^{44}Ca(^{3}He,t)　　**2013Fu08,1972Ma50**

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 190,1 (2023)	20-Jun-2023

Target ^{44}Ca $J^{\pi}=0^+$.

2013Fu08 (also 2016Fu02 conference report): E=140 MeV/nucleon ^{3}He beam produced from the K=400 Ring Cyclotron at the high-energy resolution facility of the Research Center for Nuclear Physics (RCNP, Osaka). Target was 1.83 mg/cm^2 thick (98.8% enriched) self-supporting ^{44}Ca foil. Reaction products were momentum analyzed with the Grand Raiden spectrometer (FWHM=28 keV). Measured $\sigma(E_t,\theta)$ at $\theta=0°-0.5°$ and 2.5°. Deduced levels, L-transfers, Gamow-Teller strengths from DWBA analysis. Comparison with shell-model calculations.

1972Ma50: E=25 MeV ^{3}He beam produced from the Argonne National Laboratory tandem Van de Graaff accelerator. Target of a 50 μg/cm^2 calcium (enriched to 99% in ^{44}Ca) on a 20 μg/cm^2 carbon backing. Tritons momentum analyzed by an Enge split-pole spectrograph and detected on photographic plates in the focal plane. Measured $\sigma(E_t,\theta)$. Deduced levels, J, π, L from DWBA analysis.

2011St03, 2012St22: E=420 MeV at typical beam current of 25 nA. Targets of 1.63-1.87 mg/cm^2 thickness. Tritons analyzed by Grand Raiden magnetic spectrometer at RCNP, Osaka facility. FWHM=20 keV. Measured angular distributions from 0° to 2.5° in several steps. The authors state that 59 levels with ΔL=1 and 189 new levels in ^{44}Sc were discovered up to an excitation energy of 14.2 MeV. Dipole transition strengths were deduced from these data. On enquiry by the evaluators for details of these data, the authors mentioned that the analyses of these data were still in progress.

Additional information 1.

Data are from 2013Fu08 unless indicated otherwise. Above 3.4 MeV excitation energy, data are available from 2013Fu08 only.

^{44}Sc Levels

A level at 12633.9 keV with L=1 is shown in Fig. 1 of 2011St03, it may be in ^{44}Sc.

Population intensities of levels from 2013Fu08 are in terms of raw counts in the peaks from outgoing tritons.

E(level)[†]	J^{π}[‡]	L[‡]	B(GT)[#]	Comments
0	2^+	2		L: other: $\geq$1 from 2013Fu08. Intensity=1009 *51* (2013Fu08).
70[@] *5*	1^-			
150[@] *5*	0^-			
236[&] *4*	$2^-,(3^-)$	3		E(level): other: 237 *5* (1972Ma50). L: other: $\geq$1 from 2013Fu08. Intensity=76 *18* (2013Fu08).
271[@] *5*	6^+	6		
350[@] *5*	4^+	4		
424[@] *5*	$3^-,(2^-)$	3		
533[@] *8*				
631[@] *5*	$(4,5)^-$	5		
667 *4*	1^+	0,2	0.714 *36*	E(level): other: 667 *5* (1972Ma50). L: 0 from 2013Fu08, 2 from 2011St03. B(GT): for L=0 (2013Fu08). Intensity=182999 *752* (2013Fu08).
725[@] *15*	$(1,2)^+$	(2)		
765 *4*	3^+	4		E(level): other: 765 *5* (1972Ma50). L: other: $\geq$1 from 2013Fu08. Intensity=8032 *182* (2013Fu08).
982 *5*	7^+	6		E(level): weighted average of 976 *5* (1972Ma50) and 986 *4* (2013Fu08). L: other: $\geq$1 from 2013Fu08. Intensity=251 *33* (2013Fu08).
1053[@] *5*	5^+	6		

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^{44}Ca(^{3}He,t)   2013Fu08,1972Ma50 (continued)

^{44}Sc Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	L[‡]	B(GT)[#]	Comments
1143 4	1$^+$,(2$^+$)	2		E(level): other: 1142 5 (1972Ma50). L: other: ≥1 from 2013Fu08. Intensity=1181 69 (2013Fu08).
1188 4	3$^+$	4		E(level): weighted average of 1189 5 (1972Ma50) and 1187 4 (2013Fu08). L: other: ≥1 from 2013Fu08. Intensity=3964 116 (2013Fu08).
1303[@] 10				
1330 4	3$^+$,(4$^+$)	4		E(level): other: 1330 5 (1972Ma50). L: other: ≥1 from 2013Fu08. Intensity=338 36 (2013Fu08).
1428 4	3$^+$,(4$^+$)	4		E(level): other: 1427 5 (1972Ma50). L: other: ≥1 from 2013Fu08. Intensity=356 36 (2013Fu08).
1534[@] 5	5$^+$	6		
1561[@] 10				
1608[@] 8	(3,4)$^+$	4		
1652[@] 5	3$^-$,(2$^-$)	3		
1687[@] 5	5$^-$,(4$^-$)	5		
1770 4	(2$^-$,3$^-$)	(3)		E(level): other: 1769 5 (1972Ma50). L: other: ≥1 from 2013Fu08. Intensity=835 64 (2013Fu08).
1813 4		0,2	0.059 3	E(level): weighted average of 1812 5 (1972Ma50) and 1814 4 (2013Fu08). J$^{\pi}$: (2$^+$) proposed by 1972Ma50 from L=2, but it is inconsistent with L=0 from 2013Fu08. L: 0 from 2013Fu08, 2 from 1972Ma50. B(GT): for L=0 (2013Fu08). Intensity=15114 219 (2013Fu08).
1866[@] 5				
1959 4				E(level): other: 1959 10 (1972Ma50). Intensity=133 28 (2013Fu08).
1984[@] 10				
2036[@] 10				
2069 4		0	0.007 1	L: from 2013Fu08. Intensity=1667 101 (2013Fu08).
2106[@] 5	(5,6)$^+$	6		
2174[@] 5				
2210[@] 5	(3,4)$^+$	(4)		
2240[@] 5				
2325[@] 8				
2374[@] 10				
2425 4	(3,4)$^+$	(4)		E(level): weighted average of 2423 5 (1972Ma50) and 2426 4 (2013Fu08). L: other: ≥1 from 2013Fu08. Intensity=783 70 (2013Fu08).
2484[@] 5				
2516 4		≥1		E(level): other: 2518 10 (1972Ma50). L: from 2013Fu08. Intensity=308 46 (2013Fu08).
2585[@] 10	(3)	(3)		
2625[@] 10				
2702 4		≥1		E(level): other: 2701 5 (1972Ma50). Intensity=5249 185 (2013Fu08).

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^{44}Ca(^{3}He,t)   **2013Fu08,1972Ma50 (continued)**

^{44}Sc Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	L[‡]	B(GT)[#]	Comments
2780 *4*	0$^+$	0		E(level): weighted average of 2781 *5* (1972Ma50) and 2779 *4* (2013Fu08).
				Isobar analog state (IAS).
				L: from 2013Fu08 and 1972Ma50.
				Intensity=130172 *859* (2013Fu08).
2854[@] *10*				
2916 *4*		≥1		E(level): weighted average of 2922 *10* (1972Ma50) and 2915 *4* (2013Fu08).
				Intensity=7167 *218* (2013Fu08).
2991[@] *10*				
3014 *40*		0	0.154 *8*	E(level): other: 3015 *10* (1972Ma50).
				Intensity=39126 *479* (2013Fu08).
3080 *4*		≥1		E(level): weighted average of 3076 *10* (1972Ma50) and 3081 *4* (2013Fu08).
				Intensity=524 *101* (2013Fu08).
3105[@] *10*				
3152 *4*		0	0.390 *20*	E(level): other: 3152 *10* (1972Ma50).
				Intensity=98834 *750* (2013Fu08).
3221 *4*		≥1		E(level): other: 3220 *10* (1972Ma50).
3289 *4*		(0)	0.028 *2*	E(level): other: 3292 *10* (1972Ma50).
				Intensity=6989 *224* (2013Fu08).
3326 *4*		≥1		E(level): other: 3326 *20* (1972Ma50).
				Intensity=335 *100* (2013Fu08).
3419 *4*		(0)	0.014 *1*	Intensity=3616 *179*.
3458 *4*		0	0.039 *2*	Intensity=9931 *255*.
3557 *4*		≥1		Intensity=557 *43*.
3641 *4*		0	0.274 *14*	Intensity=69055 *400*.
3711 *4*		0	0.148 *8*	Intensity=37404 *299*.
3826 *4*		≥1		Intensity=356 *45*.
3905 *4*		0	0.052 *3*	Intensity=13002 *227*.
3956? *4*		≥1		Intensity=1620 *320*.
3973? *4*		≥1		Intensity=1489 *326*.
4055 *4*		0	0.119 *6*	Intensity=29956 *268*.
4139 *4*		≥1		Intensity=8834 *236*.
4261 *4*		0	0.006 *2*	Intensity=1618 *470*.
4323 *4*		0	0.026 *1*	Intensity=6536 *158*.
4430 *4*		≥1		Intensity=1947 *72*.
4470? *4*		≥1		Intensity=2053 *205*.
4490? *4*		≥1		Intensity=4692 *226*.
4558 *4*		0	0.041 *2*	Intensity=10357 *152*.
4641? *4*		0	0.011 *2*	Intensity=2653 *352*.
4658? *4*		0	0.019 *2*	Intensity=4833 *373*.
4718 *4*		≥1		Intensity=2687 *89*.
4791 *4*		0	0.009 *1*	Intensity=2365 *83*.
4832? *4*		≥1		Intensity=490 *131*.
4857 *4*		0	0.062 *3*	Intensity=15515 *223*.
5000 *4*		0	0.093 *5*	Intensity=23328 *222*.
5065 *4*		0	0.024 *1*	Intensity=5921 *143*.
5096 *4*		0	0.010 *1*	Intensity=2614 *116*.
5200 *4*		0	0.066 *3*	Intensity=16332 *238*.
5262 *4*		0	0.033 *2*	Intensity=8148 *160*.
5295 *4*		≥1		Intensity=459 *79*.
5404 *4*		0	0.035 *2*	Intensity=8717 *157*.
5439? *4*		≥1		Intensity=1416 *131*.
5463? *4*		≥1		Intensity=1195 *129*.
5506 *4*		0	0.075 *4*	Intensity=18625 *203*.
5559 *4*		0	0.020 *1*	Intensity=5029 *118*.
5612? *4*		≥1		Intensity=2969 *170*.
5636 *4*		0	0.023 *1*	Intensity=5607 *188*.

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^{44}Ca(^{3}He,t)   **2013Fu08,1972Ma50 (continued)**

^{44}Sc Levels (continued)

E(level)[†]	L[‡]	B(GT)[#]	Comments
5700? 4	0	0.010 1	Intensity=2462 184.
5724 4	0	0.043 2	Intensity=10582 226.
5774 4	(0)	0.008 1	Intensity=1931 84.
5822 4	0	0.043 2	Intensity=10564 185.
5854? 4	(0)	0.010 1	Intensity=2459 145.
5880 4	0	0.007 1	Intensity=1779 134.
5926 4	≥1		Intensity=318 49.
5980 4	≥1		Intensity=561 75.
6013 4	0	0.045 2	Intensity=11025 194.
6043? 4	0	0.018 1	Intensity=4441 160.
6099 4	≥1		Intensity=3537 98.
6156 4	0	0.030 2	Intensity=7289 131.
6201 4	≥1		Intensity=368 57.
6246 4	≥1		Intensity=362 47.
6303 4	≥1		Intensity=1206 62.
6367 4	≥1		Intensity=966 65.
6404 4	0	0.006 1	Intensity=1592 115.
6429? 4	0	0.005 1	Intensity=1155 109.
6464 4	0	0.005 1	Intensity=1347 93.
6547 4	≥1		Intensity=555 75.
6574 4	≥1		Intensity=1366 87.
6635 4	0	0.012 1	Intensity=3054 94.
6678? 4	0	0.018 2	Intensity=4350 359.
6696? 4	0	0.013 2	Intensity=3310 354.
6737 4	0	0.012 1	Intensity=3026 103.
6776 4	0	0.003 1	Intensity=777 70.
6818 4	0	0.009 1	Intensity=2218 88.
6857 4	0	0.021 1	Intensity=5031 124.
6893 4	0	0.011 1	Intensity=2633 101.
6990 4	≥1		Intensity=1985 187.
7038 4	0	0.007 1	Intensity=1781 135.
7068? 4	0	0.004 1	Intensity=1095 92.
7104 4	0	0.009 1	Intensity=2288 90.
7150 4	0	0.008 1	Intensity=1883 191.
7171? 4	0	0.005 1	Intensity=1257 164.
7198 4	0	0.010 1	Intensity=2507 139.
7265? 4	(0)	0.005 1	Intensity=1161 113.
7291? 4	≥1		Intensity=2360 127.
7321 4	≥1		Intensity=3375 141.
7351 4	(0)	0.013 1	Intensity=3119 192.
7374? 4	≥1		Intensity=932 182.
7407 4	0	0.008 1	Intensity=1944 144.
7494? 4	0	0.011 1	Intensity=2673 222.
7514? 4	0	0.007 1	Intensity=1585 237.
7568 4	0	0.008 1	Intensity=1967 108.
7595 4	0	0.004 1	Intensity=1047 100.
7654 4	(0)	0.005 1	Intensity=1252 65.
7696 4	0	0.018 1	Intensity=4383 99.
7763? 4	≥1		Intensity=2051 85.
7797 4	0	0.012 1	Intensity=2964 95.
7873? 4	(0)	0.004 1	Intensity=967 121.
7896 4	≥1		Intensity=1914 127.
7942 4	0	0.010 1	Intensity=2434 82.
8016 4	0	0.013 1	Intensity=3235 184.
8051? 4	(0)	0.005 1	Intensity=1143 79.
8164 6	≥1		Intensity=1666 95.
8193 6	≥1		Intensity=1789 97.

^{44}Ca(^{3}He,t)   **2013Fu08,1972Ma50 (continued)**

^{44}Sc Levels (continued)

E(level)[†]	L[‡]	B(GT)[#]	Comments
8230 6	0	0.012 1	Intensity=2875 115.
8296 6	≥1		Intensity=1908 135.
8356 6	≥1		Intensity=1739 94.
8385? 6	≥1		Intensity=703 84.
8428 6	0	0.005 1	Intensity=1160 85.
8458 6	≥1		Intensity=1196 93.
8510 6	0	0.008 1	Intensity=1974 142.
8594 6	(0)	0.009 1	Intensity=2174 120.
8657 6	(0)	0.004 1	Intensity=1012 94.
8715 6	0	0.015 1	Intensity=3684 114.
8754 6	0	0.010 1	Intensity=2317 286.
8812 6	(0)	0.003 1	Intensity=826 71.
8848? 6	(0)	0.004 1	Intensity=921 206.
8862? 6	(0)	0.008 1	Intensity=2200 213.
8906 6	0	0.005 1	Intensity=1144 77.
8945? 6	≥1		Intensity=990 659.
8960 6	(0)	0.013 3	Intensity=3211 588.
9010 6	0	0.006 1	Intensity=1310 159.
9035 6	0	0.005 1	Intensity=1262 143.
9101 6	(0)	0.005 1	Intensity=1184 87.
9134 6	0	0.008 1	Intensity=1858 106.
9166 6	0	0.027 1	Intensity=6308 148.
9199 6	≥1		Intensity=1307 105.
9239 6	0	0.025 2	Intensity=5960 160.
9307 6	(0)	0.007 1	Intensity=1526 104.
9343? 6	(0)	0.010 2	Intensity=2379 388.
9363? 6	(0)	0.007 2	Intensity=1618 402.
9381 6	(0)	0.008 2	Intensity=1818 526.
9411 6	≥1		Intensity=1630 135.
9439 6	≥1		Intensity=1526 182.
9463? 6	0	0.016 1	Intensity=3801 226.
9487? 6	0	0.013 1	Intensity=3101 235.
9516 6	0	0.013 1	Intensity=2958 143.
9561 6	≥1		Intensity=1838 88.
9600 6	0	0.014 1	Intensity=3351 126.
9631? 6	≥1		Intensity=984 184.
9653? 6	(0)	0.006 1	Intensity=1476 189.
9683 6	0	0.012 1	Intensity=2780 119.
9735 6	≥1		Intensity=2964 125.
9765 6	0	0.022 1	Intensity=5172 147.
9798 6	0	0.009 1	Intensity=2174 115.
9836? 6	0	0.009 1	Intensity=2036 161.
9860? 6	0	0.014 1	Intensity=3258 165.
9892? 6	0	0.011 1	Intensity=2649 139.
9920? 6	0	0.015 1	Intensity=3479 143.
9956 6	≥1		Intensity=3992 160.
9984? 6	≥1		Intensity=966 172.
10007 6	0	0.011 1	Intensity=2610 202.
10075? 6	0	0.011 2	Intensity=2531 492.
10094? 6	0	0.007 2	Intensity=1615 445.
10112? 6	0	0.008 2	Intensity=1808 563.
10140? 6	0	0.007 1	Intensity=1608 142.
10188 6	0	0.024 1	Intensity=5574 121.
10235? 6	≥1		Intensity=777 99.
10263? 6	≥1		Intensity=1334 109.
10294 6	0	0.011 1	Intensity=2497 116.
10364 6	0	0.011 1	Intensity=2667 112.

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^{44}Ca(^{3}He,t)　　**2013Fu08,1972Ma50 (continued)**

^{44}Sc Levels (continued)

E(level)[†]	L[‡]	B(GT)[#]	Comments
10397 6	0	0.017 1	Intensity=3911 124.
10455 6	≥1		Intensity=2164 333.
10487 6	(0)	0.012 1	Intensity=2772 145.
10514? 6	≥1		Intensity=2099 142.
10573 6			Intensity=1026 74.
10653? 6	≥1		Intensity=1301 115.
10682? 6	≥1		Intensity=1788 105.
10712? 6			Intensity=1539 94.
10749 6			Intensity=1312 86.
10781? 6			Intensity=972 159.
10803? 6			Intensity=624 156.
10865 6	(0)	0.010 1	Intensity=2192 97.
10897 6	(0)	0.010 1	Intensity=2401 94.
10954 6	(0)	0.010 1	Intensity=2303 83.
10993? 6	≥1		Intensity=1272 91.
11023? 6	≥1		Intensity=1400 97.
11052? 6	≥1		Intensity=875 87.
11174 6	≥1		Intensity=1265 70.
11251? 6	≥1		Intensity=872 151.
11273? 6	≥1		Intensity=1152 177.
11319 10	≥1		Intensity=504 62.
11383? 10	≥1		Intensity=721 74.
11415? 10	≥1		Intensity=754 76.
11455 10	≥1		Intensity=767 76.
11489 10	≥1		Intensity=1168 100.
11575 10	(0)	0.013 1	T=(2)
			Intensity=3022 109.
11611? 10	≥1		Intensity=1383 83.
11656? 10	≥1		Intensity=1149 105.
11683? 10			Intensity=915 103.
11750 10	(0)	0.008 1	T=2
			Intensity=1701 93.
11783? 10	(0)	0.009 1	T=2
			Intensity=2105 110.
11815? 10	≥1		Intensity=2089 245.
11836? 10	≥1		Intensity=1835 226.
11865? 10	(0)	0.008 1	T=(2)
			Intensity=1722 243.
11931? 10	(0)	0.008 1	T=(2)
			Intensity=1828 157.
11956? 10	≥1		Intensity=1771 160.
11979? 10			Intensity=1396 171.
12100	(0)	0.005 1	Intensity=1194 82.
12560	(0)	0.005 1	T=(2)
			Intensity=1143 131.
12630	(0)	0.010 1	T=2
			Intensity=2172 107.
12820	(0)	0.012 1	T=1
			Intensity=2688 173.
13100	(0)	0.006 1	T=(2)
			Intensity=1353 101.
13380	(0)	0.023 2	T=2
			Intensity=4998 320.
13530	(0)	0.009 1	T=2
			Intensity=2042 250.
13680	(0)	0.014 1	T=2
			Intensity=3149 210.

^{44}Ca(^{3}He,t)   2013Fu08,1972Ma50 (continued)

^{44}Sc Levels (continued)

[†] From 2013Fu08, unless otherwise noted.
[‡] From DWBA analysis of measured $\sigma(\theta)$ in 1972Ma50 for levels up to 2585 and in 2013Fu08 for levels above 2585, unless otherwise noted.
[#] From 2013Fu08.
[@] From 1972Ma50 only.
[&] Possibly the same as L=1, 240.4 level in figure 1 of 2011St03.