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Amorphous Gyroscopic Topological Metamaterials NOAH P. MITCHELL, LISA M. NASH, DANIEL HEXNER, James Franck Institute, The University of Chicago, ARI M. TURNER, Technion - Israel Institute of Technology, WILLIAM T. M. IRVINE, James Franck Institute, Enrico Fermi Institute, The University of Chicago — Mechanical topological metamaterials display striking mechanical responses, such as unidirectional surface modes that are impervious to disorder. This behavior arises from the topology of their vibrational spectra. All examples of topological metamaterials to date are finely-tuned structures such as crystalline lattices or jammed packings. Here, we present robust recipes for building amorphous topological metamaterials with arbitrary underlying structure and no long-range order. Using interacting gyroscopes as a model system, we demonstrate through experiment, simulation, and theoretical methods that the local geometry and interactions are sufficient to generate topological mobility gaps, allowing for spatially-resolved, real-space calculations of the Chern number. The robustness of our approach enables the design and self-assembly of non-crystalline materials with protected, unidirectional waveguides on the micro and macro scale.

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