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Nonequilibrium model of ultrafast laser induced electron emission from a dc-biased metallic surface LIN WU, LAY KEE ANG, Nanyang Technological University, Singapore, WEE SHING KOH, Institute of High Performance Computing, Singapore — The production of very short electron bunches is critical for X-ray free electron lasers. Recently, many experiments have been conducted in using picosecond-laser or ultrafast laser to induce photo-field emission from a metallic sharp tip and the electron pulse is from 16 picoseconds down to 6 femtoseconds [1]. In this paper, we will present a nonequilibrium model to describe the low-power ultrafast laser excited electron emission from a metallic surface with a dc voltage. Using a microscopic kinetic approach, we determine the nonequilibrium electron distribution after the laser excitation, and calculate the time-dependence of the emitted electron charges and current density. It is found that the classical two temperature model valid of picosecond time scale is no longer valid when the pulse duration is less than 100 femtoseconds. Comparison with the experiments [1] and the transition to the ultrafast space charge limited current [2] will be demonstrated.
References [1] R. Canter *et al.*, Phys. Rev. Lett. **100**, 064801 (2008); C. Ropers *et al.*, Phys. Rev. Lett. **98**, 043907 (2007); B. Barwick *et al.*, New J. Phys. **9**, 142 (2007); P. Hommelhoff *et al.*, Phys. Rev. Lett. **97**, 247402 (2006). [2] L. K. Ang and P. Zhang, Phys. Rev. Lett. **98** 164802 (2007).

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