Physics Colloquium

Monday, April 17, 2017 / 428 Pupin Hall / 4:15 PM
wine and cheese following the colloquium

"From Mott Physics to Topology"

Two types of interactions commonly drive new emergent phenomena beyond textbook band theory in quantum materials: electron correlation and spin orbit coupling. The first, born from the observation of Mott that strong electron correlation can drive a system, otherwise metallic, on the verge of being an insulator, has excited the condensed matter community over the past several decades and lies at the core of many unsolved phenomena, such as unconventional superconductivity. The second, derives from the relativistic correction to the hydrogen-like atom, and has been vastly explored in the previous decades in the context of Rashba effect. Recently, the realization that strong spin orbit coupling can induce dramatic effect on the band structure of weakly interacting systems driving new phases of matter such as the topological band insulators has sparked huge interest in this emerging field. The real frontier today is to understand whether strongly interacting systems can exhibit any type of intrinsic topological order, distinct from band topology in insulators and what consequences this might have.

In this talk I will present experimental results for a variety of materials spanning the entire range of interaction, from strong correlation (Mott insulators), to strong spin orbit coupling (topological insulators) and intermediate interaction regime (spin orbit coupled Mott insulators). I will present intriguing results on the interplay between these two interactions and how, even in the most extreme case they can give rise to unexpected topological like features. The future of the field is discussed.

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