



Quantum Geometry Effects in Topological and Flat Band Superconductors

Date: November 22, 2023 (Wednesday)

Time: 4:00 p.m.

Venue: MB237, Main Building, HKU



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HKUST

Abstract:

The study of quantum geometric properties of Bloch wavefunctions in crystals has deepened our understanding of quantum states of matter. The quantum geometry of a material is characterized by the quantum geometric tensor, the imaginary part of which defines the Berry curvature. The study of Berry curvature effects in condensed matter systems has been a central topic in physics for several decades. However, much less attention has been given to the real part of the quantum geometric tensor, known as the quantum metric.

This seminar will discuss the importance of quantum geometry effects in superconductors. Firstly, we will explore how nontrivial Berry curvatures can give rise to topological superconductors, how they can be realized experimentally, and how Majorana modes in topological superconductors can be detected. Secondly, we will discuss the importance of quantum metric effects in flat band superconductors. The quantum metric measures the distance between two quantum states and defines a new electronic length scale that governs many of the important physical properties in flat band superconductors [1,2]. We will apply our theory to understand the novel properties of superconducting twisted bilayer graphene, which deviates greatly from conventional theoretical descriptions.

References:

- [1] The Ginzburg-Landau theory of flat band superconductors with quantum metric, Shuai A. Chen, K. T. Law, arXiv:2303.15504.
- [2] Anomalous Coherence Length in Superconductors with Quantum Metric, Jin-Xin Hu, Shuai A Chen, KT Law, arXiv:2308.05686.

Biography:

Professor Vic Kam Tuen Law earned his bachelor's degree from HKUST in 2003, and went on to complete his PhD at Brown University in 2008. Following a year as a joint postdoc fellow of HKUST-IAS and MIT, he became a Croucher Postdoc Fellow at MIT in 2009. In 2011, he joined the HKUST physics department as an assistant professor and is currently a professor in physics, as well as serving as the associate Dean of Science. His research interests lie in theoretical condensed matter physics, with a focus on topological materials, moiré materials, and topological and unconventional superconductors. Professor Law is a recipient of the Croucher Innovation Award and the RGC Research Fellowship. He is also an elected member and the Founding President of the Hong Kong Young Academy of Sciences.

Anyone interested is welcome to attend!

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