

凝縮系物理学ゼミナール

Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 30 November 2022

Title: Quantum metric on the Brillouin Zone in correlated electron systems and its relation to topology for Chern insulators

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Abstract:

Geometric aspects of physics play a crucial role in modern condensed matter physics. The quantum metric is one of these geometric quantities which defines the distance on a parameter space.

In free systems, relationships between the metric and the topological invariant have been reported in recent studies[1-6]. In this work, we introduce a generalized quantum metric(GQM) on the Brillouin zone for correlated electron systems. This quantum metric is based on the optical conductivity that is written by single-particle Green's functions.

We analytically prove that this definition is equivalent to the existing definition of the quantum metric in free systems and that it is positive semi-definite as necessary for a metric. We then calculate the GQM in a correlated Qi-Wu-Zhang model, which is a toy model of a Chern insulator[6,7]. We demonstrate that the GQM can detect the topological phase transition in this model by showing that the GQM is larger in the topological phase than in the trivial phase, similar to the free system. Thus, the GQM can serve as a probe to detect the topology in a general lattice model.

Reference:

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