relatively simple matter to extend the program to calculate pionic fusion with complex projectiles [e.g., the A(^{3}He,π)A+3 reaction].

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STUDIES OF THE $^{18}O(p,\pi^-)^{19}Ne^*$ AND $^{26}Mg(p,\pi^-)^{27}Si^*$ REACTIONS WITH 200 MeV POLARIZED PROTONS

J.J. Kehayias, R.D. Bent, M.C. Green, M. Hugi, H. Nann, and T.E. Ward
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

One of the exciting developments at IUCF during 1982 was the discovery of a striking and systematic selectivity in the (p,π^-) reaction. For a number of targets in the C, Ca and Zr mass regions, it was found that the reaction strength is concentrated in a small excitation region of the residual nucleus. It was conjectured that these strongly excited states have a stretched two-particle one-hole configuration with respect to the target nucleus and that their prominence is a "signature" of a two-nucleon reaction mechanism.[1]

To further elucidate the nature of the (p,π^-) reaction, we have carried out similar experiments for a number of sd-shell targets; $^{17,18}O$, $^{24,25,26}Mg$, and $^{28,29,30}Si$. The sd-shell was chosen for study because in this mass region the low level densities allow several levels to be resolved, many spin and parity assignments are known from other experiments, and full shell model calculations are possible.

The two targets which showed the most pronounced concentration of reaction strength were ^{18}O and ^{26}Mg. Spectra for these two cases are shown in Fig. 1. Complete angular distributions of the differential cross sections and analyzing powers were measured for these two reactions with 201 MeV polarized protons.

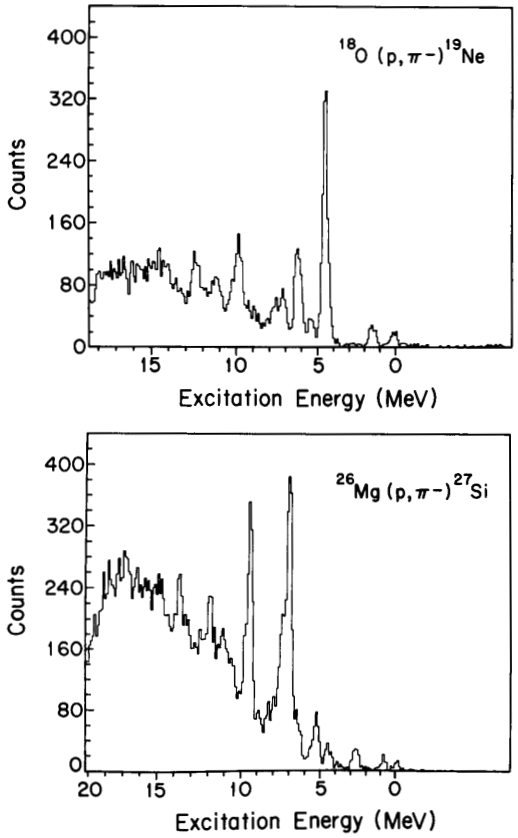

Figure 1. $^{18}O(p,\pi^-)^{19}Ne$ and $^{26}Mg(p,\pi^-)^{27}Si$ spectra both at T_p^{Lab} = 201 MeV and θ_π^{Lab} = 30°.

The data are partially analyzed, and results for the 4.6 MeV peak in the $^{18}O(p,\pi^-)^{19}Ne$ spectrum and the 9.5 MeV peak in the $^{26}Mg(p,\pi^-)^{27}Si$ spectrum are shown in

Fig. 2. The error bars include only the statistical uncertainties. The similarities between the angular distributions for these two reactions are immediately evident.

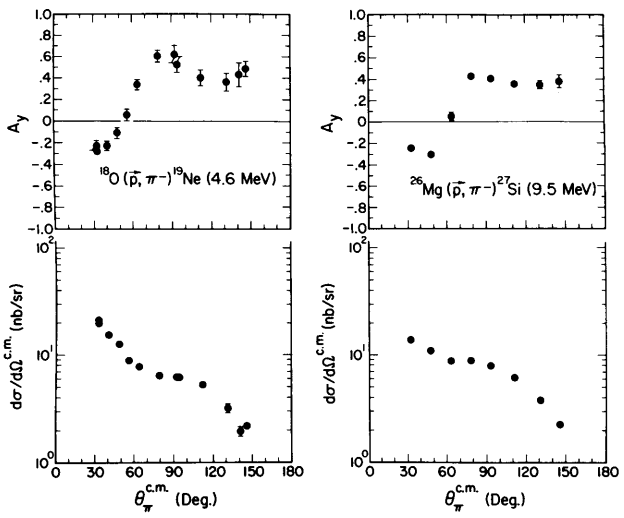

Figure 2. Center-of-mass differential cross section and analyzing power angular distributions for the reactions $^{18}O(p,\pi^-)^{19}Ne$ (4.6 MeV) and $^{26}Mg(p,\pi^-)^{27}Si$ (9.5 MeV) both at T_p^{Lab} = 201 MeV.

In the two-nucleon model the $^{18}O(p,\pi^-)^{19}Ne$ reaction is expected[1] to populate strongly stretched 2p-1h final states having the configuration $[(\pi d_{5/2})^2_{4^+} (\nu d_{5/2})^{-1}]_{13/2^+}$ or $[(\pi d_{5/2} \pi d_{3/2})_{4^+} (\nu d_{5/2})^{-1}]_{13/2^+}$ with respect to the target nucleus. There is a known $13/2^+$ state[2] in ^{19}Ne at 4.64 Mev which agrees in energy to within 50 keV with that of the strongest peak in the $^{18}O(p,\pi^-)^{19}Ne$ spectrum. A second $13/2^+$ state is known[3] in the mirror nucleus ^{19}F at 10.42 MeV, which may correspond to the 9.8 MeV peak in the $^{18}O(p,\pi^-)^{19}Ne$ spectrum. We would expect the strongest peaks in the $^{26}Mg(p,\pi^-)^{27}Si$ spectrum to correspond to similar stretched 2p-1h states in ^{27}Si.

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