In conclusion, the present calculations show that at 200 MeV bombarding energy the strong $^{14}C(p,\pi^-)^{15}O$ transition to the $7/2^+$ state at 7.3 MeV appears to go via a two-nucleon reaction mechanism dominated by intermediate Δ formation. This bombarding energy corresponds to an outgoing pion center-of-mass energy of only 30 MeV, which is well down on the low energy tail of the (3,3) resonance.

For the weak $^{12,13,14}C(p,\pi^-)^{13,14,15}O$ ground state transitions, intermediate Δ formation is strongly inhibited, and competing processes such as s-wave and non-resonant p-wave rescattering, as well as the one-nucleon mechanism, probably are important. The interference of several competing processes will make realistic calculations for these cases much more difficult.

1) M. Dillig, J.S. Conte and R.D. Bent, this report p. 25.

2) J.S. Conte, M. Dillig and R.D. Bent, this report p. 28.

3) Z-J. Cao, R.D. Bent, J.S. Conte, M. Dillig and H. Nann (private communication).

4) P. Schwandt, Indiana University Cyclotron Facility Report No. 81-3, 1981 (unpublished).

5) H.O. Meyer, P. Schwandt, W.W. Jacobs and J.R. Hall, Phys. Rev. C 27, 459 (1983).

6) M.B. Johnson and E.R. Siciliano, Phys. Rev. C 27 730 (1983) and Phys. Rev. C 27, 1647 (1983); E.R. Siciliano, private communication.

7) K. Stricker, H. McManus and J.A. Carr, Phys. Rev. C 19, 929 (1979); K. Stricker, J.A. Carr and H. McManus, Phys. Rev. C 22, 2043 (1980)

8) L.A. Charlton, Phys. Rev. C 8, 146 (1972).

9) W.W. Jacobs, T.G. Throwe, S.E. Vigdor, M.C. Green, J.R. Hall, H.O. Meyer, and W.K. Pitts, Phys. Rev. 49, 855 (1982).

10) S.E. Vigdor, T.G. Throwe, M.C. Green. W.W. Jacobs, R.D. Bent, J.J. Kehayias, W.K. Pitts and T.E. Ward, Nucl. Phys. A396, 61c (1983).

11. T.G. Throwe, Ph.D. Thesis, Indiana University (1984).

NUCLEAR STRUCTURE EFFECTS IN THE $^7Li(p,\pi^-)^8B$ REACTION

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A microscopic pion exchange model[1,2] for nuclear pion production near the pion production threshold has been under development at IUCF for several years. This model includes both one- and two-nucleon terms and deals with the multiple-scattering effects in the entrance and exit channels via proton-nucleus and pion-nucleus optical potentials. The present version of the computer code, however, contains only pion production through the (3,3) resonance (Δ-isobar excitation). The relative technical simplicity of the code makes it possible to analyze systematically a large amount of existing data at IUCF. There is also the flexibility to employ realistic nuclear wave functions in the code, which allows investigation of nuclear structure effects in the (p,π) reaction.

In this report, we present preliminary results on the sensitivity of the model to details of nuclear structure, using the $^{7}Li(p,\pi^{-})^{8}B$ reaction as an example. We choose the (p,π^{-}) reaction for these initial tests because of the simplicity resulting from the fact that only target neutrons contribute to π^{-} production. Wave functions for various states of ^{7}Li and ^{8}B were generated using the shell-model code OXBASH,[3] which works in the occupation number representation with an m-scheme basis set. The great advantage of the occupation number representation technique is that it does not require large tables of coefficients of fractional parentage, which results in a substantial reduction of computing time.

The shell model code gives possible configurations of the desired nuclear states (Figs. 1-4), as well as one- and two-particle parentage amplitudes, which are needed to derive weighting factors for the possible one-particle one-hole couplings in the two-particle one-hole wave functions. These are needed as input to the (p,π) code.

We have calculated the angular distributions of the differential cross sections and analyzing powers for the $^{7}Li(p,\pi^{-})$ reaction taking ^{7}Li as a pure configuration [Fig. 1(a)] and admixtures of two configurations for ^{8}B(g.s.) [Fig. 2], ^{8}B(0.78 MeV) [Fig. 3], and ^{8}B(2.23 MeV) [Fig. 4], corresponding to transitions to the ground state and the first and second excited states, respectively (solid curves in Figs. 5-7). Calculated differential cross sections and analyzing powers assuming only the dominant configurations for each ^{8}B state are also presented in Figs. 5-7 (dashed curves) to illustrate how sensitive the calculations are to the wave functions.

The calculations agree poorly with the data for all three transitions, and the discrepancies are not reduced very much by employing the more realistic wave

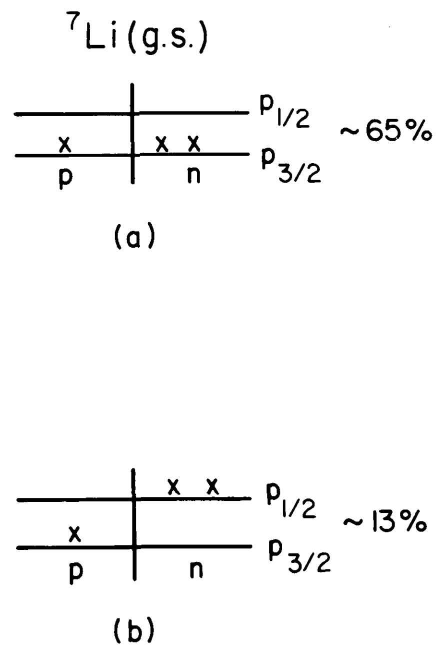

Figure 1. The most important configurations for ^{7}Li(g.s.).

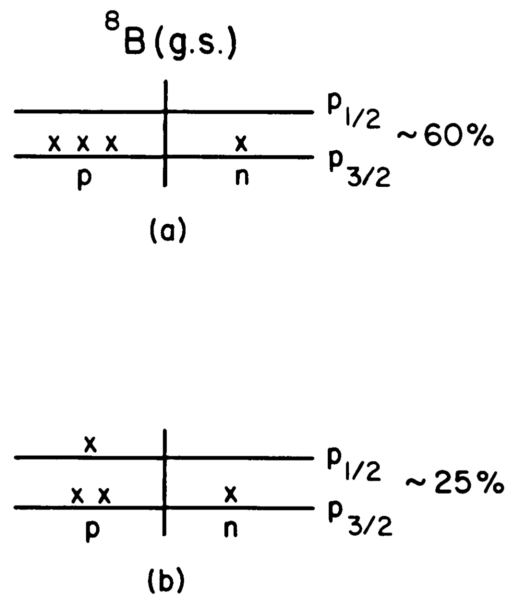

Figure 2. The most important configurations for ^{8}B(g.s.).

functions for ^{8}B. It may be possible to improve the agreement by using a more realistic pion optical potential, which is known[5] to play an important role in

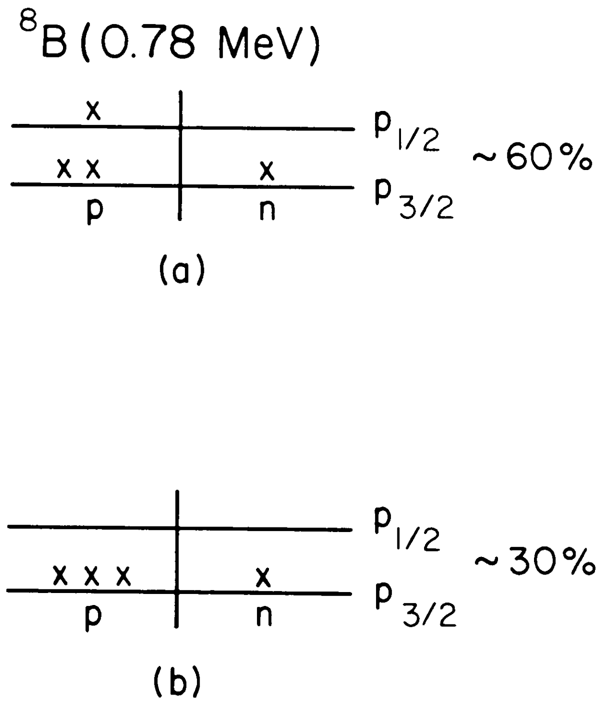

Figure 3. The most important configurations for ^{8}B(0.78 MeV).

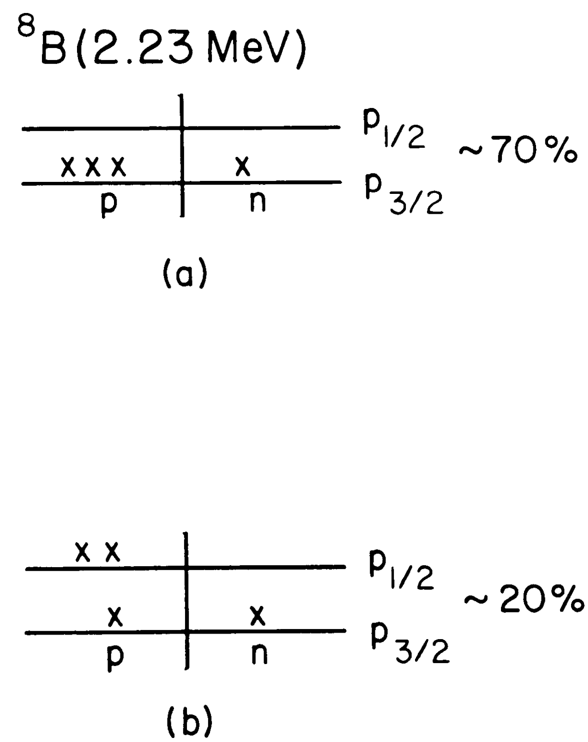

Figure 4. The most important configurations for ^{8}B(2.23 MeV).

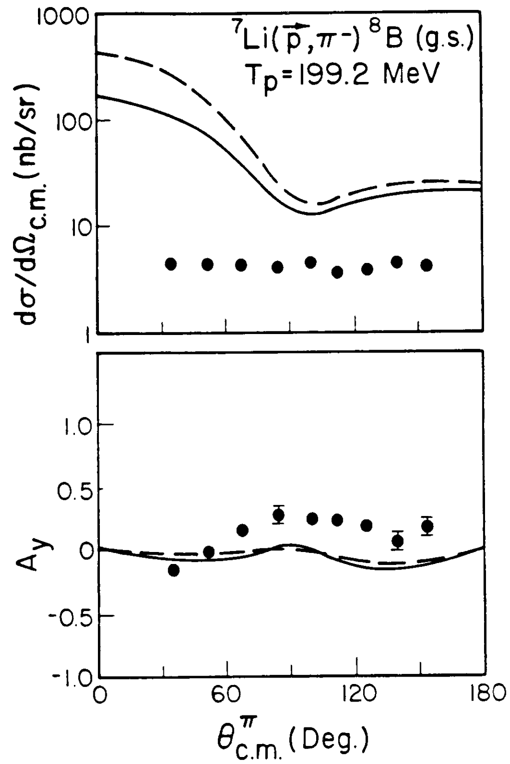

Figure 5. Calculated differential cross sections and analyzing powers assuming admixtures of two configurations (solid curves) and only the dominant configuration (dashed curves) for ^{8}B(g.s.). The data were taken at IUCF in 1984.

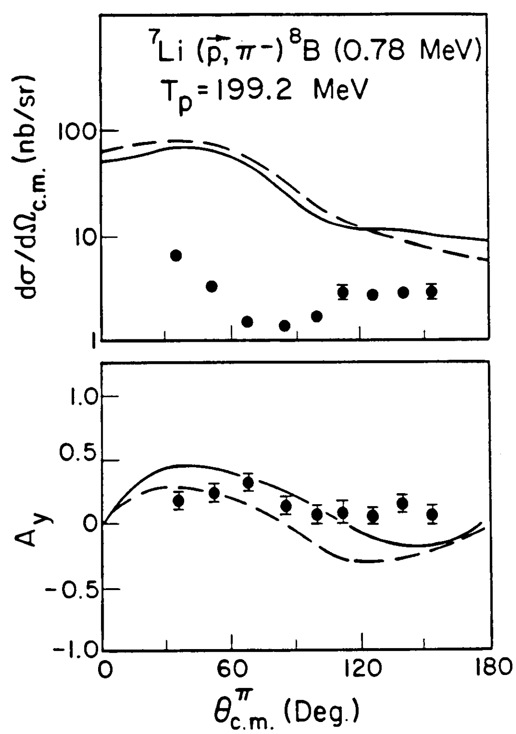

Figure 6. Calculated differential cross sections and analyzing powers assuming admixtures of two configurations (solid curves) and only the dominant configuration (dashed curves) for ^{8}B(0.78 MeV). The data were taken at IUCF in 1984.

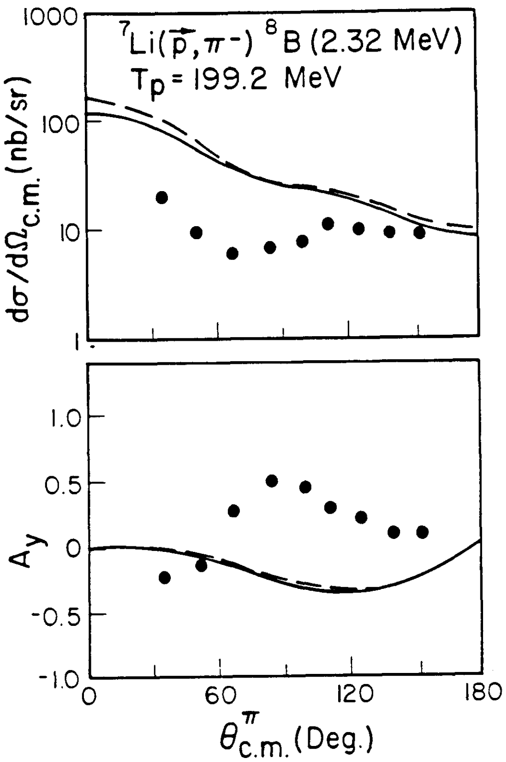

Figure 7. Calculated differential cross sections and analyzing powers assuming admixtures of two configurations (solid curves) and only the dominant configuration (dashed curves) for ^{8}B(2.32 MeV). The data were taken at IUCF in 1984.

the (p,π^-) reaction, but the results suggest that intermediate Δ formation may not play a dominant role in the ^{7}Li$(p,\pi^-)^8$B reaction at these energies, which are far below the isobar resonance.

1) M. Dillig, J.S. Conte and R.D. Bent, this report p. 25.

2) J.S. Conte, M. Dillig and R.D. Bent, this report p. 28.

3) B.A. Brown, A. Etchegoyen, W.D.M. Rae and N.S. Godwin, "The Oxford-Buenos Aires Shell Model Code", (1984).

4) R.D. Bent, J.S. Conte and M. Dillig, this report p. 30.

5) P.W.F Alons, R.D. Bent, J.S. Conte, M. Dillig, and E.R. Siciliano, this report p. 37.

CONSTRAINTS ON THE PION-NUCLEUS OPTICAL POTENTIAL FROM THE (p,π) REACTION

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In their 1979 review article[1] on the (p,π) reaction, Measday and Miller stated that: "The use of the (p,π) reaction to provide constraints on the pion-nucleus optical potential may become its most outstanding contribution to knowledge of meson-nucleus dynamics". To explore this possible use of the (p,π) reaction, we have begun to investigate the sensitivity of our two-nucleon model[2] (p,π) calculations to details of the pion-nucleus optical potential.

A characteristic feature of the $A(p,\pi)A{+}1$ reaction is the large momentum transfer to the nucleus, which is more than twice the fermi momentum of nucleons. In a