

CEBAF EXPERIMENT 93-008

Inclusive η Photoproduction in Nuclei

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Through the study of the excitation, propagation, and decay of nucleon resonances in the nuclear environment one expects to understand eventually how the strong interaction is affected by baryon structure. Over the last twenty years, a wealth of information on the $\Delta(1232)$ and its dynamics within the nuclear medium has been obtained through pion studies. However, very little is known about medium properties of the higher energy excited states of the nucleon. This is primarily due to the fact that the dominance of the Δ and the overlapping of high resonances prevents studying one specific state by π -production experiments. The η meson, on the other hand, couples only with isospin- $1/2^*$ resonances since it is an isoscalar particle, and therefore provides an excellent way to isolate these resonances. In this experiment, inclusive measurements of the photoproduction of η mesons in nuclei will be performed to investigate medium modifications of the $S_{11}(1535)$ and $P_{11}(1710)$ resonances which are the only nucleon resonances of mass less than 2 GeV with significant η decay branches.

These measurements will also provide information on the η decay branches. Due to the lack of η beams, very little is known about the interaction of η mesons with nucleons. In this equipment, final-state interactions of the η meson propagating through the nucleus will be used to investigate the ηN interaction. The study of η interactions with nucleons and nuclei can provide significant tests of our understanding of meson interactions which has been developed through pion studies. Also, a comparative study of the response of η and η' mesons in the nuclear environment may provide insight into the mixing in these two mesons and the structure of the η' .

Recently, cross sections for inclusive η photoproduction through the excitation of the $S_{11}(1535)$ resonance have been calculated with a model that includes nuclear-medium modifications of the decay width, Fermi motion, Pauli blocking, and final-state interactions [1]. The results indicate that the inclusive cross sections are quite sensitive to both medium modifications and final-state interactions at energies around the S_{11} .

The experiment will be performed with the CEBAF Large Acceptance Spectrometer (CLAS) and bremsstrahlung tagging system in Hall B. Tagged photons with energies between 0.8 and 1.5 GeV will be incident on ^2He , ^4He , and ^{12}C targets. The η mesons will be detected with the CLAS via the two-photon decay.

[1] R.C. Carrasco, Phys. Rev. **C48**, 2333 (1993).