

$^{34}\text{S}(\text{d},\text{p})$ 2024Ku24,1984Pi03,1969Mo12

$J^\pi=0^+$ for ^{34}S g.s.

2024Ku24: an 8-MeV/nucleon deuteron beam was produced from the 9-MV Super-FN tandem Van de Graaff accelerator at FSU.

The target was carbon-backed sulfur enriched in ^{34}S . Protons were spatially dispersed by the Super-Enge Split-Pole Spectrograph and detected using a position-sensitive ionization chamber (ΔE) and a plastic scintillator (E) at the focal plane with FWHM \approx 45 keV. An additional $^{34}\text{S}(\text{d},\text{p}\gamma)^{35}\text{S}$ measurement using the CeBr 3 Array (CeBrA) demonstrator provides information on some overlapping peaks produced from the ^{32}S contaminants in the target. Measured $\theta(E_p, \theta)$. Deduced 23 levels, single-neutron spectroscopic factors and strengths from finite-range PTOLEMY-DWBA analysis.

1984Pi03: a 12.3-MeV deuteron beam was produced from a cyclotron. The target was CdS (61.9% in ^{36}S , 37.7% in ^{34}S), 100 $\mu\text{g}/\text{cm}^2$ on a 20 $\mu\text{g}/\text{cm}^2$ carbon backing. Protons were analyzed by a multi-angle magnetic spectrograph and detected using a 700-mm long nuclear emulsion plates Ilford L4. Measured $\sigma(E_p, \theta)$. Deduced 13 levels, L, J, π , and spectroscopic factors from DWUCK-DWBA analysis for six excited states of ^{35}S .

1971Va18: a 10-MeV deuteron beam was produced from the Utrecht 6-MV tandem accelerator. Targets were a 100 $\mu\text{g}/\text{cm}^2$ PbS on carbon plus formvar foils and a 5 $\mu\text{g}/\text{cm}^2$ pure ^{34}S embedded in aluminum foil. Protons were detected using 15 mm long and seven 30 mm long, 0.6 mm thick position-sensitive detectors (PSD) in the focal plane of the Utrecht split-pole magnetic spectrograph. Measured $\theta(E_p, \theta)$. Deduced 17 levels, L, J, π , spectroscopic factors from DWUCK-DWBA analysis for the ground state and seven excited states of ^{35}S .

1958En51: 6.006- and 6.542-MeV deuteron beams were produced from the MIT-ONR electrostatic generator. Targets were Sb $^2\text{S}^3$ of natural isotopic constitution (4.2% ^{34}S). Energies of charged reaction products emitted from the target at angles of 50, 90, and 130° were measured by a broad-range magnetic spectrograph and nuclear emulsions. Measured $\sigma(E_p, \theta)$. Deduced 5 levels.

1966Sc09: 9- and 12-MeV deuteron beams were produced from the Argonne tandem accelerator. The target was PbS. Protons were detected using silicon surface barrier detectors. Measured $\sigma(E_p, \theta)$ for the ground state and one excited state of ^{35}S .

1969Mo12: a 6.495-MeV deuteron beam was produced from the ONR-CIT tandem accelerator. The target was an enriched target of 450 25- $\mu\text{g}/\text{cm}^2$ CdS (85% ^{34}S) evaporated onto a 301 15- $\mu\text{g}/\text{cm}^2$ gold foil and a natural target of 289 30- $\mu\text{g}/\text{cm}^2$ Sb $^2\text{S}^3$ evaporated onto a 289 30- $\mu\text{g}/\text{cm}^2$ gold foil. Protons were detected using an array of 16 Au-Si surface barrier detectors with FWHM=30 keV. Measured $\theta(E_p, \theta)$. Deduced 37 levels.

1971Ko33: a 6.6-MeV deuteron beam was produced from a cyclotron. Targets were GeS films of 70-80 $\mu\text{g}/\text{cm}^2$ (98% enrichment in ^{34}S) evaporated onto a 20 $\mu\text{g}/\text{cm}^2$ carbon substrate. Protons were detected using an 800- μ -thick Si(Li). Measured $\sigma(E_p, \theta)$. Deduced levels, J, π , L and spectroscopic factors from distorted-wave analysis for the ground state and five excited states of ^{35}S .

1971Me12: a 18-MeV deuteron beam was produced from the Yale MP tandem Van de Graaff accelerator. The target was H ^2S gas of natural isotopic composition (95.06% ^{32}S , 4.18% ^{34}S). Protons were detected using a ΔE -E telescope of silicon surface-barrier detectors. Measured $\sigma(E_p, \theta)$. Deduced levels, J, π , L and spectroscopic factors local, zero-range JULIE-DWBA analysis of $\sigma(E_p, \theta)$ for the ground state and two excited states of ^{35}S .

1979So01: a 3.55-MeV deuteron beam was produced from a Van de Graaff electrostatic generator. The target was 18- $\mu\text{g}/\text{cm}^2$ GeS (80% ^{36}S , 20% ^{34}S) on a 25- $\mu\text{g}/\text{cm}^2$ carbon backing. Protons were analyzed by a magnetic spectrograph and recorded by a spark chamber with FWHM=10-15 keV. Measured $\sigma(E_p, \theta)$. Deduced levels.

Other measurements: **1976We29:** $^{34}\text{S}(\text{d},\text{p})^{35}\text{S}$ angular distributions for the ground state and the first excited state of ^{35}S .

1973Co25: $^{34}\text{S}(\text{d},\text{p})^{35}\text{S}$ excitation functions for the two lowest excited states of ^{35}S .

Theoretical calculations: **1977Os07**, **1974Os02**.

 ^{35}S Levels

E(level)	L $\&$	C $^2\text{S}\&$	Comments
0	2	0.54 12	L: 2 also from 1971Va18 , 1971Ko33 , and 1971Me12 . C ^2S : 0.43 11 (1971Va18), 0.33 (1971Ko33), 0.46 (1971Me12).
1571.92 $^{\#}$ 19	0	0.14 7	L: 0 also from 1971Va18 , 1971Ko33 , and 1984Pi03 . C ^2S : 0.17 4 (1971Va18), 0.25 (1971Ko33), 0.154 (1984Pi03).
1991.08 $^{\#}$ 16	3	0.87 9	C ^2S : 0.91 23 assuming $J^\pi=5/2^-$, 0.68 17 assuming $J^\pi=7/2^-$ (1971Va18), 0.38 assuming $J^\pi=7/2^-$ (1971Ko33), 0.63 assuming $J^\pi=7/2^-$ (1971Me12), 0.841 assuming $J^\pi=7/2^-$ (1984Pi03).
2347.59 $^{\#}$ 15	1	0.62 7	E(level): Others: 2347 8 (1969Mo12) and 2336 10 (1971Va18). L: 1 also from 1971Va18 and 1984Pi03 . C ^2S : 0.52 13 assuming $J^\pi=3/2^-$ (1971Va18), 0.50 assuming $J^\pi=3/2^-$ (1971Me12), 0.33 assuming $J^\pi=3/2^-$ (1971Ko33), 0.505 assuming $J^\pi=3/2^-$ (1984Pi03).

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$^{34}\text{S}(\text{d,p})$ **2024Ku24,1984Pi03,1969Mo12 (continued)** ^{35}S Levels (continued)

E(level)	J^π	L	C^2S	Comments
2724 8		2	0.02 1	E(level): weighted average of 2722 8 (1969Mo12) and 2726 8 (1971Va18). L: Other: (2,3) from 1971Va18.
2941 10		2	<0.02	E(level): weighted average of 2943 10 (1969Mo12) and 2939 10 (1971Va18).
3420 8		2	0.02 1	E(level): weighted average of 3422 8 (1969Mo12) and 3415 12 (1971Va18).
3569 14				E(level): unweighted average of 3583 8 (1969Mo12) and 3555 9 (1971Va18).
3596 [†] 8				E(level): Other: 3595 9 (1971Va18).
3675 [‡] 10	(1)			L: From 1971Va18. C^2S : $<2.5 \times 10^{-3}$ assuming $J^\pi=1/2^-$ and $<1.25 \times 10^{-3}$ assuming $J^\pi=3/2^-$ (1971Va18).
3801.90 [#] 30	1		0.07 4	E(level): Others: 3804 8 (1969Mo12) and 3795 10 (1971Va18). L: 1 also from 1971Va18. C^2S : 0.09 3 assuming $J^\pi=3/2^-$ (1971Va18).
3885 [†] 10				E(level): Other: 3866? 10 (1971Va18).
3907 [‡] 10				
4025 10				E(level): weighted average of 4025 10 (1969Mo12) and 4025 10 (1971Va18).
4109 10				E(level): weighted average of 4112 10 (1969Mo12) and 4105 10 (1971Va18).
4189.87 [#] 26	1			E(level): Others: 4190 8 (1969Mo12) and 4196 12 (1971Va18). C^2S : 0.12 3 assuming $J^\pi=1/2^-$ (1971Va18).
4305 8				E(level): weighted average of 4302 8 (1969Mo12) and 4312 12 (1971Va18).
4481 [†] 8	2,3		0.07 2	E(level): Other: 4477 doublet (2024Ku24). L: 2,3 doublet (2024Ku24). C^2S : for L=2 component. Other: 0.05 2 for L=3 component (2024Ku24).
4575 [†] 8				
4837 [†] 8				
4903.28 [#] 16	1		0.78 8	E(level): Other: 4903 8 (1969Mo12). L: 1 also from 1984Pi03. C^2S : Other: 0.776 assuming $J^\pi=1/2^-$ (1984Pi03).
4963.12 [#] 16	1		0.32 3	E(level): Other: 4965 8 (1969Mo12). L: 1 also from 1984Pi03. C^2S : Other: 0.218 assuming $J^\pi=3/2^-$ (1984Pi03).
5058 [†] 8		3	0.08 1	
5126 [†] 11				
5342 [†] 8				
5475? [†] 10				
5542? [†] 8				
5740 [@] 20	(5/2 ⁻)	3	0.03 1	J^π : purely speculative (2024Ku24).
5890 [@] 20	(3/2 ⁺)	2	0.11 2	J^π : purely speculative (2024Ku24).
5980 [†] 10				
6078.6 [#] 13	1		0.086	E(level): Other: 6080 8 (1969Mo12). L, C^2S : From 1984Pi03. $C^2S=0.086$ assuming $J^\pi=1/2^-$ and 0.042 assuming $J^\pi=3/2^-$.
6292 [†] 8				
6334 [†] 8				
6344 [†] 8				
6446 [†] 8				
6496 [†] 8				
6537.7 [#] 14				
6545.1 [#] 13				E(level): Other: 6543 8 (1969Mo12).
6584 [†] 10				

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$^{34}\text{S}(\text{d,p})$ [2024Ku24](#),[1984Pi03](#),[1969Mo12](#) (continued) ^{35}S Levels (continued)

E(level)	L&	Comments
6635.2 [#] 13	(2,3)	E(level): Others: 6634 8 (1969Mo12) and 6625 30 (2024Ku24).
6677 [†] 8		
6891.3 [#] 14	(1,3)	E(level): Others: 6892 10 (1969Mo12) and 6915 30 (2024Ku24).
7021 10	(2,3)	E(level): weighted average of 7022 10 (1969Mo12) and 7005 35 (2024Ku24).
7150 [@] 35	(0,3)	
7205 [@] 35	(1,2)	
7482.7 [#] 13	(1,2)	E(level): Other: 7495 40 (2024Ku24).
7570 [@] 40	(2,3)	
7640 [@] 40	(2,3)	

[†] From [1969Mo12](#).[‡] From [1971Va18](#).# From [1984Pi03](#).[@] From [2024Ku24](#).& From [2024Ku24](#), unless otherwise noted. $N \cdot (2J_f + 1) / (2J_i + 1) \cdot C^2 S = \sigma(\theta) \exp / \sigma(\theta)^{\text{DWBA}}$, where N is the normalization factor.
N=1.58 ([1971Me12](#)), N=1.53 ([1971Va18](#)), N=1.53 ([1984Pi03](#)). $\gamma(^{35}\text{S})$

E_γ	$E_i(\text{level})$	E_f	Comments
1572	1571.92	0	E_γ : From 2024Ku24 .
1991	1991.08	0	E_γ : From 2024Ku24 .

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Level Scheme

