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Kinks in topological soft matter BRYAN CHEN, NITIN UPADHYAYA, VINCENZO VITELLI, Instituut-Lorentz, Leiden University — Weakly connected mechanical systems near the isostatic threshold are fragile in the sense that they exhibit large deformations in response to tiny perturbations. Kane and Lubensky have recently defined a new topological invariant of isostatic mechanical lattices which leads within linear elasticity to zero energy modes at the boundary akin to the edge modes studied in topological quantum matter. What happens when such prototype topological soft materials are subject to an external mechanical perturbation? In our work, we demonstrate that the linear soft modes can often integrate to non-linear deformations described by topological solitons. These solitons that are moving kinks between distinct topological phases are the basic excitations of fragile mechanical systems. We illustrate the general soliton construction in the context of a 1D chain of rotors connected by springs that can be considered the archetype of a topological mechanical structure. In the continuum limit, this chain is described by a Lorentz invariant ϕ^4 theory and the corresponding solitons exhibit a Lorentz contraction of the width, as their speed is raised.

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