)(1523γ)(θ): A_2=−0.02 *6*, A_4=+0.03 *9*. (3300p)(2422γ)(θ): A_2=+0.05 *9*, A_4=−0.10 *11*.
3389	2+	968	5 *4*	2422	2+				I_γ: from 1969Ko03. Iγ=45 *4* in 1970La22.
		1553	16 *3*	1836	0+				
		1866	100 *4*	1523	2+	M1+E2	+1.7 *−3+5*		A_2=+0.60 *4*; A_4=−0.28 *6*
		3389	89 *8*	0	0+				A_2=+0.55 *7*; A_4=−0.95 *9* (3390p)(1523γ)(θ): A_2=+0.20 *2*, A_4=−0.08 *3*.
3442	3−	693	4[d] *2*	2750	4+				I_γ: 17 (1969Te05).
		1021	59[d] *2*	2422	2+				
		1920	100[d] *3*	1523	2+	D(+Q)	+0.02 *7*		A_2=−0.26 *4*; A_4=−0.02 *4*
		3443[e]	≤3[d]	0	0+	[E3]			(3440p)(1523γ)(θ): A_2=+0.23 *2*, A_4=−0.07 *2*. (3440p)(2422γ)(θ): A_2=+0.55 *10*, A_4=−0.40 *13*.
3651	2+	1230	4 *1*	2422	2+				
		1815	<2.5	1836	0+				I_γ: from 1970La22. Other: 12 *5* (1969Ko03).

Continued on next page (footnotes at end of table)

^{42}Ca(p,p′γ) 1970La22,1969Ko03 (continued)

γ(^{42}Ca) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	Comments
3651	2+	2128	100 *3*	1523	2+	D(+Q)	0.00 *10*	A_2=+0.29 *3*; A_4=+0.02 *3* δ: other: −0.08 *−3+10* or +2.7 *+3−7* (1969Sc31).
		3651	22 *1*	0	0+			A_2=+0.41 *9*; A_4=+0.60 *10* (3650p)(1523γ)(θ): A_2=+0.20 *2*, A_4=−0.49 *2*.
3883	1−	1461	4 *2*	2422	2+			
		2046	96 *4*	1836	0+			A_2=−0.65 *6*; A_4=+0.04 *6*
		3883	100 *4*	0	0+			A_2=−0.51 *1*; A_4=−0.06 *3* (3880p)(1523γ)(θ): A_2=+0.02 *9*, A_4=+0.02 *10*.
3950	4−	510	<67[a]	3442	3−			
		1200	100[a]	2750	4+			
4000	4+	1248	6[b] *3*	2750	4+			
		1577	45[b] *5*	2422	2+			
		2475	100[b] *5*	1523	2+			A_2=+0.05 *3*; A_4=+0.43 *4* (4000p)(1523γ)(θ): A_2=+0.20 *5*, A_4=+0.35 *6*. (4000p)(899γ)(θ): A_2=+0.03 *10*, A_4=+0.12 *12*.
4043	3−	600	22[@] *5*	3442	3−			
		1293	21[@] *16*	2750	4+			
		1621	29[@] *10*	2422	2+			
		2520	100[@] *14*	1523	2+			A_2=−0.03 *7*; A_4=+0.07 *8*
4090	5−	650	14[a] *2*	3442	3−			
		903	100[a] *15*	3191	6+			
		1343	29[a] *4*	2750	4+			
4113	3−	1687	19[c] *6*	2422	2+			
		2585	100[c] *9*	1523	2+			A_2=+0.22 *3*; A_4=−0.04 *3* (4110p)(1523γ)(θ): A_2=+0.12 *1*, A_4=−0.04 *1*.
4230	1	1809	25[b] *5*	2422	2+			
		4231	100[b] *5*	0	0+			A_2=−0.05 *10*; A_4=−0.03 *12* (4230p)(1523γ)(θ): A_2=+0.30 *7*, A_4=−0.09 *9*.
4350		1100	<60[@]	3250	4+			
		1160	<100[@]	3191	6+			
		1600	100[@] *50*	2750	4+			
		2827	<40[@]	1523	2+			
4417	3−	977	43[a] *6*	3442	3−			
		2897	100[a] *15*	1523	2+			
4442	4+	1692	100[a]	2750	4+			
4450	2+	4450	100[a]	0	0+			

[†] Level-energy differences.
[‡] Weighted averages from 1970La22 and 1969Ko03, except when noted.
[#] From pγ(θ) data of 1970La22, except when noted.
[@] From 1969Ko03.
[&] Unweighted average of 1970La22 and 1969Ko03.
[a] From 1969Te05.
[b] From 1970La22.
[c] Unweighted average of 1969Ko03 and 1969Te05.
[d] From 1969Ho33.
[e] Placement of transition in the level scheme is uncertain.

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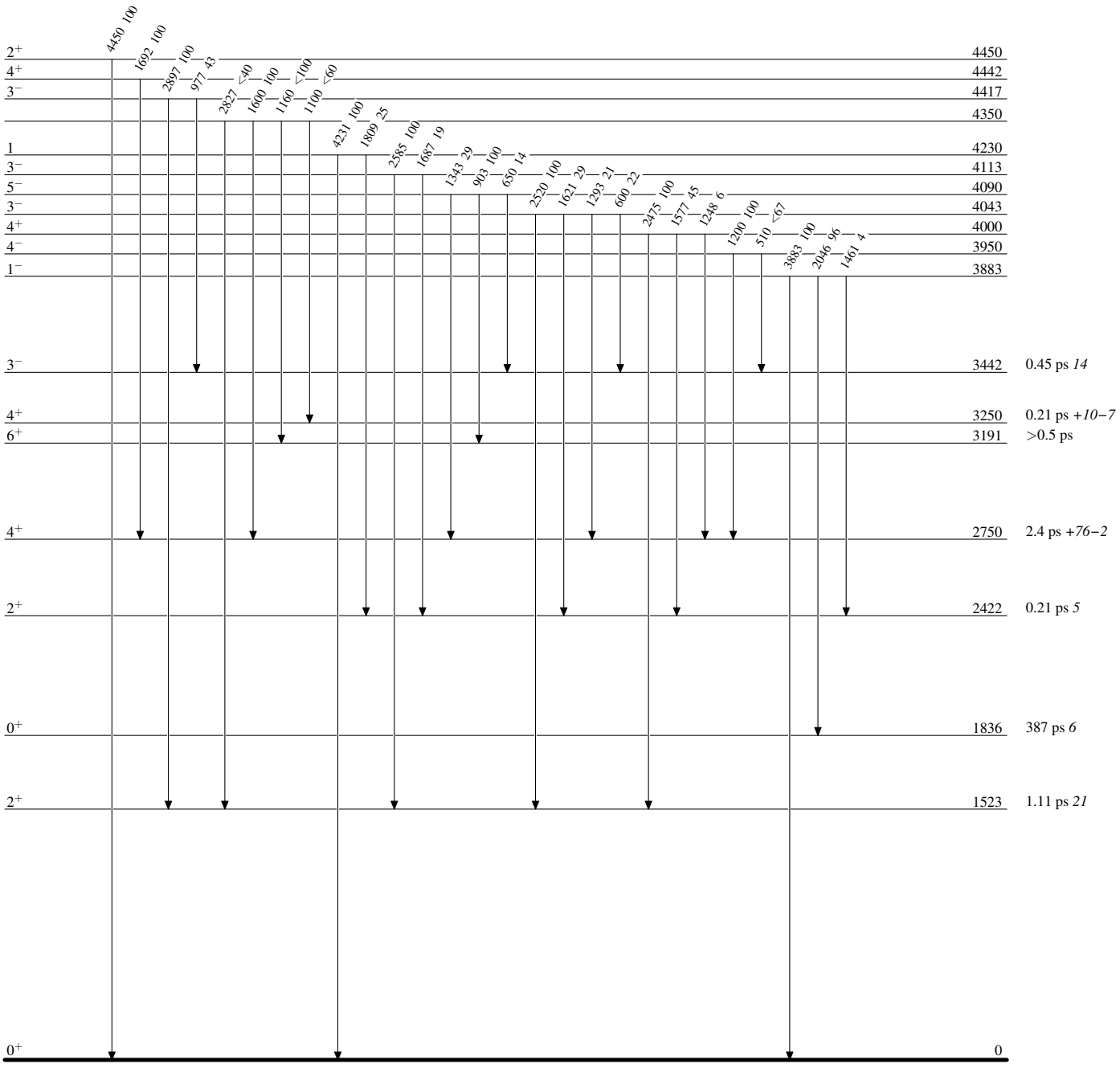
Level Scheme

Intensities: Relative photon branching from each level



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

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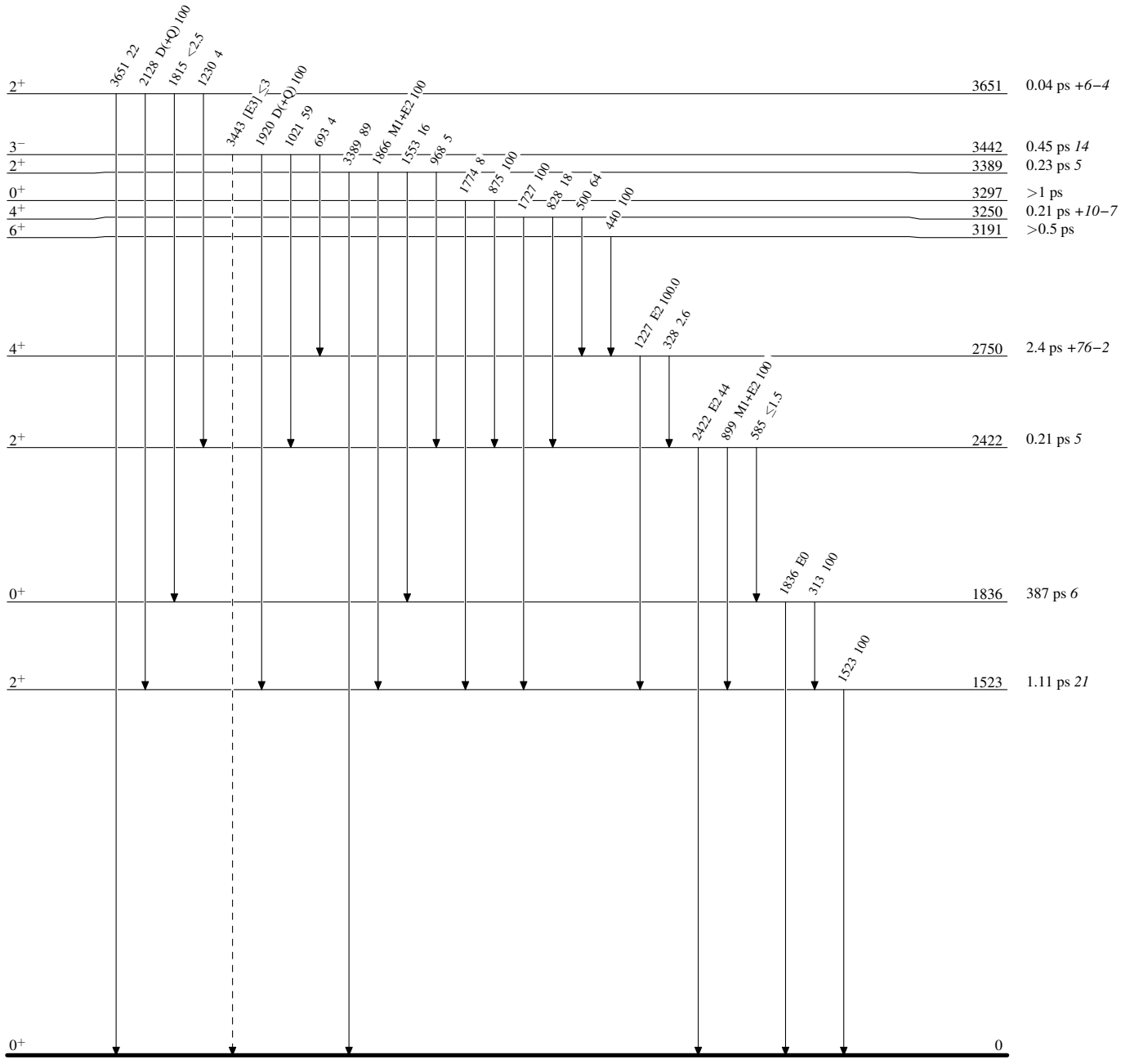
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



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