neutron channels. As noted by Gray, Tickle and Bent[1] the two proton pick-up in the Zr region using the (^{6}Li,^{8}B) reaction is useful in studying the proton configurations of the ground state and first excited 0^+ states. They assume a simple direct, single-step cluster transfer and have calculated the cross sections using a finite range DWBA code. They find good agreement between calculation and experiment for two-proton transfer to the specific states. Our data represent inclusive total cross sections for two-proton transfer to all bound and neutron unstable states of ^{91}Y. Although the α-transfer reaction is possible it is not expected to contribute greatly to the Y isotope production.

The most interesting feature of the data in Fig. 1 is the steeply rising excitation function of ^{92}Y corresponding to the (^{7}Li,^{8}B) reaction or two-proton transfer from the target in conjunction with one neutron pick-up to the target. A second possible mechanism could be the double charge exchange (DCE) reaction (pp → nn) with subsequent neutron emissions. Further analysis of the data is required before we can estimate the yield of ^{93}Y, the DCE product.

Further work is planned at lower energies, in particular at about 60 and 75 MeV, in order to obtain a consistent set of data between the BNL and IUCF results. Later, when higher energy ^{7}Li beams become available (E_{Li} > 100 MeV), we hope to observe a marked increase in the cross sections of the very neutron rich Y isotopes.

1) R.S. Tickle, W.S. Gray and R.D. Bent, "Studies in the Zr Region using the (^{6}Li,^{8}B) Two proton Pick-up Reaction." IUCF Report 121 (1979). Also see this annual report.

SEARCH FOR 3p-3h STATES IN THE A=12 AND 16 SYSTEMS WITH THE (^{6}Li,t) AND (^{6}Li, ^{3}He) REACTIONS

H. Nann, A.D. Bacher, G.T. Emery, C.C. Foster, D.L. Friesel, W.P. Jones and C. Olmer
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

There has been a great deal of interest, both experimental and theoretical, in the location of three particle-three hole (3p-3h) states in ^{12}C-^{12}B and ^{16}O-^{16}N. We started to search for these states with the (^{6}Li,t) and (^{6}Li,^{3}He) reactions on ^{9}Be and ^{13}C at 99 MeV bombarding energy. Due to the momentum mismatch between the entrance and exit channels and due to the geometrical coefficients in the structure amplitude, the transfer of a $(d_{5/2})^3_{J=13/2}$ cluster is favored. Hence, final states with a configuration of $[(\text{target})_J \otimes (d_{5/2})^3_{J=13/2}]$ are expected to be strongly excited.

Figure 1 shows spectra of the ^{13}C(^{6}Li,t)^{16}O and ^{13}C(^{6}Li,^{3}He)^{16}N reactions. States in ^{16}O at 6.13, 11.25, 14.40, 14.80, 20.80 and 24.80 MeV and states in ^{16}N at 7.65, 9.81, 11.21, 11.81 and 14.00 MeV are the most strongly populated. Analog pairs of states in ^{16}N-^{16}O are clearly seen.

A simple weak-coupling calculation using the method of Bansal-French-Zamick[1,2] predicts the centroid of the 3p-3h states with T=0 in ^{16}O of the form ^{13}C($1/2^-$,g.s.) ⊗ ^{19}F($13/2^+$,4.6) at around 15 MeV and those with T=1 at around 20.5 MeV. This is approximately what is observed. The state at 20.80 MeV has a counterpart in ^{16}N and therefore should have very likely T=1, whereas the states at 14.40 and 14.80 MeV have no counterparts, suggesting a T=0 assignment.

1) R. Bansal and J.B. French, Phys. Lett. 11, 145 (1964).

2) L. Zamick, Phys. Lett. 19, 580 (1965).

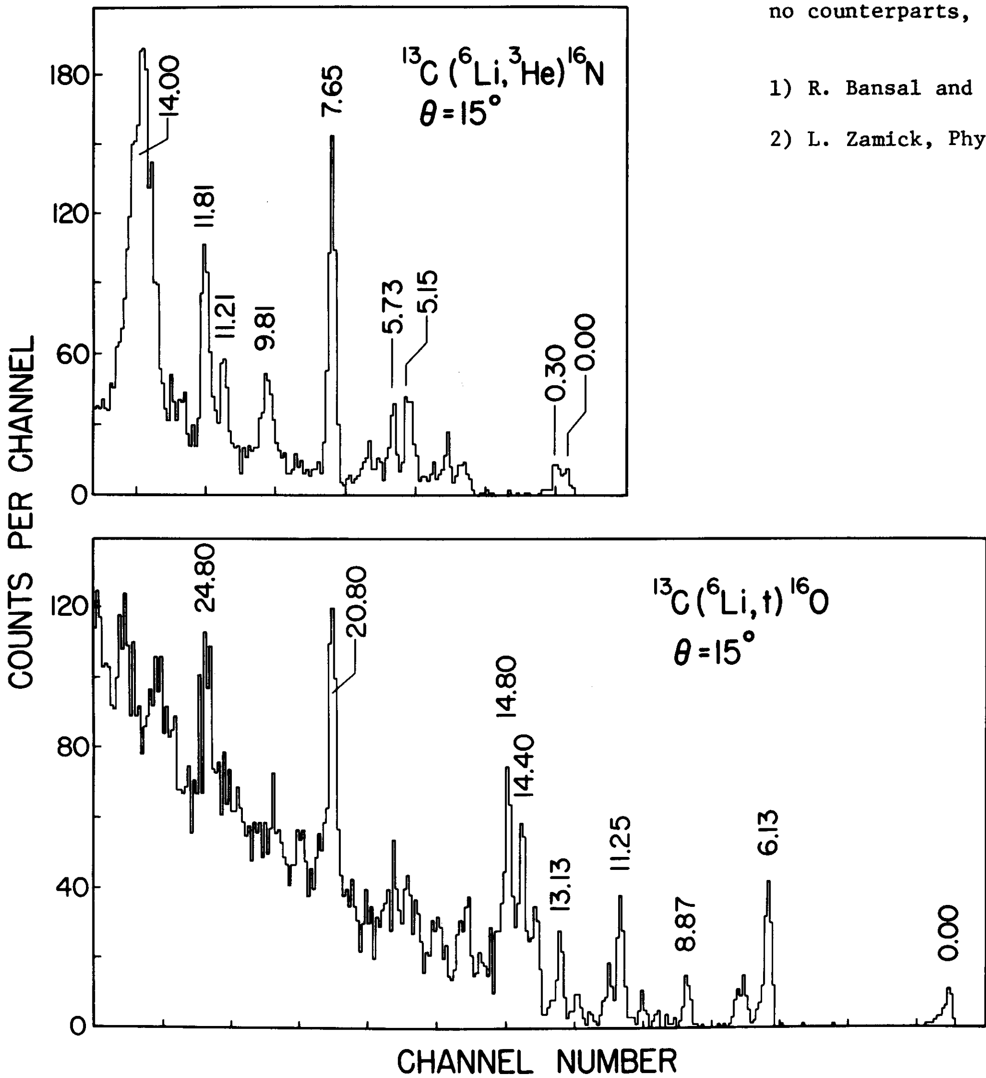

Figure 1. Spectra for ($^{6}Li,^{3}He$) and ($^{6}Li,t$) reactions on ^{13}C at 15°. The energies in MeV of various strongly excited states are noted.