

Physics 5524
Statistical Mechanics
Problem Set 7

Due: Wednesday, March 26 (in class)

7.1: Consider a 2D non-relativistic gas of non-interacting charge e Fermions moving in the xy -plane with dispersion $E(\mathbf{k}) = \frac{(\hbar\mathbf{k})^2}{2m}$. The fermions are subject to a uniform magnetic field \mathbf{B} perpendicular to the xy -plane. Assume that the chemical potential is fixed and that it is much larger than $\hbar\omega_c$.

- a) Calculate the grand canonical potential using the Poisson summation formula. Leave your answer in terms of the sum over the harmonics, without evaluating the sum explicitly.
- b) Find the non-oscillatory component of the constant area specific heat at low temperature.
- c) Find the expression for the lowest harmonic of the oscillatory component of the constant area specific heat. Plot its amplitude (*i.e.* the prefactor of the lowest harmonic cosine term) as a function of the dimensionless ratio $k_B T / \hbar\omega_c$