

CEBAF EXPERIMENT 89-045

**STUDY OF KAON PHOTOPRODUCTION ON DEUTERIUM**

An experiment using the CEBAF Large Acceptance Spectrometer

B.L. Berman, W.J. Briscoe, P.L. Cole, J.P. Connelly, K.S. Dhuga

*George Washington University, Washington, D.C.*

V.D. Burkert, W. Brooks, B.A. Mecking (spokesperson), M.D. Mestayer,

B. Niczyporuk, E.S. Smith, A. Yegneswaran

*CEBAF, Newport News, Virginia*

H. Crannell, J.T. O'Brien, D.I. Sober

*Catholic University of America, Washington, D.C.*

D. Doughty, D. Heddle

*Christopher Newport University, Newport News, Virginia*

E.V. Hungerford, K. Lan, B.W. Mayes, L.S. Pinsky

*University of Houston, Houston, Texas*

K. Maeda

*Tohoku University, Sendai, Japan*

B.G. Ritchie

*Arizona State University, Tempe, Arizona*

R.A. Schumacher

*Carnegie Mellon University, Pittsburgh, Pennsylvania*

R. Sealock, S. Thornton

*University of Virginia, Charlottesville, Virginia*

# STUDY OF KAON PHOTOPRODUCTION ON DEUTERIUM

## Physics Motivation

Experiment E-89-045 will study the photoproduction of  $\Lambda$  and  $\Sigma$  hyperons on deuterium. This process is governed by three main ingredients: the amplitudes for the elementary  $\gamma N \rightarrow KY$  process, the deuteron wave function, and the interaction between the final state hadrons. The relative importance of quasi-free production and final state interactions can be emphasized or de-emphasized by the choice of the kinematical conditions. The following questions can be investigated:

1. In quasi-free kinematics, the differential cross sections for the elementary hyperon production on the neutron can be determined. The measurements can be used to test the predictive power of the present theoretical description of hyperon photoproduction, and to determine the KYN coupling constants. The following reactions for which little experimental information is available can be investigated:

$$\gamma n \rightarrow K^+\Sigma^-, \gamma n \rightarrow K^0\Lambda, \text{ and } \gamma n \rightarrow K^0\Sigma^0$$

2.  $\Lambda n$  and  $\Sigma n$  interactions can be studied by selecting kinematical conditions far away from the quasi-free kinematics.
3.  $\Lambda - \Sigma$  channel coupling effects can be investigated; channel coupling has been predicted to lead to a rapid variation of the differential cross section (cusp) as the threshold for  $\Sigma$ -production is crossed.

## Experimental Procedure

Experiment E-89-045 will study the photoproduction of  $\Lambda$  and  $\Sigma$  hyperons on deuterium using the CEBAF Large Acceptance Spectrometer (CLAS) and the photon tagging system in Hall B. The following measurements will be made as a function of primary photon energy and kaon emission angle:

1. inclusive  $K^+$  and  $K^0$  momentum distributions,
2. measurement of exclusive  $K^+$  and  $K^0$  production off the neutron,
3. measurement of the complete hadronic final state to derive information on hyperon-nucleon interaction.

Hyperons will be produced by tagged photons via the  $\gamma D \rightarrow KYN$  reaction. Charged particles will be tracked by the CLAS drift chambers; neutral particles will be detected in the electromagnetic calorimeter.

The photon energy range of interest in this experiment is  $E_\gamma = (900 - 1500)$  MeV with the primary electron energy  $E_o$  set at 1600 MeV. A rate of tagged photons of  $10^7/\text{sec}$  will be used. Charged kaons in the momentum range of  $p_K \approx (300 - 1300)$  MeV/c will be identified by combining time-of-flight between the target and the timing counters with the  $dE/dx$  information from the drift chambers. Neutral kaons will be identified via their  $K_L \rightarrow \pi^+\pi^-$  decay. The data acquisition system will be triggered by a single charged hadron in coincidence with the tagging system resulting in a data recording rate of  $\sim 1000$  events/sec.