Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Mechanical instability at finite temperature[1] XIAOMING MAO, University of Michigan, CARLOS I. MENDOZA, Universidad Nacional, Mexico, ANTON SOUSLOV, Georgia Institute of Technology, TOM C. LUBENSKY, University of Pennsylvania — Rigidity transitions have been well studied in a wide range of athermal systems such as jammed packings and diluted lattices, in which the balance between the number of degrees of freedom and constraints generally determines the onset of mechanical instability, as predicted by Maxwell. The effects of thermal fluctuations on these transitions, however, have not yet been systematically studied. Characterizing rigidity transitions at finite temperature is very important to the understanding of fundamental problems such as the relation between the glass transition and jamming. We report an analytic study of a finite-temperature rigidity transition in the square lattice. At zero temperature, this lattice exhibits a continuous transition between the square phase and a phase composed of rhombic cells as the nonlinear potential connecting next-nearest-neighbors vary. At nonzero-temperature, diverging vibrational entropy associated with the floppy modes play a very important role in selecting the phase and determining the order of the transition. We calculate the phase diagram of this system and identify interesting behaviors such as negative thermal expansion.

[1]This work was supported in part by the NSF under Grants DMR-0804900, DMR-1104707

Xiaoming Mao
University of Michigan

Date submitted: 07 Jan 2013

Electronic form version 1.4