MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

Physics Colloquium

April, 11, 2025
4:10 – 5:00 PM
Roberts 101

Topological and nonlinear nanophotonics

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Abstract: Over the past few decades, topology has emerged as a major research direction in condensed matter physics, with the most notable achievement being the discovery of topological insulators. Extending topological concepts to photonic systems has uncovered a wealth of photonic topological states, enabling new ways to control the flow of light. However, many crucial properties unique to photonic systems – such as optical nonlinearity and light-matter interactions – have often been overlooked in prior studies.

In this talk, I will present our recent work to address these gaps. First, I will discuss both theoretical and experimental advancements in realizing nonlinear photonic topological insulators in time-modulated photonic crystals, where nontrivial band topology is induced with carefully designed driving fields. Next, I will explore how integrating 2D quantum materials with nanophotonics enables strong light-matter coupling, giving rise to topological and nonlinear exciton-polaritons. Finally, I will highlight the transformative potential of these phenomena for all-optical information processing, with applications including on- chip polaritonic neural networks and quantum polaritonics.

Bio: Li He is currently a research associate in the Department of Physics and Astronomy at the University of Pennsylvania. He received his Ph.D. degree in Physics from University of Minnesota in 2018, M.S. degree in electrical engineering from University of Washington in 2012, B.S. degree in Optics from Zhejiang University in 2010. His current research focuses on quantum nanophotonics, topological photonics and 2D quantum materials.

Host: Anton Vorontsov

**** Refreshments served in the Barnard Hall second floor atrium at 3:45 PM ****