JITCP Seminar

THE UNIVERSITY OF HONG KONG
HKU-UCAS JOINT INSTITUTE OF THEORETICAL AND COMPUTATIONAL PHYSICS
[Thursday afternoon, 4 pm, Zoom (online)]

Quantum metric and topological insulators

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When quantum states depend on a set of parameters, we can talk about how the quantum states change as one varies the parameters. Such change of quantum states defines geometrical structures of the quantum states in the parameter space. The most well-known example of geometrical properties is the Berry's phase, where the change of quantum states manifests itself as a gauge-invariant phase factor upon a cyclic evolution of the states in the parameter space. When the overall structure or the shape of the quantum states in the parameter space is nontrivial (in a proper mathematical sense), we say that the quantum states are topologically nontrivial. Topological insulators are examples of such topologically nontrivial quantum states with momentum space as the parameter space. In this talk, I focus on a geometrical structure of quantum states called the quantum metric, which defines a Riemannian metric in a parameter space. Recently, the first experimental measurements of the quantum metric appeared in various settings, including ultracold atomic gases, diamond NV centers, superconducting qubits, and exciton-polaritons. I give an introduction to the quantum metric and its experimental consequences in optical response. I also discuss how the quantum metric and the topological structure are related in topological insulators. In the final part of my talk, I explain how, in some lattice models with bands resembling Landau levels, the quantum metric and the Berry curvature (another geometrical quantity) are proportional to each other, and how these concepts are connected to the holomorphic structure of quantum states in momentum space, relating to the notion of Kähler geometry.

Online Zoom Seminar
Thursday, October 20, 2022, 4:00 pm
Meeting ID: 984 8283 9025
Password: 25600
https://hku.zoom.us/j/98482839025?pwd=ejZYdEZldjdJRXBvTjVZYmtFZXk5QT09

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