Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

Quantum critical fluctuations in cuprates and d-wave superconductivity through their coupling to fermions

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The phase diagram of the Cuprates is a collection of anomalies that has challenged our understanding of quantum many body physics. An organizing principle proposed to unify the experimental observations is the existence of a quantum critical point near optimal doping separating a phase which has broken time reversal and a renormalized Fermi liquid. I will discuss recent theoretical developments related to the nature of the fluctuations near the quantum critical point. The long wavelength theory of the time reversal violating state belongs to the dissipative 2DXY universality class. The fluctuation spectrum, at the quantum critical point, is local in space and power law in time, precisely of the form observed in the marginal fermi liquid phase near optimal doping. The fluctuations couple to the local angular momentum of the fermions to give a momentum dependence to the coupling which leads directly to pairing attraction in the d-wave channel.

Theory of superconductivity in the cuprates, Vivek Aji, Arkady Shekhter and Chandra Varma, arXiv:0807.3741
Theory of the quantum critical fluctuations in cuprate superconductors, Vivek Aji and Chandra Varma, Physical Review Letters, **99**, 067003 (2007)