^{37}Cl(α,nγ) 1973Da18,1971Ja15,1971We09

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

1973Da18(also 1974Th07): E=6.90-8.00 MeV alpha beams were produced from the Liverpool University tandem accelerator. Targets are $BaCl_2$ (96.5% in ^{37}Cl) on gold backings with thickness of 1-5 mg/cm^2. γ rays were detected with a Ge(Li) detector, a NaI(Tl) detector and a Si(Li) detector. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$. Deduced levels, J, π, γ-ray branching ratios. Comparisons with shell-model calculations. $\gamma(\theta)$ and γ(lin pol) for γ rays from 2291, 2543, 2787 and 2879 levels were measured by 1974Th07.

1971Ja15: E=6.25, 7.00, 8.00 MeV alpha beams were produced at the Oliver Lodge Laboratory at the University of Liverpool. Targets 1 mg/cm^2 $PbCl_2$ (66% enriched in ^{37}Cl) or $BaCl_2$ (95% enriched) on a gold backing. γ rays were detected by a Ge(Li) and a NaI(Tl) detector. Measured Eγ, Iγ, $\gamma\gamma$-coin, Doppler-shift attenuation. Deduced levels, J, π, lifetimes, transition strengths. Comparisons with available data and shell-model calculations.

1971We09 (also 1970Ba34): E=6.0-7.4 MeV alpha beams were produced from the Frankfurt 7 MV Van de Graaff accelerator. Target was 400 μg/cm^2 AgCl (99% enriched in ^{37}Cl) evaporated on a tantalum backing. γ rays were detected with a Ge(Li) detector (FWHM=2.8 keV at 1.33 MeV). Measured Eγ, Iγ, Doppler-shift attenuation. Deduced levels, lifetimes. 1971We09 and 1970Ba34 also study ^{40}K in (p,nγ).

Others:

1974Br12: E=5.0 MeV. Measured $\gamma(\theta$,H,t), lifetime by pulsed beam for 30-keV level.

1973Gr19: E=8.5, 9.5 MeV. Measured lifetime for 2542 level by Recoil-Distance Doppler Shift Method.

1970SkZZ: E=14 MeV. Measured Eγ, Iγ.

1969Ka18: E≈threshold. Measured lifetimes using DSAM. No data reported.

Level scheme is taken from 1973Da18.

^{40}K Levels

E(level)[†]	J$^\pi$[#]	$T_{1/2}$[&]	Comments
0	4$^-$		
29.94 *23*	3$^-$	4.30 ns *6*	g=−0.43 *3* (1974Br12) $T_{1/2}$: from γ(t) in 1974Br12.
800.6 *3*	2$^-$	0.28[a] ps *7*	Additional information 1.
891.0 *3*	5$^-$	0.78[a] ps *18*	Additional information 2.
1644.5 *5*	0$^+$		
1959.60 *25*	2$^+$	0.69[a] ps *18*	Additional information 3.
2047.0[‡] *10*	2$^-$	0.37[a] ps *11*	Additional information 4.
2069.7 *5*	3$^-$	0.43[a] ps *12*	Additional information 5.
2103.6 *4*	1$^-$	0.53[a] ps *14*	Additional information 6.
2260.6[‡] *10*	3$^+$	59[a] fs *17*	Additional information 7.
2290.8 *5*	1$^+$	76[a] fs *21*	Additional information 8.
2290.83 *18*	3$^-$	0.15[a] ps *3*	J$^\pi$: 3$^-$ is preferred by $\gamma(\theta)$ and γ(lin pol) in 1974Th07, but 4$^+$ is possible. Additional information 9.
2398.04 *24*	4$^-$	35 fs *14*	$T_{1/2}$: from 1971We09. Other: <50 fs (1971Ja15).
2420.0 *3*	2$^-$	0.46 ps *+30−18*	$T_{1/2}$: other: >0.7 ps (1971We09).
2542.5 *5*	7$^+$[@]	1.05 ns *17*	$T_{1/2}$: from mean lifetime of 1.51 ns *25*, weighted average of 1.52 ns *25* and 1.48 ns *35* measured by 1973Gr19 using Recoil-Distance method (RDM). Other: 2.1 ps to 35 ns (1971Ja15).
2576.1 *3*	2$^+$	78[a] fs *25*	Additional information 10.
2627.0 *4*	0$^-$	0.21[a] ps *7*	Additional information 11.
2731.4 *8*	1	<50 fs	
2747.76 *23*	3$^-$	0.19 ps *11*	
2756.9 *3*	2$^+$	<21 fs	
2787.2 *3*	3$^+$[@]		
2787.29 *22*	3$^-$,4$^-$	55 fs *21*	
2809.2 *4*	(1,2)$^-$	0.10 ps *7*	

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^{37}Cl(α,nγ) 1973Da18,1971Ja15,1971We09 (continued)

^{40}K Levels (continued)

E(level)[†]	J$^\pi$[#]	T$_{1/2}$[&]	Comments
2878.9 *6*	6$^{(+)}$[@]	0.27 ps *10*	J$^\pi$: 6$^+$ is favored by γ(lin pol) (1974Th07).
2950.9 *6*		35 fs *21*	
2987.8 *6*	(2$^-$,3$^+$)	69 fs *28*	
3028.2 *4*	(2$^-$,3$^+$)	<50 fs	
3099.7 *8*	(4,5)$^+$	69 fs *21*	
3128.5 *8*	(2$^-$,3$^+$)	<21 fs	
3147.5 *4*	1$^{(-)}$		
3155.2 *8*	(2$^-$,3,4$^+$)	<21 fs	
3229.9 *6*	2$^-$		

[†] From a least-squares fit to γ-ray energies, unless otherwise noted.
[‡] From 1971Ja15.
[#] From Adopted Levels, unless otherwise noted.
[@] From 1974Th07 based on $\gamma(\theta)$ and/or γ(lin pol).
[&] From 1971Ja15 using DSAM, unless otherwise noted. An estimated uncertainty of about 25% due to slowing down is included.
[a] Weighted average of values form 1971Ja15 and 1971We09 using DSAM. An estimated uncertainty of about 30% due to slowing down is included in data from 1971We09.

γ(^{40}K)

E$_i$(level)	J$_i^\pi$	E$_\gamma$[†]	I$_\gamma$[†]	E$_f$	J$_f^\pi$	Mult.[#]	δ[#]	Comments
29.94	3$^-$	29.9	100	0	4$^-$			E$_\gamma$: This transition was detected in 1973Da18 with a Si(Li) detector.
800.6	2$^-$	770.7	100	29.94	3$^-$			
891.0	5$^-$	891.0	100	0	4$^-$			
1644.5	0$^+$	843.9	20[‡] *5*	800.6	2$^-$			
		1614.5	80[‡] *5*	29.94	3$^-$			
1959.60	2$^+$	1158.9 *2*	82 *2*	800.6	2$^-$			
		1929.6 *2*	18 *2*	29.94	3$^-$			Iγ(1930)/Iγ(1159)=22 *5*/78 *5* (1971Ja15).
2047.0	2$^-$	1246.4	40[‡] *5*	800.6	2$^-$			
		2017.0	35[‡] *5*	29.94	3$^-$			
		2046.9	25[‡] *5*	0	4$^-$			
2069.7	3$^-$	1178.4 *6*	3 *1*	891.0	5$^-$			Iγ(1178)/Iγ(1269)/Iγ(2041)/Iγ(2070)=2 *1*/8 *2*/56 *5*/34 *5* (1971Ja15).
		1268.9 *6*	5 *1*	800.6	2$^-$			
		2041.0 *9*	47 *3*	29.94	3$^-$			
		2069.6	45 *3*	0	4$^-$			
2103.6	1$^-$	1303.6 *5*	22 *4*	800.6	2$^-$			Iγ(1304)/Iγ(2073)=32 *5*/68 *5* (1971Ja15).
		2073.1 *4*	78 *4*	29.94	3$^-$			
2260.6	3$^+$	2230.6	85[‡] *3*	29.94	3$^-$			
		2260.5	15[‡] *3*	0	4$^-$			
2290.8	1$^+$	221.1[@]	<2	2069.7	3$^-$			
		331.2	8 *2*	1959.60	2$^+$			
		646.2 *4*	59 *4*	1644.5	0$^+$			
		1490.3 *5*	33 *3*	800.6	2$^-$			Iγ(1490)/Iγ(646)=38 *5*/62 *5* (1971Ja15).
2290.83	3$^-$	1400.0 *4*	19 *3*	891.0	5$^-$			Iγ(1400)/Iγ(2291)=15 *2*/85 *2* (1971Ja15).
		2290.8 *2*	81 *3*	0	4$^-$	(M1+E2)	−0.9 *4*	δ: for J=3$^-$. A$_2$=+0.40 *1*, A$_4$=−0.09 *2*, POL=−0.67 *8* (1974Th07).
2398.04	4$^-$	2367.9 *3*	70 *4*	29.94	3$^-$			

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^{37}Cl(α,nγ) 1973Da18,1971Ja15,1971We09 (continued)

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

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	δ[#]	Comments
2398.04	4^-	2398.1 *3*	30 *4*	0	4^-			Iγ(2398)/Iγ(2368)=35 *10*/65 *10* (1971Ja15).
2420.0	2^-	460.4[@]	<2	1959.60	2^+			
		1619.6 *2*	79 *3*	800.6	2^-			
		2389.7 *3*	15 *2*	29.94	3^-			Iγ(2390)/Iγ(1620)=10 *5*/90 *5* (1971Ja15).
		2419.4 *5*	6 *1*	0	4^-			
2542.5	7^+	1651.5 *5*	88 *2*	891.0	5^-	M2(+E3)	0.00 *3*	I_γ: 100 (1971Ja15). A_2=+0.56 *4*, A_4=−0.27 *4*, POL=−0.68 *8* (1974Th07).
		2542.4 *10*	12 *2*	0	4^-			
2576.1	2^+	2546.1 *2*	100	29.94	3^-			
2627.0	0^-	523.3 *5*	70 *3*	2103.6	1^-			
		667.4[@]	<5	1959.60	2^+			
		1826.4 *2*	30 *3*	800.6	2^-			Iγ(1826)/Iγ(523)<20/100 (1971Ja15).
2731.4	1	440.6[@]	<12	2290.8	1^+			
		1086.9 *6*	94 *4*	1644.5	0^+			I_γ: 100 (1971Ja15).
		1930.7	6 *4*	800.6	2^-			
2747.76	3^-	678.1[@]	<3	2069.7	3^-			
		789 *1*	4 *1*	1959.60	2^+			Iγ(789)/Iγ(2718)/Iγ(2748)=10 *3*/60 *10*/30 *10* (1971Ja15).
		2717.7 *2*	64 *5*	29.94	3^-			
		2747.7 *3*	32 *3*	0	4^-			
2756.9	2^+	1956.0 *2*	66 *3*	800.6	2^-			
		2727.3 *3*	34 *3*	29.94	3^-			Iγ(2727)/Iγ(1956)=38 *12*/62 *12* (1971Ja15).
2787.2	3^+	827.60 *25*	22 *3*	1959.60	2^+			Iγ(828)/Iγ(2757)=19 *5*/27 *8* (1971Ja15).
		2757.2 *3*	78 *3*	29.94	3^-	E1(+M2)	−0.09 +*22*−*5*	A_2=+0.35 *2*, A_4=−0.01 *2*, POL=−1.02 *20* (1974Th07).
2787.29	3^-,4^-	496.8 *5*	40 *8*	2290.83	3^-			
		1896.3 *5*	19 *8*	891.0	5^-			Iγ(1896)/Iγ(496)/Iγ(2787)=12 *1*/19 *2*/23 *2* (1971Ja15).
		2787.10 *25*	41 *8*	0	4^-			
2809.2	$(1,2)^-$	2008.5 *2*	100	800.6	2^-			
2878.9	$6^{(+)}$	336.4 *4*	62 *4*	2542.5	7^+			
		1987.8 *7*	38 *4*	891.0	5^-	D(+Q)	−0.06 +*4*−*5*	A_2=−0.33 *5*, A_4=−0.10 *6*, POL=+0.32 *26* (1974Th07). Iγ(1988)/Iγ(336)=40 *5*/60 *5* (1971Ja15).
2950.9		2950.8 *6*	100	0	4^-			
2987.8	$(2^-,3^+)$	2186.2 *10*	15 *10*	800.6	2^-			Iγ(2186)/Iγ(2958)=65 *35*/35 *35* (1971Ja15).
		2958.1 *6*	85 *10*	29.94	3^-			
3028.2	$(2^-,3^+)$	737.5 *5*	23 *4*	2290.83	3^-			
		1068.2 *5*	54 *5*	1959.60	2^+			
		3028.8 *8*	23 *4*	0	4^-			I_γ: 100 (1971Ja15).
3099.7	$(4,5)^+$	2208.7 *7*	45 *10*	891.0	5^-			Iγ(2209)/Iγ(3100)=35 *7*/65 *7* (1971Ja15).
		3099.6	55 *10*	0	4^-			
3128.5	$(2^-,3^+)$	1081.5[@]	<10	2047.0	2^-			
		3098.4	53 *10*	29.94	3^-			
		3128.4 *8*	47 *10*	0	4^-			I_γ: 100 (1971Ja15).
3147.5	$1^{(-)}$	1503.1 *4*	33 *5*	1644.5	0^+			
		2346.8 *2*	67 *5*	800.6	2^-			
3155.2	$(2^-,3,4^+)$	3155.1 *8*	100	0	4^-			
3229.9	2^-	2428.4 *10*	<16	800.6	2^-			

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^{37}Cl(α,nγ) 1973Da18,1971Ja15,1971We09 (continued)

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

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π
3229.9	2$^-$	3201.1 *10*	75 *6*	29.94	3$^-$
		3229.4 *10*	25 *6*	0	4$^-$

† From 1973Da18, unless otherwise noted. Values of Eγ without uncertainties are from level-energy differences. Quoted values of Iγ are % branching from each level.
‡ From 1971Ja15.
# Based on measured $\gamma(\theta)$ and γ(lin pol) in 1974Th07.
@ Placement of transition in the level scheme is uncertain.

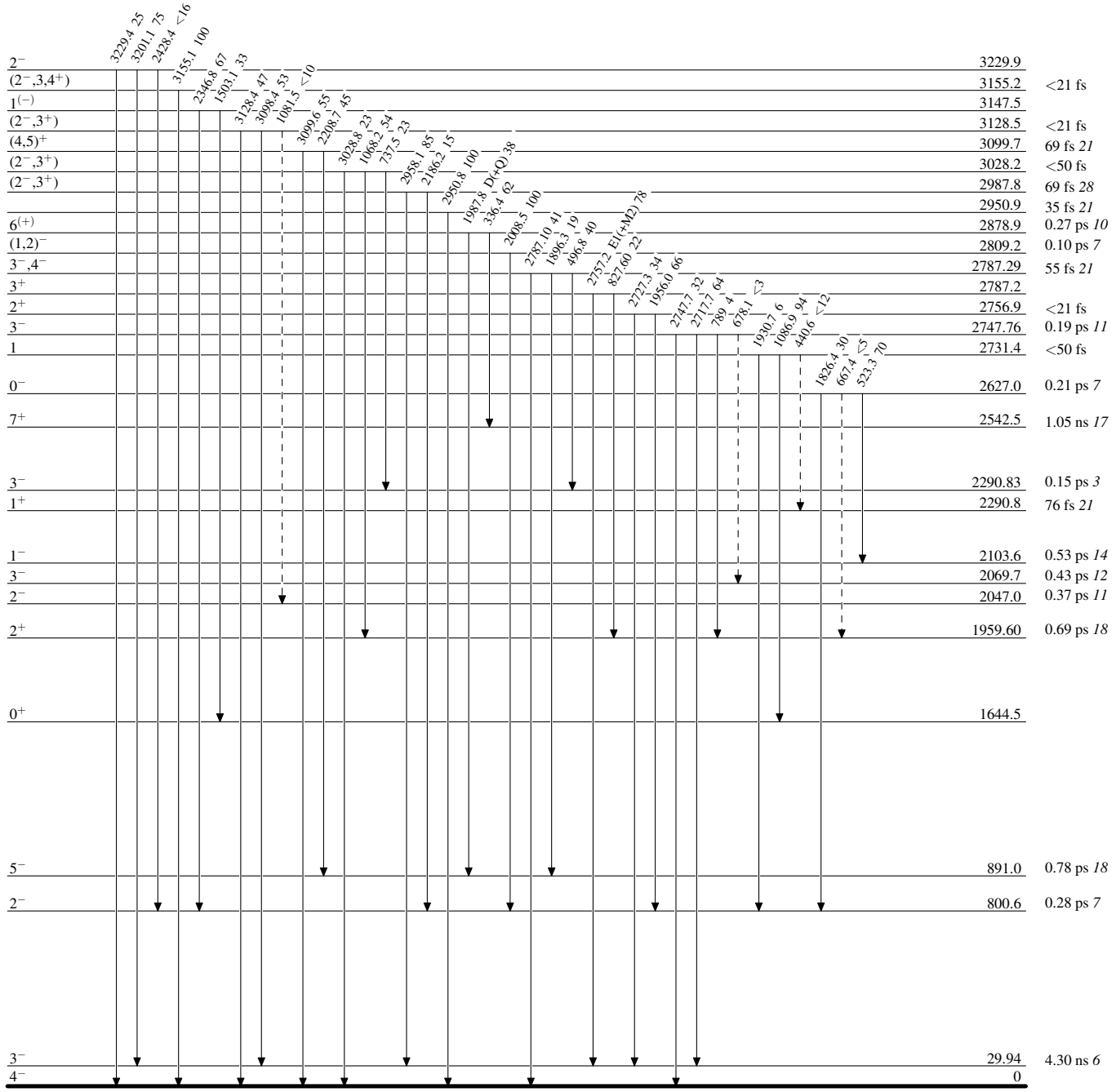
^{37}Cl(α,nγ) 1973Da18,1971Ja15,1971We09

Legend

Level Scheme

Intensities: % photon branching from each level

γ Decay (Uncertain)



$^{40}_{19}K_{21}$

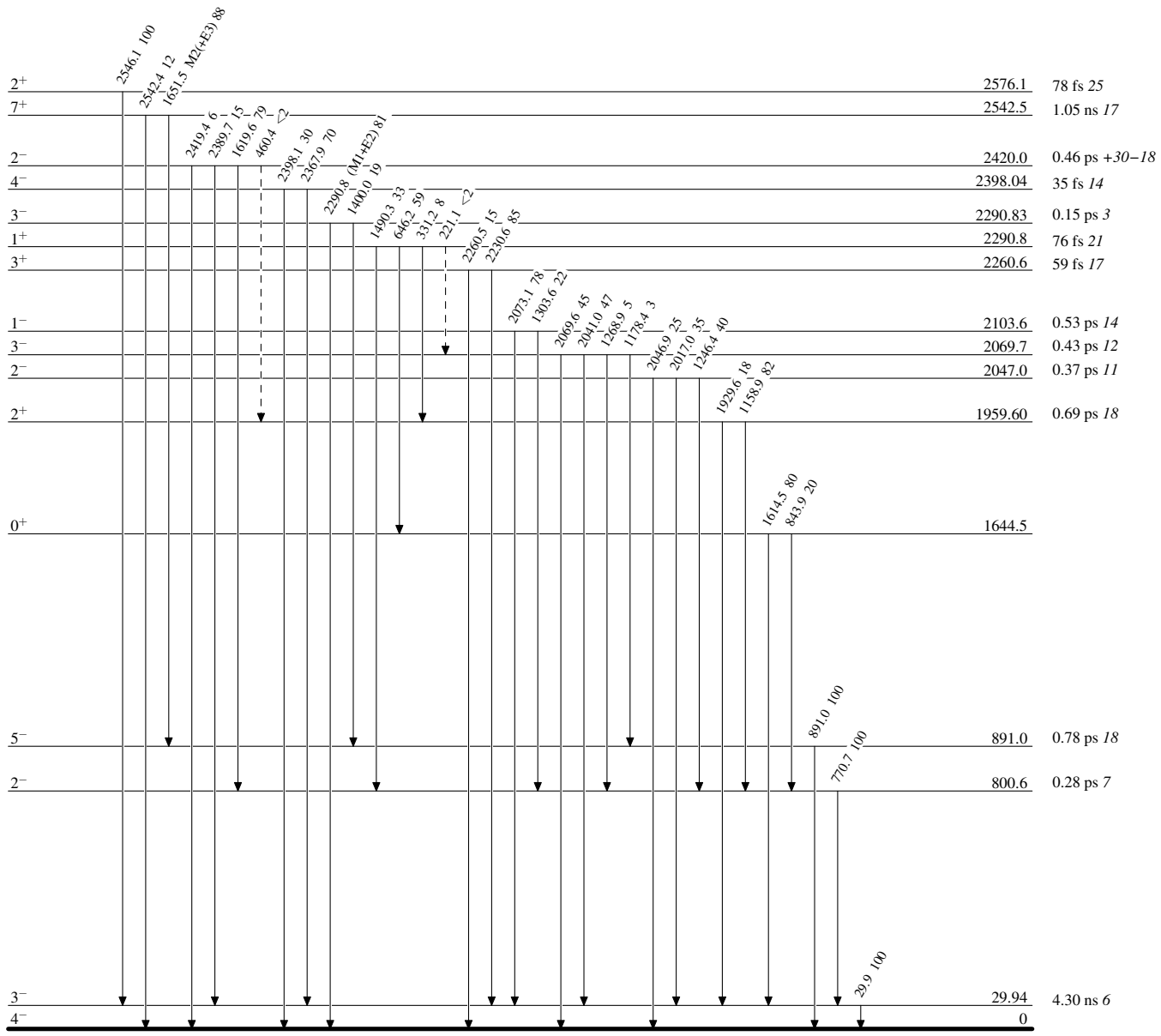
^{37}Cl(α,nγ) 1973Da18,1971Ja15,1971We09

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

γ Decay (Uncertain)



$^{40}_{19}K_{21}$