

CONDENSED MATTER THEORY SEMINAR

Subject: **From Mott to not: aspects of the cuprate phase diagram**

Speaker: **Prof. Dr. Peter Hirschfeld (University of Florida in Gainesville, FL (USA))**

Date & time: **Friday, May 11th, 2018 at 3.15 p.m.**

Venue: **Seminar room 1.114**

Until recently, it was believed that as one overdoped cuprate superconductors, correlations weakened, and one could obtain a reasonable description within Fermi liquid theory. Recent superfluid density measurements on overdoped LSCO films have challenged this picture, and suggested that quantum fluctuations dominate the overdoped regime. I argue that these experiments can in fact be understood entirely within the theory of disordered d-wave superconductors[1], with modest many-body renormalizations of the plasma frequency. The large scattering rates deduced from experiments are shown to arise predominantly from weak scatterers, probably Sr and O dopants out of the CuO₂ plane. Results suggest that, while some of the decrease in T_c with overdoping may be due to weakening of the pairing, disorder plays an essential role.

In a second study, I discuss the underdoped phases of cuprates, with an eye towards understanding the longstanding observation by STM of short range CDW-like order, apparently consistent with recent x-ray experiments. I show that inhomogeneous solutions of the t-J model within renormalized mean field theory display a remarkable agreement [2] with the details of the STM conductance maps, when the lattice Green's function of the theory is dressed by the Cu dx²-y² Wannier functions associated with the usual effective tight-binding model. These states are found to be primarily of commensurate pair density wave (PDW) character. The PDW coexists with uniform d-wave superconductivity and induces weak charge order at the wave vector observed by x-rays.

[1] N. R. Lee-Hone, V. Mishra, D. M. Broun, P. J. Hirschfeld, arXiv:1802.10198

[2] P. Choubey et al., NJP 19, 013028 (2017)