



Condensed Matter Theory Center

Seminar

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Friday, April 9

11:00 AM-12:30 PM

2202 Physics Building

“Scattering sources in graphene: the role of the substrate”

Despite many theoretical and experimental studies, the topic of scattering sources in graphene remains controversial. In this talk, I will present our effort in understanding this important issue. By simultaneously measuring the transport and quantum scattering time of carriers in graphene, we show that charges residing at the graphene/substrate are likely the major culprits responsible for limiting mobility to the current level of $10,000 \text{ cm}^2/\text{Vs}$ at low temperature. Using an epitaxial crystalline PbZrTiO_3 (PZT) film, we demonstrate a 10-fold mobility increase to $140,000 \text{ cm}^2/\text{Vs}$. Through electron-surface optical phonon interactions, the substrate (superstrate) also plays a critical role in two other aspects of the electron transport in graphene: temperature-dependent resistivity and the current saturation in high electric field transport. We determine the strength of the electron-surface optical phonon coupling and its impact on electron mobility at high temperature in dual oxide gated graphene field effect transistors. Combining theory and experiment, we demonstrate unambiguously that the emission of surface optical phonons of the substrate (superstrate) governs the high electric field electron transport and heat dissipation in graphene devices.