

Chez Pierre

Presents ...

Monday, April 1, 2019

12:00pm Noon

MIT Room 4-331

Chez Pierre Seminar

John Tranquada – Brookhaven National Laboratory

“From Pseudogaps to Pair-Density Waves in Cuprate Superconductors”

The nature of the phase diagram (temperature vs. doping) for cuprate superconductors continues to be controversial. I will present a fresh analysis of a large range of experimental characterizations, making the case for two pseudogaps: (1) a large pseudogap resulting from the competition between the energy of superexchange-coupled local Cu moments and the kinetic energy of doped holes; (2) a small pseudogap that results from dopant disorder and consequent variations in local charge density, leading to a distribution of local superconducting onset temperatures. The large pseudogap closes as hole kinetic energy dominates at higher doping and the antiferromagnetic correlations become overdamped. Establishing spatially-homogeneous *d*-wave superconductivity is limited by those regions with the smallest antiferromagnetic spin gap, consistent with our experimental observation that the spin gap is an upper limit for the coherent superconducting gap [1]. The presence of superconductivity together with static spins, as in the case of $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ with $x = 1/8$ where spin-stripe order occurs, requires a spatially-modulated superconducting wave function, such as the proposed pair-density-wave state. Our recent high-field transport study provides evidence that stripes are good for pairing, even if they are not optimal for superconducting phase coherence [2].

1. Yangmu Li et al., Phys. Rev. B **98**, 224508 (2018).
2. Yangmu Li et al., arXiv:1810.10646.

