CEBAF EXPERIMENT 93-022

Measurement of the Polarization of the $\phi(1020)$ in Electroproduction

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Vector meson production has been an important tool used in understanding the hadronic properties of the photon. For low values of Q^2 and W, the photon interacts with the target predominately through vector meson intermediate states which diffractively scatter from the target. However, as was first discovered in the mid 1970's, for larger values of Q^2, the photon directly probes the constituents in the nucleon.

Measurements at high Q^2 show that exclusive production of vector mesons becomes a hard scattering process. The EMC Collaboration has measured exclusive ρ vector meson production with muons, i.e. $\mu p \to \mu \rho^o p$. Their data indicate that for $Q^2 \gtrsim 1$ GeV^2, the soft hadron-like properties of the photon have disappeared and the (virtual) photon acts as a pure electromagnetic probe of the nucleon structure. The signature for the departure from the diffractive nature of the reaction mechanism was given by the $\rho^o \to \pi^+\pi^-$ angular decay distribution.

Because the valence quark structure of ϕ mesons is pure $s\overline{s}$, the electroproduction of ϕ vector mesons has a cleaner interpretation than that of ω or ρ. Quark exchange diagrams are OZI suppressed to a level between 0.1 - 5% of OZI allowed reactions. Thus a measurement of the component of ϕ electroproduction arising from a ϕ-nucleon interaction significantly greater than 5% could indicate an $s\overline{s}$ component in the nucleon. The existing limits of such interactions is 30-40%.

We propose to measure the reaction $e^- \ p \ \to \ e^- \ p \ \phi$ at a beam energy of 4 GeV. The polarization of the ϕ meson will be determined from the angular correlations in the decay $\phi \to K^+K^-$ at Q^2 between 0.3 and 2 GeV^2. The complete angular coverage of the CLAS detector allows independent determinations of longitudinal and transverse scattering to about 10 %. In addition, we expect to measure the dependence of the decay distributions on the azimuthal angle, which has not been possible for the higher energy experiments. Such measurements may allow us to identify hard production mechanisms if they exist in this kinematic region.

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