

STUDIES OF KNOCK-OUT REACTIONS

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We have continued our program of reaction mechanism studies using the (p,2p) reaction. Earlier studies examined two-step processes<sup>1</sup> and the factorization approximation.<sup>2</sup> In the current year we have successfully brought the two-telescope hyperpure germanium counter system<sup>3</sup> on line and have taken preliminary data to investigate whether or not distortion effects can be separated from deficiencies in the specification of the nuclear wavefunction in the DWIA.

In the Factorized Distorted Wave Impulse approximation (DWIA),<sup>4</sup> the cross section is given by

$$\frac{d^3\sigma}{d\Omega_1 d\Omega_2 dE_1} = K \sum_{\Lambda} |G_{LJ}^{\Lambda}|^2 S_{\text{Spins}}^{LJ\Sigma} |T_{pp}|^2,$$

where K is a kinematic factor,  $S^{LJ}$  is the spectroscopic factor for the particular final state,  $T_{pp}$  is the proton-proton matrix element and  $G_{LJ}^{\Lambda}$  is the distorted momentum distribution. The last factor contains the nuclear bound state information:

$$G_{LJ}^{\Lambda} = \langle \chi_1^{-*} \chi_2^{-*} | \phi_{LJ}^{\Lambda} \chi_0^+ \rangle,$$

where the  $\chi_i$  represent the incoming and outgoing distorted waves and  $\phi_{LJ}^{\Lambda}$  is the nuclear overlap integral between initial and final states. Typically,  $\phi_{LJ}^{\Lambda}$  is estimated by calculating the Woods-Saxon potential required for the correct binding energy. For an  $\ell \neq 0$  knock-out at  $\vec{q}=0$  (i.e., the momentum transfer equal to zero) the cross section should be zero, except for the effect of the nuclear dis-

tortion on the incoming and outgoing waves. In such a kinematic region the knock-out reaction should be able to differentiate between contributions to the cross section from purely distortion and those resulting from the improper specification of the overlap integral.

In our first run we chose to investigate the  $^{40}\text{Ca}(p,2p)^{39}\text{K}^*(2.52,1/2^+)$  reaction at  $E_p=150$  MeV and  $|\vec{q}|=100$  MeV/c. These kinematic conditions are near the node in the 2s wavefunction, but still result in a reasonable cross section (5-50  $\mu\text{b}/\text{sr}^2\text{-MeV}$ ). We used the fixed condition geometry of Jackson,<sup>5</sup> in which  $|\vec{q}|$  and  $\Lambda=E_1/(E_1+E_2)$  are fixed and  $\theta_3$  (the angle of  $\vec{q}$  with respect to the incident beam) is varied in order to maximize the sensitivity of the tests.

The first results were quite encouraging, but rather limited in statistics, particularly as  $\theta_3$  went beyond  $60^\circ$ . Now that the set-up and operation of the two-telescope arrangement is well developed, additional runs should be productive enough to produce high-statistics data.

- 1) D.W. Devins et al., *Australian Journal of Physics*, 32, 323 (1979).
- 2) P.G. Roos et al., *Phys. Rev. Lett.* 40, 1439 (1978).
- 3) D.L. Friesel, this report.
- 4) G. Jacob and Th.A.J. Maris, *Rev. Mod. Phys.* 38, 121 (1966)
- 5) A.A. Ioannides and D.F. Jackson, *Nucl. Phys.* A308, 345 (1978).