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Dynamics in an isostatic mechanical lattice with topological zero-energy bulk modes at finite wavevector BRYAN GIN-GE CHEN, Leiden University, DAVID ZEB ROCKLIN, University of Michigan, MARTIN FALK, Massachusetts Institute of Technology, TOM LUBENSKY, University of Pennsylvania, VINCENZO VITELLI, Leiden University — Weakly connected mechanical systems near the isostatic threshold are marginally stable and exhibit large deformations in response to tiny perturbations, meaning that they enter the nonlinear regime immediately. Kane and Lubensky have defined a new topological invariant of isostatic mechanical lattices which leads within linear elasticity to zero energy modes localized at boundaries akin to the edge modes studied in topological quantum matter. This invariant is defined only if the phonon spectrum is gapped away from the acoustic modes at zero momentum, and indeed some lattices admit zero energy bulk modes at nonzero momentum, known as Weyl modes. We present the results of theory and simulations on the dynamics and energy transport in a family of lattices where the wavelengths of these Weyl modes can be tuned via a continuous parameter. Our findings include (1) the Weyl modes provide a route to inducing large deformations in the bulk of a mechanical system via boundary activation (2) the deformation corresponding to the Weyl modes propagates via a nonlinear shock and (3) we elucidate the connection between Weyl modes and the unit-cell shape changing mechanisms that are generic to isostatic lattices.

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