Jefferson Lab Proposal

Study Of Excited Intermediate States In $p(e,e'K)\Sigma^0$ Reactions

This proposal describes an experiment to study excited intermediate states in kaon electro-production via the $\Delta^* \rightarrow K^+\Sigma^0$ decay channel. The physics goals are: investigation of SU(3) violation and information on the transition form factors by measurement of the Q^2 dependence of Δ^* resonance decays; test of Regge theory at intermediate energy and experimental signatures of possible missing, molecular or exotic resonances.

The experiment will use unpolarized electron beam in Hall C, using standard equipment: the HMS and SOS detector packages as were used in the kaon electro-production experiments which were completed during the fall of 1996, and the 4 cm liquid hydrogen target.

The $\Delta^*(1900)$, $\Delta^*(1910)$, and $\Delta^*(1920)$ resonances, the candidate pentaquark baryonium system $X(2000)$, and possible missing resonances will be studied by looking at the invariant mass W distribution of the $\Delta^* \rightarrow p + \pi^0$ and $p(e,e'K)\Sigma^0$ reactions; the Σ^0-hyperon being selected by missing mass in the $p(e,e'K)Y$ reaction (where $Y = \Lambda, \Sigma^0$).

By detecting the proton from the $\Delta^* \rightarrow p + \pi^0$ decay for the same kinematic settings than the Σ^0 channel, relative information on the $g_{\Delta^* K\Sigma^0}$, and $g_{\Delta^* p\pi^0}$ coupling constants will be extracted. In addition, a Q^2 dependence will be performed to probe the transition form factors of these resonances produced during the reaction.

The more speculative exotic baryon will be distinguished from background threshold effect processes by looking at its Q^2 dependence: the N^* and Δ^* resonance dominated background is expected to follow a different Q^2 dependence than the X-baryon.

These measurements will provide unique information on intermediate excited states, missing resonances and on exotic systems in strangeness production. This experiment will be unprecedented for measurements of the Q^2 distribution in the resonance region and evidence of such exotic systems at non zero invariant four-momentum transfer with high precision in the Σ^0 channel.

Fifteen (15) days of beam time is requested to cover the necessary invariant mass region for fifteen (15) settings at four-momentum transfers ranging from 0.55 to 1.05 $(\mathrm{GeV/c})^2$.