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Plasmon-Phonon Interaction and Phonon Induced Transparency in Graphene Plasmonic Nanostructures WEI MIN CHAN, PARINITA NENE, JARED STRAIT, CHRISTINA MANOLATOU, TIWARI SANDIP, PAUL MCEUEN, FARHAN RANA, Cornell University — Electrons in graphene interact via Coulomb forces but also via an optical phonon-mediated interaction. As a result of the chiral nature of electrons, these two interactions are additive. This phonon-mediated interaction results in strong coupling between the plasmons and phonons. Plasmons in graphene also interact strongly with the substrate optical phonons. In this talk we will present experimental results on plasmon-phonon interactions. We patterned disc-shaped plasmon resonators in CVD grown graphene with radii varying from 16-80 nm and studied plasmon resonances using IR spectroscopy. Sharp features appear in the plasmon absorption spectra when the plasmon frequencies are close to the phonon frequencies. When the plasmon frequency matches the zone-center optical phonon frequency, a narrow transparency dip appears in the plasmon absorption spectra. This transparency, which resembles EIT in optics, can be explained in terms of the cancellation between the Coulomb and the phonon-mediated electron-electron interactions. Our theoretical model, based on the eigenvalue equation for confined plasmon modes, explains the data well and enables us to extract parameters related to the plasmon-phonon interaction in graphene.

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