Homework 3
289A Statistical mechanics of crystalline solids
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Fall 2015

Question 1: Determine the dynamical matrix for a triangular lattice assuming only nearest neighbor spring constants. As force constants, use your results from homework 2. If possible, leave the dynamical matrix in parametric form (i.e. in terms of the independent coefficients of the force constants).

Question 2: Determine the reciprocal lattice for a triangular lattice. Construct the Brillouin zone and trace out high symmetry directions in the Brillouin zone.

Question 3: Since the dynamical matrix has dimensions 2x2, you can come up with analytical expressions for its eigenvalues. The vibrational frequencies are the square root of these eigenvalues. Plot the dispersion curves along high symmetry directions for a particular set of numerical values for the force constants.

Question 4: Pick a non-zero k-point in the Brillouin zone (e.g. a high symmetry point) and on an ideal triangular grid, plot the displacement field corresponding to the different eigenvectors at that k-point.