Abstract for IAS Focused Program on Mathematical Foundations of Topological Materials (January 6-9, 2026)

Photonics Topology in Semiconductor Platforms: Basics and Applications

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Transforming the concept of band topology fostered in electron systems to electromagnetic waves opens a completely new direction for harnessing propagation of light. It is observed that electromagnetic modes in honeycomb photonic crystals exhibit Dirac-type frequency dispersions, which are accompanied by emergent spin degree of freedom, and that deforming the honeycomb structure in a designed way gives birth to a photonic analogue of quantum spin Hall effect. In this talk I will first show that the main physics can be captured phenomenologically by the k·p theory, and discuss that the photonic topology can be characterized in terms of the Wilson loops based on the C_2 T symmetry. Then I will introduce examples to demonstrate how the recipe can be exploited for harnessing light and deriving advanced optic properties.