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LECTURE

"Ultrafast dynamics of hot carriers in quantum materials"

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Ultrafast dynamics of hot carriers in quantum materials

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Low-dimensional (e.g., atomically thin) continues to gain prominence in applications ranging from electronics to photonics and energy conversion systems. Critical to efficiently developing these systems is the understanding of the fundamental processes related to the dynamics of charge carriers, phonons, and other excitations (i.e. excitons, polaritons). Understanding the principles that govern these excitations will enable the fabrication of optoelectronic and photonic devices with novel and enhanced functionalities. While significant studies of nanomaterials, optical, and electrical transport properties are often made, identifying the mechanisms and timescales governing the interactions between electrons, phonons, and other excitations can be extremely challenging. In this talk, I will focus on electron-phonon interactions (scattering) in carbonic materials through which the charge carriers lose their energy. The electron-phonon scattering processes are essential to understanding and controlling the energy and charge flow in electronic and energy conversion devices. For this study, we used time-resolved pump-probe spectroscopy with sub-picosecond resolution to observe charge carrier dynamics in bilayer graphene.