Tunable Topological Phononic Crystals

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Topological insulators, first proposed in electrons, have inspired many analogues in photonic and phononic crystals, in which fantastic one-way propagation edge states are supported because of topological nontrivial bandgaps. To achieve such a bandgap, one can break the time-reversal symmetry so as to lift the degeneracy associated with Dirac cones at the corner of the Brillouin zone. Here, we construct a phononic crystal exhibiting a Dirac-like cone in the Brillouin zone center. We demonstrate that simultaneously breaking the time-reversal symmetry and altering the geometric size result in a topological transition which is verified by the Chern number calculation and edge mode analysis. The topology of the bandgap can be tuned by varying both the velocity field and the geometric size, which may dramatically enrich the design of acoustic topological insulators.