Seminarankündigung

Dienstag, 1. February 2022
13:30 Uhr

ONLINE via ZOOM

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“Measuring electronic structure of operating 2D material devices”

Understanding electronic and structural mechanisms that define intrinsic and extrinsic performance limits of two-dimensional (2D) materials integrated in functional device architectures is essential for the realization of truly 2D technologies. Obtaining such insights demands a probe that is capable of visualizing electronic structure on mesoscopic length scales and during operating conditions of devices.

Here, I will demonstrate the ability to visualize the energy- and momentum-dependent quasiparticle dispersion in 2D devices composed of graphene supported on a hexagonal boron nitride (hBN) dielectric and a graphite back-gate. The charge carrier-dependent spectral function of graphene is resolved using angle-resolved photoemission spectroscopy with nanoscale spatial resolution (nanoARPES) while the back-gate voltage is tuned. I will discuss how such measurements directly reveal the doping-dependent renormalized Fermi velocity of Dirac quasiparticles and elucidate electron-phonon and electron-plasmon interactions in graphene. Position-resolved measurements of the graphene Dirac cone in the presence of an electrical transport current provide a map of the local electrostatic potential, which is combined with the local doping to estimate the spatially-dependent carrier mobility of graphene on hBN. The work demonstrates the powerful concept of unifying spectroscopic and transport measurements on 2D materials, which allows for a simultaneous noninvasive local measurement of composition, structure, many-body effects and carrier mobility in the presence of high current densities and tunable charge carrier concentrations.

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