Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Influence of Disorder on Spontaneous Coherence and Collective Transport in Bilayer Quantum Hall Systems ENRICO ROSSI, ALLAN H. MACDONALD, University of Texas at Austin — Disorder-free bilayer quantum Hall systems have spontaneous interlayer phase coherence. The degree of phase coherence in these systems and the associated anomalies in inter-layer and counter-flow transport are strongly influenced by disorder. We discuss a realistic model of a disordered $\nu = 1$ quantum Hall bilayer which is based on a mean-field treatment of intra-layer and inter-layer Hartree and exchange interactions and a smooth disorder potential that models randomness in remote ionized donor layers. The charge density is approximated as being proportional to the local curvature of the pseudospin that describes bilayer coherence and layer polarization. This model leads to a picture in which electrons are nearly fully polarized toward one of the two-layers in large parts of the sample, with areas of strong coherence separating regions that are polarized toward opposite layers. Weak coherence in large parts of the sample explains the surprisingly small inter-layer tunneling conductance. The relationship between charge density and pseudospin curvature leads to a ground state that contains many vortices. Sufficiently strong disorder can drive the KT transition temperature to zero. We will discuss attempts to quantitatively relate disorder strength, KT temperatures, and transport anomalies.

Enrico Rossi
University of Texas at Austin

Date submitted: 07 Dec 2004 Electronic form version 1.4