

PHYSICS 140A : STATISTICAL PHYSICS
HW ASSIGNMENT #8

(1) For the Dieterici equation of state,

$$p(V - Nb) = Nk_B T e^{-Na/Vk_B T},$$

find the virial coefficients $B_2(T)$ and $B_3(T)$.

(2) Consider a gas of particles with dispersion $\varepsilon(\mathbf{k}) = \varepsilon_0 |\mathbf{k}\ell|^{5/2}$, where ε_0 is an energy scale and ℓ is a length scale.

- (a) Find the density of states $g(\varepsilon)$ in $d = 2$ and $d = 3$ dimensions.
- (b) Find the virial coefficients $B_2(T)$ and $B_3(T)$ in $d = 2$ and $d = 3$ dimensions.
- (c) Find the heat capacity $C_V(T)$ in $d = 3$ dimensions for photon statistics.

(3) At atmospheric pressure, what would the temperature T have to be in order that the electromagnetic energy density should be identical to the energy density of a monatomic ideal gas?

(4) Find the internal energy and heat capacity for a two-dimensional crystalline insulator, according to the Debye model.