



Department of Physics
THE UNIVERSITY OF HONG KONG

Physics
Colloquium

Emergent Pseudo-Gauge Field in Dirac Materials

Date: April 21, 2021 (Wednesday)

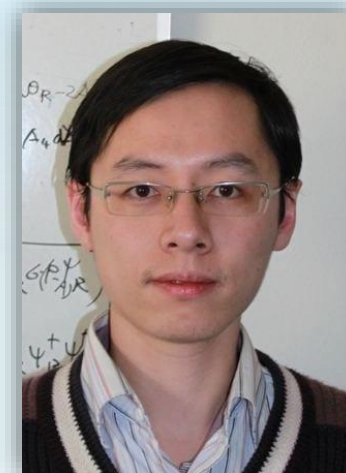
Time: 10:00 a.m.

Zoom Online Lecture:

<https://bit.ly/3fRDc49>

Meeting ID: 986 5653 1617

Password: 2859



Professor Chaoxing Liu
Pennsylvania State University

Abstract:

Electrons in solids are usually described by non-relativistic Schrodinger equation since electron velocity is much slower than the speed of light. However, the relativistic Dirac/Weyl equation can emerge as a low energy effective theory for electrons in certain solid materials. These systems are dubbed “Dirac materials” and provide a tunable platform to test quantum relativistic phenomena in table-top experiments. More interestingly, different types of perturbations in these Dirac materials, such as magnetic fluctuations, lattice vibration, strain, and material inhomogeneity, can couple to relativistic electrons in a similar form as the minimal gauge coupling. We thus dubbed these types of perturbations as the emergent “pseudo-gauge field”. It can be shown that under certain condition, the pseudo gauge field mimics the axial gauge field in quantum electrodynamics and thus can lead to rich and intriguing physical phenomena in these Dirac materials. In this talk, I will show that the concept of pseudo-gauge field in these Dirac materials can help us to predict a variety of physical phenomena, including chiral modes in a magnetic vortex core of Weyl semimetals [1] or in inhomogeneous optical Weyl metamaterials [2], topological piezo-magnetoelectric response [3,4], and Berry-curvature induced phonon dynamics. Moreover, exploring physical phenomena induced by pseudo-gauge field in Dirac materials may also deepen our understanding of some fundamental physics, such as chiral anomaly and axion electrodynamics.

References:

[1] Physical Review B, 2013, 87(23): 235306; [2] Science, 363, 148-151 (2019);
[3] Nature Communications 11, 2290 (2020); [4] ArXiv:2008.10620, 2020.

Biography:

Prof. Chaoxing Liu is currently an associate professor in the Physics Department at Pennsylvania State University. Prof. Chaoxing Liu obtained his BS in 2003, and PhD in 2009, both in Physics, from Tsinghua University. He was a visiting researcher at the University of Hong Kong in 2006, and a visiting researcher at Stanford University from 2007 to 2008. From 2009 to 2011, he was a Postdoctoral Researcher of Alexander von Humboldt Research fellowship at the University of Wurzburg in Germany. His research interests include topological insulators and other symmetry protected topological states, topological superconductivity and unconventional superconductivity, spintronics, and quantum transport of charge and spin.

Anyone interested is welcome to attend!

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