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Bulk properties of topological crystalline insulators

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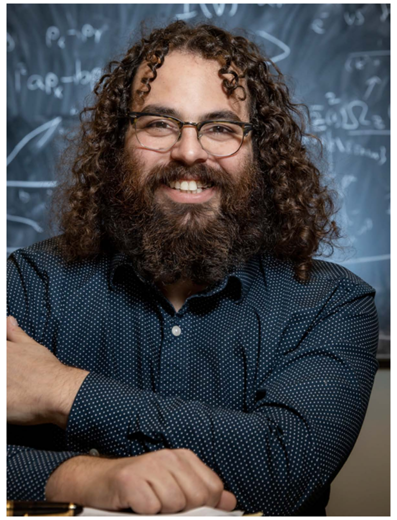

Prof. Barry Bradlyn

University of Illinois Urbana-Champaign, USA

Date & Time- August 12th, 2022 at 10 am EST

Seminar link:
https://www.youtube.com/channel/UCAwzWog7PqFw5R0q90KI6KQ

Bio:
Prof. Barry Bradlyn is an assistant professor in the physics department at the University of Illinois- Urbana-Champaign since 2018. He received his bachelor's degree in Physics from the Massachusetts Institute of Technology in 2009 and went on to receive Ph.D. in Physics from Yale University in 2015, under the supervision of Prof. Nicholas Read. His thesis research focused on linear response and Berry phases in the fractional quantum Hall effect. His primary contributions was the development of a formalism for computing the viscoelastic and thermal response functions for two dimensional Topological phases. From 2015 to 2018, Professor Bradlyn held a postdoctoral research position at the Princeton Center for Theoretical Science, where he studied the role of crystal symmetries in topological insulators and semimetals. He predicted the existence of topologically charged, multiply degenerate fermions in weakly interacting crystals with no known analogue in high energy physics. Additionally, he developed a real-space formulation of topological band theory, allowing for the prediction of many new topological insulators and semimetals.

Abstract:
The discovery of topological materials is one of the most transformative recent breakthroughs in condensed matter physics, revealing new conceptual surprises in established topics such as the phases of matter and the behavior of electrons in insulators. Most work on topological insulators has focused on their metallic surface states that are present regardless of how dirty the system. In this talk, I will emphasize that topological materials feature anomalous bulk properties that can be probed by external fields even when the surfaces are gapped. Using the tools of topological quantum chemistry, I will show how magnetic and nonmagnetic topological insulators protected by crystal symmetries can be characterized in the bulk. Focusing on "higher-order" topological insulators (HOTIs) protected by inversion symmetry, I will review how magnetic HOTIs have a nontrivial bulk magnetoelectric response and anomalous gapped surfaces. Then, by introducing a new notion of spin-resolved band topology, I will show how to extend this understanding to nonmagnetic helical HOTIs.