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Topological modes bound to lattice dislocations in mechanical metamaterials[1] JAYSON PAULOSE, BRYAN CHEN, VINCENZO VITELLI, Lorentz Institute — The mechanical rigidity of frameworks – nodes connected by springs or rigid bars – underlies the structural integrity of bridges, the response of granular materials, and the design of metamaterials with unusual mechanical properties. A fundamental question governing rigidity is the existence of mechanisms: motions that do not significantly stretch or compress the constituent elements of the structure. We demonstrate a novel way to introduce approximate mechanisms at desired locations in a metamaterial, by exploiting the properties of a recently introduced class of topological metamaterials. These are special periodic frameworks which exhibit localized edge modes, analogous to the electronic edge states of topological insulators. We show that dislocations in such metamaterials are associated with soft modes of topological origin. The existence of the modes is determined by the interplay between two Berry phases – the Burgers vector of the dislocation and a topological "polarization" characterizing the underlying lattice. Simple prototypes built out of triangular plates joined by hinges provide a visual demonstration of these modes.

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