“Symmetry, topology and electronic phases of matter”

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Hammond Auditorium (Engineering 120)

Abstract

Symmetry and topology are two of the conceptual pillars that underlie our understanding of matter. While both ideas are old, over the past several years a new appreciation of their interplay has led to dramatic progress in our understanding of topological electronic materials. 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 and are impossible to get rid of. In this talk we will discuss the application of this idea to the quantum Hall effect, topological insulators, topological semimetals and topological superconductors. The latter case has led to the quest for observing Majorana fermions in condensed matter, which opens the door to proposals for topological quantum computation. We will close by surveying the frontier of topological phases in the presence of strong interactions.

Biography

Charles Kane is the Christopher H. Browne Distinguished Professor of Physics at the University of Pennsylvania. He received a bachelor’s degree in physics from the University of Chicago in 1985 and a Ph.D. in physics from MIT in 1989. After a post doc at IBM T.J. Watson Research Center he joined the faculty of the University of Pennsylvania in 1991. Professor Kane is a theoretical condensed matter physicist who is known for his work characterizing quantum electronic states of matter, including quantum Hall states, Luttinger Liquids, carbon nanotubes and topological insulators. Recently his research has focused on the theory of topological electronic materials. Kane is a Fellow of the American Physical Society and a member of the National Academy of Sciences. His work on topological insulators has been recognized by several awards, including the Oliver Buckley Prize (2012), the P.A.M. Dirac Medal (2012), the Benjamin Franklin Medal (2015), the Breakthrough Prize (2018),the BBVA Frontiers of Knowledge Award (2019) and the Fudan-Zhongzhi Science Award (2020).