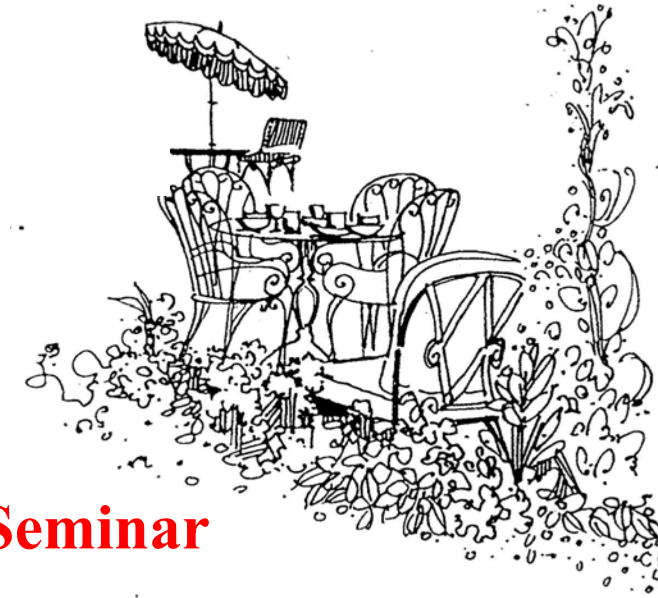
Chez Pierre

Presents ...

Monday, October 21, 2019

12:00pm Noon

MIT Room 4-331



Chez Pierre Seminar

Zhi-Xun Shen – Stanford University

"Electronic Phase Diagram of Cuprate Superconductors – a Balancing Act"

High-temperature superconductivity in cupper based materials, with critical temperature well above what was anticipated by the BCS theory, remains a major unsolved physics problem more than 30 years after its discovery. The problem is fascinating because it is simultaneously simple - being a single band and ½ spin system, yet extremely rich - boasting d-wave superconductivity, pseudogap, spin and charge orders, and strange metal phenomenology. For this reason, cuprates emerge as the most important model system for correlated electrons – stimulating conversations on the physics of Hubbard model, quantum critical point, Planckian metal and others.

Heart of this challenge is the complex electronic phase diagram consisting of intertwined states with unusual properties. Angle-resolved photoemission spectroscopy has emerged as the leading experimental tool to understand the electronic structure of these states and their relationships [1]. In this talk, I will describe our results on band structures and Fermi surfaces [2-3]; d-wave superconducting state[4, 5]; the birth of a metal from a Mott insulator [7-10]; the two energy scales of the pseudogap [7,8,11-12]; the temperature, doping and symmetry properties of the low energy pseudogap and its competition with superconductivity [13-17]; the missing quasiparticle and the chemical potential puzzle [18-19], the interplay of electron-electron and electron-phonon interactions and the enhanced superconductivity [20-23]; the incoherent metal sharply bounded by a critical doping and quantum critical point[24-25]. The rich phenomenology suggests that a delicate balance between local Coulomb interaction and electron-phonon interaction holds the key to cuprate physics.

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