Seminar

Theories of transport scaling in disordered semimetals and topological excitonic insulators in graphite under high magnetic field

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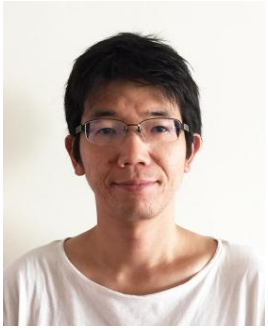

Time: 4:00pm, May. 8, 2018 (Tuesday)

时间: 2018年5月8日 （周二）下午 4:00

Venue: Room W563, Physics Building, Peking University

地点: 北京大学物理楼 西563

Abstract

In the first part of this talk, I will talk about transport scaling theories in disordered semimetal [1,2]. In electronic band structure of solid state material, two band touching points with linear dispersion (called as `Weyl node') appear in pair in the momentum space. When they annihilate with each other, the system undergoes a quantum phase transition from Weyl semimetal (WSM) phase to a band insulator (BI) phase. The phase transition is described by a new critical theory with a `magnetic dipole' like object in the momentum space. The critical theory hosts a disorder-driven quantum multicritical point, which is encompassed by three quantum phases, WSM phase, BI phase, and diffusive metal (DM) phase. Based on the renormalization group argument, we clarify novel transport scaling properties around the Weyl node at the quantum multicritical point as well as all phase boundaries among these three phases [1,2].

In the second part of the talk, I will argue that a new quantum state of matter named as three-dimensional topological excitonic insulator is realized in graphite under high magnetic field [3,4]. Graphite under high magnetic field exhibits consecutive metal-insulator (MI) transitions as well as re-entrant insulator-metal (IM) transition at low temperature. We first explain these enigmatic insulator phases as manifestation of excitonic insulator phases with spin nematic orderings (SNEI phases). We next explain unusual field-dependences of in-plane resistivity in the graphite experiment by surface transports via 2+1 massless surface Dirac fermion in one of the SNEI phases [3,4].

[1] https://arxiv.org/abs/1803.09051, under review
[2] https://arxiv.org/abs/1710.00572, selected as PRB editors' suggestion
[3] https://arxiv.org/abs/1802.10253, under review
[4] in preparation

About the Speaker

Dr. Ryuichi Shindou is a condensed matter physics theorist. He graduated from University of Tokyo in 1999, where he obtained Ph.D in 2004. After postdoc research in UCSB (2005-2007), RIKEN (2008-2010), and Tokyo Institute of Technology (2010-2012), he became an project assistant professor (non-tenured) in Tokyo Institute of Technology (2012-2013). Since 2013 January, he has been a tenure-track associate professor in ICQM in Peking University. He has been working on theories of quantum spintronics, magnetism and transport as well as correlated electron systems.