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Nonlinear THz Plasmonic Disk Resonators HUSEYIN SEREN, Boston Univ. Dept. of Mech. Eng., JINGDI ZHANG, GEORGE KEISER, Boston Univ. Dept. of Physics, SCOTT MADDOX, MRC UT-Austin, KEBIN FAN, Boston Univ. Dept. of Mech. Eng., LINGYUE CAO, Boston Univ. Dept. of Physics, SETH BANK, MRC UT-Austin, XIN ZHANG, Boston Univ. Dept. of Mech. Eng., RICHARD AVERITT, Boston Univ. Dept. of Physics — Particle surface plasmons (PPSs) at visible wavelengths continue to be actively investigated with the goal of nanoscale control of light. In contrast, terahertz (THz) surface plasmon experiments are at a nascent stage of investigation. Doped semiconductors with proper carrier density and mobility support THz PSPs. One approach is to utilize thick doped films etched into subwavelength disks. Given the ease of tuning the semiconductor carrier density, THz PSPs are tunable and exhibit interesting nonlinear THz plasmonic effects. We created THz PSP structures using MBE grown 2um thick InAs films with a doping concentration of 1e17cm^{-3} on 500um thick semi-insulating GaAs substrate. We patterned 40um diameter disks with a 60um period by reactive ion etching. Our THz time-domain measurements reveal a resonance at 1.1THz which agrees well with simulation results using a Drude model. A nonlinear response occurs at high THz electric field strengths (>50kV/cm). In particular, we observed a redshift and quenching of the resonance due to impact ionization which resulted in changes in the carrier density and effective mass due to inter-valley scattering.

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