

$^{40}\text{Ca}(\text{p,t})$ 2017Lo05,1972Pa02,1977Ku01

Type	Author	History Citation	Literature Cutoff Date
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2017Lo05: E=100 MeV proton beam was produced from the K=200 Separated Sector Cyclotron (SSC) of iThemba LABS. Target was 2.1 mg/cm² 99% enriched self-supporting ^{40}Ca . Reaction products were momentum analyzed using the K=600 spectrograph (FWHM \approx 35 keV) and detected with the focal plane detector system consisting of XU-wire drift chambers and two plastic scintillating detectors. Measured triton spectra. Deduced levels. Comparisons with available data. Calculations of astrophysical reaction rates for $^{34}\text{Ar}(\alpha,\text{p})^{37}\text{K}$.

1972Pa02: E=40.1 MeV proton beam was produced from the Michigan State University sector-focused cyclotron. Target was a self-supporting foil of natural calcium (96.97% in ^{40}Ca , 863 $\mu\text{m}/\text{cm}^2$ thick) on a tantalum backing. Reaction products were detected with a $\Delta\text{E-E}$ telescope of surface-barrier detectors (FWHM=60 keV). Measured $\sigma(\theta)$. Deduced levels, J, π , L-transfer from DWBA analysis. Comparisons with available data. Report 22 levels up to 8595.

1977Ku01 (also **1974Ku03**): E=51.9 MeV proton beam was produced from the Institute for Nuclear Study (INS) synchrocyclotron at University of Tokyo. Targets were self-supporting natural and enriched metallic calcium foils. Reaction products were momentum-analyzed with a broad-range magnetic spectrometer (FWHM=80 keV) and detected by an array of 200 proportional counters. Measured $\sigma(\theta)$. Deduced levels, J, π , L-transfers from DWBA analysis (CCBA analysis for 3060, L=0 group). Report 15 levels up to 7800.

1966Ha32: E=39.8 MeV proton beam was produced from the Proton Linear Accelerator at the Rutherford Laboratory. Target was natural calcium. Reaction products were detected with a semi-conductor counter telescope (FWHM=230 keV). Measured $\sigma(\theta)$. Deduced levels, J, π , L from DWBA analysis. Report levels at 0, 2200, 3720, 4360 and 4840.

Others:

2012Be55: E=100 MeV; measured triton spectrum at iThemba LABS.

1985Mi06: E=51.9 MeV; measured $\sigma(\text{at } 22^\circ)$ for g.s., DWBA analysis.

1983Se18: E=35 MeV; measured $\sigma(\theta)$ for g.s. and first 2^+ .

1983Sa01: E=40 MeV; measured $\sigma(\theta)$ for g.s.. DWBA analysis.

 ^{38}Ca Levels

E(level) [†]	L [‡]	Comments
0	0 [#]	
2213 4	2 [#]	E(level): weighted average of 2215 3 (2017Lo05) and 2206 5 (1972Pa02). Others: 2200 30 (1977Ku01), 2200 30 (1966Ha32).
3060 30	0	E(level),L: from 1977Ku01 only, anomalous L=0 transition.
3695 5	2(+3)	E(level): from 2017Lo05 and 1972Pa02. Others: 3690 30 (1977Ku01), 3720 30 (1966Ha32). L: $\sigma(\theta)$ in 1977Ku01 differs somewhat from L=2 for 2206 group; the difference may be due to the presence of a 3720, 3 ⁻ unresolved group. Others: L=3 for 3720 30 (1966Ha32), 3,2 for 3695 5 (1972Pa02).
4191 5	(5)	E(level): from 1972Pa02. Other: 4180 30 (1977Ku01).
4385 4	2	E(level): weighted average of 4387 4 (2017Lo05) and 4381 5 (1972Pa02). Others: 4370 30 (1977Ku01), 4360 40 (1966Ha32), L: 0 from 1966Ha32, (2) from 1972Pa02.
4751 5	(3)	E(level): weighted average of 4754 6 (2017Lo05) and 4748 5 (1972Pa02). Other: 4750 30 (1977Ku01).
4902 4	2	E(level): weighted average of 4904 4 (2017Lo05) and 4899 5 (1972Pa02). Others: 4890 30 (1977Ku01), 4840 40 (1966Ha32). L: (2) from 1972Pa02 and 1966Ha32.
5164 7		E(level): weighted average of 5170 8 (2017Lo05) and 5159 7 (1972Pa02).
5266 4	2	E(level): weighted average of 5267 4 (2017Lo05) and 5264 5 (1972Pa02). Other: 5250 30 (1977Ku01).
5430 6		E(level): weighted average of 5438 9 (2017Lo05) and 5427 6 (1972Pa02).
5601 7		E(level): weighted average of 5608 10 (2017Lo05) and 5598 7 (1972Pa02). Other: 5600 30 (1977Ku01).
5704 5		E(level): weighted average of 5705 5 (2017Lo05) and 5698 10 (1972Pa02).
5816 7		E(level): weighted average of 5832 8 (2017Lo05), 5810 5 (1972Pa02) and 5810 30 (1977Ku01).
6136 6		E(level): from 1972Pa02 only.
6277 3	0	E(level): weighted average of 6277 3 (2017Lo05) and 6280 8 (1972Pa02). Other: 6270 30 (1977Ku01). L: (0) from 1972Pa02.
6485 6		

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$^{40}\text{Ca}(\text{p,t})$ 2017Lo05,1972Pa02,1977Ku01 (continued) ^{38}Ca Levels (continued)

<u>E(level)[†]</u>	<u>Comments</u>
6601 3	E(level): weighted average of 6601 3 (2017Lo05) and 6598 7 (1972Pa02). Other: 6600 30 (1977Ku01).
6704 3	E(level): weighted average of 6704 3 (2017Lo05) and 6702 10 (1972Pa02).
6770 13	E(level): weighted average of 6772 13 (2017Lo05) and 6768 15 (1972Pa02).
6801 12	E(level): from 1972Pa02 only.
6950 5	
7041 8	
7176 4	
7208? 15	E(level): from 1972Pa02 only.
7370 5	
7480 9	
7801 3	E(level): weighted average of 7801 3 (2017Lo05) and 7800 12 (1972Pa02). Other: 7800 30 (1977Ku01).
8026 5	
8189 6	
8322 5	
8507 9	
8587 3	E(level): weighted average of 8586 3 (2017Lo05) and 8595 10 (1972Pa02).
8672 6	
8717 8	
8924 9	
8994 9	
9073 9	
9157 8	
9230 9	
9296 8	
9735 8	
9809 6	
10104 9	
10410 9	
10557 8	
10946 11	
11089 11	
11189 13	
11861 11	

[†] From weighted average of values from 2017Lo05 and 1972Pa02 where available up to 8587 level and from 2017Lo05 only for the rest, unless otherwise stated.

[‡] From 1977Ku01, unless otherwise noted.

[#] Also from 1972Pa02 and 1966Ha32.