PROBLEMS

Lecture 4

1. Consider viscous flow of of the phonon gas and find condition when this flow is viscous. Show that thermoconductivity could be replaces by the second sound under these condition. Find temperature dependence of thermoconductivity and spead of the second sound.

2. Consider thermal transport in dielectric crystal with high impurity concentration at low temperatures. Find effective thermoconductivity equation.

3. Phonon spectrum in He^4 has a concave dispesion law:

$$\omega(q) = sq + \gamma q^3.$$

   Show that:

   (a) This dispersion law allows a decay of a phonon into two phonons.

   (b) Find rate of this process and angle between phonons in the final state

   (c) Write kinetic equation discribing phonon distributions in modulae and direction of phonon's wave vectors.

   (d) Find time evolution of a beam of phonons.