CMP Seminar
Michigan State University

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Plasmon losses in monolayer graphene

Nanoplasmonics, the branch of Condensed Matter Physics that aims at confining light to subwavelength scales by coupling it with plasmons, thereby achieving the electrical control of radiation, continues to attract a huge deal of interests. Thanks to the high tunability of plasmons, plasmonic devices could span in principle from biosensing application, to solar energy harvesting, hot-electron production, nanoelectronic switches, and many other. However, uncontrolled plasmon losses have been so far the major bottleneck for plasmonic applications. Graphene sheets encapsulated between hexagonal Boron Nitride (hBN) slabs display superb electronic properties due to very limited scattering from extrinsic disorder sources such as Coulomb impurities and corrugations. Such samples are therefore expected to be ideal platforms for highly-tunable low-loss plasmonics in a wide spectral range, and allow for the first time systematic studies of plasmon losses. We present a theory of collective electron density oscillations in a graphene sheet encapsulated between two hBN slabs. We study the impact of phonons, impurities, electron-electron interactions and temperature on the plasmon lifetime. We show that graphene plasmons can reach record-high lifetimes of the order of 500 fs, an order of magnitude longer than what reported for subwavelength plasmons in silver, the metal with the longest plasmon decay time.

Monday, February 22, 2016
4:10 p.m.
BPS 1400
Prof. Carlo Piermarocchi - Host