Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

MeV Photoelectron Spectrometer for Ultraintense Laser Interactions with Atoms and Molecules[1] BARRY WALKER, SIYU LUO, PAT GRUGAN, ZACH GERMAIN, ZAHIDE DEMIRCIOGLU, AMYLIA HOOS, RACHAEL MCINTYRE, YI JI, University of Delaware — Spectroscopy techniques such as time-of-flight (TOF), velocity map imaging (VMI), and cold target recoil ion momentum spectroscopy (COLTRIMS) revolutionized laser matter interaction measurements. These traditional laser-matter spectroscopy techniques fail to accurately analyze photoelectrons and ions from ultrahigh intensity studies with terawatt and petawatt laser systems. At 10^{19} W/cm^2 the interaction of ultraintense lasers with atoms and molecules creates photoelectrons with energies of 10^6 eV, well beyond the $\sim$ 100 eV limit of conventional apparatus. Quantifying the products from ultrahigh intensity lasers requires a new generation of spectrometers. We present a magnetic deflection, photoelectron spectrometer for ultrahigh intensity laser interactions with atoms and molecules in the single atom / molecule limit. The specifications included a range of energies from 20 keV to 2 MeV, an angular resolution of 2°, an adjustable measurement angle within a solid angle of $\sim 2\pi$ steradian, and a noise floor of order 10^{-1} events/(shot-Torr-keV). The spectrometer fabrication and calibration with beta decay sources will be presented as well as example photoelectron spectra for argon and chloromethane over the energy range from 20 keV to 2MeV.

[1]This material is based upon work supported by the National Science Foundation under Grant No. 1607321.

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Date submitted: 01 Feb 2019 Electronic form version 1.4