Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Topological Phononics and Phonon Diode YIZHOU LIU, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, People's Republic of China, YONG XU, Collaborative Innovation Center of Quantum Matter, Beijing 100084, People's Republic of China, SHOU-CHENG ZHANG, Department of Physics, McCullough Building, Stanford University, Stanford, California 94305-4045, USA, WENHUI DUAN, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, People's Republic of China — The quantum anomalous Hall effect, an exotic topological state first theoretically predicted by Haldane and recently experimentally observed, has attracted enormous interest for low-power-consumption electronics. In this work, we demonstrated that the concept of topology can be generalized to phonons, and derived a Schrdinger-like equation of phonons, where topology-related quantities, time reversal symmetry (TRS) and its breaking can be naturally introduced. Furthermore, we proposed a Haldane model of phonons, which gives novel quantum (anomalous) Hall-like phonon states characterized by one-way gapless edge modes within the bulk gap. The topologically nontrivial phonon states are useful not only for conducting phonons without dissipation but also for designing highly efficient phononic devices, like phonon diode, which could find important applications in future phononics.

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Date submitted: 02 Nov 2016 Electronic form version 1.4