

Colloquium
Dahlem Center for Complex Quantum Systems

Topological Boundary Modes from Hard to Soft Matter

Prof. Dr. Charles Kane

University of Pennsylvania, USA

Recipient of the Europhysics Prize 2010, the Buckley Prize 2012, and the Physics Frontiers Prize 2013, all for his role in the discovery of topological insulators.

Time: Thursday, July 3rd 2014, 14:00 c.t.

Location: Hörsaal A (1.3.14)

Abstract:

Over the past several years, our understanding of topological electronic phases of matter has advanced dramatically. A paradigm that has emerged is that insulating electronic states with an energy gap fall into distinct topological classes.

Interfaces between different topological phases exhibit gapless conducting states that are protected topologically and are impossible to get rid of.

In this talk we will review the application of this idea to the quantum Hall effect, topological insulators and topological superconductors. We will then show that similar ideas arise in a completely different class of problems.

Isostatic lattices are arrays of masses and springs that are at the verge of mechanical instability. They play an important role in our understanding of granular matter, glasses and other 'soft' systems. Depending on their geometry, they can exhibit zero-frequency 'floppy' modes localized on their boundaries that are insensitive to local perturbations. The mathematical relation between this classical system and quantum electronic systems reveals an unexpected connection between theories of hard and soft matter.