

5. Compute the pressure of a photon gas constrained in a two-dimensional box of size $A = L^2$ at temperature T . Recall that the Hamiltonian $H_i = \hbar\omega_i$ for photons. Also $\mu = 0$, because the photon number is not conserved.

a) Calculate the grand canonical partition function Z_G .

b) Recall that the grand potential $\Phi_G = -pV = k_B T \ln Z_G$. Calculate the pressure.

Hint: $\int_0^\infty \frac{x^2}{e^x - 1} dx = \zeta(3)$ (Riemann zeta function).