CONDENSED MATTER SEMINAR

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Phase transitions in the ultra-quantum limit of a Weyl semimetal

Under extreme magnetic fields electrons in a metal are confined to a single highly-degenerate Landau level - a regime known as the quantum limit. Electrons under such conditions are unstable to the formation of new states of matter, such as the fractional quantum Hall states in two dimensions. The fate of 3D metals in the quantum limit, on the other hand, has been relatively unexplored. The discovery of monopnictide Weyl semimetals brings a new ingredient to the table for the formation of new states of matter - chiral "Weyl" fermions. We use magnetic fields up to 95 Tesla to take the Weyl semimetal TaAs into its ultra-quantum limit, isolating its 0th Landau level from the rest of the electronic spectrum, and observe two phase transitions as a function of field. The first is accompanied by a two-order-of-magnitude increase in the resistivity, indicating a gapped state. The second transition is accompanied by a large increase in ultrasonic attenuation, suggesting the onset of an order parameter and possible domain formation. Weyl fermions appear to be unstable to the formation of new states of matter once topological protection of the nodes has been lifted by high magnetic fields.

Tuesday, November 14, 2017
4:00 pm
Room 334 JFB