

Massachusetts Institute of Technology
Department of Physics

CONDENSED MATTER THEORY SEMINAR

**“Don’t Go with the Flow: The Sign of the Hall
Response in Superconductors”**

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Abstract: The Hall response of superconductors in the vortex liquid regime is poorly understood. Recent experiments in the cuprate superconductors show that upon suppressing T_c with an applied field, in certain doping regimes, the Hall resistivity changes its sign. Here, we consider properties of a single vortex in a simple model of a clean two-dimensional superconductor. The sign of the Hall response is determined by a Berry phase term in the vortex action. In a Galilean invariant system, this term is simply proportional to the superfluid density. In the presence of a lattice potential, the Hall response undergoes discrete jumps as a function of parameters. We show that in the weak coupling limit, the jump in the Hall response occurs at the van Hove density, in which the topology of the normal state Fermi surface changes. Therefore, the Hall response evolves continuously from the normal state to the superconductor. At intermediate coupling, however, the density of the jump in the superconductor is different from that of the normal state. As a result, the Hall response can undergo a sign change as a function of temperature.

3:30 PM
Friday, May 3, 2013
Room 6C-442 (Cosman Room)