

Physics 540: Statistical Mechanics I

Read: LL 1-9

Special attention: LL 7,9

Problems to study: K.1 ex 2,3,4

“LL 1” means section 1 from Landau and Lifshitz book

“K.1 ex 2” means example 2 from section 1 of Kubo’s book.

Homework 1

Exercise 1

Calculate the phase space for N classical particles with mass m put in the $3d$ harmonic oscillator trap potential $V = \frac{1}{2}m\omega^2 r^2$ for energy E less than E_0 . Use it to calculate the entropy $S(E)$ and relation between the energy and temperature T .

Exercise 2

There is a system consisting of N independent particles. Each particle can have only one of the three energy levels $-\epsilon_0, 0, +\epsilon_0$. Find the thermodynamic weight W_M of a state with the total energy $E = M\epsilon_0$ ($M = -N, \dots, N$). Calculate the entropy of the system as a function of its energy. Find the relation between the temperature and the energy of the system. How does the energy of the system depend on the temperature in limits a) $T \ll \epsilon_0$, b) $T \gg \epsilon_0$.