

Massachusetts Institute of Technology  
Department of Physics

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Condensed Matter Theory Seminar

"Numerical Study of Quantum Hall Systems with Half-filled Landau Levels:  
Anisotropy Effect on Moore-Read State & Phase Diagram of  $1/2+1/2$  Bilayers"

**Zheng Zhu**, Massachusetts Institute of Technology

**Abstract:** In this talk, I will mainly introduce our recent work on numerical study of Quantum Hall systems with half-filled Landau levels by exact diagonalization (ED) and density matrix renormalization group (DMRG) methods. In the first part, I will talk about the nature of the quantum Hall liquid in a half-filled second Landau level ( $n=1$ ) as a function of band mass anisotropy. We find increasing the mass anisotropy induces a quantum phase transition from the Moore-Read state to a charge density wave state. In the second part, I will show the phase diagram of  $1/2+1/2$  quantum Hall bilayer systems of the lowest Landau level as a function of layer distances. We identify three distinct phases, including an exciton superfluid phase with spontaneous interlayer coherence at small distance, a composite Fermi liquid at large distance, and a new intermediate phase between them.

**12:00pm**  
**Tuesday, May 16, 2017**  
**Duboc Room (4-331)**

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Host: Liang Fu