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ELECTRON EMISSION FROM A METAL ELECTRODE SUBJECT TO A HIGH INTENSITY LASER IN THE PRESENCE OF DC ELECTRIC FIELDS*

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Laser-driven ultrafast electron emission offers the possibility of manipulation and control of coherent electron motion in ultrashort spatiotemporal scales. Superposition of a high DC field will enable the generation of high electron emission currents. The process would be facilitated by quantum tunneling across the potential barrier at the surface [1], aided by the absorption of energy which would alter the electronic energies and create a nonequilibrium distribution at elevated temperatures.

In this contribution, the process of electron emission from a dc biased metal surface illuminated by a single frequency laser is assessed. The time-dependent evolution of the electron distribution function and its equivalent temperature are obtained through energy balance rate equations. The results are found to simplify to and yield the Fowler-Nordheim characteristic in the absence of an external laser under equilibrium conditions. However, with the laser excitation, the currents are predicted to be much higher, and dependent on the incident intensity. The role of possible electric field enhancement at the emitting tip will also be discussed.

[1]. W. S. Truscott, Wave functions in the presence of a time-dependent field: Exact solutions and their application to tunneling. Phys. Rev. Lett., vol. 70, pp. 1900–1903 (1993).

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