

$^{36}\text{Ar}(^3\text{He},\alpha)$ **1973Be26**

$J^\pi=0^+$ for ^{36}Ar 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 ^{36}Ar . 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, and spectroscopic factors from local zero-range DWUCK-DWBA analysis of the measured $\sigma(\theta)$. Comparisons with shell-model calculations and the mirror nucleus ^{35}Cl .

 ^{35}Ar 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 $(^3\text{He},\alpha)$ 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 $^{35}\text{Cl}(^3\text{He},d)^{36}\text{Ar}(\text{g.s.})$ $S=4.73$ (**1970Mo10**) and the **1973Be26** measured $^{36}\text{Ar}(^3\text{He},\alpha)^{35}\text{Ar}(\text{g.s.})$ $NS=85.4$. **1973Be26** adopted the average $N=16.8$.

E(level)	J^π^\dagger	L	C^2S^\ddagger	Comments
0	$3/2^+$	2	2.545	
1179 10	$1/2^+$	0	1.19	
1738 10	$5/2^+$	2	0.025	
2637 10	$3/2^+$	2	0.57	
2982 10	$5/2^+$	2	1.39	
3193 10	$7/2^-$	3	0.39	
3884 10	$1/2^+$	0	0.02	
4012 10	$(3/2)^-$	1	0.065	
4110 10				
4142 10	$(3/2)^-$	1	0.025	
4350 10				
4530 10				
4721 10	$1/2^+$	0	0.05	
4782 10				
5048 10				
5116 10	$(3/2,5/2)^+$	2	0.25,0.145 [#]	
5205 10				
5387 10				
5484 10	$(3/2,5/2)^+$	2	0.77,0.445 [#]	
5591 10	$(3/2,5/2)^+$	2	1.98,1.14 [#]	
5911 10				
6033 10	$(3/2,5/2)^+$	2	1.3,0.755 [#]	
6153 10				
6258 10				
6631 10	$1/2^+$	0	0.36	probable doublet.
6827 10				
6959 10				
7055 10				
7117 10				
7293 10				
7423 10				
7502 10				
7840 10				
8019 10				

[†] Assumed for extracting C^2S .

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

 ^{35}Ar Levels (continued)

[‡] 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 $5/2^+$.