Photoproduction of the exclusive reaction at CLAS

\[ \gamma p \rightarrow K^{*+} Y (\Lambda \text{or} \Sigma^0) \]

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1. Previous work

Most data analyses used $\pi N$ coupling

Koniuk and Isgur et al. suggested search of other couplings for missing $N^*$.  

$\gamma$ \hspace{3cm} $N^*$ \hspace{3cm} $\pi$ \hspace{3cm} $N$ \hspace{3cm} $p$ \hspace{3cm} $(Y)$  

$K Y$ coupling  
$K^* Y$ coupling  
$K$ --- kaon  
$Y$ --- hyperon
KY coupling

Many works have been published for KY coupling. There are some evidence of the existence of the missing baryon states.


What about K*Y coupling?
Study of $K^*\gamma$ coupling

$\gamma + p \rightarrow K^{*0}\Sigma^+$

Full circle CBELSE data, empty square CLAS data.


Preliminary measurement of the Photoproduction of $K^{*+}\Lambda$ at JLAB

\[ \gamma + p \rightarrow K^{*+} + \Lambda \]

K*Y sensitive to Kappa-meson coupling, Kappa doesn’t couple to KY t-channel

Oh and Kim, Phys Rev c 73, 065602(2006)
Our Measurement

\[ \gamma + p \rightarrow K^{*+} + \Lambda \]
\[ K^{*+} \rightarrow K^0 + \pi^+ \]
\[ K^0 \rightarrow \pi^+ + \pi^- \]

Detecting \( \pi^+ \pi^+ \pi^- \) and the missing mass gives the invariant mass of either \( \Lambda \) or \( \Sigma \)
$K^{*+}$ missing mass

Left: data for photon energy between 1.6-1.7 GeV. ($\cos (K^*) -1.0 -0.78$)

Right: data for photon energy between 2.3-2.4 GeV. ($\cos(K^*) -0.11 -0.11$).
Total cross section

\[ \frac{d\sigma}{d\cos(\theta)} = Y(\text{counts}) \Big/ (N_{\text{target}} N_{g\text{flux}} \varepsilon \Delta \cos(\theta) f_{dt}) \]

Preliminary total cross section of

\[ \gamma + p \rightarrow K^{*+} + \Lambda \]

Peak around \( W = 2.1 \text{ GeV} \)

PDG: \( N(2190), N(2220), N(2250) \)
Preliminary result of $K^{*+}\Lambda$ recoil polarization
1. These are the world’s first high-statistics data for $K^*\Lambda$ photoproduction.

2. We measured cross section of the reaction $\gamma + p \rightarrow K^{*+} + \Lambda$ at CLAS, and found a resonance-like peak around $W=2.1$ GeV. High-mass resonances may couple directly to this reaction, but more theoretical studies are needed.

3. Existence of the kappa meson can be studied by comparing these new data and theory.

4. We also measured the recoil polarization, and this will provide a large constraint on theoretical models of $K^*$ photoproduction, similar to constraints seen for $K$ photoproduction as measured by CLAS.
Thank you!