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Controlling and Creating Plasmonic Absorption Processes in Graphene Nanostructures VICTOR BRAR, MIN JANG, MICHELLE SHERROTT, SEYOON KIM, JOSUE LOPEZ, LAURA KIM, HARRY ATWATER, California Institute of Technology — Graphene has been recently shown to support electronically tunable ,Mid-IR plasmons with optical mode volumes that are 10^7 times smaller than freespace, and plasmon wavelengths more than 100 times shorter. In this talk we will demonstrate how the plasmonic absorption of graphene resonators is enhanced and perturbed in controllable ways by varying the thickness and permittivity of the supporting substrate. We will show the results of recent experiments where 17.5% absorption is achieved in a sheet of graphene resonators by carefully selecting the properties of an underlying silicon nitride substrate. We also demonstrate how additional absorption pathways can be created by modifying the surrounding dielectric environment to have optical resonances that can couple to the graphene plasmons. By placing graphene nanoresonators on a monolayer boron nitride (BN) sheet new surface phonon plasmon polariton (SPPP) modes arise due to coupling between the graphene plasmon and BN optical phonon. We map the dispersion relations of these modes, and show that the high quality factor of the BN phonon leads to epsilon near zero (ENZ) behavior in the SPPP mode. These experimental observations are compared to a theoretical model that has been developed to explain optically active graphene devices.

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