

neutron channels. As noted by Gray, Tickle and Bent¹ the two proton pick-up in the Zr region using the (⁶Li,⁸B) 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 ⁹¹Y. 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 ⁹²Y corresponding to the (⁷Li,⁸B) 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 ⁹³Y, 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 IUUCF results. Later, when higher energy ⁷Li 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 (⁶Li,⁸B) Two proton Pick-up Reaction." IUUCF Report 121 (1979). Also see this annual report.

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

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There has been a great deal of interest, both experimental and theoretical, in the location of three particle-three hole (3p-3h) states in ¹²C-¹²B and ¹⁶O-¹⁶N. We started to search for these states with the (⁶Li,t) and (⁶Li,³He) reactions on ⁹Be and ¹³C 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 ($d_{5/2}$)_{J=13/2}³ cluster is favored. Hence, final states with a configuration of [(target)_J ⊗ ($d_{5/2}$)_{J=13/2}³] are expected to be strongly excited.

Figure 1 shows spectra of the ¹³C(⁶Li,t)¹⁶O and

¹³C(⁶Li,³He)¹⁶N reactions. States in ¹⁶O at 6.13, 11.25, 14.40, 14.80, 20.80 and 24.80 MeV and states in ¹⁶N at 7.65, 9.81, 11.21, 11.81 and 14.00 MeV are the most strongly populated. Analog pairs of states in ¹⁶N-¹⁶O 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 ¹⁶O of the form ¹³C(1/2⁻,g.s.) ⊗ ¹⁹F(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 ¹⁶N 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).

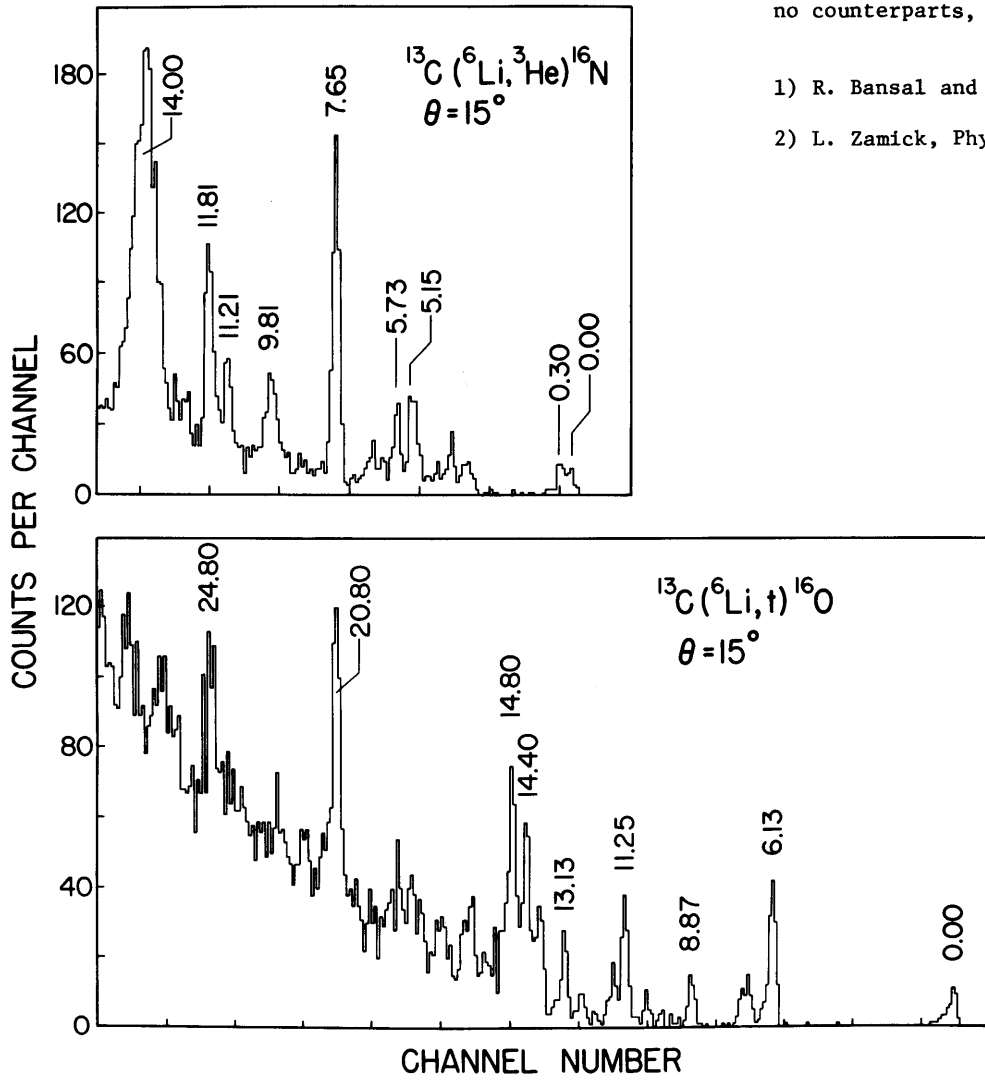


Figure 1. Spectra for $(^6\text{Li},^3\text{He})$ and $(^6\text{Li},t)$ reactions on ^{13}C at 15° . The energies in MeV of various strongly excited states are noted.