

Massachusetts Institute of Technology
Department of Physics

SPECIAL CONDENSED MATTER PHYSICS SEMINAR

**“Fractional Quantum Hall States in
Strongly Correlated Multi-orbital Systems”**

Jörn Venderbos

*Leibniz Institute for Solid-State and Materials
Research, Dresden*

Abstract: For topologically nontrivial and very narrow bands, Coulomb repulsion between electrons has been predicted to give rise to a spontaneous fractional quantum-Hall (FQH) state in absence of magnetic fields, i.e. a fractional Chern insulator (FCI) state. I will discuss how orbital degrees of freedom in frustrated lattice systems lead to a narrowing of topologically nontrivial bands. This robust effect does not rely on fine-tuned long-range hopping parameters and is directly relevant to a wide class of transition metal compounds. In addition, I will show that strongly correlated electrons in a t_{2g} -orbital system on a triangular lattice self-organize into a spin-chiral magnetic ordering pattern that induces precisely the required topologically nontrivial and flat bands. On top of a self-consistent mean-field approach, we use exact diagonalization to study an effective one-band model for the emerging flat band in the presence of longer-range interactions and establish the signatures of an FCI state. I will discuss the effect of disorder in the spin-chiral magnetic order on the stability of the FCI state and the competition with a charge-density wave state.

**12:00 Noon
Friday, April 12, 2012
Room 4-331**