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Problems set # 13 **Physics 303** December 9, 2014

1. Derive the density of states $\rho(\varepsilon)$ as a function of ε for a free electron gas in one-dimension. (Assume periodic boundary conditions or confine the linear chain to some length L). Then calculate the Fermi energy ε_F at zero temperature for an N electron system.

2. Calculate the average energy per particle, ε, for a Fermi gas a $T = 0$, given that ε_F is the Fermi energy. Consider two cases separately, non-relativistic and relativistic.

3. For a system of electrons, assumed non-interacting, show that the probability of finding an electron in a state with energy Δ above the chemical potential μ is the same as the probability of finding an electron absent from a state with energy Δ below μ at any given temperature T.