Massachusetts Institute of Technology
Department of Physics

CONDENSED MATTER THEORY SEMINAR

"Breakdown of Fermi liquid behavior near the hot spots in a two-dimensional model: A two-loop renormalization group analysis"

Hermann Freire
Federal University of Goiás (Brazil) and MIT

Abstract: Motivated by a recent experimental observation of a nodal liquid on both single crystals and thin films of $Bi_2Sr_2CaCu_2O_{8+\delta}$ by Chatterjee *et al.* [Nature Physics **6**, 99 (2010)], we perform a field-theoretical renormalization group (RG) analysis of a two-dimensional model consisting of eight points located near the "hot spots" on the Fermi surface which are directly connected by spin density wave ordering wave vector. We derive RG equations up to two-loop order describing the flow of renormalized couplings, quasiparticle weight, several order-parameter response functions, and uniform spin and charge susceptibilities of the model. We find that while all the order-parameter susceptibilities investigated here become non-divergent at two loops, the quasiparticle weight vanishes in the low-energy limit, indicating a breakdown of Fermi liquid behavior at this RG level. Moreover, both uniform spin and charge susceptibilities become suppressed in the scaling limit which indicate gap openings in both spin and charge excitation spectra of the model. We argue that all these results consistently suggest that the low-energy state of this model satisfies important conditions to be characterized as an insulating spin liquid, giving further support to a previous analysis based on a one-loop RG approach for this model available in the literature.

3:30 PM
Wednesday, May 22, 2013
Room 4-331 (Duboc Room)

Host: Maksym Serbyn