Physics Colloquium

Wednesday

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4:00 P.M.

Rm 118 NSH

Illuminating and manipulating quantum materials with femtosecond light

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Uncovering and controlling emergent phenomena in quantum materials through external stimuli is a central goal of modern condensed matter physics. However, a major challenge lies in disentangling many different yet closely coupled interactions and fluctuating orders. Moreover, since many quantum processes in these materials are coherent only over ultrashort time scales, it is difficult to probe them using conventional static techniques. In this talk, I will demonstrate how ultrafast femtosecond optical techniques can selectively decipher and alter collective behavior in two of the most intensely researched quantum materials in the past decade, high-Tc superconducting cuprates and topological insulators. For superconducting cuprates, ultrafast infra-red pump-probe and time-domain THz spectroscopy are used to detect elementary excitations and short-lived fluctuating orders. For topological insulators, time-and-angle resolved photoemission spectroscopy is used to dynamically engineer new light-induced 'Floquet-Bloch' electronic states. Such studies lay the foundation for utilizing coherent light-matter interaction to steer materials into a desired quantum phase.

PHYSICS