^{32}S(^{3}He,d) 1972Ko02,1970Mo08,1975In03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 199,1 (2025)	30-Sep-2024

Target J^{π}(^{32}S g.s.)=0^{+}.

1972Ko02: E=29.7 and 34.5 MeV ^{3}He beams were produced from the Texas A&M cyclotron. Targets was natural H_2S gas (95.0% in ^{32}S) contained in a 8.9-cm-diam by 1.3-cm high cylindrical gas cell with 1.8-mg/cm^2-thick Havar windows. Reaction products were detected with a solid-state detector telescope consisting of a 1-mm-thick silicon surface-barrier ΔE detector and 1.8- and 3-mm-thick Si(Li) E detectors (FWHM=80-100 keV). Measured $\sigma(E_d,\theta)$, θ=9.5° to 55.0°. Deduced levels, J, π, L-transfers, spectroscopic factors from DWBA analysis. Report 16 levels.

1970Mo08: E=12 MeV ^{3}He beam was produced from the NOR-CIT tandem accelerator. Targets were 78(16) μg/cm^2 CdS containing natural sulfur on 282(60) μg/cm^2 gold foil and 141(10) μg/cm^2 CdS on 323(30) μg/cm^2 gold foil. Reaction products were detected with an array of 16 Au-Si surface-barrier detectors on the focal plane (FWHM=31 keV). Measured $\sigma(E_d,\theta)$, $\theta_{c.m.}$=5° to 50°. Deduced levels, J, π, L-transfers from DWBA analysis. Comparisons with available data. Report 10 levels.

1975In03: E=10.4 MeV ^{3}He beam was produced from the 5.5 MV Van de Graaff accelerator of the Laboratori Nazionali di Legnaro (Padua). Targets were PbS enriched to 25.54% in ^{33}S, evaporated onto thin carbon backings. Reaction products were detected with surface-barrier detectors telescopes (FWHM=60 keV). Measured $\sigma(E_d,\theta)$,θ=15° to 48°. Deduced levels, J, π, L-transfers, spectroscopic factors from DWBA analysis. Report 5 levels.

1970Mo01: E=15 MeV ^{3}He beam was produced from the Argonne tandem Van de Graaff accelerator. Targets were natural sulfur. Reaction products were detected with two telescopes of silicon surface-barrier detectors (FWHM≈80 keV) or analyzed with a magnetic spectrograph (FHWM≈20 keV) at θ<20°. Measured $\sigma(E_d,\theta)$, $\theta_{c.m.}$≈5° to 100°. Deduced levels, J, π, L-transfers, spectroscopic factors. Report 6 levels.

1966Gr26: E=12 MeV ^{3}He beam was produced from the MIT-ONR Van de Graaff generator. Target was thin Ag-S-Ag sandwich made from natural sulphur. Reaction products were momentum-analyzed with a magnetic spectrometer and detected with three 2×10 in. nuclear track plates. Measured $\sigma(E_d,\theta)$. Deduced energies, L-transfers, spectroscopic factors of the following levels: 0 (L=2), 810 (L=0), 2352 (L=2), 2685 (L=3) and 2846 (L=1).

Others:

2021Lo14: E(^{3}He)=9.6 MeV from the εN Van de Graaff accelerator of the Laboratori Nazionali di Legnaro (LNL). Measured E(d), $\sigma(\theta)$ using the OSCAR two-stage hodoscope, and ΔE-E telescope technique. Deduced levels at 0, 810, 2352, 2685 and 3826 keV, L-transfers, and spectrocopic factors using finite-range DWBA and CRC calculations.

Additional information 1.

1994Ve04: E=25 MeV beam was produced from the Orsay MP Tandem Van de Graaff accelerator. Target was a ZnS with natural sulfur, evaporated onto a carbon foil. Reaction products were momentum-analyzed with an Enge split-pole magnetic spectrograph and detected with a three-layer detector combination consisting of a position-sensitive proportional counter, a ΔE proportional counter and a plastic scintillator. Measured $\sigma(E_d,\theta)$, $\theta_{c.m.}$=5° to 31°. Deduced levels, J, π, L-transfers, spectroscopic factors from DWBA analysis for 0 and 811 level.

^{33}Cl Levels

Spectroscopic factor is defined by $N\times g\times C^2S=\sigma(\theta)_{exp}/\sigma(\theta)_{DWBA}$, where N=4.42 and $g=(2J_f+1)/(2J_i+1)$ (1966Ba54) used by 1972Ko02. 1966Gr26 used N=4.4.

E(level)[†]	J^{π}[‡]	L[†]	C^2S[†]	Comments
0	$3/2^{+}$	2	0.67	C^2S: average of 0.70 and 0.63 for two sets of optical parameters (1972Ko02). Others: 0.47 *14* (1966Gr26), 0.90 (1970Mo01), 0.54 (1975In03), 0.86 and 0.69 for two sets of optical parameters in 1994Ve04, 0.73 (2021Lo14).
809 *6*	$1/2^{+}$	0	0.35	E(level): weighted average of 806 *12* (1970Mo01), 810 *9* (1970Mo08), and 810 *6* (1972Ko02). Others: 810 (1975In03, 2021Lo14). C^2S: average of 0.32 and 0.37 for two sets of optical parameters (1972Ko02). Others: 0.22 *7* (1966Gr26), 0.29 (1970Mo01), 0.22 (1975In03), 0.37 (1994Ve04), 0.25 (2021Lo14).
1978[#] *14*				E(level): other: 1990 (1970Mo01).

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^{32}S(^{3}He,d) 1972Ko02,1970Mo08,1975In03 (continued)

^{33}Cl Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	L[†]	C^{2}S[†]	Comments
2353 *9*	3/2$^+$,5/2$^+$	2	0.061,0.033	E(level): weighted average of 2360 *20* (1970Mo01), 2351 *9* (1970Mo08), and 2358 *25* (1972Ko02). Others: 2358 (1975In03), 2352 (2021Lo14). C^{2}S: other: 0.073 (2021Lo14).
2687 *8*	7/2$^-$	3	0.46	E(level): weighted average of 2690 *12* (1970Mo01), 2686 *8* (1970Mo08), and 2686 *16* (1972Ko02). Others: 2686 (1975In03), 2685 (2021Lo14). C^{2}S: average of 0.50 and 0.41 for two sets of optical parameters (1972Ko02). Others: 1.1 *3* (1966Gr26), 0.73 (1970Mo01), 0.52 (1975In03), 0.44 (2021Lo14).
2850 *9*	3/2$^-$	1	0.54	E(level): weighted average of 2860 *12* (1970Mo01), 2848 *9* (1970Mo08), and 2842 *15* (1972Ko02). Others: 2860 (1975In03), 2846 (2021Lo14). C^{2}S: average of 0.50 and 0.58 for two sets of optical parameters (1972Ko02). Others: 0.74 *22* (1966Gr26), 0.55 (1970Mo01), 0.72 (1975In03), 0.28 (2021Lo14).
2980[#] *9*				
4119 *9*	3/2$^-$	1	0.075	E(level): weighted average of 4119 *9* (1970Mo08) and 4120 *20* (1972Ko02). C^{2}S: average of 0.060 and 0.075 for two sets of optical parameters (1972Ko02).
4450 *30*				E(level): from 1970Mo01 only.
4780 *20*	5/2$^-$,7/2$^-$	3	0.074,0.040	
5090 *20*	5/2$^-$,7/2$^-$	3	0.031,0.017	C^{2}S: other: 0.059 for L=(2) and J^{π}=(3/2$^+$) (1972Ko02).
5550 *30*	7/2$^-$	3	0.012	C^{2}S: average of 0.010 and 0.013 for two sets of optical parameters (1972Ko02).
5870 *20*	5/2$^-$	3	0.027	
6250 *30*	5/2$^-$,7/2$^-$	3	0.094,0.052	C^{2}S: average of 0.097 and 0.091 for 5/2$^-$ and average of 0.054 and 0.050 for 7/2$^-$ for two sets of optical parameters (1972Ko02).
6580 *30*		(3,4)		C^{2}S: 0.060 for L=(3), J^{π}=(5/2$^-$), average of 0.059 and 0.061; 0.034 for L=(3), J^{π}=(7/2)$^-$; 0.028 for L=(4), J^{π}=(9/2$^+$), average of 0.032 and 0.024. Two values for each J^{π} are from two sets of optical parameters (1972Ko02).
7230 *40*	5/2$^-$,7/2$^-$	3	0.073,0.041	
8150 *40*	(5/2$^-$,7/2$^-$)	(3)	0.042,0.025	C^{2}S: average of 0.041 and 0.042 for 5/2$^-$ and average of 0.024 and 0.025 for 7/2$^-$ for two sets of optical parameters (1972Ko02).
8350 *50*	(5/2$^-$,7/2$^-$)	(3)	(0.03,0.02)	
8710 *50*	5/2$^-$,7/2$^-$	3	0.05,0.03	

[†] From 1972Ko02, unless otherwise noted. Values of L and C^{2}S are extracted from the comparison of $\sigma(\theta)$ distributions with the DWBA calculations. Where two values of C^{2}S are given, they correspond to different J^{π} as listed.

[‡] Quoted values are those used for the purpose of extracting C^{2}S in the DWBA analysis.

[#] From 1970Mo08.