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

R.S. Tickle,* W.S. Gray,* and R.D. Bent

Of the four types of reactions which transfer two identical nucleons, the two-proton pickup reaction is the only one which has yet to be extensively applied to investigations of nuclear structure. Recent improvements in the ^{6}Li beam intensity at IUCF as well as the availability of a gridded ionization chamber[1] suitable for the detection of the lighter heavy ions have made it possible to begin experiments using the (^{6}Li,^{8}B) two-proton pickup reaction. One of the interesting questions to be answered is whether or not the (^{6}Li,^{8}B) reaction will pick out and selectively populate certain nuclear states as does, for instance, the (p,t) reaction in the lead region.

The group at Colorado has recently obtained some very interesting results[2] in the tin region. In a study of the (^{3}He,n) reaction on the even isotopes of cadmium, they have observed in five isotopes of tin, ranging from mass number 108 to 118, excited 0^+ states which they have interpreted as proton vibrational states. There is also some experimental evidence[3] that these same states may be deformed.

We have started some experiments at IUCF to determine whether or not states similar to those seen in (^{3}He,n) will be excited in the two-proton pickup reactions Te(^{6}Li,^{8}B)Sn. Our experiments are designed to look for states in the heavier tin isotopes (A $\geq$ 120). Unfortunately, because of target availability, our work cannot be made to overlap with the Colorado results, which end at ^{118}Sn.

In Figs. 1, 2, and 3 we show some of our preliminary spectra obtained at a forward angle with a ^{6}Li beam of approximately 90 MeV. The ground state cross sections (lab) for ^{120}Sn, ^{124}Sn, and ^{128}Sn are 2.6, 1.6, and 0.89 μb/sr respectively. As can be seen, the

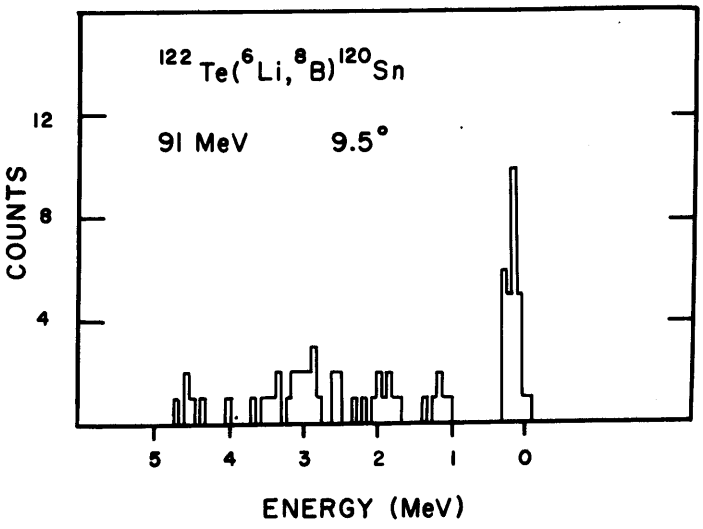

Figure 1.

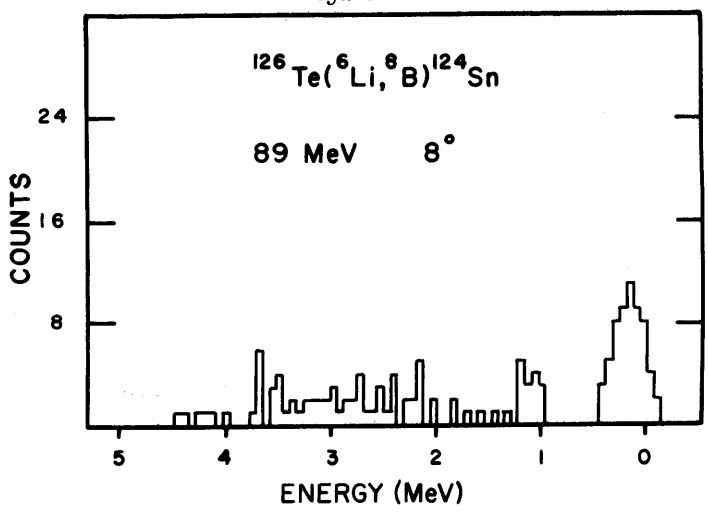

Figure 2.

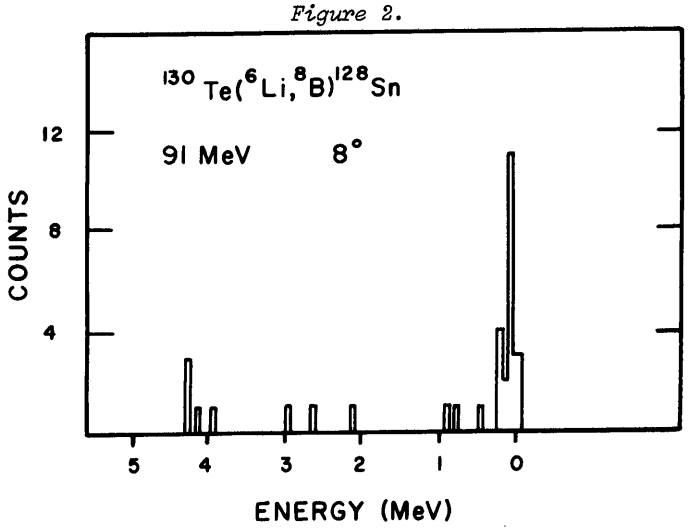

Figure 3.

(^{6}Li,^{8}B) reaction of these targets at this energy shows no evidence for a selective enhanced population of any excited states. In Fig. 1, the state at about 1.85 MeV in ^{120}Sn is probably the 0^+ state seen[4] in the ^{124}Te(d, ^{6}Li)^{120}Sn reaction at approximately the same excitation. Based on the (^{3}He,n) systematics, the energy of this state is approximately where one would expect to observe a 0^+ "pairing" state. Contrary to what is observed with the (^{6}Li,^{8}B) reaction, however, in the (^{3}He,n) work[2] one or more excited 0^+ states were populated with an intensity comparable to that of the ground state in each of the five isotopes of tin that were studied.

Figure 4 shows a spectrum measured at 8° for the ^{66}Zn(^{6}Li,^{8}B)^{64}Ni reaction. The ground state cross section, which is 27.3 μb/sr (lab), is considerably larger than the cross sections measured in the tin region. An angular distribution, essentially structureless, is shown in Fig. 5.

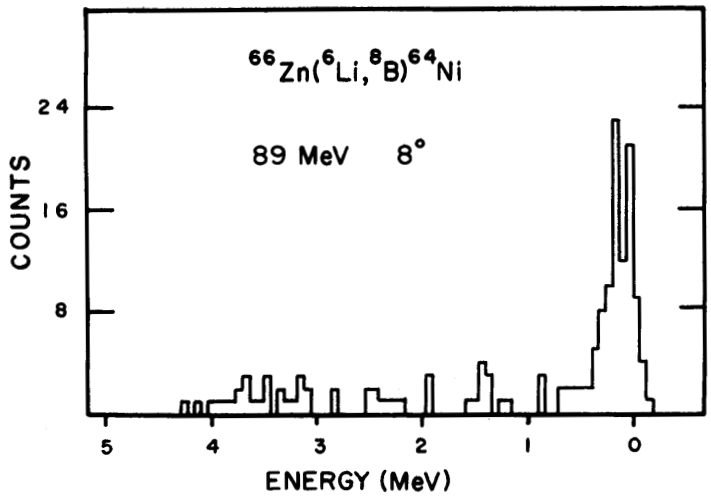

Figure 4.

*The University of Michigan, Ann Arbor, MI 48109

1) IUCF Annual Report (1977), p. 19 & 54.

2) H.W. Fielding, et al., Nucl. Phys. A281, 389 (1977).

3) J. Bron et al., Proc. Int. Conf. on Nucl. Structure, Tokyo, 1977 in J. Phys. Soc. Japan 44, 513 (1978).

4) J. Janecke, F.D. Becchetti, H. Song, and C.E. Thorn, Proc. Int. Conf. on Nucl. Structure, (Tokyo, 1977) p. 358.

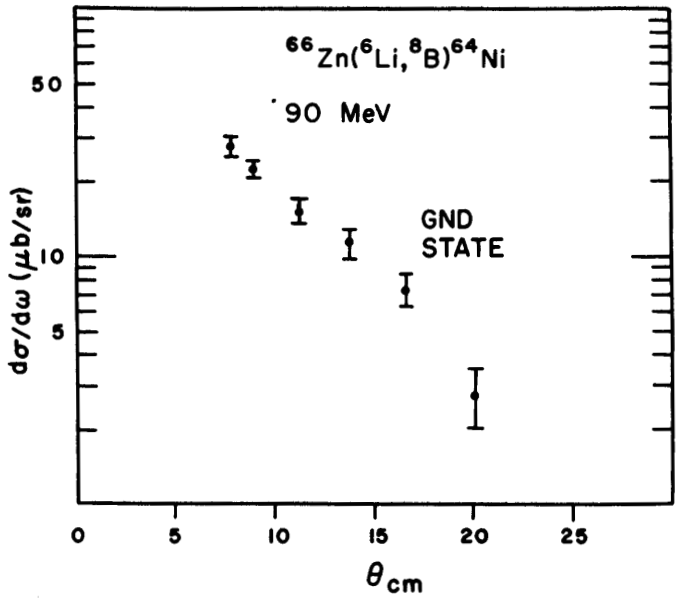

Figure 5.