Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Electron Shell Ionization with Classical, Relativistic Scattering by Ultrastrong Fields: the Single Atom Response NAGITHA EKANAYAKE, SUI LUO, PATRICK GRUGAN, WILLOW CROSBY, ARIELLE CAMILO, CAITLIN MCCOWAN, ROSIE SCALZI, ANTHONY TRAMONTOZZI, LAUREN HOWARD, SARAH WELLS, CHRIS MANCUSO, TEDDY STANEV, MATTHEW DECAMP, BARRY WALKER, University of Delaware, Newark, Delaware 19716, USA — We investigate the forward scattering of ionization from neon, argon, and xenon in ultrahigh intensities of 2×10^{19} W/cm^2. Comparisons between the gases reveal the energy of the outgoing photoelectron determines its momentum, which can be scattered as far forward as 45 degrees from the laser wavevector for energies greater than 1 MeV. The shell structure in the atom manifests itself as modulations in the photoelectron yield and the width of the angular distributions. We arrive at an agreeable comparison with theory using an independent electron model for the atom, dipole approximation for the bound state interaction and a relativistic, three-dimensional, classical radiation field including the laser magnetic field for continuum dynamics. The studies presented here are at the highest intensity yet observed in single atom studies. This work is supported by the Army Research Office under Award No. W911NF-09-1-0390 and National Science Foundation under Award No. 0757953. MFD acknowledges support from the DOE-EPSCoR grant DE-FG02-11ER46816.

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Date submitted: 23 Jan 2013 Electronic form version 1.4