THE ^{46,48}Ti($\vec{p}$,α) REACTION

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The ($\vec{p}$,α) reaction study at E_p=80 MeV has been performed on two Ti isotopes with 3 objectives in mind. (1) This reaction is expected to excite preferentially the highest spin states in the residual nuclei, ^{43}Sc and ^{45}Sc, and particularly those which can be reached by pickup of a $[\nu f_{7/2}^2 \pi f_{7/2}]_{J^-}$ configuration. Thus this study can select these states, and determine the nature of their wave functions. These ^{43}Sc states are important to a determination of nuclear 3-body forces. (2) Since very little (p,α) reaction data exist at intermediate energies, it is hoped that this study will help to determine the reaction mechanisms involved. (3) The analyzing power data are expected to provide both spectroscopic information and a further delineation of the reaction mechanisms.

The experiment has been performed in two runs, one in December, 1978, the other in January, 1980. The IUCF dispersion-matched polarized proton beam (typically 65% polarized, 200 nA on target) was incident on 1 mg/cm^2 thick Ti targets. Alpha particle detection was provided by the magnetic spectrograph and the IUCF helical wire counter, followed by 1/8" and 1/4" thick scintillators. A resolution of about 70 keV FWHM was achieved in the second run.

Several notable features appear in the data. Firstly, the high spin states are indeed strongly populated, with $19/2^-$ and $15/2^-$ states being very prominent in both the ^{43}Sc and ^{45}Sc spectra. However, states at higher excitation, i.e., around 4-5 MeV, also are strongly excited. In particular, a state in ^{45}Sc at 5.42 MeV, tentatively assigned[1] a spin of $21/2^-$ or $23/2^-$, was seen very strongly, even though the maximum spin achievable from one step pickup of a $[\nu f_{7/2}^2 \pi f_{7/2}]$ configuration would be expected to be 19/2. A simple two-step reaction calculation involving inelastic excitation and triton transfer, appears to predict the observed strength of this state, if the J^π is $23/2^-$.

The analyzing powers exhibit very strong effects, with maximum values close to $\pm$ 1.0 being observed for several states. Thus the general features of these analyzing powers can, in some cases, be used to provide parity assignments.

The results of the January, 1980, run are presently being analyzed. Those of the December, 1978, run have been presented[2] at an APS meeting, along with preliminary reaction calculations. Further reaction calculations using microscopic form factors, are in progress.

1) P.G. Bizzeti, A.M. Bizzeti-Sona, M. Bucciolini, R. Huber, W. Kutschera, H. Moringa, R.A. Ricci and C. Signorini, Nuovo Cimento 26A, 25 (1975).

2) R.N. Boyd, S.L. Blatt, T.R. Donoghue, H.J. Hausman, S. Vigdor, P. Schwandt, E. Sugarbaker and H.W. Fulbright, Bull. Am. Phys. Soc. 24, 630 (1979).

THE (d,^{6}Li) REACTION STUDIES

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We are beginning a study of the (d,^{6}Li) reaction with vector polarized deuterons at the IUCF. Several interesting features of the vector analyzing powers are predicted by DWBA reaction calculations. Firstly, the VAP is expected to exhibit much more sensitivity to the transferred angular momentum, L_{Tr}, than do the differential cross sections. Thus, it is hoped that the VAP will provide considerably more definitive spectroscopic information than can be obtained from the cross sections alone. Secondly, this sensitivity of the VAP to L_{Tr} should provide the possibility of accurate determinations of L_{Tr}-mixing in (d,^{6}Li) reactions on odd A targets. These features provide the motivation for the ($\vec{d}$,^{6}Li) studies on ^{39}K and ^{40}Ca.

In addition, the DWBA calculations suggest that the VAP is, for some nuclei, quite sensitive to the spin-orbit term of the ^{6}Li distorting potential. While this is not the case for ^{39}K and ^{40}Ca targets, this sensitivity does appear for fp shell targets. We therefore plan to examine ($\vec{d}$,^{6}Li) data on Ni targets, both in the hope of producing some systematic data on alpha clustering states, and of determining the ^{6}Li spin-orbit potential.

STUDY OF TWO-PROTON PICKUP USING THE (^{6}Li,^{8}B) REACTION

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A considerable body of experimental data has been obtained from reactions which transfer two identical nucleons - reactions such as (p,t), (t,p), and (^{3}He,n).

Almost no data are available, however, from reactions which pickup two protons from a target. We have studied one such reaction, the (^{6}Li,^{8}B) two-proton pickup reaction, on nine even targets ranging from ^{56}Fe to ^{130}Te. Some of these results, principally on targets in the tin region, were presented in the 1978 IUCF Progress Report.[1]

Using a ^{6}Li bombarding energy of 90 MeV, we have measured lab cross sections at 8^o for ground-state transitions which have ranged from 27 μb/sr for a ^{66}Zn target to 0.3 μb/sr for ^{130}Te.