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**Coherent control of intense terahertz radiation in laser-produced plasmas**

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Intense, broadband terahertz (THz) pulse generation is of great current interest owing to its potential application in nonlinear THz optics and spectroscopy. Although such intense THz radiation exceeding tens of microjoules can be obtained from large-scale electron accelerator facilities such as free electron lasers and synchrotrons, there is a present and growing need for high-energy, compact THz sources at a tabletop- scale. One potential scheme is using tabletop, femtosecond, terawatt lasers to produce tenuous plasmas for scalable THz generation. Recently, intense THz generation has been observed upon mixing a femtosecond laser's fundamental and second harmonic fields in gases. The underlying mechanism has been examined and now understood in the context of a plasma current model. In this model, a transverse asymmetric electron current arises when the bound electrons undergo rapid tunneling ionization and acceleration in the two-color field. Since this current surge occurs on the timescale of the laser pulse duration, in the case of ultrafast lasers (<100 fs), this process can generate electromagnetic radiation at THz frequencies. Experimentally, we have recently demonstrated a high-energy (>5 microjoule), super-broadband tabletop source generating ultrafast THz pulses (>75 THz) in gases via two- color photoionization [1]. We also observed strongly anti- correlated third harmonic radiation. By controlling the relative phase between two-color fields, we can switch the output energy between THz and third harmonic [1]. Our current model can be applied to explain this phase-sensitive control, as well as to characterize the carrier envelope phase of few- cycle laser pulses undergoing ultrafast tunneling ionization.

[1] K. Y. Kim et al., Nature Photonics, doi:10.1038/nphoton.2008.153 (2008)