^{42}Ca(^{3}He,t) 2015Fu08,1971Sh16

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen[#] and Balraj Singh	NDS 135, 1 (2016)	31-May-2016

2015Fu08 (also 2014Fu02): E=140 MeV/nucleon ^{3}He beam was produced at the K=400 Ring Cyclotron at RCNP. Target was a self-supporting foil of 1.78 mg/cm^{2} 93.7% enriched in ^{42}Ca. Reaction products were momentum analyzed with the Grand Raiden spectrometer (FWHM=29 keV) and detected with a focal-plane detector. Measured $\sigma(E_t,\theta)$ with five angle cuts (≤0.5°, 0.5°−0.8°, 0.8°−1.2°, 1.2°−1.6°, 1.6°−2.0°). Deduced levels, L-transfers, Gamow-Teller β strengths. Comparisons with shell-model calculations, and with the data published earlier for ^{46}V, ^{50}Mn, and ^{54}Co produced from the (^{3}He,t) reaction. In 2014Fu02 only the ground state and levels at 611, 1889 and 3688 are discussed.

2016Fu02, 2012Fu02, 2012St22, 2011St03 and 2007Ad27: conference papers which discuss the results of the same experiment as in 2015Fu08 and 2014Fu02 primary publications.

1971Sh16: E=26 MeV ^{3}He beam was produced from the University of Rochester MP Tandem. Target of 94.4% enriched ^{42}Ca about 30 μg/cm^{2} on a 10 μg/cm^{2} carbon backing. Tritons were momentum analyzed with the Split Pole Magnetic Spectrograph and detected with 100 micron Kodak NTB emulsion plates, energy resolution FWHM=9 keV. Measured $\sigma(E_t,\theta)$. Deduced levels, J^{π}, L from DWBA analysis.

Others:

1989Va09: E=73 MeV. Measured $\sigma(E_t,\theta)$. Deduced effective projectile-nucleon force parameters.

1987Ko34: E=18.86 MeV. Measured triton energy differences.

1977Vo02: measured Q-values. Measured $\sigma(E_t,\theta)$.

1974Ha35: E=33 MeV.

1971Be29: E=24.6 MeV. Deduced Q value and Coulomb-displacement energy.

^{42}Sc Levels

The B(GT) strengths and count rates for levels are from 2015Fu08. Total experimental B(GT) strength=2.7 *4* (2015Fu08) out of which ≈80% is concentrated in the 613, 1^{+} state.

Total counts observed (2015Fu08) within θ=0° to 0.5° are given under comments.

E(level)[†]	J^{π}[c]	L	Relative dσ/dΩ[d]	Comments
0	0^{+}	0	84[g]	T=1 E(level): IAS of ^{42}Ca g.s. L: from 1971Sh16 and 2015Fu08. Counts(0°)=34563 *543*.
613[@] *4*	1^{+}	0[a]	170[e]	L=0 in 2015Fu08; 2,1+3 in 1971Sh16. E(level): 612 *4* (2015Fu08), 615 *5* (1971Sh16). J$^{\pi}$: from 2014Fu02, 2015Fu08, 1971Sh16. B(GT) strength=2.173 *47* for 612 level, which represents about 80% of the total B(GT) strength in ^{42}Sc. Counts(0°)=241037 *1069*.
624[&] *5*			≤10[j]	J$^{\pi}$: 7^{+} (1971Sh16).
1494[@] *4*		2+4,3+5[b]	68[g]	E(level): 1491 *4* (2015Fu08), 1498 *5* (1971Sh16). J$^{\pi}$: 3^{+} (1971Sh16). Counts(0°)=10039 *156*.
1518[&] *5*		4+6,5+7[b]	34[h]	J$^{\pi}$: 5^{+} (1971Sh16).
1589[@] *4*		2,1+3[b]	29[e]	E(level): 1586 *4* (2015Fu08), 1593 *5* (1971Sh16). J$^{\pi}$: 2^{+} (1971Sh16). Counts(0°)=666 *46*.
1844[&] *5*			3.5[h]	J$^{\pi}$: (3^{+},4^{-}) (1971Sh16).
1887[‡@] *4*	1^{+}	0[a]	15[f]	E(level): 1887 *4* (2015Fu08), 1888 *5* (1971Sh16). J$^{\pi}$: (3^{-}),(0^{+} and 1^{+}) (1971Sh16). B(GT) strength=0.097 *3*.

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^{42}Ca(^{3}He,t) 2015Fu08,1971Sh16 (continued)

^{42}Sc Levels (continued)

E(level)[†]	Jπ[c]	L	Relative dσ/dΩ[d]	Comments
				E(level),Jπ: from 2014Fu02, 2015Fu08. Counts(0°)=10701 *159*.
2185[&] *5*			≈2[g]	Jπ: (3+,4−) (1971Sh16).
2221[@] *4*	1+	0[a]	12[e]	E(level): 2220 *4* (2015Fu08), 2222 *5* (1971Sh16). Jπ: from 2015Fu08; 1+,2 in 1971Sh16. B(GT) strength=0.028 *1*. Counts(0°)=3081 *110*.
2268[@] *5*			20[e]	E(level): 2272 *4* (2015Fu08), 2262 *5* (1971Sh16). Jπ: 1+,2 (1971Sh16). Counts(0°)=486 *42*.
2387[&] *5*			8[g]	Jπ: 4 (1971Sh16).
2452 *4*	1+	0[a]		Level only from 2015Fu08. B(GT) strength=0.014 *1*. Counts(0°)=1537 *73*.
2484[@] *4*			≈35[f]	Jπ: 1+,2+ (1971Sh16). E(level): 2484 *4* (2015Fu08), 2484 *5* (1971Sh16). Counts(0°)=460 *53*.
2510?[&] *5*			3[g]	
2650[&] *5*			8[h]	Jπ: (4+) (1971Sh16).
2669[‡&] *5*			17[f]	
2812[&] *5*		4,4+6[b]	17[h]	Jπ: 4+ (1971Sh16).
2842[‡@] *4*			8[e]	E(level): 2841 *4* (2015Fu08), 2844 *5* (1971Sh16). Counts(0°)=457 *35*.
2907[‡&] *5*			8[e]	
2967 *4*	1+	0[a]		Level only from 2015Fu08. B(GT) strength=0.018 *1*. Counts(0°)=1946 *69*.
3080?[&] *5*			1.6[k]	
3232[@] *4*		6,5+7[b]	11[i]	E(level): 3229 *4* (2015Fu08), 3237 *5* (1971Sh16). Jπ: 6+ (1971Sh16), (3+,4,5+) in 2015Fu08. Counts(0°)=6572 *139*.
3282[&] *5*			8[h]	Jπ: (4) (1971Sh16).
3312[&] *5*			13[g]	Jπ: 3+ (1971Sh16).
3346[‡@] *4*	1+	0[a]	5[f]	E(level): 3349 *4* (2015Fu08), 3340 *5* (1971Sh16). B(GT) strength=0.040 *1*. Counts(0°)=4418 *112*.
3366[&] *5*			10[e]	Jπ: 1+,2+ (1971Sh16).
3386[@] *4*			15[f]	E(level): 3389 *4* (2015Fu08), 3380 *5* (1971Sh16). Jπ: 3,4− (1971Sh16). Counts(0°)=521 *64*.
3583[&] *5*			8[g]	
3680[@] *8*	1+	0[a]	5[i]	E(level): 3686 *4* (2015Fu08), 3670 *5* (1971Sh16). Jπ: from 2014Fu02, 2015Fu08. B(GT) strength=0.127 *3*. Counts(0°)=13768 *182*.
3775[&] *5*			3[f]	Jπ: (2+) (1971Sh16).
3807[&] *5*		3,1+3[b]	24[e]	Jπ: 2−,3− (1971Sh16).
3880[&] *5*			16[f]	Jπ: 1+,2+ (1971Sh16).
3915[&] *5*			16[e]	Jπ: 1+,2+ (1971Sh16).
3934[@] *4*			14[h]	E(level): 3931 *4* (2015Fu08), 3938 *5* (1971Sh16).

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^{42}Ca(^{3}He,t) 2015Fu08,1971Sh16 (continued)

^{42}Sc Levels (continued)

E(level)†	Jπ c	L	Comments
			Jπ: (3+,4+) (1971Sh16).
			Counts(0°)=1499 *62*.
4070 *4*			Counts(0°)=334 *31*.
4177 *4*			Counts(0°)=333 *34*.
4272 *4*			Counts(0°)=904 *48*.
4370 *4*			Counts(0°)=245 *27*.
4547 *10*			Counts(0°)=345 *33*.
4590# *20*			Counts(0°)=364 *46*.
4619# *20*			Counts(0°)=560 *52*.
4821 *10*			Counts(0°)=435 *33*.
4873 *10*			Counts(0°)=3680 *86*.
4928 *10*	1+	0	B(GT) strength=0.020 *1*.
			Counts(0°)=2117 *67*.
5094 *10*			Counts(0°)=532 *35*.
5143 *10*	1+	0	B(GT) strength=0.021 *1*.
			Counts(0°)=2269 *66*.
5686# *20*	(1+)	(0)	B(GT) strength=0.005 *1*.
			Counts(0°)=483 *51*.
5716# *20*	1+	0	B(GT) strength=0.012 *1*.
			Counts(0°)=1221 *63*.
5803 *10*			Counts(0°)=1268 *64*.
5958 *10*			Counts(0°)=573 *38*.
6007 *10*			Counts(0°)=1804 *71*.
6078 *10*			Counts(0°)=516 *40*.
6167 *10*			Counts(0°)=1085 *59*.
6327 *10*	1+	0	B(GT) strength=0.018 *1*.
			Counts(0°)=1924 *70*.
6364 *10*			Counts(0°)=567 *57*.
6737 *10*			Counts(0°)=1100 *50*.
7068 *10*			Counts(0°)=1241 *58*.
7129 *10*			Counts(0°)=476 *62*.
7261 *10*			Counts(0°)=876 *78*.
7295 *10*			Counts(0°)=830 *57*.
7418 *10*			Counts(0°)=2988 *83*.
7491 *10*			Counts(0°)=653 *57*.
7586 *10*			Counts(0°)=430 *37*.
7678 *10*			Counts(0°)=441 *38*.
7776 *10*			Counts(0°)=2094 *68*.
7884 *10*			Counts(0°)=543 *64*.
7923 *10*			Counts(0°)=2313 *76*.
7974 *10*			Counts(0°)=1503 *62*.
8105 *10*	(1+)	(0)	B(GT) strength=0.004 *1*.
			Counts(0°)=458 *42*.
8182 *10*			Counts(0°)=835 *70*.
8251 *10*			Counts(0°)=1152 *59*.
8292 *10*			Counts(0°)=520 *47*.
8338 *10*			Counts(0°)=522 *49*.
8373 *10*			Counts(0°)=418 *65*.
8400 *10*			Counts(0°)=1239 *79*.
8492 *10*			Counts(0°)=431 *57*.
8540# *20*			Counts(0°)=749 *216*.
8732 *10*	(1+)	(0)	B(GT) strength=0.007 *1*.
			Counts(0°)=754 *47*.
8810 *10*			Counts(0°)=1492 *60*.
8854 *10*			Counts(0°)=1020 *62*.

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^{42}Ca(^{3}He,t) 2015Fu08,1971Sh16 (continued)

^{42}Sc Levels (continued)

E(level)[†]	Jπ[c]	L	Comments
8887 *10*			Counts(0°)=1710 *72*.
8929 *10*			Counts(0°)=1537 *80*.
8981 *10*	(1$^+$)	(0)	B(GT) strength=0.008 *1*. Counts(0°)=801 *116*.
9068[#] *20*			Counts(0°)=549 *164*.
9088[#] *20*			Counts(0°)=792 *149*.
9113[#] *20*			Counts(0°)=491 *100*.
9156 *10*			Counts(0°)=643 *48*.
9203 *10*			Counts(0°)=1291 *66*.
9236 *10*			Counts(0°)=1044 *63*.
9280[#] *20*			Counts(0°)=551 *56*.
9312[#] *20*			Counts(0°)=1106 *64*.
9406 *10*			Counts(0°)=916 *67*.
9565 *10*			Counts(0°)=524 *47*.
9611 *10*			Counts(0°)=651 *49*.
9793[#] *20*			Counts(0°)=858 *64*.
9826[#] *20*			Counts(0°)=1124 *69*.
9874 *10*			Counts(0°)=620 *75*.
9901 *10*			Counts(0°)=888 *79*.
9947[#] *20*			Counts(0°)=953 *75*.
9978[#] *20*			Counts(0°)=1436 *88*.
10011 *10*	1$^+$	0	B(GT) strength=0.032 *2*. Counts(0°)=3137 *156*.
10118[#] *20*			Counts(0°)=1241 *155*.
10142[#] *20*			Counts(0°)=2324 *184*.
10165[#] *20*			Counts(0°)=1726 *195*.
10195[#] *20*			Counts(0°)=670 *86*.
10250[#] *20*	1$^+$	0	B(GT) strength=0.017 *2*. Counts(0°)=1651 *174*.
10271[#] *20*			Counts(0°)=822 *171*.
10338 *10*	1$^+$	0	B(GT) strength=0.016 *1*. Counts(0°)=1530 *69*.
10395 *10*			Counts(0°)=556 *56*.
10437 *10*	1$^+$	0	B(GT) strength=0.020 *1*. Counts(0°)=1956 *78*.
10561 *10*	(1$^+$)	(0)	B(GT) strength=0.006 *1*. Counts(0°)=604 *55*.
10695 *10*			Counts(0°)=670 *59*.
10735 *10*			Counts(0°)=466 *61*.
10809 *10*			Counts(0°)=495 *70*.
11070 *20*			Counts(0°)=1273 *89*.
11180 *20*			Counts(0°)=623 *59*.
11220 *20*			Counts(0°)=745 *75*. Additional information 1.
11260 *20*			Counts(0°)=852 *59*.
11400 *20*			Counts(0°)=1566 *76*.
11620 *20*			Counts(0°)=617 *96*.
11810 *20*			Counts(0°)=614 *207*.
11830 *20*	(1$^+$)	(0)	B(GT) strength=0.010 *2*. Counts(0°)=964 *232*.
12000 *20*	(1$^+$)	(0)	B(GT) strength=0.010 *1*. Counts(0°)=963 *77*.

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$^{42}Ca(^{3}He,t)$ 2015Fu08,1971Sh16 (continued)

^{42}Sc Levels (continued)

E(level)[†]	Comments
12420 *20*	Counts(0°)=631 *82*.
12700 *20*	Counts(0°)=640 *195*.

[†] From 2015Fu08 unless otherwise stated. Based on authors′ general comments about uncertainties for level energies, evaluators assign 4 keV up to 4500 keV excitation, 10 keV from 4500 to about 11 MeV, and 20 keV for levels above 11 MeV and for doublets. Levels from 1971Sh16 are available up to 4 MeV.

[‡] Doublet in 1971Sh16, based on $\sigma(\theta)$ distribution.

[#] Component peak of an unresolved multiplet, energy value is less accurate (2015Fu08).

[@] Weighted average of values from 2015Fu08 and 1971Sh16.

[&] From 1971Sh16, level not reported in 2015Fu08.

[a] From 2015Fu08, based on comparisons of measured angular distributions with that of the 612-keV state which is identified with an L=0 pattern.

[b] From 1971Sh16, with first set of L-transfer value(s) more probable than the second set.

[c] Above the g.s., L=0 transitions are assumed as Gamow-Teller (2015Fu08). The assignments proposed by 1971Sh16 in column 6 of their Table 2 are listed under comments.

[d] Values are from 1971Sh16 for an angle where the cross section is the maximum. For absolute $d\sigma/d\Omega$ in μb/sr, multiply by a factor of ≈3.

[e] At 10°.

[f] At 15°.

[g] At 20°.

[h] At 25°.

[i] At 30°.

[j] At 35°.

[k] At 40°.