^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja, E. A. Mccutchan	NDS 133, 1 (2016)	30-Sep-2015

Main references:
^{2}H(^{40}Ca,pγ): 1978Be20.
^{40}Ca(d,pγ): 1987Ta03, 1980Sa14, 1975Ta13, 1974Mc01, 1971Fo09, 1970Jo03.

1987Ta03: (d,pγ), E(d)= 6 MeV from Van de Graaff accelerator at Legnaro National Laboratory, Padova. Detected gammas with HPGe detector (FWHM= 2.3 keV) and protons with two silicon detectors. Measured Ep, Eγ, pγ coin, lifetimes by DSAM.
1980Sa14: (d,pγ), E(d)= 3 MeV from pulsed beam facility at Queen's University 4 MV Van de Graaff accelerator. Gammas detected with Ge(Li). Measured Eγ, Iγ, lifetime.
1978Be20: (^{40}Ca,pγ), E(^{40}Ca)= 60 MeV from MP tandem Van de Graaff accelerator, Strasbourg. Gammas detcetd with a Ge(Li) detcetor (FWHM= 2.7 keV). Measured lifetimes by DSAM.
1975Ta13: (d,pγ), E(d)= 3 MeV from University of Pennsylvania EN tandem accelerator. Protons detected with an annular silicon surface-barrier detector and gammas with a Ge(Li) detector (FWHM= 2.7 keV). Measured pγ coin, Eγ, Iγ and lifetimes by DSAM.
1974Mc01 (also 1972Mc15): (d,pγ), E(d)= 3 MeV. Protons detected with an annular silicon surface-barrier detector and gammas with a Ge(Li) detector (FWHM= 2.7 keV). Measured Eγ, p$\gamma(\theta)$ and branching ratio.
1971Fo09 (also 1971La07,1968Sc25): (d,pγ), E(d)=3-4.03 MeV from Van de Graaff accelerator at Orsay. Gammas detected with Ge(Li). Measured Eγ, p$\gamma(\theta)$, lifetimes by DSAM.
1970Jo03: (d,pγ), E(d)=4.04 MeV from Orsay 4 MV Van de Graaff accelerator. Protons detected with an annular silicon surface-barrier detector and gammas detected with a NaI(Tl) detector. Measured Eγ, p$\gamma(\theta)$.

Others:
1974Co29: (d,pγ), E(d)= 3.2 MeV. Measured p$\gamma(\theta)$, deduced spin assignments for 1943, 2462, 3944, 4187, 4604 and 4753 levels.
1973Ta17: (d,pγ), E(d)=11 MeV. Measured γ decay of the 3.62 MeV state.
1971Co25: (d,pγ), E(d)< 4 MeV. Measured Eγ and branching ratios.
1967Fr06: (d,pγ), E(d)= 4.8 MeV. Measured p$\gamma(\theta)$, proton polarization. DWBA analysis.
1964Za03: (d,pγ), E(d)= 6.6 MeV. Measured p$\gamma(\theta)$.
1963Le12: (d,pγ). Measured p$\gamma(\theta)$.
1959Ta01: (d,pγ), E=7.78 MeV. Measured p$\gamma(\theta)$ for 1947 level.

^{41}Ca Levels

E(level)†	J$^{\pi}$‡	T$_{1/2}$†	Comments
0	7/2$^-$		
1942.4 *2*	3/2$^-$	0.47 ps *5*	T$_{1/2}$: Weighted average of 0.39 ps *6* (1987Ta03), 0.40 ps *7* (1980Sa14), 0.55 ps *7* (1978Be20), 0.55 ps *5* (1975Ta13), 0.32 ps *10* (1971La07).
2009.7 *2*	3/2$^+$	506 ps *12*	T$_{1/2}$: From 1980Sa14. Other: > 2.6 ps (1987Ta03).
2462.2 *2*	3/2$^-$	4.4 ps *6*	T$_{1/2}$: Weighted average of 4.6 ps *6* (1978BeE20) and 3.8 ps *11* (1975Ta13). Others: > 1.0 ps (1987Ta03), ≥ 1.0 ps (1971La07).
2574.9 *3*	5/2$^-$	180 fs *20*	
2605.1 *3*	5/2$^+$	0.39 ps *5*	
2669.8 *2*	1/2$^+$	2.8 ps *6*	T$_{1/2}$: Weighted average of 2.7 ps *+7−5* (1975Ta13) and 3.1 ps *9* (1978Be20). Other: 0.33 ps *10* (1971La07).
2883.1 *5*	7/2$^+$	21 fs *17*	
2959.3 *4*	7/2$^-$	41 fs *13*	
3049.1 *3*	3/2$^+$	1.12 ps *+19−15*	T$_{1/2}$: Other: 0.24 ps *+30−15* (1971La07).
3200.3 *6*	9/2$^+$	40 fs *20*	
3369.2	11/2$^+$		
3399.8 *3*	1/2$^+$	82 fs *21*	
3494.7 *3*	5/2$^+$	0.30 ps *6*	
3525.3 *3*	3/2$^+$	33 fs *17*	
3613.0 *6*	7/2$^+$	<19 fs	

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^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01 (continued)

^{41}Ca Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[†]	Comments
3613.5 *3*	1/2$^-$	0.11 ps *5*	$T_{1/2}$: Weighted average of 0.17 ps *3* (1975Ta13) and 0.067 ps *+28−25* (1987Ta03). Other: ≤ 35 fs (1971La07).
3675.7 *10*	9/2$^-$	53 fs *28*	
3730.4 *3*	3/2$^-$	0.26 ps *5*	
3739.4 *3*	(3/2,5/2)$^+$		
3829.5	15/2$^+$		
3845.9 *6*	1/2$^+$	111 fs *31*	
3914.7	13/2$^+$		
3943.7 *4*	1/2$^-$	<37 fs	$T_{1/2}$: Others: <15 fs (1987Ta03), ≤ 17 fs (1971La07).
3973.3 *8*	7/2$^+$	88 fs *35*	
4017?[#]			
4094.1 *6*	5/2$^+$	<20 fs	
4184.2 *5*	(3/2,5/2)	39 fs *12*	
4279.0 *10*	(5/2,7/2,9/2)$^-$	<26 fs	
4327.5 *8*		<111 fs	
4340.0 *12*	9/2$^-$	132 fs *35*	
4417.0 *4*	3/2$^+$	42 fs *10*	
4446.6 *18*	9/2$^+$	<101 fs	
4546.7 *10*		87 fs *31*	
4603.0 *5*	3/2$^-$	<37 fs	$T_{1/2}$: Other: < 53 fs (1987Ta03).
4728.1 *6*	(3/2)$^+$	<30 fs	
4730.2 *4*	(5/2)$^+$	40 fs *13*	
4752.5 *4*	1/2$^-$	30 fs *10*	$T_{1/2}$: Other: <24 fs (1987Ta03).
4778.1 *5*	(3/2)$^+$	<15 fs	
4813.9 *10*	5/2$^+$	<37 fs	
4876.2 *8*	5/2$^-$	<34 fs	
4969.5 *10*	9/2$^+$	<25 fs	
5011?[#]			
5069?[#]			
5120.1 *5*	3/2$^-$	<46 fs	
5159?[#]			
5218.7	(13/2,17/2)$^+$		
5282.3 *5*	5/2$^+$	<37 fs	
5411.4 *6*	5/2$^+$	<30 fs	
5464?[#]			
5480?[#]			
5643?[#]			
5751?[#]			
5800?[#]			

[†] From 1975Ta13, unless otherwise stated.
[‡] From Adopted Levels.
[#] From 1971Fo09 only. This level is treated as questionable by the evaluators since it is not confirmed in later higher-resolution studies of 1975Ta13 and 1974Mc01.

^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01 (continued)

$\gamma(^{41}Ca)$

A_2 values are from 1974Mc01. Mixing ratio limits are also deduced by 1974Mc01 from $\gamma(\theta)$ data.

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Comments
1942.4	3/2$^-$	1942.4	100	0	7/2$^-$	A_2=+0.10 *3*.
2009.7	3/2$^+$	2009.6	100	0	7/2$^-$	A_2=+0.02 *4*.
2462.2	3/2$^-$	519.8	100	1942.4	3/2$^-$	A_2=+0.27 *1*.
2574.9	5/2$^-$	2574.8	100	0	7/2$^-$	A_2=+0.35 *4*.
2605.1	5/2$^+$	2605.0	100	0	7/2$^-$	A_2=−0.19 *4*.
2669.8	1/2$^+$	660.1	29 *2*	2009.7	3/2$^+$	A_2=−0.03 *4*.
		727.4	71 *2*	1942.4	3/2$^-$	A_2=−0.03 *4*.
2883.1	7/2$^+$	2883.0	100	0	7/2$^-$	A_2=+0.19 *9*. Other: +0.21 *8* (1970Jo03).
2959.3	7/2$^-$	2959.2	100	0	7/2$^-$	A_2=+0.11 *6*. Other: +0.29 *3* (1970Jo03).
3049.1	3/2$^+$	379.3	3 *1*	2669.8	1/2$^+$	A_2=−0.24 *24*.
		444.0	30 *2*	2605.1	5/2$^+$	A_2=−0.04 *3*.
		1039.4	41 *2*	2009.7	3/2$^+$	A_2=−0.03 *4*. Other: 0.00 *3* (1970Jo03).
		1106.7	26 *2*	1942.4	3/2$^-$	A_2=+0.14 *7*.
		3049[ab]		0	7/2$^-$	E_γ: 3052 *3* (1971Fo09).
3200.3	9/2$^+$	594[b]	≤5	2605.1	5/2$^+$	E_γ,I_γ: from 1970Jo03.
		1256[b]	≤2	1942.4	3/2$^-$	E_γ,I_γ: from 1970Jo03.
		3200.2	100	0	7/2$^-$	A_2=−0.20 *7*. Other: −0.25 *3* (1970Jo03).
3369.2	11/2$^+$	168.9	62	3200.3	9/2$^+$	
		3369.1	38	0	7/2$^-$	
3399.8	1/2$^+$	1390.1	100	2009.7	3/2$^+$	A_2=+0.10 *7*.
3494.7	5/2$^+$	445.6	12[&] *3*	3049.1	3/2$^+$	
		1485.0	83[&] *6*	2009.7	3/2$^+$	A_2=+0.06 *6*.
		3494.5	5[&] *2*	0	7/2$^-$	
3525.3	3/2$^+$	855.5	10 *2*	2669.8	1/2$^+$	
		1515.6	35 *3*	2009.7	3/2$^+$	
		1582.9	55 *3*	1942.4	3/2$^-$	A_2=+0.12 *11*.
3613.0	7/2$^+$	3612.8	100	0	7/2$^-$	A_2=+0.31 *9*. Other: +0.26 *4* (1970Jo03), +0.33 *6* (1972Mc15).
3613.5	1/2$^-$	943.7	16[#] *2*	2669.8	1/2$^+$	A_2=−0.05 *16*. Other: +0.01 *21* (1972Mc15).
		1151.3	33[#] *4*	2462.2	3/2$^-$	A_2=+0.15 *20* (1972Mc15).
		1671.1	51[#] *4*	1942.4	3/2$^-$	A_2=−0.16 *10*. Other: +0.03 *11* (1972Mc15).
3675.7	9/2$^-$	3675.5	100	0	7/2$^-$	A_2=−0.44 *8*. Other: −0.67 *10* (1972Mc15).
3730.4	3/2$^-$	1155.5	24[@] *7*	2574.9	5/2$^-$	A_2=−0.45 *20* (1972Mc15).
		1268.2	35[@] *6*	2462.2	3/2$^-$	A_2=+0.06 *10*. Other: +0.17 *9* (1972Mc15).
		1788.0	17[@] *4*	1942.4	3/2$^-$	
		3730.2	24[@] *4*	0	7/2$^-$	A_2=+0.05 *8*. Other: +0.05 *8* (1972Mc15).
3739.4	(3/2,5/2)$^+$	1134.3	34 *3*	2605.1	5/2$^+$	A_2=−0.13 *8* (1972Mc15).
		1729.7	66 *3*	2009.7	3/2$^+$	A_2=−0.05 *14*. Other: −0.03 *11* (1972Mc15).
3829.5	15/2$^+$	460.3	100	3369.2	11/2$^+$	
3845.9	1/2$^+$	1836.2	80 *5*	2009.7	3/2$^+$	
		1903.5	20 *5*	1942.4	3/2$^-$	
3914.7	13/2$^+$	545.5	100	3369.2	11/2$^+$	
3943.7	1/2$^-$	1273.9[ab]	2 *1*	2669.8	1/2$^+$	E_γ: 1280.0 *15* (1971Fo09).
		1481.5	9 *3*	2462.2	3/2$^-$	
		2001.2	91 *3*	1942.4	3/2$^-$	
3973.3	7/2$^+$	1368.2	50 *7*	2605.1	5/2$^+$	
		3973.1	50 *7*	0	7/2$^-$	
4017?		1555[ab]	100	2462.2	3/2$^-$	E_γ: 1565.0 *15* (1971Fo09).
4094.1	5/2$^+$	2084.3	58 *5*	2009.7	3/2$^+$	

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^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01 (continued)

$\gamma(^{41}Ca)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Comments
4094.1	$5/2^+$	4093.9	42 *5*	0	$7/2^-$	
4184.2	(3/2,5/2)	1579.1	31 *3*	2605.1	$5/2^+$	
		2174.4	69 *3*	2009.7	$3/2^+$	
4279.0	$(5/2,7/2,9/2)^-$	1673.9[ab]		2605.1	$5/2^+$	I_γ: I(γ)(1674)/I(γ)(4279)=18 *10*/82 *10* (1971Fo09). E_γ: 1684.0 *25* (1971Fo09).
		4278.8	100	0	$7/2^-$	
4327.5		1127.2	100	3200.3	$9/2^+$	
4340.0	$9/2^-$	4339.8	100	0	$7/2^-$	
4417.0	$3/2^+$	1811.9	30 *2*	2605.1	$5/2^+$	
		2407.2	70 *2*	2009.7	$3/2^+$	
4446.6	$9/2^+$	4446.3	100	0	$7/2^-$	
4546.7		4546.4	100	0	$7/2^-$	
4603.0	$3/2^-$	1933[ab]		2669.8	$1/2^+$	I_γ: I(γ)(1933)/I(γ)(2660)=20 *10*/80 *10* (1971Fo09). E_γ: 1943.0 *15* (1971Fo09).
		2660.5	100	1942.4	$3/2^-$	
4728.1	$(3/2)^+$	2718.3	100	2009.7	$3/2^+$	
4730.2	$(5/2)^+$	2267.9	43 *6*	2462.2	$3/2^-$	
		2787.7	39 *5*	1942.4	$3/2^-$	
		4729.9	18 *4*	0	$7/2^-$	
4752.5	$1/2^-$	2290.2	33 *2*	2462.2	$3/2^-$	
		2810.0	67 *2*	1942.4	$3/2^-$	
4778.1	$(3/2)^+$	2768.3	100	2009.7	$3/2^+$	
4813.9	$5/2^+$	1930.8	59 *7*	2883.1	$7/2^+$	
		4813.6	41 *7*	0	$7/2^-$	
4876.2	$5/2^-$	4875.9	100	0	$7/2^-$	
4969.5	$9/2^+$	2086.3	58 *19*	2883.1	$7/2^+$	
		4969.2	42 *19*	0	$7/2^-$	
5011?		1611[ab]	45 *12*	3399.8	$1/2^+$	E_γ: 1618.0 *15* (1971Fo09).
		3001[ab]	55 *12*	2009.7	$3/2^+$	E_γ: 3012.0 *15* (1971Fo09).
5069?		5069[ab]	100	0	$7/2^-$	E_γ: 5058 *3* (1971Fo09).
5120.1	$3/2^-$	2450.2	59 *10*	2669.8	$1/2^+$	
		5119.8	41 *10*	0	$7/2^-$	
5159?		5159[ab]	100	0	$7/2^-$	E_γ: 5171 *3* (1971Fo09).
5218.7	$(13/2,17/2)^+$	1389.2	100	3829.5	$15/2^+$	
5282.3	$5/2^+$	3272.5	100	2009.7	$3/2^+$	
5411.4	$5/2^+$	3468.8	100	1942.4	$3/2^-$	
5464?		5464[ab]	100	0	$7/2^-$	E_γ: 5472 *3* (1971Fo09).
5480?		2431[ab]	80 *8*	3049.1	$3/2^+$	E_γ: 2437 *3* (1971Fo09).
		5480[ab]	20 *8*	0	$7/2^-$	E_γ: 5490 *4* (1971Fo09).
5643?		5643[ab]	100	0	$7/2^-$	E_γ: 5667 *3* (1971Fo09).
5751?		5751[ab]	100	0	$7/2^-$	E_γ: 5782 *3* (1971Fo09).
5800?		5800[ab]	100	0	$7/2^-$	E_γ: 5813 *3* (1971Fo09).

[†] From level-energy differences. Recoil energies have been subtracted by evaluators.
[‡] Branching ratios from 1975Ta13, unless otherwise stated.
[#] From 1973Ta17.
[@] From 1972Mc15.
[&] From 1971La07.
[a] From 1971Fo09 only. Eγ is from level-energy difference. Experimental Eγ quoted by 1971Fo09 is given under comments which

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^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01 (continued)

$\gamma(^{41}Ca)$ (continued)

differs significantly from that obtained from level-energy difference. This γ is treated as questionable by the evaluators since it is not confirmed in any of the other studies.

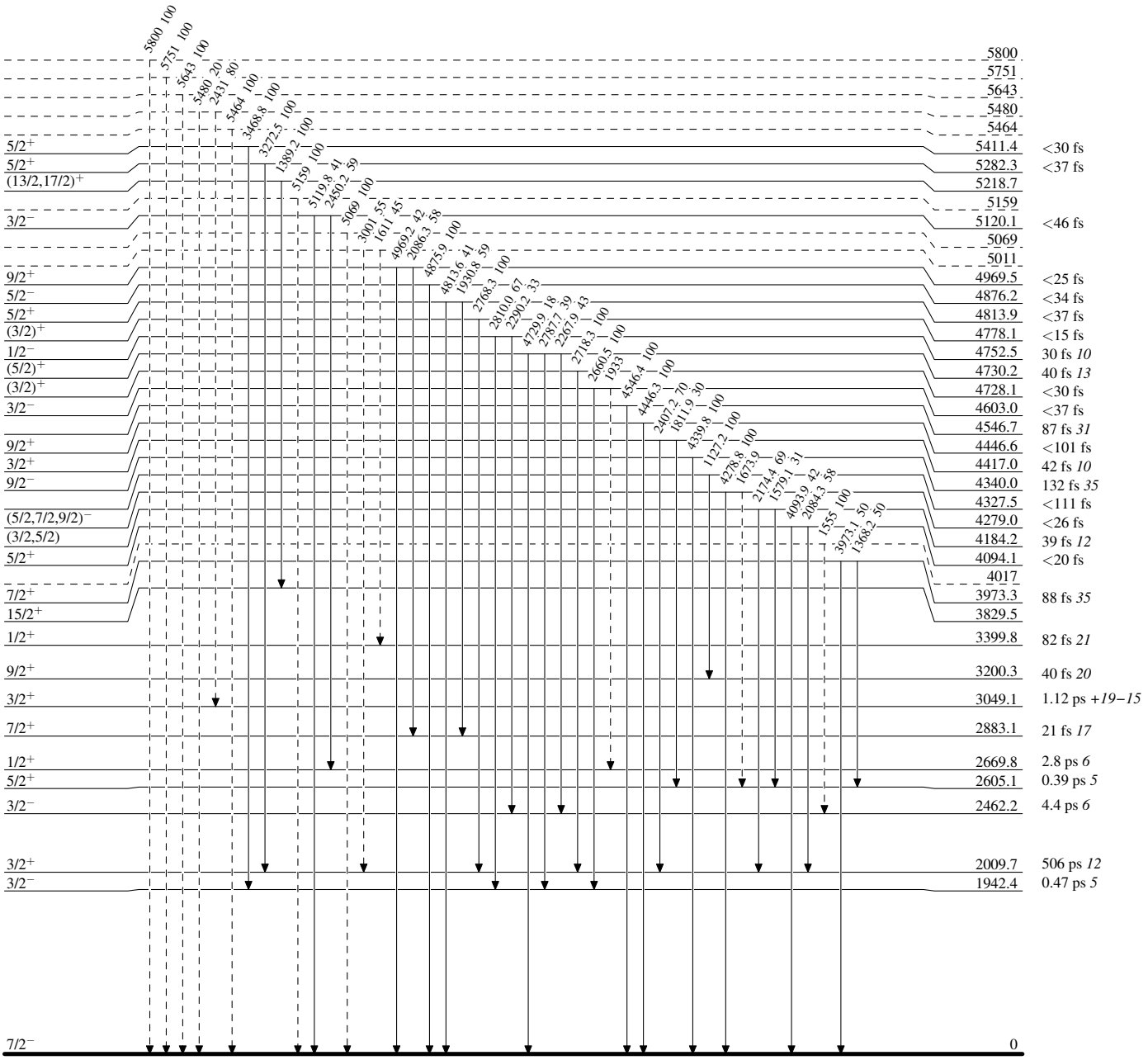
[b] Placement of transition in the level scheme is uncertain.

^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01 Legend

Level Scheme

Intensities: % photon branching from each level

γ Decay (Uncertain)



$^{41}_{20}Ca_{21}$

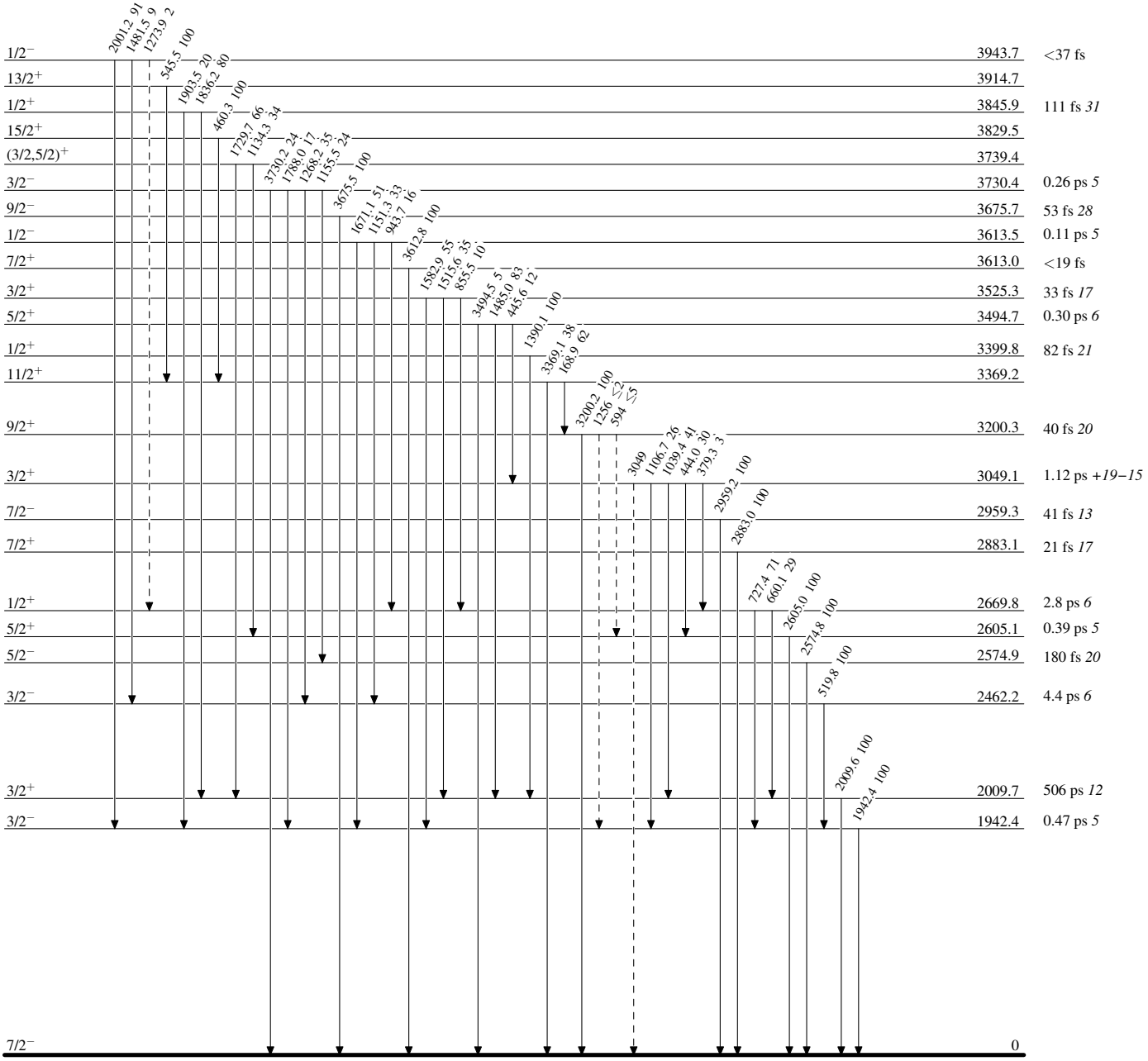
^{40}Ca(d,pγ),^{2}H(^{40}Ca,pγ) 1975Ta13,1980Sa14,1974Mc01

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

γ Decay (Uncertain)



$^{41}_{20}Ca_{21}$