Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Attosecond Electro-Magnetic Forces Acting on Metal Nanospheres Induced By Relativistic Electrons[1] M.J. LAGOS, P.E. BATSON, IAMDN, Rutgers U., USA, A. REYES-CORONADO, Benemerita U., Mexico, P.M. ECHENIQUE, J. AIZPURUA, DIPC, Spain; Fisica de Mater. CSIC-UPV/EHU, Spain — Swift electron scattering near nanoscale materials provides information about light-matter behavior, including induced forces. We calculate time-dependent electromagnetic forces acting on 1-1.5 nm metal nanospheres induced by passing swift electrons, finding both impulse-like and oscillatory response forces. Initially, impulse-like forces are generated by a competition between attractive electric forces and repulsive magnetic forces, lasting a few attoseconds (5-10 as). Oscillatory, plasmonic response forces take place later in time, last a few femtoseconds (1- 5 fs), and apparently rely on photon emission by decay of the electron-induced surface plasmons. A comparison of the strength of these two forces suggests that the impulse-like behavior dominates the process, and can transfer significant linear momentum to the sphere. Our results advance understanding of the physics behind the observation of both attractive and repulsive behavior of gold nano-particles induced by electron beams in aberration-corrected electron microscopy.

[1]Work supported under DOE, Award # DE-SC0005132, Basque Gov. project ETORTEK inano, Spanish Ministerio de Ciencia e Innovacion, No. FIS2010-19609-C02-01

Philip Batson
Rutgers Univ

Date submitted: 15 Nov 2013 Electronic form version 1.4