Geometry and topology tango in mechanics

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After an introduction to topological insulators in mechanics, I will present a generic framework to describe, detect and design robust zero-energy deformations in periodic and amorphous metamaterials. This framework relies on a fundamental symmetry of the vibrational spectra shared not only by all elastic mechanical structures but also by numerous photonic, electronic, and acoustic materials.

I will introduce two central quantities to count zero-energy states of mechanical metamaterials : the chiral charge and the chiral polarization. I will then show how they can be effectively used to go beyond the celebrated Maxwell count of floppy and self-stress modes in periodic mechanical structures. In disordered materials, I will show how simple yet generic geometrical rules makes it possible to detect localized zero energy deformations at the junction between regions of space hosting inequivalent topological phases. I will close my talk presenting robust guidelines to engineer zero-mode waveguides in amorphous metamaterials (fig. 1).

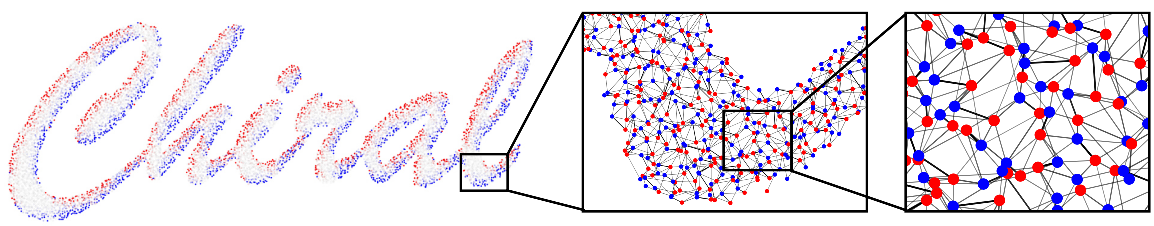

Figure 1. Waveguide in a disordered metamaterial. Left : Amorphous metamaterial conducting zero-energy modes (red and blue) at the edges, forming the word "Chiral". **Right :** Details of the system connectivity, where red and blue indicate the two different lattices.

Références

1. M. Guzmán, D. Bartolo, D. Carpentier, Geometry and Topology Tango in Chiral Materials, *arXiv preprint arXiv :2002.02850*.