16 Dec Thursday 12:00 – 12:45 Chair: HO Wen Wei (何文维)

Two-State Edge Berry Phase Mechanism for Dirac And Majorana Kramers Pairs of Corner Modes

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Professor LIU Xiong-Jun received Ph.D. in Texas A&M University in 2011, and was a postdoctoral fellow in University of Maryland, IAS HKUST and MIT (2011-2014). He joined the faculty of International Center for Quantum Materials at Peking University (09/2014), became tenured (07/2018), and now is a full professor (from 02/2019). He works in condensed matter theory and ultracold atoms, focusing on quantum simulation and topological quantum matter, such as the topological superconductors, synthetic gauge fields, non-equilibrium topological quantum systems, quantum thermalization and many-body localization, and strongly correlated topological states. He has been awarded the NSFC Distinguished Young Scholars (2018), and AAPPS-APCTP Chen-Ning Yang Award (2019), etc.

Abstract:

We uncover an edge geometric phase mechanism to realize exotic corner modes in second-order topological insulators and topological superconductors (SCs), and predict realistic material for the realization. The theory is built on a novel result shown here that the nontrivial pseudospin textures of edge states in a class of two-dimensional (2D) topological insulators (TIs) give rise to the two-state geometric phases defined on the edge, for which the effective edge mass domain walls or intrinsice π-junctions are obtained across corners when external magnetic field or s-wave superconductivity is considered, and the Dirac or Majorana Kramers pair corner modes are resulted. Remarkably, with this mechanism we predict the Majorana Kramers pairs of corner modes by fabricating 2D topological insulator on only a uniform and conventional s-wave SC, in sharp contrast to the previous proposals which apply unconventional SC pairing or fine-tuned SC π-junction. This result also changes a traditional viewpoint that the edge of a time-reversal invariant TI could always be gapped out by a uniform s-wave SC which pairs up time-reversal partners. We find that Au/GaAs(111) can be a realistic material candidate for realizing such Majorana Kramers corner modes.

References
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