Abstract Submitted
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THz-Induced, High-Energy Electron Emission from Nano-Structured Metals[1] SHA LI, ANNA YANCHENKO, R.R. JONES, Univ of Virginia — Single-cycle THz pulses have been used to induce keV electron emission from tungsten nano-tipped wires. Single tips are exposed, in vacuum, to intense THz pulses generated via tilted pulse front optical rectification of 150 fs Ti:Sapphire laser pulses. Electrons emitted from the tip are subsequently driven to very high energies by the locally enhanced THz field. The electron yield follows the Fowler-Nordheim tunneling prediction for weak THz pulses, but falls well below that prediction at high fields. The maximum electron energy is proportional to the THz field component along the tip axis, and reaches several keV for incident THz fields <500 kV/cm. Our results can be understood using a model recently proposed for sub-cycle emission from nano-tips in mid-infrared fields [Herink et al., Nature 483, 190 (2012)], assuming a field enhancement factor of $\sim$ 1000 in the vicinity of the tip. We observe electron energies that are 10 times greater than those produced with mid-infrared pulses even though the THz intensity is five orders of magnitude smaller. Comparison of the maximum electron energy as a function of tip radius and cone angle provides additional insight into the local electron-field interaction.

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