STUDIES OF KNOCK-OUT REACTIONS

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The program of the knock-out group has proceeded along two lines during the grant year: studies of two-step processes and a high-resolution study of $^{40}Ca(p,2p)$. Earlier work[1] using $^{12}C(p,2p)$ in a symmetric geometry at 100 MeV gave little evidence for two-step processes which could lead to the $5/2^-$(4.44 MeV) state in ^{11}B. A more detailed analysis of that data indicated that, though significantly reduced in magnitude, the $5/2^-$ state was populated; see Figure 1. The considerable difference between this result and results obtained[2] at 50 MeV led us to speculate that an asymmetric energy sharing geometry, more equivalent to the lower energy experiment, could help determine the extent to which two-step processes are important. Such an experiment was done using Director's discretionary time, with results shown in Figure 2. It may be possible to explain the differences between these results by invoking two-step processes involving the 2^+ 1st excited state of ^{12}C. There is also speculation that giant resonances play the intermediate role.[3] Distorted wave calculations are under way to test this latter point, and may be helpful in suggesting additional measurements which, when approved, could remove any ambiguities.

The $^{40}Ca(p,2p)^{39}K$ reaction was studied at 150 MeV using a symmetric coplanar energy-sharing technique. Typical spectra for two different values of

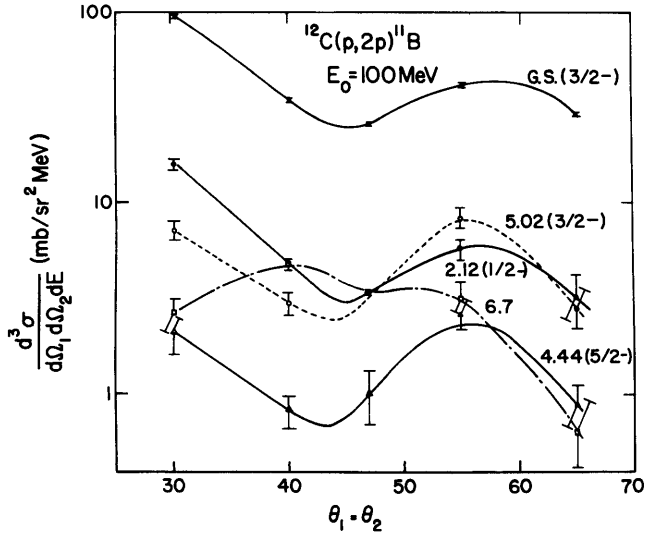

Figure 1.

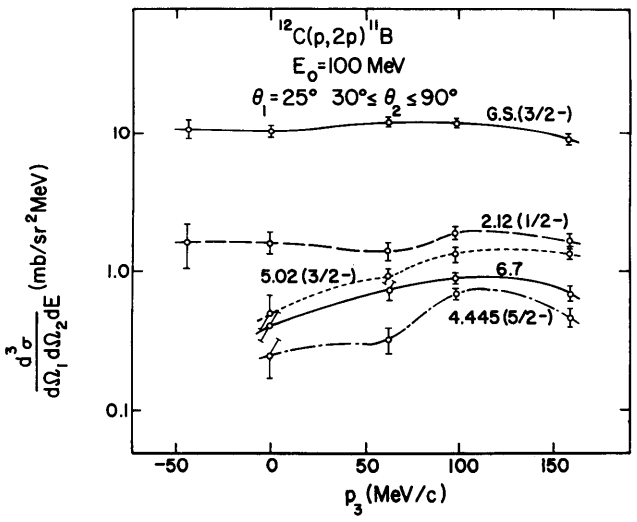

Figure 2.

the recoil momentum, p_3, are shown in Figure 3. The FWHM is abour 320 keV, caused primarily by target thickness. The $1d_{3/2}$ ground state and $2s_{1/2}$ 1st excited state at 2.53 MeV are clearly delineated. Additional structure extending well beyond 9 MeV, a typical upper limit for transfer reactions, is evident. A DWIA calculation has been made for the first two states using a code supplied by Chant.[4] The results, in Figure 4, yield spectroscopic factors of 3.89 and 1.74 for the $1d_{3/2}$ and $2s_{1/2}$ states, respectively, values quite close to those expected from Hartree-Fock calculations.[5] Peakfitting to the higher excitation region has yielded energy correlations for several other states, as shown in Figure 5. The knock-out reaction is clearly well suited for the study of these high excitations; such additional studies will be pursued when the recommendation of the IUCF Program Advisory Committee can be obtained.

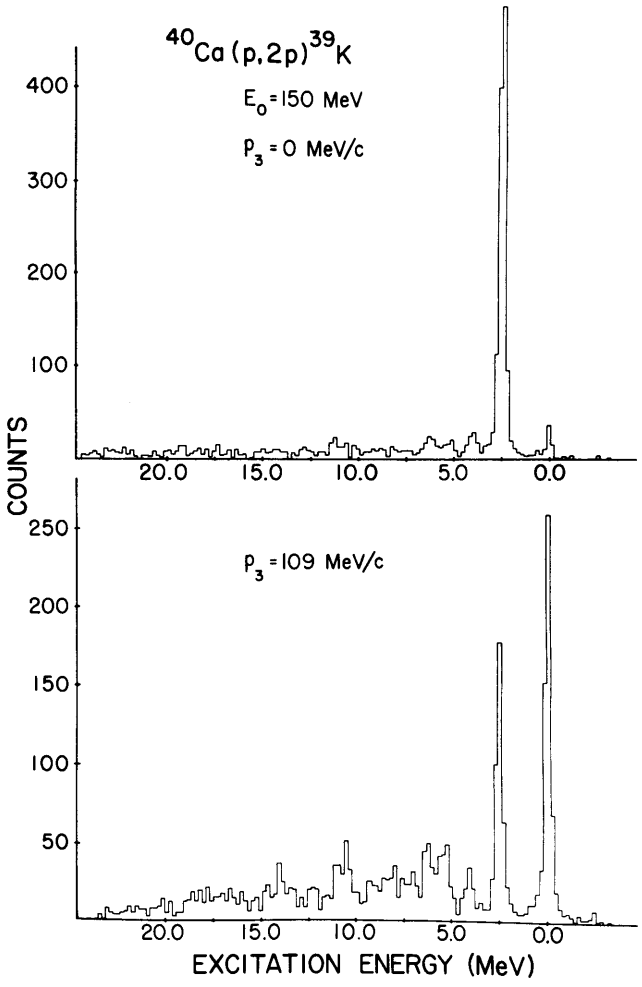

Figure 3.

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1) IUCF Technical and Scientific Report, Nov. 1, 1975 - Jan. 31, 1977.

2) Pugh et al., Phys. Rev. 155, 1054 (1967).

3) K. Amos, private communication.

4) N.S. Chant and P.G. Roos, Proc. of 2nd Int. Conf. on Clustering, College Park, Md., 1975.

5) Blewler et al., Nuovo Cimento 52B, 119 (1967).

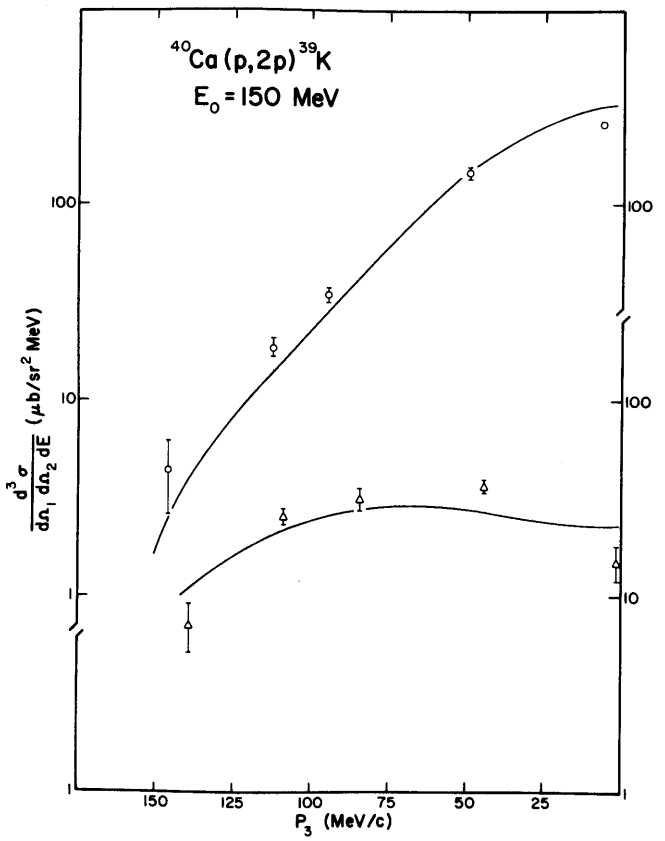

Figure 4.

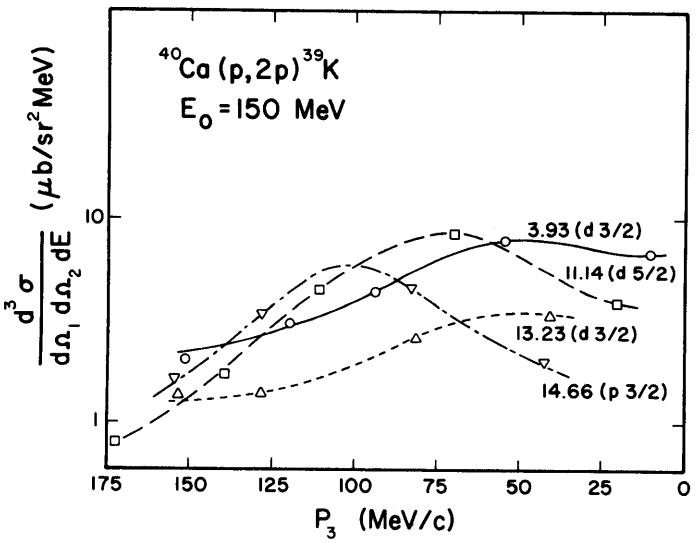

Figure 5.