Chez Pierre

Presents ...

Monday, November 13, 2023

12:00 noon- 1:00 pm

Duboc Room 4-331

Chez Pierre Seminar

Hsin Lin Institute of Physics, Academia Sinica (Taiwan)

"Feature Spectrum Topology"

Study of the ground state topology of quantum systems is a fundamentally important field in physics, dating back to the integer quantum Hall effect. It has continued to be a rich and deep area of research in condensed matter physics, culminating in the discovery of symmetry-protected topological states. However, symmetry-based topological characterizations rely heavily on the symmetry analysis and are incapable of detecting the topological phase in systems where the symmetry is broken, thus missing a large portion of interesting topological physics. Here, we propose a new approach to understanding the topological nature of quantum materials, which we call feature spectrum topology. In this framework, the ground-state is separated into different partitions by the eigenspectrum of a feature, a particular chosen internal quantum degree of freedom, such as spin or pseudo-spin, and the topological properties are determined by analysis of these ground-state partitions. We show that bulk-boundary correspondence guarantees gapless spectral flows in either one of the energy or feature spectrum. Most importantly, such "feature-energy duality" of gapless spectral flows serves as a fundamental manifestation of a topological phase, thereby paving a new way towards topological characterizations beyond symmetry considerations. Further, by elucidating a system with pole-expanded approximated self-energy, we show that feature spectrum topology correctly captures the topological boundary states previously invisible to the traditional topological characterization methods, exhibiting more facets of the nature of the interacting topological phase.