

⁴²Ca(p,p):resonances 1976Wi16,1974Ma39

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen [#]		NDS 126, 1 (2015)	31-Mar-2015

S(p)=4929.8 19 (2012Wa38).

1976Wi16: E=1.2-3.0 MeV proton beams were produced from the TUNL 3 MV Van de Graaff accelerator, FWHM=325 eV.

Targets of enriched CaCO₃ (94.42% ⁴²Ca) on carbon backings. Elastically scattered protons were detected by surface barrier detectors. Measured σ(E,θ). Deduced resonances, levels, J, Γ_p.

1974Ma39: E=1.20-3.23 MeV proton beams were produced from the Aerospace Research Laboratories (ARL) 8-MeV tandem accelerator, FWHM=200 eV. Targets of enriched CaCO₃ on carbon backings. Scattered protons were detected by surface barrier detectors. Measured σ(E,θ). Deduced resonances, levels, J, π, Γ.

1968Br27: E=1.24-1.82 MeV. Deduced resonances at 1240, 1792, 1802, 1817.

⁴³Sc Levels

E(level) [†]	Jπ [‡] #	Γ _p [†]	E(p) (lab) [†]	γ _p ² keV [†]	Comments
6149.5	3/2 ⁻	125 eV 15	1248.7	129.90	E(p)=1241.9 5, Γ _p =145 eV 5, γ _p ² =145 keV (1974Ma39).
6222.9	1/2 ⁺	50 eV 10	1323.9	10.99	
6417.6	1/2 ⁺	15 eV 5	1523.2	1.10	
6440.6	1/2 ⁺	1.5 eV 5	1546.8	0.99	
6510.7	1/2 ⁺	15 eV 5	1618.5	0.72	
6561.4	1/2 ⁻	180 eV 20	1670.4	18.52	
6564.1	1/2 ⁺	15 eV 5	1673.2	0.57	
6570.1	1/2 ⁺	10 eV 5	1679.4	0.37	
6630.0	1/2 ⁻	5 eV 3	1740.7	40.3	
6651.0	1/2 ⁺	175 eV 20	1762.2	4.72	
6677.4	(1/2 ⁻)	10 eV 5	1789.2	0.68	
6684.4	1/2 ⁺	15 eV 5	1796.4	0.36	
6685.3	3/2 ⁻	65 eV 10	1797.3	4.01	E(p)=1797 1, J ^π =1/2 ⁻ , Γ _p =120 eV 10, γ _p ² =145 keV (1974Ma39).
6694.8	1/2 ⁻	45 eV 10	1807.0	2.68	E(p)=1803.3 5, Γ _p =75 eV 5, γ _p ² =7.8 keV (1974Ma39).
6709.2	1/2 ⁻	900 eV 90	1821.8	50.71	
6709.5	1/2 ⁻	300 eV 30	1822.1	16.88	E(p)=1822 1, Γ _p =1450 eV 50, γ _p ² =135 keV (1974Ma39).
6736.6	3/2 ⁻	45 eV 10	1849.8	2.29	
6795.1	1/2 ⁻	500 eV 50	1909.7	20.60	
6795.4	1/2 ⁻	500 eV 50	1910.0	20.58	
6815.3	1/2 ⁺	30 eV 7	1930.4	0.46	
6827.0	3/2 ⁻	40 eV 10	1942.4	1.48	
6849.7	(3/2 ⁺)	10 eV 5	1965.6	1.96	
6850.8	1/2 ⁻	25 eV 7	1966.8	0.85	
6853.9	(3/2 ⁺)	10 eV 5	1969.9	1.93	
6855.0	1/2 ⁻	22 eV 7	1971.0	0.74	
6859.0	(3/2 ⁺)	13 eV 5	1975.1	2.47	
6868.2	1/2 ⁺	45 eV 10	1984.6	0.58	
6880.1	1/2 ⁺	120 eV 15	1996.7	1.50	
6899.7	1/2 ⁻	190 eV 20	2016.8	5.52	E(p)=2021 1, Γ _p =310 eV 10, γ _p ² =13.7 keV (1974Ma39).
6912.4	1/2 ⁺	240 eV 25	2029.8	2.73	E(p)=2033 1, Γ _p =280 eV 10, γ _p ² =5.3 keV (1974Ma39).
6936.4	1/2 ⁺	150 eV 15	2054.4	1.59	E(p)=2059 1, Γ _p =205 eV 5, γ _p ² =4 keV (1974Ma39).
6943.7	1/2 ⁻	165 eV 15	2061.9	4.19	E(p)=2066 1, Γ _p =214 eV 5, γ _p ² =9.6 keV (1974Ma39).
6966.0	(3/2 ⁺)	15 eV 5	2084.7	1.95	
6978.9	(3/2 ⁺)	20 eV 5	2097.9	2.49	
6983.6	1/2 ⁻	8 eV 5	2102.7	0.18	
7013.7	(3/2 ⁻)	15 eV 5	2133.5	0.31	
7024.7	(3/2 ⁺)	15 eV 5	2144.8	1.61	
7027.7	1/2 ⁻	150 eV 15	2147.8	2.97	E(p)=2151 1, Γ _p =224 eV 5, γ _p ² =7.2 keV (1974Ma39).
7032.1	1/2 ⁺	10 eV 5	2152.4	0.08	

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$^{42}\text{Ca}(\text{p,p}):$ resonances **1976Wi16,1974Ma39** (continued) ^{43}Sc Levels (continued)

E(level) [†]	J ^π ‡#	Γ _p [†]	E(p) (lab) [†]	γ _p ² keV [†]	Comments
7037.2	3/2 ⁻	35 eV 7	2157.6	0.67	
7046.4	(5/2 ⁺)	25 eV 7	2167.0	2.50	
7067.5	1/2 ⁺	800 eV 80	2188.6	5.99	
7074.9	1/2 ⁻	25 eV 7	2196.2	0.43	
7085.6	1/2 ⁻	300 eV 30	2207.1	5.05	
7094.4	3/2 ⁻	75 eV 15	2216.1	1.23	
7099.1	1/2 ⁺	50 eV 10	2221.0	0.35	
7116.8	1/2 ⁻	2.50 keV 25	2239.1	38.71	
7123.4	(3/2 ⁺)	10 eV 5	2245.8	0.79	
7125.0	1/2 ⁺	350 eV 35	2247.5	2.28	
7132.3	(3/2 ⁺)	10 eV 5	2254.9	0.77	
7138.0	3/2 ⁻	600 eV 60	2260.8	8.80	
7140.2	1/2 ⁺	600 eV 60	2263.0	3.77	
7150.5	(3/2 ⁺)	25 eV 7	2273.6	1.82	
7155.8	3/2 ⁻	50 eV 10	2279.0	0.70	
7170.2	1/2 ⁻	600 eV 60	2293.7	8.10	
7176.5	(5/2 ⁻)	5 eV 3	2300.2	3.37	
7185.2	(3/2 ⁺)	10 eV 5	2309.1	0.66	
7211.0	(1/2 ⁻)	10 eV 5	2335.5	0.12	
7215.3	(1/2 ⁺)	5 eV 3	2339.8	0.03	
7222.9	3/2 ⁺	35 eV 7	2347.7	2.07	
7227.1	(3/2 ⁺)	10 eV 5	2352.0	0.58	
7231.2	1/2 ⁻	500 eV 50	2356.2	5.81	
7240.8	(3/2 ⁺)	10 eV 5	2366.0	0.56	
7247.5	1/2 ⁻	150 eV 15	2372.9	1.68	
7251.0	(3/2 ⁺)	15 eV 5	2376.5	0.82	
7255.4	1/2 ⁺	70 eV 10	2381.0	0.34	
7256.8	3/2 ⁻	30 eV 7	2382.4	0.33	
7266.3	(3/2 ⁺)	20 eV 5	2392.1	1.05	
7281.0	(1/2 ⁻)	10 eV 5	2407.2	0.10	
7289.8	3/2 ⁺	35 eV 7	2416.2	1.73	
7290.9	(3/2 ⁺)	25 eV 7	2417.3	1.23	
7307.6	3/2 ⁻	40 eV 10	2434.4	0.39	
7309.1	1/2 ⁻	1.00 keV 10	2435.9	9.69	
7311.2	(3/2 ⁺)	5 eV 3	2438.1	0.23	
7315.8	1/2 ⁺	25 eV 7	2442.8	0.11	
7326.9	1/2 ⁻	3.00 keV 30	2454.2	27.92	E(p)=2460 1, Γ _p =2.92 keV 5, γ _p ² =42.2 keV (1974Ma39).
7329.5	(3/2 ⁺)	20 eV 5	2456.8	0.89	
7339.4	1/2 ⁺	600 eV 60	2467.0	2.46	E(p)=2473 1, Γ _p =540 eV 20, γ _p ² =4 keV (1974Ma39).
7363.5	1/2 ⁺	100 eV 15	2493.7	0.39	E(p)=2500 2, Γ _p =130 eV 10, γ _p ² =0.9 keV (1974Ma39).
7365.1	1/2 ⁻	90 eV 15	2493.3	0.77	
7369.7	1/2 ⁻	700 eV 70	2498.0	5.93	E(p)=2504 2, Γ _p =676 eV 5, γ _p ² =8.6 keV (1974Ma39).
7370.8	1/2 ⁻	40 eV 10	2499.1	0.34	
7378.5	1/2 ⁺	80 eV 15	2507.0	0.30	E(p)=2514 2, Γ _p =85 eV 5, γ _p ² =0.5 keV (1974Ma39).
7385.5	(5/2 ⁻)	5 eV 3	2514.2	0.77	
7390.3	1/2 ⁺	300 eV 30	2519.1	1.12	
7395.7	3/2 ⁺	40 eV 10	2524.6	1.50	
7412.4	1/2 ⁻	225 eV 25	2541.7	1.74	
7414.5	(3/2 ⁺)	5 eV 3	2543.9	0.18	
7419.4	3/2 ⁻	110 eV 15	2548.9	0.84	
7424.7	5/2 ⁺	30 eV 7	2554.3	1.05	
7439.9	5/2 ⁺	50 eV 10	2569.9	1.69	
7445.0	1/2 ⁺	400 eV 40	2575.1	1.35	
7448.4	1/2 ⁻	20 eV 5	2578.6	0.14	
7461.7	(3/2 ⁺)	15 eV 5	2592.2	0.48	
7463.7	3/2 ⁻	20 eV 5	2594.2	0.14	

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$^{42}\text{Ca}(\text{p,p}):$ resonances **1976Wi16,1974Ma39** (continued) ^{43}Sc Levels (continued)

E(level) [†]	J ^π ‡	Γ _p [†]	E(p) (lab) [†]	γ _p ² keV [†]	Comments
7476.6	1/2 ⁻	500 eV 50	2607.4	3.40	
7477.1	(5/2 ⁺)	25 eV 7	2608.0	0.77	
7478.6	3/2 ⁻	30 eV 7	2609.5	0.20	
7483.8	(5/2 ⁻)	2 eV 2	2614.8	0.54	
7492.0	1/2 ⁺	175 eV 20	2623.2	0.54	
7502.0	(5/2 ⁻)	5 eV 3	2633.4	1.28	
7508.5	3/2 ⁻	70 eV 10	2640.1	0.45	
7512.1	1/2 ⁻	1.00 keV 10	2643.8	6.34	
7517.6	(5/2 ⁺)	15 eV 5	2649.4	0.42	
7527.5	(3/2 ⁻)	15 eV 5	2659.6	0.09	
7539.1	3/2 ⁻	550 eV 55	2671.4	3.31	
7540.0	1/2 ⁺	15 eV 5	2672.3	0.04	
7557.1	(5/2 ⁺)	20 eV 5	2689.9	0.51	
7560.2	3/2 ⁻	150 eV 15	2693.0	0.87	
7564.1	(3/2 ⁺)	15 eV 5	2697.0	0.38	
7570.1	1/2 ⁺	400 eV 40	2703.2	1.08	E(p)=2715 2, Γ _p =380 eV 30, γ _p ² =1.1 keV (1974Ma39).
7586.6	1/2 ⁻	125 eV 15	2720.1	0.69	E(p)=2727 2, Γ _p =150 eV 10, γ _p ² =1.2 keV (1974Ma39).
7595.5	(3/2 ⁺)	15 eV 5	2729.2	0.35	
7596.9	1/2 ⁻	400 eV 40	2730.6	2.16	E(p)=2737 2, Γ _p =550 eV 20, γ _p ² =4.5 keV (1974Ma39).
7599.6	1/2 ⁺	80 eV 15	2733.4	0.21	E(p)=2740 2, Γ _p =90 eV 10, γ _p ² =0.4 keV (1974Ma39).
7604.5	(3/2 ⁺)	15 eV 5	2738.4	0.35	
7614.2	3/2 ⁻	20 eV 5	2748.3	0.10	
7615.6	(1/2 ⁻)	10 eV 5	2749.7	0.05	
7619.5	1/2 ⁻	3.50 keV 35	2753.7	18.16	E(p)=2761 2, Γ _p =770 eV 40, γ _p ² =5.6 keV (1974Ma39).
7620.8	(3/2 ⁺)	10 eV 5	2755.1	0.22	
7625.8	(3/2 ⁺)	15 eV 5	2760.2	0.33	E(p)=2768 2, Γ _p =30 eV 10, γ _p ² =1 keV (1974Ma39).
7627.1	(5/2 ⁺)	20 eV 5	2761.6	0.44	
7630.7	3/2 ⁻	185 eV 20	2765.2	0.94	E(p)=2772 2, J ^π =1/2 ⁻ , Γ _p =320 eV 10, γ _p ² =2.3 keV (1974Ma39).
7639.4	3/2 ⁻	20 eV 5	2774.1	0.10	
7644.1	(3/2 ⁺)	15 eV 5	2778.9	0.32	
7646.1	(3/2 ⁺)	15 eV 5	2781.0	0.32	
7659.6	3/2 ⁻	50 eV 10	2794.5	0.24	
7666.6	1/2 ⁺	500 eV 50	2802.0	1.17	
7668.0	1/2 ⁺	600 eV 60	2803.4	1.40	
7675.7	3/2 ⁻	50 eV 10	2811.3	0.24	
7683.6	(5/2 ⁻)	18 eV 5	2819.4	2.90	
7693.2	1/2 ⁻	60 eV 10	2829.2	0.27	
7703.3	(5/2 ⁺)	8 eV 5	2839.5	0.15	
7708.3	1/2 ⁺	100 eV 10	2844.7	0.22	
7711.1	1/2 ⁻	700 eV 70	2847.5	3.10	
7714.8	(5/2 ⁻)	15 eV 5	2851.3	2.24	
7721.7	1/2 ⁻	25 eV 7	2858.4	0.11	
7733.7	(5/2 ⁺)	20 eV 5	2870.7	0.35	
7738.3	1/2 ⁻	75 eV 15	2875.4	0.32	
7738.5	1/2 ⁺	25 eV 7	2875.6	0.05	
7744.3	3/2 ⁻	700 eV 70	2881.5	2.93	
7747.3	1/2 ⁻	40 eV 10	2884.6	0.17	
7751.4	1/2 ⁻	25 eV 7	2888.8	0.10	
7754.0	(5/2 ⁺)	25 eV 7	2891.4	0.42	
7760.9	(5/2 ⁺)	25 eV 7	2898.5	0.42	
7761.3	1/2 ⁻	35 eV 7	2898.9	0.14	
7769.4	1/2 ⁺	650 eV 65	2907.2	1.32	
7784.7	(3/2 ⁺)	15 eV 5	2922.9	0.24	
7785.3	(5/2 ⁻)	5 eV 3	2923.5	0.63	
7797.5	(5/2 ⁺)	30 eV 7	2936.0	0.47	

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$^{42}\text{Ca}(\text{p,p}):$ resonances **1976Wi16,1974Ma39** (continued) ^{43}Sc Levels (continued)

$E(\text{level})^\dagger$	$J^\pi \ddagger$	Γ_p^\dagger	$E(p)$ (lab) †	γ_p^2 keV †
7803.6	1/2 ⁺	125 eV 15	2942.2	0.24
7807.2	3/2 ⁻	115 eV 15	2945.9	0.44
7807.7	1/2 ⁻	35 eV 7	2946.4	0.13
7810.8	(3/2 ⁺)	5 eV 3	2949.6	0.08
7815.6	(5/2 ⁺)	10 eV 5	2954.5	0.15
7818.6	1/2 ⁺	200 eV 20	2957.6	0.38
7819.0	1/2 ⁺	80 eV 15	2958.0	0.15
7820.5	(5/2 ⁺)	20 eV 5	2959.5	0.30
7829.6	1/2 ⁻	25 eV 7	2968.8	0.09
7830.3	3/2 ⁻	240 eV 25	2969.6	0.88
7832.0	(5/2 ⁻)	3 eV 3	2971.3	0.34
7832.8	(3/2 ⁺)	30 eV 7	2972.1	0.44
7836.2	(5/2 ⁻)	8 eV 5	2975.6	0.90
7838.0	(3/2 ⁺)	25 eV 7	2977.4	0.36
7841.4	1/2 ⁺	200 eV 20	2980.9	0.37
7844.2	3/2 ⁻	120 eV 15	2983.3	0.43
7850.5	3/2 ⁻	75 eV 15	2990.2	0.27
7859.2	1/2 ⁻	225 eV 25	2999.1	0.79
7859.8	1/2 ⁻	30 eV 7	2999.8	0.11
7861.6	3/2 ⁺	20 eV 5	3001.6	0.28
7868.5	3/2 ⁻	50 eV 10	3008.7	0.17
7919 ‡	3/2 ⁺ , (5/2 ⁺) ‡	150 ‡ eV 20	3060 ‡	7 ‡
7926 ‡	1/2 ⁻ , (3/2 ⁻) ‡	420 ‡ eV 50	3067 ‡	2 ‡
7933 ‡	1/2 ⁺ ‡	270 ‡ eV 20	3074 ‡	0.6 ‡
7941 ‡	1/2 ⁺ ‡	1.36 ‡ keV 6	3083 ‡	3.1 ‡
7954 ‡	1/2 ⁻ , (3/2 ⁻) ‡	160 ‡ eV 10	3096 ‡	0.7 ‡
7961 ‡	1/2 ⁻ , (3/2 ⁻) ‡	150 ‡ eV 10	3103 ‡	0.6 ‡
8014 ‡	1/2 ⁻ ‡	260 ‡ eV 10	3157 ‡	1 ‡
8019 ‡	3/2 ⁺ , (5/2 ⁺) ‡	30 ‡ eV 10	3163 ‡	0.4 ‡
8034 ‡	3/2 ⁺ , (5/2 ⁺) ‡	80 ‡ eV 10	3178 ‡	1 ‡
8045 ‡	3/2 ⁺ , (5/2 ⁺) ‡	40 ‡ eV 10	3189 ‡	0.5 ‡
8048 ‡	1/2 ⁺ ‡	140 ‡ eV 10	3192 ‡	0.3 ‡
8061 ‡	1/2 ⁻ ‡	300 ‡ eV 10	3206 ‡	1 ‡
8065 ‡	3/2 ⁻ , (1/2 ⁻) ‡	90 ‡ eV 10	3210 ‡	0.3 ‡
8071 ‡	3/2 ⁻ ‡	80 ‡ eV 10	3216 ‡	2.6 ‡
8075 ‡	9/2 ⁺ , (7/2 ⁺) ‡	>55 ‡ eV	3220 ‡	53 ‡

† From **1976Wi16**, unless otherwise indicated. Uncertainty in proton energies is estimated to be 0.1 keV (as specified in a previous paper by **1976Wi16**), whereas the uncertainty in the excitation energy is 2 keV, essentially due to $\Delta S(p)$.

‡ From **1974Ma39**.

$^\#$ From theoretical fits to the experimental data.