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Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Festkörperforschung
Fachbereich Physik, Universität Stuttgart

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Hybrid

Login data will be announced by e-mail and on the colloquium webpage.

Dienstag, 25.06.2024	16.15 Uhr	Lecture Hall 2D5

Max-Planck-Institut für Festkörperforschung, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

Topological phases with and without spectral flow

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Abstract

Topological insulators are materials whose interiors insulate while their surfaces conduct. In the iconic case of the quantum Hall effect, the conducting surface states spanning different surfaces are connected at high energies through the bulk of the material by delocalized “bridging states.” This surface-bulk connection is called spectral flow, and it underpins some of the most unusual properties of topological matter, such as the ability to pump electrons from one surface to the other through the bulk.

In this colloquium, I demonstrate that most 3D topological phases do not possess spectral flow. For these topological phases the surface states can be completely detached from the bulk and there need not be delocalized bridging states in the bulk.

The most remarkable physical consequences of these findings concern the response of the surface states to disorder, which is inevitable in real materials. I show that disorder can destroy the conducting properties of surface states in topological classes that do not possess spectral flow. By contrast, all surface states are robustly protected from disorder in topological phases that possess spectral flow (such as the quantum Hall effect).