A systematic study of $A=2$, 3, and 4 few-body nuclear systems

Mohammad W. Ahmed (Spokesperson)$^1$, Sean Stave (Co-Spokesperson),
Henry R. Weller, Richard M. Prior$^2$, Mark C. Spraker$^2$, and Moshe Gai$^3$

May 20, 2009

$^1$ Duke University and TUNL, email: ahmed@tunl.duke.edu
$^2$ North Georgia College and State University
$^3$ LNS at Avery Point, Universities of Connecticut
Abstract

A program to measure total and differential cross sections and analyzing powers in photodisintegration of the deuteron, $^3$He, and $^4$He is proposed. These measurements will utilize the newly commissioned optical time projection chamber (OTPC), as well as an array of neutron detectors. In the case of the deuteron, this study is motivated by the lack of cross section data in the energy region of Big-Bang Nucleosynthesis (BBN). For the case of $^3$He, recent results from HIGS on three-body photodisintegration show a discrepancy with the theoretical predictions in the neutron energy distribution as a function of gamma-ray energy. The proposed research will perform a systematic study of this discrepancy in an energy region overlapping and lower than the previous work. Unlike the lack of cross section data for the deuteron in the BBN energy region, the $^4$He system suffers from large sets of cross section data which are inconsistent with one another. A self-consistent study to obtain $^4$He photodisintegration data for all breakup channels is proposed in this work.