

## Photoproduction of $\eta$ and $\eta'$ Mesons

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This experiment will make high precision measurements of the differential cross sections for  $\eta(549)$  and  $\eta'(958)$  photoproduction. Tagged photons of energies from 0.65 to 2.25 GeV will be incident on a liquid hydrogen target. Identification of the  $\eta$  and  $\eta'$  will be made by detection of the recoil proton in the CLAS. The measurements will provide important information on properties of the mesons themselves and on the  $S_{11}(1535)$  and  $P_{11}(1710)$  nucleon resonances and form a firm basis for future experiments studying  $\eta$  and  $\eta'$  interactions with nuclei. These measurements are of great interest for many reasons, among which are:

1. Existing data are too sparse in kinematical coverage or are too limited in precision to provide accurate determination of the amplitudes involved in the elementary process  $\gamma p \rightarrow \eta p$ . Data on the photoproduction of  $\eta'$  mesons from the nucleon are practically nonexistent.
2.  $\eta$  photoproduction cross sections on the nucleon provide an isospin selectivity which will be extremely valuable in unraveling the spectrum of baryon resonances.
3. Significant questions about the structure of the mesons themselves, particularly the  $\eta'$ , exist.
4. It may be possible that the strange content of the mesons can be exploited to help probe the strange quark content, if any, of the nucleon.
5. Investigations of  $\eta$  and  $\eta'$  interactions with the neutron and with nuclei require a detailed understanding of  $\eta$  and  $\eta'$  interactions with the proton.

Differential cross sections for the photoproduction on the proton of  $\eta(549)$  and  $\eta'(958)$  mesons will be measured using the CEBAF Hall B bremsstrahlung photon tagger and the CEBAF Large Acceptance Spectrometer in Hall B. Using this combination of unique resources, the cross sections provided by this experiment for  $\eta$  photoproduction will be of much greater precision than existing measurements and will extend over regions presently unmeasured. Simultaneously, the first extensive systematic cross sections for  $\eta'$  photoproduction will be measured. Data taken during this experiment may also result in more precise measurements of the branching ratios for  $\eta$  decays dominated by charged particles.

The experiment meshes closely in terms of experimental requirements with several of the approved experiments using the tagger, supplements the present generation of photoproduction experiments elsewhere, and complements the CEBAF electroproduction measurements presently under consideration by the Nucleon Resonance collaboration. It will also provide a foundation for subsequent studies by the collaboration of the photoproduction of these mesons by heavier targets and with polarized photon and/or polarized targets.