Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Ultrafast Laser Matter Interaction and Pump-probe Imaging of Transient Electric Fields JIAN-MIN ZUO, HYUK PARK, Materials Science and Engineering, University of Illinois — Ultrafast electron diffraction and microscopy use pulsed laser as pump to initiate dynamic processes in solids. Under irradiation of pulsed laser beam of picoseconds or less, electrons inside a solid can be heated to high temperatures for a short period of time (several picoseconds). A part of hot electrons can be emitted from the surface in a similar way of thermionic emission. The emitted electrons, travel at speeds, produce transient electric fields (TEFs) together with the positively charged surface [1]. However, the effect of photoemitted electrons and their electric fields on ultrafast electron diffraction and microscopy has been a subject of debate [2]. Here we report direct measurement of TEFs using time-resolved electron beam imaging techniques based on the pump-probe approach. Results obtained from Pt thin films, Cu and ZnO nanowires will be shown. We demonstrate that TEFs produced by ultrafast laser irradiation can lead to large beam deflections that depend on the electron beam distance to sample surface, laser fluence and laser wavelength. The work shows that there is clearly a critical need for better understanding of TEFs in the field of ultrafast electron microscopy. The work is supported by DOE DEFG02-01ER4592, DEFG02-91-ER45439 and DOE DEFG02-07ER46453. [1] H. Park and J. M. Zuo, Applied Physics Letters 94, 251103 (2009). [2] H. Park and J. M. Zuo, Physical Review Letters 105, 059603 (2010).

Jian-Min Zuo
Materials Science and Engineering, University of Illinois

Date submitted: 27 Dec 2010 Electronic form version 1.4