Condensed Matter Physics Seminar Series

Unusual Magnetic Oscillations in Kagome Mott Insulators

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The observations of the Landau Level quantizations in narrow-gapped correlated Kondo insulators raise intriguing questions on the origins [1, 2, 3]. However, none of the models suggest the phenomena existing in wide-gap insulators. Kagome lattice Mott insulator Herbertsmithite is a well-established Dirac fermion spin liquid candidate. Yet, our search for magnetic oscillations in Herbertsmithite yielded only a series of magnetic transitions [4], possibly due to the ion disorders on the kagome lattice. This problem is resolved in the recently discovered sibling compound YCu3(OH)6.5Br2.5 [5]. Using ultrasensitive magnetometry on the kagome Mott insulator YCu3(OH)6.5Br2.5 in 70 T intense fields, we observe both the 1/3-plateau and 1/9-plateau transitions. Even more surprisingly, the magnetometry reveals strong oscillations in the magnetic torque. While the temperature dependence follows the Fermi liquid theory, the oscillations appear to be roughly periodic in the magnetic field B, opposite to the 1/B trend in conventional metals. Furthermore, a strong angular dependence is observed for the oscillation fields, which indicates the orbital effect. Separating the orbital effect and the Zeeman effect, we further show that this magnetic oscillation pattern is consistent with a Dirac fermion existing near the 1/9 plateau, and the fermion's chemical potential is shifted by the Zeeman effect [6, 7].

Professor Li was born in China. He received his B.S degree from the University of Science and Technology of China in 2002 and Ph.D. from Princeton University in 2008. He spent three years at MIT as a Pappalardo Fellow before joining the physics department of University of Michigan in 2011. Professor Li is interested in the investigation of novel magnetic and transport properties of strongly correlated systems, such as novel oxide interfaces, frustrated quantum magnets, and high Tc superconductors. In these systems, the strong correlation drives the interplay between various states of spins and orbitals and gives rise to an amazingly rich diversity of novel phenomena. Right now his research focuses on the topological quantum materials.

Friday, October 11th at 10am
4-330 PAB