

Chez Pierre

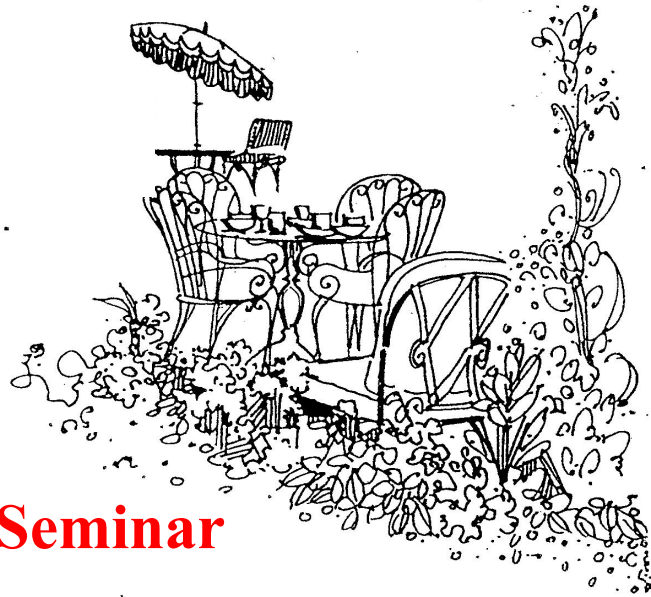
Presents ...

Monday, December 11, 2017

12:00pm Noon

MIT Room 4-331

Chez Pierre Seminar



Joonho Jang – Massachusetts Institute of Technology

“Tunneling “ARPES” of a 2D electronic system: Wigner Crystal Resonance and Momentum Resolved Tunneling”

The single-particle spectral function measures the density of electronic states (DOS) in a material as a function of both momentum and energy, providing central insights into phenomena such as superconductivity and Mott insulators. While scanning tunneling microscopy (STM) and other tunneling methods have provided partial spectral information, until now only angle-resolved photoemission spectroscopy (ARPES) has permitted a comprehensive determination of the spectral function of materials in both momentum and energy. However, ARPES operates only on electronic systems at the material surface and cannot work in the presence of applied magnetic fields. To overcome these issues, we have developed unique approaches to tunneling spectroscopy. In this talk, first, I will introduce Time Domain Capacitance Spectroscopy, a method that allows accurate measurements of the density of states of two-dimensional holes in GaAs at 20 mK and in high magnetic field. We discovered filling factor dependent resonances that are antisymmetric in energy and density around filling factor $n=1$ [1]. Analysis of the resonance structure gives evidence that holes are dressed by interactions with phonons of a long-range ordered electronic Wigner crystal. Building upon this technique, we developed a new method for determining the full momentum- and energy-resolved electronic spectral function of a 2D electronic system embedded in a semiconductor [2]. In contrast with ARPES, the technique remains operational in the presence of large externally applied magnetic fields and functions for electronic systems with zero electrical conductivity or with zero electron density. I will discuss how this technique provides a direct high-resolution and high-fidelity probe of the dispersion and dynamics of the interacting 2D electron system, thus uncovering delicate signatures of many-body effects involving electron-phonon interactions, plasmons, polarons, and a novel phonon analog of the vacuum Rabi splitting in atomic systems.

[1] Joonho Jang, B. M. Hunt, L. N. Pfeiffer, K. W. West, and R. C. Ashoori, Nature Physics 13, 340–44 (2017)

[2] Joonho Jang, H. M. Yoo, L. N. Pfeiffer, K. West, K. W. Baldwin, and R. C. Ashoori, Science 358, 901 (2017)