- Problems **4.5, 5.1 and 5.3** from the textbook.

- And **this problem.** Consider vibrations in a monoatomic *two-dimensional* crystal of the size $L \times L$.

a) Show that the phonon density of states in the Debye approximation is

$$D(\omega) = A\omega$$

(per polarization). Find the constant A in terms of L and the sound velocity c.

b) Assuming there are N atoms in the crystal oscillating in 3 independent directions find the expression for the Debye frequency ω_D and the Debye temperature θ_D.

c) What is the temperature dependence of the phonon specific heat for $T \ll \theta_D$?