Abstracts for lectures of Tom Lubensky

**Lecture 1: Lagrangian Elasticity**

Strains, elastic energy; Three kinds of stress – Lagrangian and first and second Piola-Kirchhoff stress tensors and their associated work functions; Polar decomposition theorem; Sound and surface Rayleigh waves.

**Lecture 2: Lattice Models and the Maxwell-Calladine theorem**

Construction of lattice models and their harmonic and elastic limits; Zero modes and mechanisms; States of self-stress and the Maxwell-Calladine theorem; Elastic mode count and Guest-Hutchinson modes. Dynamics and zero modes of kagome lattices.

**Lecture 3: Topological Mechanics**

Review of the Su-Schrieffer-Heeger model and its topologically protected edge modes. Construction of topological kagome lattices and analysis of their edge modes including the existence of rigid and doubly soft surface modes.

**Lecture 4” Beyond Maxell lattices**

Distorted square lattices, 2D Weyl modes and other miscellany. Analysis of a topological mechanical model on a honeycomb lattice otherwise known as “mechanical graphene.”

A partial list of references:

1. Ye, F. F., and T. C. Lubensky. “Phase Diagrams of Semisoft Nematic Elastomers.”

Journal of Physical Chemistry B 113, no. 12 (Mar 2009): 3853-72.

1. Lubensky, T. C., and F. F. Ye. “Elastic Response and Ward Identities in Stressed Nematic Elastomers.” Physical Review E 82, no. 1 (Jul 2010): 011704.
2. DiDonna, B. A., and T. C. Lubensky. ”Nonaffine Correlations in Random Elastic Media. Physical Review E 72, no. 6 (Dec 2005): 066619/1-23.
3. Lubensky, T. C., C. L. Kane, Xiaoming Mao, A. Souslov, and Kai Sun. “Phonons and Elasticity in Critically Coordinated Lattices.” Reports on progress in physics.

Physical Society (Great Britain) 78, no. 7 (2015-Jul 2015): 073901.

1. Mao, X. M., and T. C. Lubensky. ”Maxwell Lattices and Topological Mechanics. Annual Review of Condensed Matter Physics, Vol 9, edited by S. Sachdev and M. C. Marchetti. Annual Review of Condensed Matter Physics, 413-33, 2018.
2. Kane, C. L., and T. C. Lubensky. ”Topological Boundary Modes in Isostatic Lattices Nature Physics 10, no. 1 (Jan 2014): 39-45.
3. Stenull, O., C. L. Kane, and T. C. Lubensky. ”Topological Phonons and Weyl Lines in Three Dimensions.” Physical Review Letters 117, no. 6 (Aug 2016): 068001.
4. Stenull, O., C. L. Kane, and T. C. Lubensky. ”Topological Phonons and Weyl Lines in Three Dimensions.” Physical Review Letters 117, no. 6 (Aug 2016): 068001.

