^{36}Ar(^{3}He,α) 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. 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 $C^2S=(2j+1)\times\sigma(\theta)_{exp}/\sigma(\theta)_{DWBA}/N$, where the isospin Clebsch-Gordan coefficient C^2 is 1/2 in this case, j is the transferred angular momentum, and the normalization factor N=16.8. 1973Be26 states that the overall normalization for the (^{3}He,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 ^{35}Cl(^{3}He,d)^{36}Ar(g.s.) S=4.73 (1970Mo10) and the 1973Be26 measured ^{36}Ar(^{3}He,α)^{35}Ar(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	
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*				

[†] Converted from the S values in 1973Be26 with C^2=1/2.

Continued on next page (footnotes at end of table)

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

^{35}Ar Levels (continued)

‡ 1973Be26 states that the differences for j=3/2 and 5/2 are small in the DWBA-calculated l_n=2 shapes. It is not possible to differentiate between the two allowed j values for l_n=2 transitions. Both C^2S values are given for the two allowed J values. Assuming that all four levels have spins of 3/2 would lead to a summed l_n=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 $5/2^+$.