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Controlling the ultrafast hot electron dynamics in hybrid plasmonic nanostructures HAYK HARUTYUNYAN, Department of Physics, Emory University — Plasmons hold promise for applications in photonic circuitry because of their ability to squeeze light into sub-wavelength dimensions and also for their ultrafast response times. To this end, it is important to fabricate plasmonic systems that can generate large optical signals at ultrafast timescales. This goal has been accomplished using coherent harmonic generation or wave mixing at metallic nanostructures where the femtosecond plasmonic response is attributed to plasmon dephasing. However, the multi-frequency nature of these optical effects makes their practical use challenging. Plasmonic devises based on Kerr-type nonlinear optical effects, on the other hand, can operate at a single, fundamental frequency. However, the ultrafast response of gold nanostructures so far has been measured to be in the picosecond timescales attributed to electron – phonon scattering. By designing and fabricating metal-oxide hybrid nanosystems with ultra-high field enhancements we were able to demonstrate much faster, femtosecond dynamics of the optical response. Moreover, our experiments show that the nonlinear optical response can be further tuned in both time and spectral domains by tuning the material composition of our hybrid nanomaterials. Use of the Center for Nanoscale Materials was supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357..

Hayk Harutyunyan
Department of Physics, Emory University

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