Engineering topologically protected modes inspired by topological insulators

Camelia Prodan*[1]

[1]Fordham University – United States

Abstract

Topological mechanics offers a versatile platform for realizing robust, defect-tolerant functionalities in engineered structures. We present experimental and computational platforms results on mechanical metamaterials designed to host several types of topologically protected modes . By tuning lattice geometry and coupling, we can generate flat bands and zero-energy edge states, analogous to Majorana wires or we can turn any lattice into a topological one but introducing complex couplings. All these types of modes enable controlled localization and transport (pumping) of mechanical excitations, robust to disorder. We also demonstrate steps towards braiding protocols through manipulation of interface modes, with topological protection. Our work establishes a mechanical analogue of topological quantum operations and opens new directions for robust wave control and mechanical information processing.

*Speaker