CMP Seminar
Michigan State University

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Engineering Quantum Matter: From Superfluids to Low-Dimensional Electrons

Creating and controlling novel quantum states of matter is at the forefront of modern condensed matter physics. I will discuss two examples of this "create and control" paradigm from my experiences. First, I will describe how we have utilized anisotropic disorder, in the form of high porosity aerogel, to create new chiral superfluid states of ^3He. The understanding of these staes has broad implications regarding the stability of chiral superconductivity in other compounds, such as Sr_2RuO_4. In the second part of my talk I will discuss a new device architecture that allows for *in situ* tunability of the electron density in two-dimensional electron systems (2DES) in gallium-arsenide (GaAs). At high magnetic fields and low temperatures, Coulomb interactions in two-dimensions lead to a wide variety of collective electron states including fractional quantum Hall fluids, nematic liquid crystals and exotic solids composed of multi-electron bubbles. Our variable density device provides us with the ability to control the Coulomb interactions responsible for such ground states. Finally, I will remark on how the lessons learned from studying superfluid ^3He and 2DES can be harnessed to develop hybrid quantum systems composed of free electrons floating on the surface of liquid helium coupled to nanoscale structures of topological states of matter. These systems provide a unique platform for studying the fundamental physics of low dimensional quantum systems and their potential quantum computing applications.

Thursday, February 12, 2015
10:00 a.m.
BPS 1400
Prof. Norman Birge - Host