Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Mechanical topological insulators: from metamaterials to active liquids"

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Abstract: The effect of constraints on a many-body system is a subject as deeply rooted in mechanical and robotic control theory as in modern theoretical physics. In this talk, I discuss how networks of springs or rigid bars connected by joints mimic electronic topological insulators with zero-energy edge and bulk modes. In some cases, solitons arise from the same constraint equations that, upon linearisation, predict topological edge modes. Non-linear field theories with a topological boundary term capture these zero modes coupled to domain walls or dislocations. Our real space approach goes beyond topological band theory and provides concrete guidelines to design metamaterials that break or fold in controlled ways. Finally, I discuss how to build classical Chern insulators using active liquids that flow spontaneously without external drive. The active flow generates a synthetic gauge field that breaks time-reversal symmetry. As a result, unidirectional acoustic waveguides emerge at sample edges and domain walls. These topological sound waves, immune to disorder, can propagate past obstacles without back-scattering.

11:00AM
Thursday, April 7, 2016
Duboc Room (4-331)

Host: Liang Fu