

$^{36}\text{Ar}(\text{p,d})$ [1968Jo04,1968Ko11](#)

$J^\pi=0^+$ for ^{36}Ar ground state.

[1968Jo04](#): A 27.5(1)-MeV proton beam was produced by the 1.3-m FFAG cyclotron at the Nuclear Physics Laboratory at the University of Colorado. Targets were natural argon gas (99.6% ^{40}Ar) and 99.0% enriched ^{36}Ar gas. Deuterons were detected using a telescope of a 0.228-mm transmission surface barrier detector and a 0.37-cm lithium-drifted stopping counter with FWHM=120 keV. Measured $\sigma(E_d, \theta)$. Deduced levels, L-transfers, and spectroscopic factors from finite-range DWUCK-DWBA analysis of the measured $\sigma(\theta)$.

[1968Ko11](#): A 33.6-MeV proton beam was produced by the 64-in. sector-focusing cyclotron at Michigan State University. The target was >99% isotopically enriched ^{36}Ar gas. Deuterons were detected using a telescope of a 279- μm silicon surface barrier detector and a 3-mm lithium-drifted silicon counter with FWHM=130 keV. Measured $\sigma(E_d, \theta)$. Deduced levels, J, π , L-transfers, and spectroscopic factors from zero-range Macefield-DWBA analysis of the measured $\sigma(\theta)$.

 ^{35}Ar Levels

Spectroscopic factor $C^2S=\sigma(\theta)_{\text{exp}}/\sigma(\theta)_{\text{DWBA}}/N$, where $N=1.65*3/2$ is a normalization factor adopted by [1968Jo04](#). The DWBA calculation in [1968Ko11](#) assumed neutron-well radius parameter $r_{0n}=1.15$ F for $d_{5/2}$ pickup and 1.35 F for $d_{3/2}$ pickup, respectively, to reproduce the forward-angle J-dependence observed in the L=2 deuteron angular distributions. [1968Ko11](#) demonstrates that a larger radius results in a larger DWBA-calculated cross section and this gives rise to problems in extracting absolute spectroscopic factors, and therefore, the evaluators put the C^2S from [1968Ko11](#) in comments. [1968Ko11](#) states that there is some evidence that the radius parameter corresponding to the best DWBA fit to the data might also result in the most trustworthy value for the spectroscopic factor.

E(level)	J^π	L^\dagger	C^2S^\ddagger	Comments
0	$3/2^+$	2	2.92	J^π : assigned based on the $3/2^+$ ground state of ^{35}Cl . C^2S : other: 3.03 for 1.15 F and 1.76 for 1.35 F (better fit) (1968Ko11).
1180 20	$1/2^+$	0	2.50	E(level), J^π : from 1968Jo04 and 1968Ko11 . C^2S : other: 1.29 for 1.15 F and 1.05 for 1.35 F (1968Ko11).
1700 30	$(5/2^+)$			E(level): from 1968Ko11 . J^π : assigned based on the $5/2^+$ mirror level in ^{35}Cl (1968Ko11). C^2S : 0.1 for 1.15 F from 1968Ko11 .
2615 20	$(3/2)^+$	2		E(level): weighted average of 2630 20 (1968Jo04) and 2600 20 (1968Ko11). J^π : assigned based on the observed J dependence of the deuteron angular distributions (1968Ko11). L, C^2S : 0.42 for 1.15 F and 0.28 for 1.35 F (better fit) for L=2 from 1968Ko11 Other: $C^2S=0.12$ for L=1 from 1968Jo04 . 1973Be26 determined L=2 from $^{36}\text{Ar}(^3\text{He}, \alpha)^{35}\text{Ar}$ and states that L=1 is probably in error as this level corresponds well with the known $3/2^+$ state at 2695 keV in ^{35}Cl and there are no nearby negative-parity states in ^{35}Cl .
2970 20	$(5/2)^+$	2	2.47	E(level): weighted average of 2990 20 (1968Jo04) and 2950 20 (1968Ko11). J^π : assigned based on the observed J dependence of the deuteron angular distributions (1968Ko11). C^2S : assuming $5/2^+$ (1968Jo04). Other: 3.10 assuming $3/2^+$ (1968Jo04). 2.31 for 1.15 F (better fit) and 1.53 for 1.35 F from 1968Ko11 .
3200 20	$7/2^-$	3	0.63	E(level): weighted average of 3210 20 (1968Jo04) and 3190 20 (1968Ko11). J^π : assigned based on the shell model and the mirror level in ^{35}Cl (1968Ko11). C^2S : other: 0.64 for 1.15 F and 0.37 for 1.35 F (better fit) (1968Ko11).
4756 28	$(1/2^+)$	0	0.172	E(level): weighted average of 4770 20 (1968Jo04) and 4700 40 (1968Ko11). J^π : from 1968Ko11 . C^2S : other: 0.05 for 1.15 F and 0.04 for 1.35 F (1968Ko11).
5102 20		3	0.46	E(level): weighted average of 5110 20 (1968Jo04) and 5070 40 (1968Ko11). J^π : $7/2^-$ from simple shell-model considerations (1968Jo04). L: from 1968Jo04 . L is not reported in 1968Ko11 . 1973Be26 determined L=2 from $^{36}\text{Ar}(^3\text{He}, \alpha)^{35}\text{Ar}$ and states that L=2 gives a much better account of the data than does L=3.
5400 50				E(level): from 1968Ko11 .

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$^{36}\text{Ar}(\text{p,d})$ **1968Jo04,1968Ko11** (continued) ^{35}Ar Levels (continued)

<u>E(level)</u>	<u>J^{π}</u>	<u>L[†]</u>	<u>C²S[‡]</u>	<u>Comments</u>
5598 20	(3/2,5/2) ⁺	2	2.93,2.37	E(level): weighted average of 5610 20 (1968Jo04) and 5570 30 (1968Ko11). C ² S: for 3/2 ⁺ and 5/2 ⁺ , respectively (1968Jo04). Other: 1.77 for 1.15 F (better fit) and 1.25 for 1.35 F (1968Ko11).
6024 20	(3/2,5/2) ⁺	2	1.58,1.31	E(level): weighted average of 6030 20 (1968Jo04) and 6010 30 (1968Ko11). C ² S: for 3/2 ⁺ and 5/2 ⁺ , respectively (1968Jo04). Other: 1.18 for 1.15 F and 0.83 for 1.35 F (better fit) (1968Ko11).
6620 30	(1/2 ⁺)	0		E(level),J ^{π} ,L: from 1968Ko11 . C ² S: 0.24 for 1.15 F and 0.19 for 1.35 F (1968Ko11).
6700 20	7/2 ⁻	3	2.60	E(level),J ^{π} ,L,C ² S: from 1968Jo04 .
6820 30	(3/2,5/2) ⁺	2		E(level),J ^{π} ,L: from 1968Ko11 . C ² S: 0.72 for 1.15 F (better fit) and 0.51 for 1.35 F (1968Ko11).
7030 20	(3/2,5/2) ⁺	2	2.20,1.79	C ² S: for 3/2 ⁺ and 5/2 ⁺ , respectively (1968Jo04).

[†] From [1968Jo04](#) and [1968Ko11](#), unless otherwise noted.

[‡] From [1968Jo04](#).