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Far-IR Spectroscopy and FDTD Simulations of Graphene Plasmonic Structures JARED STRAIT, PARINITA NENE, WEIMIN CHAN, CHRISTINA MANOLATOU, JOSHUA KEVEK, PAUL MCEUEN, FARHAN RANA, Cornell University — Plasmonics, the field of manipulating charge density waves, is uniquely suited to graphene due to graphene's high mobility and tunable plasma frequency in the THz range. Graphene microstructures, such as strips, discs, and rings confine plasmon modes, leading to plasma resonances with THz frequencies. These micro- and nanostructures form the building blocks of graphene plasmonic devices for tunable terahertz generation, detection, filtering, and switching. We present experimental results on the spectroscopy of plasmon resonances in the far-IR wavelength range in various graphene microstructures. Analytical methods of modeling even the simplest graphene plasmonic structures are not quantitatively accurate, and as such, we developed a 3D finite-difference time-domain (FDTD) tool for simulating the plasmon modes. By fitting simulations to the measured data, we have quantitatively extracted the parameters characterizing graphene's intraband conductivity and carrier scattering time with good accuracy. We have also investigated the interaction between plasmon modes of nearby structures and found them to be strong when the distance between structures is less than the dimension of the structures. FDTD simulations enable a quantitative characterization of such interactions.

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