

# Chez Pierre

Presents ...

Thursday, February 20, 2014  
2:30pm  
MIT Room 4-331



## Special Chez Pierre Seminar

Milan Allan

ETH – Zurich, Switzerland

### *“Visualizing Electronic Nematicity and Cooper Pairing in Iron-based Superconductors”*

Spectroscopic-imaging STM can elucidate the microscopic processes in quantum materials, by direct imaging of the relevant quantum mechanical waves on the atomic scale. In my talk, I will describe the use of this technique to understand the mechanism of high-temperature superconductivity, both in terms of how the phases evolve with doping and in terms of the actual Cooper pairing process. I will discuss our discovery of strong electronic nematicity in the parent state of iron-based superconductors [1], and the recent realization of how dopant-atom induced unidirectional impurity states and anisotropic scattering can explain the mysterious anisotropic transport characteristics in this material [2]. Next, I will describe our exploration of the superconducting energy gaps and electron-boson interaction in the canonical Fe-based superconductor LiFeAs. The interactions generating unconventional Cooper pairing are often conjectured to be of electronic nature. We introduced Bogoliubov quasiparticle scattering interference (QPI) techniques for determination of both the superconducting gaps in momentum space [3] and the electron-boson coupling self-energy [4]. We identified anisotropic gaps and strong effects in the interband direction only, pointing towards a spin-fluctuation mechanism for Cooper pairing. Finally, I will outline the new techniques for atomic-scale imaging that I propose in order to address the most pressing open questions in quantum materials.

