Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

An Exact Formulation of Laser Assisted Electron Emission on a Biased Metal Surface[1] PENG ZHANG, Y.Y. LAU, University of Michigan, L.K. ANG, Singapore University of Technology and Design, D. SHIFFLER, Air Force Research Lab, K.L. JENSEN, Naval Research Lab, R.M. GILGENBACH, University of Michigan — Laser-driven ultrafast electron emission [1, 2] is important to free electron lasers (FELs), laser acceleration of relativistic electrons, and ultrafast electron diffraction. It would enable exciting technological development on four-dimensional (4D) time-resolved electron microscopy [3]. We constructed an analytic solution for the highly nonlinear electron emission from a metal surface that is exposed to both a dc biased electric field and a single frequency laser field. The solution is valid for arbitrary combinations of dc electric field, laser electric field, laser frequency, metal work function and Fermi level. Various emission mechanisms, such as multiphoton absorption or emission, optical or dc field emission, are all included in this single formulation. The time-dependent emission current reveals that intense current modulation may be possible even with a low intensity laser, by merely increasing the applied dc bias.

[1] P. Hommelhoff et al., Phys. Rev. Lett. 97, 247402 (2006).
[2] C. Ropers, et al. Phys. Rev. Lett. 98, 043907 (2007).
[3] Y. Zhu and H. Dürr, Phys. Today 68, 32 (2015).

[1]This work was supported by AFOSR Grant No. FA9550-14-1-0309.

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Date submitted: 24 Jul 2015 Electronic form version 1.4