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

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

1973Be26: An 18-MeV $^{3}$He 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. $\alpha$ 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, $\pi$, 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 $^{35}$Cl. Also see 1972MiZO.

### $^{35}$Ar Levels

Spectroscopic factor $C^2S=(2j+1)\times\sigma(\theta)_{exp}/\sigma(\theta)_{DWBA}/N$, 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 ($^{3}$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 $^{35}$Cl($^{3}$He,d)$^{36}$Ar(g.s.) S=4.73 (1970Mo10) and the 1973Be26 measured $^{36}$Ar($^{3}$He,$\alpha$)$^{35}$Ar(g.s.) NS=85.4. 1973Be26 adopted the average N=16.8.

| E(level) | $J^{\pi}$ [†] | L | $C^2S$ [‡] | 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* | | | | |

[†] As given in 1973Be26, also used for extracting $C^2S$.

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**$^{36}$Ar($^{3}$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 $5/2^+$.