

Metamaterials and Topological Mechanics

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Metamaterials are engineered to have properties not found in nature, such as a negative optical index of refraction, one-way light or vibration waves, or exotic elastic behavior. Made-to-order structures at length scales as short as a micron can now be fabricated with advanced materials processing like 3D printing. Topology is a unifying mathematical concept related to properties that do not change under continuous changes in parameters. *Topological materials*, like topological insulators, have bulk excitation spectra characterized by topological invariants, associated with the opening of bandgaps, that determine physical properties like the Hall conductivity or the nature of edge excitations. This talk will discuss mechanical metamaterials with topologically protected zero-energy edge states in an idealized limit. These states exist at every wavenumber on a surface so that any surface shape distortion costs no energy. Changing the topological class of the material causes one or more zero modes per wavenumber to move from one side of a sample to the opposite creating rigid and supersoft edges.