STUDY OF THE $^{48}Ca(d,\alpha)^{46}K$ REACTION

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Recent years have witnessed a resurgence of activity directed at understanding the deuteron transfer reaction mechanism. This mechanism has been known,[1] through (α,d) and (d,α) reaction studies, to be poorly described by the standard one-step DWBA using the Bayman-Kallio form factor. A recent experimental study[2] has resulted in the conclusion that the inclusion of sequential transfer processes is essential to a correct description of such a reaction. However, a subsequent theoretical analysis[3] disputed that claim, and obtained a qualitative representation of the Ref. 2 results by accounting for the D-state of the alpha particle.

Thus, we have performed another deuteron transfer reaction study, that of the $^{48}Ca(d,\alpha)^{46}K$, to try to add additional information for use in elucidating that reaction mechanism. In this experiment both differential cross sections and analyzing powers were measured; it was hoped that the additional sensitivity to reaction amplitudes afforded by the analyzing power data would help to clarify the reaction mechanism.

The 80 MeV polarized deuteron beam from the IUCF was used to bombard the 270 $\mu g/cm^2$ thick ^{48}Ca target. The reaction alpha particles were momentum analyzed with the QDDM, and detected using the helical wire focal plane detector. This system resulted in a typical resolution of 60 keV FWHM. The differential cross sections obtained agree well with those obtained in an earlier experiment[4] on this same nucleus at about the same incident energy for the states which are well resolved. However, the higher resolution of our experiment has resulted in data for many more states

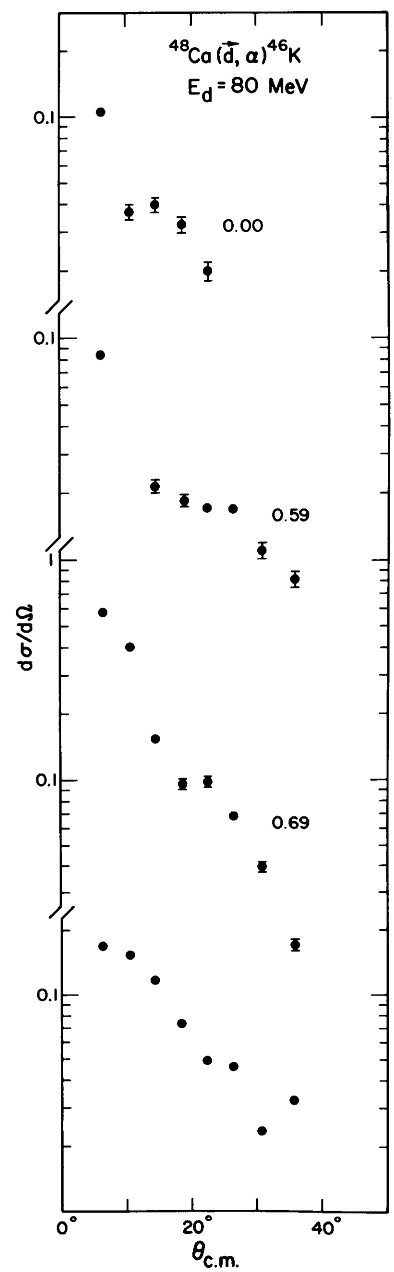

Figure 1. Cross sections measured for selected states in the $^{48}Ca(d,\alpha)^{46}K$ reaction.

than could be identified in Ref. 4.

Angular distributions were obtained for both cross sections and vector analyzing powers for states at 0.00(2$^-$), 0.59 (3-), 0.69 (4-), 0.89 (5-), 1.94 (1+), 3.38 (?), 4.34 (3+), 4.54 (?), and 5.95 (7+) MeV. The data are shown for some of these states in Figs. 1 and 2. Reaction calculations using both one-step and sequential transfer reaction mechanisms are presently in progress; particular emphasis will be given to states for which the transfer configuration is thought[4] to be well known.

1) See, e.g., J.R. Comfort et al., Phys. Rev. C 10, 2399 (1974).

2) W.W. Daehnick et al., Phys. Rev. Lett. 41, 639 (1978); W.W. Daehnick, et al., Phys. Rev. C 23, 1906 (1981).

3) M.A. Nagarajan and G.R. Satchler, Phys. Rev. Lett. 49, 1899 (1982).

4) N. Frascari et al., Phys. Rev. C 10, 1422 (1974).

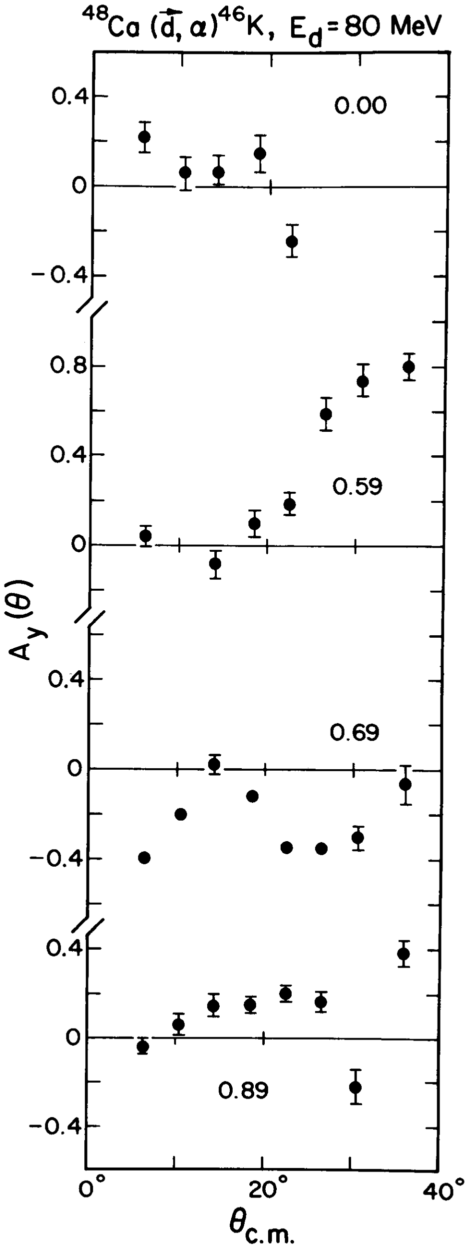

Figure 2. Analyzing powers measured for selected states in the $^{48}Ca(d,\alpha)^{46}K$ reaction.