

**Physics 5524**  
**Statistical Mechanics**  
**Problem Set 8**

Due: Wednesday, April 8 (in class)

8.1:

Assuming  $k_B T \gg \hbar \omega_c$ , calculate the leading correction to the chemical potential due to uniform magnetic field  $B$  in the degenerate limit of a non-relativistic charged Fermi gas in 3D, which contains  $N$  particles.

8.2:

Consider a dissociation reaction  $2A \leftrightarrow A_2$  occurring in a dilute gas phase. Model the atom  $A$  as a spinless point particle with mass  $m$  and the molecule  $A_2$  as a rigid rod, which can translate and rotate, of length  $b$ . Assume that the binding energy of the molecule is  $\epsilon_b$ . Calculate the equilibrium reaction constant at constant volume and temperature appearing in the law of mass action in the limits when the quantized rotational levels are frozen out and in the limit when very many of them are thermally populated.