Title:

Flow of (higher) Berry curvature and bulk-boundary correspondence in parametrized quantum systems

Abstract:

In this talk I will introduce the physics of parametrized gapped quantum many-body systems, which can be viewed as a generalization of conventional topological phases of matter. In such systems, rather than considering a single Hamiltonian, one considers a family of Hamiltonians that depend continuously on some parameters.

As concrete examples, we formulate a bulk-boundary correspondence for an important bulk quantity, the Kapustin-Spodyneiko higher Berry curvature, first in one spatial dimension and then in arbitrary dimension. This clarifies the physical interpretation of the higher Berry curvature, which in one spatial dimension is a flow of (ordinary) Berry curvature. In d dimensions, the higher Berry curvature is a flow of (d-1)-dimensional higher Berry curvature. Based on this, we discuss one-dimensional systems that pump Chern number to/from spatial boundaries, resulting in anomalous boundary modes featuring isolated Weyl points. In higher dimensions, there are pumps of the analogous quantized invariants obtained by integrating the higher Berry curvature. We also discuss the consequences for parametrized systems of Kitaev's proposal that invertible phases are classified by a generalized cohomology theory, and emphasize the role of the suspension isomorphism in generating new examples of parametrized systems from known invertible phases. This talk is based on arXiv:2112.07748.