^{36}S(p,d) 2026Jo01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Lijie Sun and Jun Chen	NDS 211,1 (2026)	30-Sep-2025

$J^\pi=0^+$, T=2 for ^{36}S g.s.

2026Jo01: E=66 MeV dispersion-matched proton beam was produced from the Separated Sector Cyclotron facility of iThemba LABS, South Africa. The target was 1-mg/cm^2, 99.24%-enriched ^{36}S powder encapsulated between two 0.5−μm Mylar foils. The outgoing deuteron and triton reaction products were momentum-analyzed by the K=600 quadrupole-dipole-dipole magnetic spectrometer and detected by the focal-plane detectors consisting of two multiwire drift chambers (MWDC) and a downstream plastic scintillator. Measured $\sigma(E_d,\theta)$. Deduced 98 levels, L-transfers, and single-neutron spectroscopic factors for 81 levels from zero-range adiabatic distorted-wave approximation (ADWA) calculations using DWUCK4. Deduced J-dependence of L=2 angular distributions and reproduced with finite-range ADWA calculations. Comparisons with large-scale shell-model and ab initio calculations. Confirmed the N=20 shell closure in ^{36}S.

Also see Ph.D. Thesis 2021JoZZ.

^{35}S Levels

T: T=3/2 or 5/2 for ^{35}S levels populated in the ^{36}S(p,d) reaction based on T=2 for the 0$^+$ g.s. of ^{36}S. ^{35}S levels below 9 MeV are likely T=3/2 and those above 9 MeV are likely T=5/2 considering the binding, Coulomb, and proton-neutron mass differences suggest the IAS of ^{35}P ground state (T=5/2) should be around 9017 keV in ^{35}S. C^{2}S extracted for these ^{35}S levels show excellent agreement with proton-removal data from ^{35}P when scaled by expected Clebsch-Gordan ratio of 0.167 (2026Jo01).

E(level)	J^{π} †‡	L †	C^{2}S †#	Comments
0 *5*	3/2$^+$	2	3.5 *4*	J^π: L-1/2 transfer from J-dependence.
1569 *5*	1/2$^+$	0	1.28 *14*	
1990 *5*	7/2$^-$	3	0.170 *19*	
2348 *5*	3/2$^-$	1	0.033 *4*	
2718 *5*	5/2$^+$	2	0.53 *6*	J^π: L+1/2 transfer from J−dependence.
2937 *5*	3/2$^+$	2	0.034 *4*	J^π: L-1/2 transfer from J-dependence.
3420 *5*	5/2$^+$	2	0.50 *6*	J^π: L+1/2 transfer from J−dependence.
3558 *5*	(5/2$^+$)	(2)	0.0300 *34*	
3592 *5*	(5/2$^+$)	(2)	0.0040 *5*	
3800 *5*	3/2$^-$	1	0.0200 *23*	
3883 *5*	7/2$^-$	3	0.0180 *20*	
4023 *5*	(3/2$^+$)	(2)	0.0056 *6*	
4107 *7*	(3/2$^+$)	(2)	0.00230 *26*	
4182 *5*	1/2$^-$	1	0.00100 *11*	
4300 *7*	(1/2$^-$,3/2$^-$)	(1)	3.00×10^{-4} *34*	
4486 *7*	7/2$^-$	3	0.045 *5*	
4574 *5*	3/2$^+$	2	0.080 *9*	J^π: L-1/2 transfer from J-dependence.
4614 *5*	5/2$^+$	2	0.110 *12*	
4838 *5*	(1/2$^+$)	(0)	0.0035 *4*	
4907 *5*	1/2$^+$	0	0.0110 *12*	
4955 *5*	5/2$^+$	2	0.250 *28*	J^π: L+1/2 transfer from J−dependence.
5121 *5*	1/2$^+$	0	0.0092 *10*	
5286 *5*	(1/2$^-$,3/2$^-$)	(1)	6.5×10^{-4} *7*	
5476 *5*	3/2$^+$	2	0.0090 *10*	
5630 *5*	5/2$^+$	2	0.110 *12*	
5766 *5*	5/2$^+$	2	0.76 *9*	J^π: L+1/2 transfer from J−dependence.
5844 *5*	(5/2$^+$)	(2)	0.080 *9*	
6121 *5*	(3/2$^+$)	(2)	0.035 *4*	
6218 *5*	(7/2$^-$)	(3)	0.00300 *34*	
6338 *5*	1/2$^+$	0	0.044 *5*	
6439 *5*	(1/2$^+$)	(0)	0.00260 *29*	
6550 *5*	3/2$^+$	2	0.0035 *4*	

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^{36}S(p,d) 2026Jo01 (continued)

^{35}S Levels (continued)

E(level)	J^{π} †‡	L †	C^2S †#	Comments
6639 *5*	5/2$^+$	2	0.250 *28*	
6682 *5*	1/2$^+$	0	0.056 *6*	
6790 *5*	(5/2$^+$)	(2)	0.037 *4*	
6962 *5*	(1/2$^-$,3/2$^-$)	(1)	0.0050 *6*	
7019 *5*	(1/2$^-$,3/2$^-$)	(1)	0.00150 *17*	
7102 *5*	(1/2$^-$,3/2$^-$)	(1)	0.00200 *23*	
7151 *5*	(7/2$^-$)	(3)	0.0090 *10*	
7215 *5*	3/2$^+$	2	0.0120 *14*	
7249 *5*	(3/2$^+$)	(2)	0.0120 *14*	
7279 *5*	1/2$^+$	0	0.0068 *8*	
7326 *5*	1/2$^+$	0	0.0073 *8*	
7349 *5*	(1/2$^+$)	(0)	0.0095 *11*	
7441 *5*	1/2$^+$	0	0.0094 *11*	
7490 *5*	1/2$^-$	1	0.0060 *7*	
7753 *5*	5/2$^+$	2	0.200 *23*	
7885 *5*	(5/2$^+$)	(2)	0.0300 *34*	
7980 *7*	3/2$^-$	1	0.00200 *23*	
8073 *7*	(5/2$^+$)	(2)	0.0180 *20*	
8103 *5*	1/2$^-$	1	0.00170 *19*	
8221 *5*	1/2$^-$	1	0.0040 *5*	
8270 *5*	1/2$^-$	1	0.0090 *10*	
8410 *7*	(5/2$^+$)	(2)	0.0100 *11*	
8465 *7*	(5/2$^+$)	(2)	0.0100 *11*	
8509 *5*	5/2$^+$	2	0.0120 *14*	
8557 *7*	(7/2$^-$)	(3)	0.00300 *34*	
8602 *5*	(7/2$^-$)	(3)	0.0100 *11*	
8649 *7*	(7/2$^-$)	(3)	0.0065 *7*	
8707 *5*	(5/2$^+$)	(2)	0.0220 *25*	
8761 *7*	(5/2$^+$)	(2)	0.0110 *12*	
8822 *5*	(1/2$^-$,3/2$^-$)	(1)	0.0060 *7*	
8876 *5*	(1/2$^-$,3/2$^-$)	(1)	0.00250 *28*	
8947 *7*	(1/2$^-$,3/2$^-$)	(1)	0.00100 *11*	
9032 *15*	(1/2$^-$,3/2$^-$)	(1)	0.0070 *8*	
9065 *15*	(1/2$^-$,3/2$^-$)	(1)	0.0070 *8*	
9126 *7*	1/2$^+$	0	0.35 *4*	T=5/2 J^{π},T: isobaric analog state of 1/2$^+$, T=5/2, g.s. of ^{35}P (2026Jo01).
9180 *5*	1/2$^+$	0	0.060 *7*	
9219 *15*	(1/2$^-$,3/2$^-$)	(1)	0.00300 *34*	
9294 *8*	(1/2$^-$,3/2$^-$)	(1)	0.0100 *11*	
9339 *8*	(1/2$^-$,3/2$^-$)	(1)	0.00200 *23*	
9395 *5*	(1/2$^-$,3/2$^-$)	(1)	0.0045 *5*	
9446 *7*	(1/2$^-$,3/2$^-$)	(1)	0.00180 *20*	
9510 *10*	(1/2$^-$,3/2$^-$)	(1)	0.0035 *4*	
9565 *20*	(1/2$^-$,3/2$^-$)	(1)	0.0033 *4*	
9615 *10*	(1/2$^-$,3/2$^-$)	(1)	0.00280 *32*	
9666 *10*	(1/2$^-$,3/2$^-$)	(1)		
9716 *10*	(1/2$^-$,3/2$^-$)	(1)		
9774 *10*	(1/2$^-$,3/2$^-$)	(1)		
9849 *10*	(1/2$^-$,3/2$^-$)	(1)		
9911 *10*	(1/2$^-$,3/2$^-$)	(1)		
9989 *10*	(1/2$^-$,3/2$^-$)	(1)		
1.0049×10^4 *10*	(1/2$^-$,3/2$^-$)	(1)		
1.0166×10^4 *10*	(1/2$^-$,3/2$^-$)	(1)		
1.0225×10^4 *10*	(1/2$^-$,3/2$^-$)	(1)		
1.0277×10^4 *10*	(1/2$^-$,3/2$^-$)	(1)		

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^{36}S(p,d) 2026Jo01 (continued)

^{35}S Levels (continued)

E(level)	J^{π}†‡	L†	C^2S†#	Comments
1.0350×10^4 *10*	($1/2^-$,$3/2^-$)	(1)		
1.0421×10^4 *10*	($1/2^-$,$3/2^-$)	(1)		
1.0493×10^4 *10*	($7/2^-$)	(3)	0.0200 *23*	
1.0563×10^4 *10*	($1/2^-$,$3/2^-$)	(1)		
1.0663×10^4 *10*	($1/2^-$,$3/2^-$)	(1)		
1.0746×10^4 *10*	($1/2^-$,$3/2^-$)	(1)		
1.0810×10^4 *10*	($1/2^-$,$3/2^-$)	(1)		
1.147×10^4 *2*	$3/2^+$	2	0.052 *6*	T=5/2 J^{π},T: IAS of $3/2^+$, T=5/2, 2387 level in ^{35}P (2026Jo01).
1.288×10^4 *10*	$5/2^+$	2	0.49 *6*	T=5/2 J^{π},T: IAS of $5/2^+$, T=5/2, 3860 level in ^{35}P (2026Jo01).
1.368×10^4 *10*	$5/2^+$	2	0.156 *18*	T=5/2 J^{π},T: IAS of $5/2^+$, T=5/2, 4666 level in ^{35}P (2026Jo01).
1.422×10^4 *10*	$5/2^+$	2	0.247 *28*	T=5/2 J^{π},T: IAS of $5/2^+$, T=5/2, 5199 level in ^{35}P (2026Jo01).
1.470×10^4 *10*				

† From ADWA analysis of the measured $\sigma(\theta)$ in 2026Jo01. L-transfers are not specifically given but can be inferred from the reported J^{π}.

‡ As given in 2026Jo01, which selected some J=L−1/2 or L+1/2 based on known J^{π} values (2011Ch48). When considered in the Adopted Levels, J=L−1/2 and L+1/2 are both possible unless other constraints are available.

C^2S from 2026Jo01. For levels with J^{π}=($1/2^-$,$3/2^-$), the C^2S values are given for $3/2^-$. C^2S is normalized to a ^{40}Ca benchmark where Woods-Saxon parameters (r_0=1.27 fm, a_0=0.70 fm) were adjusted to ensure the summed strength of the $1d_{3/2}$, $2s_{1/2}$, and $1f_{7/2}$ orbitals equals 6. A systematic uncertainty of 11.2% is associated with all spectroscopic factors due to the effective target-thickness variation (10%) and the nominal target thickness uncertainty (5%) (2026Jo01). This uncertainty is included by the evaluators.