

$^{29}\text{Si}(^3\text{He,p})$ 1980A116,1978A117,1969Mo03

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh		NDS 184, 29 (2022)	24-Jun-2022

Target $J^\pi(^{29}\text{Si g.s.})=1/2^+$.

[1980A116,1978A117](#): E=15 MeV from University of Pennsylvania Tandem accelerator. Measured E(p) using photographic emulsion in the focal plane of a multi-angle spectrograph. Silicon oxide target enriched to 95% in ^{29}Si . FWHM=40 keV. Spectra taken from 3.75 to 86 degrees (lab, 7.5° steps). Measured $\sigma(E_p, \theta)$. Deduced levels, L-transfers from DWBA analysis. Comparisons with Nilsson model calculations. [1978A117](#) report 27 levels up to 6.4 MeV and [1980A116](#) report 39 levels between 6.4 MeV and 9.7 MeV.

[1969Mo03](#): E=9.009 MeV from ONR-CIT tandem accelerator. Enriched Si foil targets (95% enriched ^{29}Si). Measure E(p) using an array of 16 Au-Si surface barrier detectors in focal plane of double focusing magnetic spectrometer (FWHM=25 keV). Spectra taken at 15, 30 and 45 degrees. Report 41 levels.

[1975Na09](#): E=26 MeV from tandem accelerator in the Max-Planck Institute. Silicon oxide target foils (98% enriched in ^{29}Si). Multigap magnetic spectrograph with Ilford L-4 nuclear emulsions for particle detection. Measured proton spectra and angular distributions, 5.5°–88° (3.5° steps) DWBA analysis. FWHM=40-45 keV. Report 12 levels.

[1982A128](#): re-analysis of $\sigma(\theta)$ data in [1975Na09](#). Deduced $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}$.

 ^{31}P Levels

E(level) [†]	L [†]	Comments
0	0	L: also from 1975Na09 . $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.61$ (1982A128), 0.91 (1975Na09), 0.85 or 0.92 (1978A117). $\sigma_{\text{max}}=938$ $\mu\text{b/sr}$ (1978A117).
1262 5	2+0	L: other: 2(+0) (1975Na09). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=1.24$ (1982A128), 1.27 (1975Na09), 0.79 (1978A117). $\sigma_{\text{max}}=111$ $\mu\text{b/sr}$ (1978A117).
2233 5	2+4	L: other: 2 (1975Na09). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=3.3$ (1982A128), 3.54 (1975Na09), 0.07 (1978A117). $\sigma_{\text{max}}=61$ $\mu\text{b/sr}$ (1978A117).
3130 5	0(+2)	L: from other: 0+2 (1975Na09). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=3.75$ (1982A128), 2.09 (1975Na09 ,tentative), 5.40 or 2.19 (1978A117). $\sigma_{\text{max}}=325$ $\mu\text{b/sr}$ (1978A117).
3296 5	2(+4)	L: other: 2 (1975Na09). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.41$ (1982A128), 0.45 (1975Na09), 0.17 (1978A117). $\sigma_{\text{max}}=227$ $\mu\text{b/sr}$ (1978A117).
3417 5	4	E(level): weighted average of 3415 9 (1969Mo03), 3418 5 (1978A117). L: also from 1975Na09 . $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.96$ (1982A128), 3.64 (1975Na09 ,tentative), 0.14 (1978A117). $\sigma_{\text{max}}=14$ $\mu\text{b/sr}$ (1978A117).
3509 5	0+2	E(level): weighted average of 3507 9 (1969Mo03), 3509 5 (1978A117). L: from 1975Na09 . Other: 0(+2) from 1978A117 . $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.74$ (1982A128), 0.91 (1975Na09 ,tentative), 0.23 or 0.16 (1978A117). $\sigma_{\text{max}}=148$ $\mu\text{b/sr}$ (1978A117).
4190 5	2	E(level): weighted average of 4191 9 (1969Mo03), 4189 5 (1978A117). L: also from 1975Na09 . $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=2.32$ (1975Na09), 0.18 (1978A117). $\sigma_{\text{max}}=38$ $\mu\text{b/sr}$ (1978A117).
4259 5	2(+0)	E(level): weighted average of 4260 9 (1969Mo03), 4259 5 (1978A117). L: other: 2(+0) (1975Na09). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=8.65$ (1975Na09 ,tentative), 0.32 (1978A117). $\sigma_{\text{max}}=64$ $\mu\text{b/sr}$ (1978A117).
4430 5	3	E(level): weighted average of 4435 9 (1969Mo03), 4428 5 (1978A117). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.36$ (1978A117). $\sigma_{\text{max}}=98$ $\mu\text{b/sr}$ (1978A117).
4594? 5	(2)	E(level): weighted average of 4595 9 (1969Mo03), 4594 5 (1978A117).

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$^{29}\text{Si}(^3\text{He},\text{p})$ **1980AI16,1978AI17,1969Mo03 (continued)** ^{31}P Levels (continued)

E(level) [†]	L [†]	Comments
		L: other: (0) from 1975Na09 perhaps unresolved from 4630. $\sigma_{\text{max}}=23 \mu\text{b/sr}$ (1978AI17).
4641 5	4	E(level): weighted average of 4646 9 (1969Mo03), 4640 5 (1978AI17). L: other: (4) (1975Na09). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.32$ (1978AI17). $\sigma_{\text{max}}=12 \mu\text{b/sr}$ (1978AI17).
4780 5	(2+4)	L: from 1975Na09. Other: (2+4) from 1978AI17. E(level): weighted average of 4783 9 (1969Mo03), 4779 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.78$ (1975Na09). $\sigma_{\text{max}}=7 \mu\text{b/sr}$ (1978AI17).
5011 5	1(+0)	E(level),L: doublet from L=1(+0) (1978AI17) or 1+3 (1975Na09) for 5010+5020 doublet. E(level): weighted average of 5016 9 (1969Mo03), 5010 5 (1978AI17). $\sigma_{\text{max}}=660 \mu\text{b/sr}$ (1978AI17).
5116 5	2+4	L: other: 4(+2) (1975Na09). E(level): weighted average of 5115 9 (1969Mo03), 5116 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.11$ (1978AI17). $\sigma_{\text{max}}=40 \mu\text{b/sr}$ (1978AI17).
5257 5	0	L: also from 1975Na09. E(level): weighted average of 5255 9 (1969Mo03), 5257 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=1.10$ (1975Na09,tentative). $\sigma_{\text{max}}=222 \mu\text{b/sr}$ (1978AI17).
5340 5	4	L: from 1975Na09. Other: (4) from 1978AI17. E(level): weighted average of 5340 9 (1969Mo03), 5340 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.48$ (1975Na09). $\sigma_{\text{max}}=13 \mu\text{b/sr}$ (1978AI17).
5529 5	2	L: other: (4) (1975Na09). Perhaps 5530+5560 doublet with L=0+4. E(level): weighted average of 5532 12 (1969Mo03), 5529 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.03$ (1978AI17). $\sigma_{\text{max}}=34 \mu\text{b/sr}$ (1978AI17).
5555 5	0	L: other: (0) (1975Na09). E(level): weighted average of 5560 12 (1969Mo03), 5554 5 (1978AI17). $\sigma_{\text{max}}=97 \mu\text{b/sr}$ (1978AI17).
5671 5	1+3,2+4	E(level): weighted average of 5673 11 (1969Mo03), 5671 5 (1978AI17). $\sigma_{\text{max}}=118 \mu\text{b/sr}$ (1978AI17).
5766 5	2+4,1+3	E(level): weighted average of 5772 11 (1969Mo03), 5765 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.09$ (1978AI17). $\sigma_{\text{max}}=14 \mu\text{b/sr}$ (1978AI17).
5890 5	4	E(level): weighted average of 5889 9 (1969Mo03), 5890 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.18$ (1978AI17). $\sigma_{\text{max}}=31 \mu\text{b/sr}$ (1978AI17).
5993 5	(0+2)	E(level): weighted average of 5988 11 (1969Mo03), 5994 5 (1978AI17). $\sigma_{\text{max}}=27 \mu\text{b/sr}$ (1978AI17).
6048 5	(2+4)	E(level): weighted average of 6048 9 (1969Mo03), 6048 5 (1978AI17). $\sigma_{\text{max}}=11 \mu\text{b/sr}$ (1978AI17).
6080 5	(4)	E(level): weighted average of 6079 9 (1969Mo03), 6080 5 (1978AI17). $\sigma_{\text{max}}=13 \mu\text{b/sr}$ (1978AI17).
6235 5	(3,2+4)	E(level): weighted average of 6236 9 (1969Mo03), 6235 5 (1978AI17). $\sigma_{\text{max}}=15 \mu\text{b/sr}$ (1978AI17).
6332 [‡] 9		
6379 5	2	E(level): weighted average of 6383 9 (1969Mo03), 6378 5 (1978AI17). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.87$ (1978AI17). $\sigma_{\text{max}}=196 \mu\text{b/sr}$ (1978AI17).
6461 6	2+4	E(level): weighted average of 6460 9 (1969Mo03), 6462 6 (1980AI16). $\sigma_{\text{max}}=78 \mu\text{b/sr}$ (1980AI16).
6493 6	1+3	E(level): weighted average of 6496 9 (1969Mo03), 6491 6 (1980AI16). $\sigma_{\text{max}}=198 \mu\text{b/sr}$ (1980AI16).
6593 6	1+3(+5)	$\sigma_{\text{max}}=412 \mu\text{b/sr}$ (1980AI16).

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$^{29}\text{Si}(^3\text{He},\text{p})$ [1980AI16](#),[1978AI17](#),[1969Mo03](#) (continued) ^{31}P Levels (continued)

E(level) [†]	L [†]	Comments
6611 [‡] 9		
6833 [‡] 9		
6914 6	1(+0)	E(level): weighted average of 6914 9 (1969Mo03), 6914 6 (1980AI16). $\sigma_{\text{max}}=58 \mu\text{b/sr}$ (1980AI16). $\sigma_{\text{max}}=15 \mu\text{b/sr}$ (1980AI16).
6931 6	4	
7074 6	0(+1)	E(level): weighted average of 7077 9 (1969Mo03), 7073 6 (1980AI16). $\sigma_{\text{max}}=151 \mu\text{b/sr}$ (1980AI16).
7138 6	0	E(level): weighted average of 7145 9 (1969Mo03), 7135 6 (1980AI16). $\sigma_{\text{exp}}/\sigma_{\text{DWBA}}=0.64$ (1978AI17). $\sigma_{\text{max}}=500 \mu\text{b/sr}$ (1980AI16).
7213 6	1	E(level): weighted average of 7210 9 (1969Mo03), 7214 6 (1980AI16). $\sigma_{\text{max}}=80 \mu\text{b/sr}$ (1980AI16).
7313 6	0	E(level): weighted average of 7314 9 (1969Mo03), 7313 6 (1980AI16). $\sigma_{\text{max}}=130 \mu\text{b/sr}$ (1980AI16).
7349 6	3+1	E(level): weighted average of 7356 9 (1969Mo03), 7346 6 (1980AI16). $\sigma_{\text{max}}=45 \mu\text{b/sr}$ (1980AI16).
7466 6	3(+5)	E(level): weighted average of 7465 9 (1969Mo03), 7467 6 (1980AI16). $\sigma_{\text{max}}=58 \mu\text{b/sr}$ (1980AI16).
7715 6	0+2,(1+3)	E(level): weighted average of 7718 9 (1969Mo03), 7713 6 (1980AI16). $\sigma_{\text{max}}=379 \mu\text{b/sr}$ (1980AI16).
7778 6	1	E(level): weighted average of 7777 9 (1969Mo03), 7778 6 (1980AI16). $\sigma_{\text{max}}=232 \mu\text{b/sr}$ (1980AI16).
7825 [‡] 12		
7853 6	(0+2,1)	E(level): weighted average of 7847 9 (1969Mo03) and 7856 6 (1980AI16). $\sigma_{\text{max}}=125 \mu\text{b/sr}$ (1980AI16).
7897 6	(2,1+3)	E(level): weighted average of 7900 9 (1969Mo03) and 7895 6 (1980AI16). $\sigma_{\text{max}}=325 \mu\text{b/sr}$ (1980AI16).
7994 6	1	$\sigma_{\text{max}}=118 \mu\text{b/sr}$ (1980AI16).
8042 6	1	$\sigma_{\text{max}}=131 \mu\text{b/sr}$ (1980AI16).
8085? [‡] 11		
8213 6	0	$\sigma_{\text{max}}=314 \mu\text{b/sr}$ (1980AI16).
8242 6	1+3	$\sigma_{\text{max}}=120 \mu\text{b/sr}$ (1980AI16).
8352 6		$\sigma_{\text{max}}=38 \mu\text{b/sr}$ (1980AI16).
8462 6	2(+4)	$\sigma_{\text{max}}=324 \mu\text{b/sr}$ (1980AI16).
8549 6	1(+3)	$\sigma_{\text{max}}=322 \mu\text{b/sr}$ (1980AI16).
8576 6	2(+4)	$\sigma_{\text{max}}=243 \mu\text{b/sr}$ (1980AI16).
8646 6	0+2	$\sigma_{\text{max}}=219 \mu\text{b/sr}$ (1980AI16).
8731 6	0+2	$\sigma_{\text{max}}=112 \mu\text{b/sr}$ (1980AI16).
8755 6	(0+2,1)	$\sigma_{\text{max}}=277 \mu\text{b/sr}$ (1980AI16).
8908 6		L: (0+2+4,1+3). $\sigma_{\text{max}}=140 \mu\text{b/sr}$ (1980AI16). $\sigma_{\text{max}}=339 \mu\text{b/sr}$ (1980AI16).
8934 6	0	$\sigma_{\text{max}}=168 \mu\text{b/sr}$ (1980AI16).
9010 6	2	$\sigma_{\text{max}}=168 \mu\text{b/sr}$ (1980AI16).
9044 6	2(+4)	$\sigma_{\text{max}}=256 \mu\text{b/sr}$ (1980AI16).
9121 6	2+4	$\sigma_{\text{max}}=137 \mu\text{b/sr}$ (1980AI16).
9155 6	0+3	$\sigma_{\text{max}}=561 \mu\text{b/sr}$ (1980AI16).
9203 6	2	$\sigma_{\text{max}}=160 \mu\text{b/sr}$ (1980AI16).
9242 6	(3,2+4)	E(level): 9142 in 1980AI16 is presumed as misprint. $\sigma_{\text{max}}=114 \mu\text{b/sr}$ (1980AI16).
9316 6	(0+2)	$\sigma_{\text{max}}=140 \mu\text{b/sr}$ (1980AI16).
9353 6	(3+5,4)	$\sigma_{\text{max}}=159 \mu\text{b/sr}$ (1980AI16).
9406 6		$\sigma_{\text{max}}=194 \mu\text{b/sr}$ (1980AI16).
9515 6		$\sigma_{\text{max}}=243 \mu\text{b/sr}$ (1980AI16).
9583 6		$\sigma_{\text{max}}=448 \mu\text{b/sr}$ (1980AI16).
9659 6	2	$\sigma_{\text{max}}=160 \mu\text{b/sr}$ (1980AI16).

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$^{29}\text{Si}(\text{}^3\text{He,p})$ [1980A116](#),[1978A117](#),[1969Mo03](#) (continued)

^{31}P Levels (continued)

[†] From [1978A117](#) up to 6378 and from [1980A116](#) above that, unless otherwise stated. Uncertainty of 5-6 keV is stated by [1980A116](#), evaluators assign 6 keV for values from [1980A116](#). Energy values are also available in [1969Mo03](#) and average is taken where multiple values are available. L-transfers are from DWBA fit to measured $\sigma(\theta)$.

[‡] From [1969Mo03](#) only.