Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Understanding the ultrafast electron photoemission process, from simulation to experiment[1] JENNI PORTMAN, HE ZHANG, ZHENSHENG TAO, CHONG-YU RUAN, MARTIN BERZ, PHILIP DUXBURY, Michigan State University — The ongoing efforts to develop a reliable ultrafast electron diffraction and imaging system require a stable source of photoemitted electrons and an understanding of how the properties of the generated bunch depend on the photocathode. In order to gain more understanding of this process, we combine the three-step photoemission model with N-particle electron simulations. By using the Fast Multipole Method to treat space charge effects, we are able to follow the time evolution of pulses containing over 10^6 electrons and investigate the role of laser fluence and extraction field on the total number of electrons that escape the surface. The results of these simulations are compared to experimental images of the photoemission process collected using the shadow imaging technique. We are able to show good quantitative agreement both for the number of electrons generated and the pulse parameters. We also see evidence of a virtual cathode limit, which gives an upper limit to the number of electrons that is is possible to extract. The extension of these results to various extraction fields, laser pulse shapes and photocathode material parameters, represents a very interesting future development, allowing to better optimize the materials used in electron pulse generation.

[1]This work was supported by the National Science Foundation under Grant No. NSF-DMR 1126343

Jenni Portman
Michigan State University

Date submitted: 08 Nov 2012 Electronic form version 1.4