

Massachusetts Institute of Technology  
Department of Physics

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Condensed Matter Theory Seminar

" Field-induced neutral Fermi surface and QCD<sub>3</sub>-Chern-Simons quantum criticalities in Kitaev materials"

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**Abstract:** I will present our numerical and theoretical studies on the phase diagram of the Kitaev materials in the presence of a magnetic field. We find that a new quantum spin liquid state with neutral Fermi surfaces emerges at intermediate field strengths, between the regimes for the non-Abelian chiral spin liquid state and for the trivial polarized state. We discuss the exotic field-induced quantum phase transitions from this new state with neutral Fermi surfaces to its nearby phases. We also theoretically study the field-induced quantum phase transitions from the non-Abelian chiral spin liquid to the symmetry-broken zigzag phase and to the trivial polarized state. Utilizing the recently developed dualities of gauge theories, we find these transitions can be described by critical bosons or gapless fermions coupled to emergent non-Abelian gauge fields, and the critical theories are of the type of a QCD<sub>3</sub>-Chern-Simons theory. We propose that all these exotic quantum phase transitions can potentially be direct and continuous in the Kitaev materials, and I will present sound evidence for this proposal. Therefore, besides being systems with intriguing quantum magnetism, Kitaev materials may also serve as table-top experimental platforms to study the interesting dynamics of emergent strongly interacting quarks and gluons in  $2+1$  dimensions.

Reference: arXiv: 1809.09091

**12:00pm noon**  
**Tuesday, November 6, 2018**  
**Duboc Room (4-331)**

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Host: Debanjan Chowdhury