^{40}Ca(n,n′γ)　　1972Di10,1972Ni05,1984El12

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

1972Di10: E=4.85-8.05 MeV neutron beams were produced via D(d,n) reaction with pulsed deuteron beams provided by the Oak Ridge National Laboratory 6-MV Ven de Graaff accelerators. Target was natural calcium. γ rays were detected with a 45-cm^3 coaxial Ge(Li) detector. Measured Eγ, σ(Eγ) at 6 different neutron energies. Deduced levels.

1972Ni05: Fission-spectrum neutrons were produced from the McMaster reactor. γ rays were detected with Ge(Li) and NaI(Tl) detectors. Measured Eγ, Iγ. Deduced levels, γ-ray branching ratios.

1984El12 (also 1989Ge09): E=fast. Measured γ, lifetime by DSA.

1981KaZL: E=fast. Measured Eγ, Iγ, Doppler-shift attenuation. Deduced levels, T$_{1/2}$.

Others:

1963Ho08: E=14 MeV. Measured Eγ.

Additional information 1.

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Differential cross sections (mb/sr) at different energies (125°)      (1972Di10)
 Eγ    4.85 MeV   5.40 MeV   5.90 MeV   6.45 MeV   7.00 MeV   7.50 MeV  8.05 MeV
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Eγ	4.85 MeV	5.40 MeV	5.90 MeV	6.45 MeV	7.00 MeV	7.50 MeV	8.05 MeV
755	0.55 10	1.20 15	1.3 2	2.6 3	3.2 3	3.1 3	4.1 4
780					0.18 9	0.20 6	0.23 7
1122			0.32 6	0.91 14	1.14 18	1.10 24	1.45 22
1303		0.70 11	0.95 14	1.51 20	1.31 19	1.20 20	1.04 15
1345			0.41 8	0.33 5	0.28 4	0.61 15	0.39 11
1374		0.30 15	1.3 2	2.33 25	2.9 3	2.6 3	2.7 3
1651						0.50 10	0.66 11
1793					0.91 22	0.75 10	1.09 13
1877			0.42 8	0.81 9	0.69 13	0.63 10	0.75 19
2124				0.70 15	1.15 15	1.09 15	1.10 15
2288				1.70 20	2.7 4	2.7 5	2.6 4
2380					0.22 11	0.60 25	0.70 15
2605					0.64 22	0.45 22	
2854						0.16 7	
3013						0.74 14	0.45 11
3193						0.55 10	
3737	9.8 10	9.8 10	8.0 12	10.1 10	12.6 13	12.5 13	14.4 15
3905	12.6 13	9.6 10	8.6 13	9.7 10	10.5 11	10.0 10	8.7 9
5249		0.26 7	1.5 2	2.20 22	2.35 24	2.23 25	1.71 18
5629			0.3 1	1.7 3	1.3 3	1.05 15	1.7 3
5903				0.66 8	1.17 17	0.95 11	0.97 13
6909						1.02 17	1.40 20
6949						0.51 8	0.79 12

^{40}Ca Levels

E(level)[†]	J^{π}[&]	T$_{1/2}$	Comments
0	0$^+$		
3353	0$^+$		Decays by pair production and consequently by annihilation radiation (1972Di10).
3737	3$^-$		
3904	2$^+$	36 fs *14*	T$_{1/2}$: from DSAM (1984El12,1989Ge09). Other: 33 fs *30* by DSAM (1981KaZL).
4491	5$^-$		
5212	0$^+$		E(level): from 1972Ni05. Other: 5208 (1972Di10).
5249	2$^+$		
5279	4$^+$	0.19 ps *4*	T$_{1/2}$: from DSAM (1981KaZL).
5614	4$^-$		

Continued on next page (footnotes at end of table)

^{40}Ca(n,n′γ)　　1972Di10,1972Ni05,1984El12 (continued)

^{40}Ca Levels (continued)

E(level)[†]	J$^{\pi}$[&]	E(level)[†]	J$^{\pi}$[&]	E(level)[†]	J$^{\pi}$[&]
5629	2$^+$	6285	3$^-$	6750[‡]	2$^-$
5903	1$^-$	6508[‡]	4$^+$	6909[‡]	2$^+$
6025	2$^-$	6543?[@]	4$^+$	6930[‡#]	6$^+$
6030	3$^+$	6582?[@]	3$^-$	6931[‡#]	3$^-$
				6950[‡]	1$^-$

[†] Rounded values from Adopted Levels, unless otherwise noted.

[‡] From 1972Di10 only.

[#] According to Adopted Levels and Gammas, 1651γ and 3193γ are from two separate levels near 6930, although 1972Di10 seem to show only one level.

[@] The evaluator have put these levels here from the placements of some unplaced γ rays in 1972Di10 based on Adopted Gammas.

[&] From Adopted Levels.

γ(^{40}Ca)

E$_{\gamma}$[†]	dσ/dΩ (mb/sr) At 125°[#]	E$_i$(level)	J$^{\pi}_i$	E$_f$	J$^{\pi}_f$	Comments
755 2	3.1 3	4491	5$^-$	3737	3$^-$	
780 2	0.20 6	6030	3$^+$	5249	2$^+$	Iγ(780)/Iγ(2124)=10/80 (1972Ni05).
1122 2	1.10 24	5614	4$^-$	4491	5$^-$	Iγ(1124)/Iγ(1880)=30/70 (1972Ni05).
1262[ab] 2	0.37 12	6543?	4$^+$	5279	4$^+$	
1308[&]	1.20 20	5212	0$^+$	3904	2$^+$	1303 in 1972Di10 includes a line from ^{40}K.
1345 2	0.61 15	5249	2$^+$	3904	2$^+$	Iγ(1344)/Iγ(5249)=20/80 (1972Ni05).
1374.0 2	2.6 3	5279	4$^+$	3904	2$^+$	E$_{\gamma}$: from 1981KaZL. Other: 1374 2, may include contribution from ^{40}K line (1972Di10).
1651[‡] 2	0.50 10	6930	6$^+$	5279	4$^+$	
1793 2	0.75 10	6285	3$^-$	4491	5$^-$	may include contribution from ^{40}K line (1972Di10).
1877 2	0.63 10	5614	4$^-$	3737	3$^-$	
1897[a] 2	0.16 8	5249	2$^+$	3353	0$^+$	
2121[&@]		6025	2$^-$	3904	2$^+$	E$_{\gamma}$: 2124 in 1972Di10 is probably a doublet 2120+2124. Iγ(2120)/Iγ(2290)=20/80 (1972Ni05).
2124 2	1.09 15	6030	3$^+$	3904	2$^+$	
2275[a] 2	0.50 13	5629	2$^+$	3353	0$^+$	Iγ(2277)/Iγ(5627)=9/91 (1972Ni05).
2288 2	2.7 5	6025	2$^-$	3737	3$^-$	Doublet 2288+2294.
2293[&]		6030	3$^+$	3737	3$^-$	E$_{\gamma}$: 2288γ in 1972Di10 is a doublet 2288+2293. Iγ(2294)/Iγ(2124)=10/80 (1972Ni05).
2380 2	0.60 25	6285	3$^-$	3904	2$^+$	Iγ(2379)/Iγ(1793)=25/75 (1972Ni05).
2605[‡] 2	0.45 22	6508	4$^+$	3904	2$^+$	
2679[ab] 2	0.22 9	6582?	3$^-$	3904	2$^+$	
^{x}2748[a]	0.72 16					
2854[‡] 2	0.16 7	6750	2$^-$	3904	2$^+$	
3013[‡] 2	0.74 14	6750	2$^-$	3737	3$^-$	
3193[‡] 2	0.55 10	6931	3$^-$	3737	3$^-$	
^{x}3503[a]	0.23 10					
3737 2	12.5 13	3737	3$^-$	0	0$^+$	
3904.2 4	10.0 10	3904	2$^+$	0	0$^+$	E$_{\gamma}$: from 1981KaZL, 3905 2 from 1972Di10.
5249 2	2.23 25	5249	2$^+$	0	0$^+$	
5629 2	1.05 15	5629	2$^+$	0	0$^+$	includes contribution from ^{16}O (1972Di10).

^{40}Ca(n,n$'\gamma$)   **1972Di10,1972Ni05,1984El12 (continued)**

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

E_γ[†]	dσ/dΩ (mb/sr) At 125°[#]	E_i(level)	J^π_i	E_f	J^π_f
5903 *2*	0.95 *11*	5903	1^-	0	0^+
6909[‡] *2*	1.02 *17*	6909	2^+	0	0^+
6949[‡] *2*	0.51 *8*	6950	1^-	0	0^+

[†] From 1972Di10, unless otherwise stated. 1972Di10 give $\Delta E\gamma$=2 keV for unplaced γ rays but not for those placed. The evaluator have assumed $\Delta E\gamma$=2 keV also for those γ-ray energies.

[‡] γ from 1972Di10 only.

[#] From 1972Di10 for E(n)=7.5 MeV. Values for other neutron energies are listed in the table of differential cross sections above.

[@] Transition from 1972Ni05 only.

[&] From level-energy difference.

[a] Unplaced γ from 1972Di10 only. Placements are made by evaluator based on Adopted Gammas if applicable.

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

[x] γ ray not placed in level scheme.

^{40}Ca(n,n'γ)   **1972Di10,1972Ni05,1984El12**

Legend

Level Scheme

Intensities: dσ/dΩ (mb/sr)

	I$_\gamma$ < 2%×I$_\gamma^{max}$
	I$_\gamma$ < 10%×I$_\gamma^{max}$
	I$_\gamma$ > 10%×I$_\gamma^{max}$
	γ Decay (Uncertain)

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