Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Localization and percolation in random elastic networks JACOB KRICH, University of Ottawa, ARIEL AMIR, Harvard University, VINCENZO VITELLI, Leiden University, YUVAL OREG, YOSEPH IMRY, Weizmann Institute of Science — We consider a minimal model for a disordered phonon system that shows rich behavior in the localization properties of the phonons. We use a percolation analysis to argue for a localization/delocalization transition of the phonon modes and predict the speed of sound in the delocalized region, with comparison to numerics. We show that in contrast to the behavior in electronic systems (cf. Anderson localization), the transition exists for arbitrarily large disorder, albeit with an exponentially small critical frequency. The structure of the modes reflects a divergent percolation length that arises from the disorder in the springs without being explicitly present in the definition of our model. We calculate the critical frequency as a function of density and test the prediction numerically using a recursive Green function method. We further explore the existence of delocalized states in the two-dimensional version of this model.

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Date submitted: 09 Nov 2012 Electronic form version 1.4