CONDENSED MATTER SCIENCES SEMINAR

Professor Anton Souslov

University of Cambridge

Host

Dr Kun Yang

Title

Classifying topological floppy modes in the continuum

Tuesday, October 1st, 2024

1st Floor – B101

15:00-16:00

Abstract

In floppy mechanical lattices, robust edge states and bulk Weyl modes are manifestations of underlying topological invariants. To explore the universality of these phenomena independent of microscopic detail, we formulate topological mechanics in the continuum. By augmenting standard linear elasticity with additional fields of soft modes, we define a continuum version of Maxwell counting, which balances degrees of freedom and mechanical constraints. With one additional field, these augmented elasticity theories can break spatial inversion symmetry and harbor topological edge states. We also show that two additional fields are necessary to harbor Weyl points in two dimensions and define continuum invariants to classify these states. In addition to constructing the general form of topological elasticity based on symmetries, we derive the coefficients based on the systematic homogenization of microscopic lattices. Our discovery formulates novel design principles and efficient computational tools for topological states of matter, and points to their experimental implementation in mechanical metamaterials.

Bio

I received my B.S. degree from F.S.U. in 2006 with a double major in physics and applied mathematics. I then went on to a physics Ph.D. in 2011 from the University of Pennsylvania working with Tom Lubensky on descriptions of granular media, mechanical metamaterials, and colloids. Before my current appointment as Associate Professor in the Theory of Condensed Matter group at the Cavendish Laboratory, Department of Physics at Cambridge, I was a postdoctoral researcher at Georgia Tech, Leiden University, and UChicago, and faculty at the University of Bath, UK.