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4.8 318 and 498 MeV Proton Scattering from ^{16}O

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As part of a comprehensive study of $^{16}O(\vec{p},\vec{p}')$ at energies greater then 100 MeV[1], cross sections and analyzing powers have been measured at 318 and 498 MeV for transitions leading to states in ^{16}O with excitation energies up to approximately 13 MeV. Also, at 498 MeV, the spin-transfer observables (Wolfenstein parameters) have been measured for $^{16}O(\vec{p},\vec{p})$ elastic scattering and for $^{16}O(\vec{p},\vec{p}')$ inelastic transitions to the 3^- (6.13 MeV), 2^+ (6.92 MeV), and 1^- (7.11 MeV) levels. Momentum transfers up to 3.5 fm^{-1} are covered by these data. The High resolution Spectrometer (HRS) facility, and its associated focal plane polarimeter[2], at the Los Alamos Meson Physics Facility (LAMPF) was used for these measurements.

The targets were ceramic BeO wafers of various thicknesses, with resolutions on the order of 45 KeV at 318 MeV, and 70 KeV at 498 MeV. Most of the data were taken with one momentum setting of the HRS, corresponding to about 17 MeV excitation centered about 6 MeV. In addition, a second "inelastic bite" centered about 12 MeV was also taken at 318 MeV. Because of significant backgrounds and peak overlap all the inelastic states were fitted with the fitting code "Allfit"[3]. For the focal plane polarimeter data the sector method was used with missing mass spectra being fitted. The statistical accuracy of the data limited the extraction of the spin observables to the strong low-lying natural parity transitions in ^{16}O. Also, the levels in ^9Be, both wide and narrow, obscured levels or groups of levels in ^{16}O as they moved across the ^{16}O $(\vec{p},\vec{p}')$ spectra as a function of angle. Typical data are presented in Figures 1 and 2.

Figure 2 shows that the relations between the spin transfer observables, $D_{LS}=-D_{SL}$ and $D_{LL}=D_{SS}$ hold, within statistics, for the strong $(\vec{p},\vec{p}')$ transition to the natural parity 6.13 MeV 3^- level in ^{16}O. The first of these relations is expected within the context of the adiabatic (frozen nucleus) approximation[4] for the reaction mechanism, while the second relation should be valid for strong natural parity transtions[5]. Non-relativistic and relativistic calculations are now in progress to fit these data.

References

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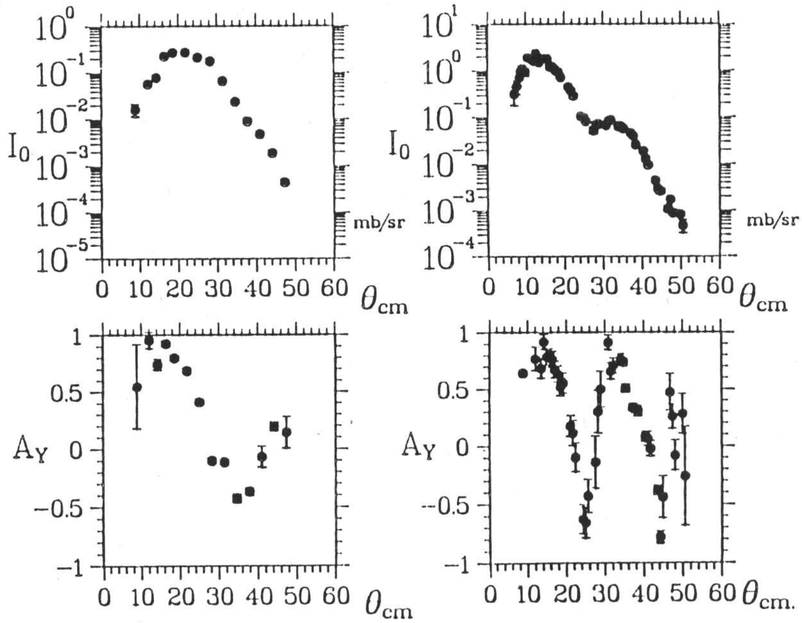

Fig. 1. I_0 and A_y for the 4^+ (10.35 MeV) and 2^+ (11.52 MeV) states in ^{16}O at 318 MeV

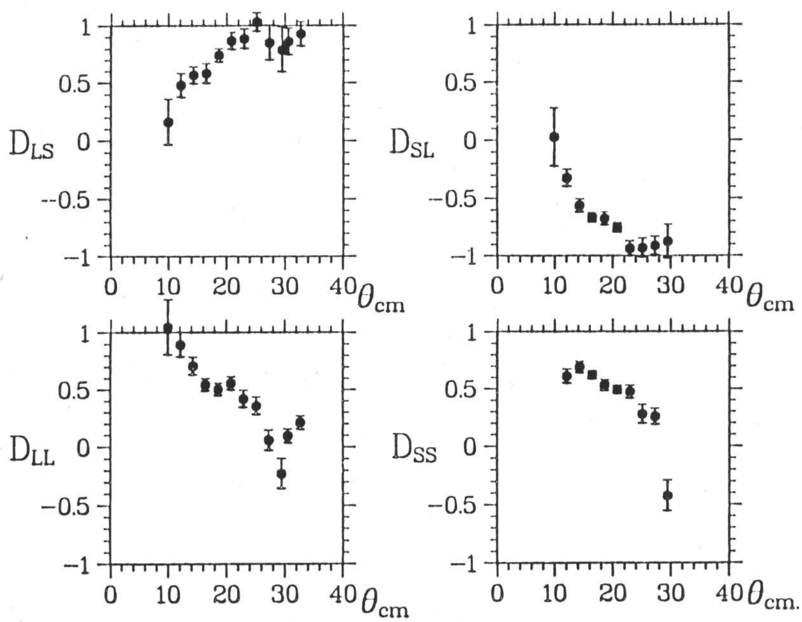

Fig. 2. Spin observables for the 3^- (6.13 MeV) state in ^{16}O at 498 MeV