PHYS 7603 Feb 2

Distribution Functions

Start with $Z(T, V, \mu)$. Want to derive for Fermions

$\langle N \rangle = \sum_i \frac{1}{e^{\beta(\epsilon_i - \mu)}+1}$
two ways to go about this

- Harmonic Oscillator
- Box

Derivation online (Feb 2 Notes)
Same as Schroeder pp. 315 Eq [7.121] ???

logistics

- take a look on Canvas Discussions: *Degeneracy of Fermions*
- Jan 24 notes uploaded
- Quantum Ideal Gas notes are uploaded

Box

- Example Fermions
  - electrons in metals
  - 1/2 integer atom or molecule
  - neutrons in eutron stars

temperature is zero

$H = \sum_i^N \frac{\hat{p_i}^2}{2m} \to E = \sum_{\vec{k}} \epsilon_{\vec{k}}$ where i labels for a particle

single particle energies $\epsilon_{\vec{k}} = \frac{\hbar^2 k^2}{2m}$, $\psi_{\vec{k}} = \frac{1}{\sqrt{V}} e^{i\vec{k}\cdot\vec{r}}$

wavevector $\vec{k} = (k_x, k_y, k_z)$, momentum carried by wave is $\vec{p} = \hbar\vec{k}$

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Fuck this just read chapter 7.3

we talked about

- Fermi Energy (Schroeder pp 272-288) ϵ_F
- Average Energy per Particle $\frac{U(T=0)}{N} = \frac{3}{5}\epsilon_F$
  $$* Also probably covered chapter 7.3 section "small nonzero temperature"