5) A.E.L. Dieperink and I. Sick, Phys. Lett. 1093, 1 (1982).

6) P. Doll et al., Nucl. Phys. A263, 210 (1976).

7) S.M. Banks et al., Z. Phys. A316, 241 (1984), and Nucl. Phys. A437, 381 (1985).

8) A.P. Zucker, Proc. Top. Conf. on the Structure of $1f_{7/2}$ Nuclei, Legnaro (Padova) 1971, ed. R.A. Ricci (Editrice Compositori, Bologna, 1971), p. 94.

STUDY OF THE $^{12}C(^{7}Li,t)^{16}O$ α-TRANSFER REACTION AT HIGH ENERGIES

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A study of $^{12}C(^{7}Li,t)^{16}O$ at $E(^{7}Li)$ = 101 MeV was completed at IUCF using two Si ΔE detectors backed by thick intrinsic Ge E detectors. Also, α-particles were observed in coincidence at back angles to identify decay from high spin states in ^{16}O. This utilized a 600 mm^2 Si E detector with time-of-flight used for identification.

In addition to the well-known levels at E_x < 20 MeV, we may have observed new levels at E_x > 20 MeV to 30 MeV and possibly some at E_x > 30 MeV (see Figure 1). The analysis of the coincidence α-particle decay data from specific levels has just begun.

A related high-resolution study of $^{12}C(^{7}Li,t)$ for the region in ^{16}O, E_x < 10 MeV was started at NSCL (MSU) using $E(^{7}Li)$ = 80 MeV with the k = 320 spectrometer. An initial run resolved both the 7.12/6.92 MeV $1^-/2^+$ doublet and the 9.6 MeV 1^- level in ^{16}O which are of interest in astrophysics (helium burning). A second run is scheduled for Spring 1986. This work will be continued and may be extended to higher energies at IUCF using the new k = 600 spectrometer.

The high energy $^{12}C(^{7}Li,t)^{16}O$ data should provide new information on high-spin α-cluster levels in ^{16}O, E_x > 10 MeV. It will also permit comparisons with our earlier[1] data and analysis of $^{12}C(^{6}Li,d)^{16}O$ done at IUCF with $E(^{6}Li)$ = 90 MeV. These data can be used to

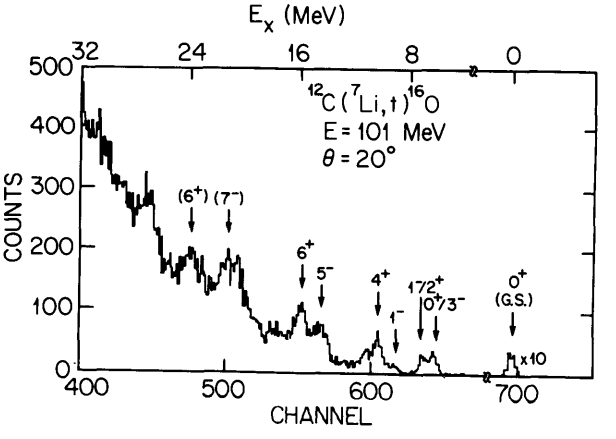

Figure 1. A triton energy spectrum and corresponding levels in ^{16}O observed in $^{12}C(^{7}Li,t)$ at $E(^{7}Li)$ = 101 MeV.

test various α-cluster models[2] of ^{16}O and provide additional measurements of α-widths needed for astrophysical calculations.

1) F.D. Becchetti, D. Overway, J. Janecke, and W.W. Jacobs, Nucl. Phys. A344, 336 (1980).

2) D. Overway, F.D. Becchetti, and J. Janecke, 4th International Conference Chester, England, July 1984, p. 101.

SEARCH FOR HIGH SPIN STATES IN ^{27}Al AND ^{27}Si

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Previous studies[1] of the $A(p,\pi^-)A+1$ reaction have demonstrated the high selectivity of the reaction for states in the residual nucleus which are presumed to have a stretched or nearly stretched two-particle one-hole configuration with respect to the target nucleus. This feature of the (p,π^-) reaction has been observed for both light and heavy nuclei[1] and for two cases in the sd-shell: $^{18}O(p,\pi^-)^{19}Ne$ and $^{26}Mg(p,\pi^-)^{27}Si$.[2] Studies throughout the lower half of the sd-shell are in progress.[3] To increase the reliability of the (p,π^-) reaction as a spectroscopic tool in the sd-shell, it is necessary to obtain, for at least a few cases, independent evidence regarding the spin structure of the states preferentially populated in the (p,π^-) reaction.

It has been observed that the $^{26}Mg(p,\pi^-)^{27}Si$ reaction populates selectively and strongly two excited states in ^{27}Si at excitation energies of 7 MeV and 9.5 MeV. These states have been tentatively assigned $13/2^+$ spin and parity. This is the highest spin possible if all the active nucleons are restricted to the sd-shell. Recent shell model calculations[4] predict a $13/2^+$ state in ^{27}Si at an excitation energy between 7 and 8 MeV and several high spin states around 10 MeV excitation energy.

To date there is little experimental evidence for high spin states in ^{27}Si besides that provided by the (p,π^-) reaction. The $^{27}Al(^3He,t)^{27}Si$ reaction is expected to populate the presumed stretched two-particle one-hole states seen in the $^{26}Mg(p,\pi^-)^{27}Si$ reaction, and the $^{24}Mg(\alpha,p)^{27}Al$ reaction can populate the mirror states in ^{27}Al. We have studied these two reactions in order to obtain supporting evidence for the high spin assignments inferred from the (p,π^-) reaction.

We measured the angular distributions of the $^{24}Mg(\alpha,p)^{27}Al$ and $^{27}Al(^3He,t)^{27}Si$ reactions using the Princeton AVF (K=60) cyclotron and Quadrupole-Three Dipoles (Q3D) magnetic spectrograph. The angular distributions of the reaction $^{26}Mg(^3He,t)^{26}Al$ leading to the known 5^+ (g.s.), 0^+ (0.228 MeV), and 3^+ (0.417 MeV) states were also measured in order to calibrate the "L-signature" for possible high spin state transitions in the $^{27}Al(^3He,t)^{27}Si$ reaction.

The spectra obtained from the $^{24}Mg(\alpha,p)^{27}Al$ and $^{27}Al(^3He,t)^{27}Si$ reactions at bombarding energies of