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Theory of supersymmetry "protected" topological phases of isostatic lattices and highly frustrated magnets MICHAEL LAWLER, Binghamton University — I generalize the theory of phonon topological band structures of isostatic lattices to highly frustrated antiferromagnets. I achieve this with a discovery of a many-body supersymmetry (SUSY) in the phonon problem of balls and springs which also applies to geometrically frustrated magnets. The Witten index of the SUSY model, when restricted to the single body problem (meaningful for linearized phonons), is then shown to be the Calladine-Kane-Lubensky index of mechanical structures that forms the cornerstone of the phonon topological band structure theory. "Spontaneous supersymmetry breaking" is then identified as the need to gap all modes in the bulk to create the topological state. The many-body SUSY formulation shows that the topology is not restricted to a band structure problem but extends to systems of coupled bosons and fermions that are in principle also realizable in solid state systems. The analogus supersymmetry of the magnon problem turns out to be particularly useful for highly frustrated magnets with the kagome family of antiferromagnets an analog of topological isostatic lattices. Thus, a solid state realization of the theory of phonon topological band structure may be found in highly frustrated magnets. However, our results show that this topology is protected not

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