

³⁶Ar(³He,α) 1973Be26,1998VoAA

$J^\pi=0^+$ for ³⁶Ar ground state.

1973Be26: An 18-MeV ³He beam was produced by the University of Pennsylvania tandem Van de Graaff accelerator. The target was pure argon gas enriched to 99.8% in ³⁶Ar. α particles were momentum analyzed in a multi-angle spectrograph and detected using Ilford K-1 nuclear emulsions with FWHM=35 keV. Measured $\sigma(E_\alpha, \theta)$. Deduced levels, J, π , L-transfers, and spectroscopic factors from local zero-range DWUCK-DWBA analysis of the measured $\sigma(\theta)$. Comparisons with shell-model calculations and the mirror nucleus ³⁵Cl. Also see **1972MiZO**.

1998VoAA: A 25-MeV ³He at 0.5-μA intensity was provided from the FN Tandem accelerator at the Nuclear Structure Laboratory of the University of Notre Dame. The targets were made by implanting 75-keV ³⁶Ar into 40 μg/cm² carbon foils from the University of Toledo ion source. The reaction products were momentum analyzed by the Notre Dame broad-range magnetic spectrograph. The particles were subsequently detected at the focal surface of the spectrograph by a position sensitive proportional gas detector backed with a plastic scintillator. Measured E_α . Deduced levels.

³⁵Ar Levels

Spectroscopic factor $C^2S=(2j+1)\times\sigma(\theta)_{\text{exp}}/\sigma(\theta)_{\text{DWBA}}/N$, where the isospin Clebsch-Gordan coefficient C^2 is 1/2 in this case, j is the total angular momentum of the transferred neutron, and the normalization factor $N=16.8$. **1973Be26** states that the overall normalization for the (³He,α) reaction is not well determined and therefore resort to empirical means to determine N. $N=15.5$ deduced from shell-model calculated total $S=3.52$ for all four $1/2^+$ states and the **1973Be26** measured $NS=54.6$. $N=18.1$ deduced from the ³⁵Cl(³He,d)³⁶Ar(g.s.) $S=4.73$ (**1970Mo10**) and the **1973Be26** measured ³⁶Ar(³He,α)³⁵Ar(g.s.) $NS=85.4$. **1973Be26** adopted the average $N=16.8$.

E(level)	J^π	L	$C^2S^\#$	Comments
0	3/2 ⁺	2	2.545	
1175 2	1/2 ⁺	0	1.19	E(level): weighted average of 1179 10 (1973Be26) and 1175 2 (1998VoAA).
1747 2	5/2 ⁺	2	0.025	E(level): weighted average of 1738 10 (1973Be26) and 1747 2 (1998VoAA).
2649 2	3/2 ⁺	2	0.57	E(level): weighted average of 2637 10 (1973Be26) and 2649 2 (1998VoAA).
2983 2	5/2 ⁺	2	1.39	E(level): weighted average of 2982 10 (1973Be26) and 2983 2 (1998VoAA).
3197 2	7/2 ⁻	3	0.39	E(level): weighted average of 3193 10 (1973Be26) and 3197 2 (1998VoAA).
3882 5	1/2 ⁺	0	0.02	E(level): weighted average of 3884 10 (1973Be26) and 3881 5 (1998VoAA).
4001 3	(3/2) ⁻	1	0.065	E(level): weighted average of 4012 10 (1973Be26) and 4000 3 (1998VoAA).
4113 4				E(level): weighted average of 4110 10 (1973Be26) and 4113 4 (1998VoAA).
4135 4	(3/2) ⁻	1	0.025	E(level): weighted average of 4142 10 (1973Be26) and 4134 4 (1998VoAA).
4350 6				E(level): weighted average of 4350 10 (1973Be26) and 4350 6 (1998VoAA).
4515 5				E(level): weighted average of 4530 10 (1973Be26) and 4514 3 (1998VoAA).
4713 6	1/2 ⁺	0	0.05	E(level): weighted average of 4721 10 (1973Be26) and 4710 6 (1998VoAA).
4774 6				E(level): weighted average of 4782 10 (1973Be26) and 4771 6 (1998VoAA).
5059 11				E(level): unweighted average of 5048 10 (1973Be26) and 5069 4 (1998VoAA).
5116 2	(3/2,5/2) ⁺	2	0.25,0.145 [@]	E(level): weighted average of 5116 10 (1973Be26) and 5116 2 (1998VoAA).
5207 3				E(level): weighted average of 5205 10 (1973Be26) and 5207 3 (1998VoAA).
5389 8				E(level): weighted average of 5387 10 (1973Be26) and 5391 8 (1998VoAA).
5482 2	(3/2,5/2) ⁺	2	0.77,0.445 [@]	E(level): weighted average of 5484 10 (1973Be26) and 5482 2 (1998VoAA).
5594 2	(3/2,5/2) ⁺	2	1.98,1.14 [@]	E(level): weighted average of 5591 10 (1973Be26) and 5594 2 (1998VoAA).
5916 3				E(level): weighted average of 5911 10 (1973Be26) and 5916 3 (1998VoAA).
6036 3	(3/2,5/2) ⁺	2	1.3,0.755 [@]	E(level): weighted average of 6033 10 (1973Be26) and 6036 3 (1998VoAA).
6162 2				E(level): weighted average of 6153 10 (1973Be26) and 6162 2 (1998VoAA).
6262 10				E(level): weighted average of 6258 10 (1973Be26) and 6267 12 (1998VoAA).
6615 3	1/2 ⁺	0	0.36	E(level): weighted average of 6631 10 (1973Be26) and 6614 2 (1998VoAA). Probable doublet in 1973Be26 .
6823 2				E(level): weighted average of 6827 10 (1973Be26) and 6823 2 (1998VoAA).
6948 2				E(level): weighted average of 6959 10 (1973Be26) and 6948 2 (1998VoAA).
7043 4				E(level): weighted average of 7055 10 (1973Be26) and 7042 3 (1998VoAA).
7117 [†] 10				
7293 [†] 10				

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 $^{36}\text{Ar}(^3\text{He},\alpha)$ [1973Be26](#), [1998VoAA](#) (continued)

 ^{35}Ar Levels (continued)E(level)7423[†] 107502[†] 107840[†] 108019[†] 10[†] From [1973Be26](#).[‡] As given in [1973Be26](#), also used for extracting C^2S .# Converted from the S values in [1973Be26](#) with $C^2=1/2$.

@ [1973Be26](#) states that the differences for $j=3/2$ and $5/2$ are small in the DWBA-calculated $L=2$ shapes. It is not possible to differentiate between the two allowed j values for $L=2$ transitions. Both C^2S values are given for each level with two spin values. Assuming that all four levels have spins of $3/2$ would lead to a summed $L=2$ C^2S that exceeds the simple shell-model sum rule limit of 8 for combined $1d_{3/2}$ and $1d_{5/2}$ pickup, which suggests that all four of these levels probably have $5/2^+$.