Chapter 10

Identical Particles

7. Bose Einstein Gas at Low Temperature

As temperature decreases, the particles start to reach the ground state (let say $E = 0$) . Let say N_o be the particles at in the ground state and N_e the no of particle in excited state.

So $N = N_o + N_e$

$$N_e = 2g\pi V\left(\frac{2mk_BT}{h^2}\right)^{3/2}\int_0^\infty \frac{u^{1/2}}{Ae^u - 1}du = \frac{gV}{\lambda^3}g_{3/2}(A)$$

$$U = 2g\pi Vk_BT\left(\frac{2mk_BT}{h^2}\right)^{3/2}\int_0^\infty \frac{u^{3/2}}{Ae^u - 1}du = \frac{3}{2}k_BT_B\frac{gV}{\lambda^3}g_{5/2}(A)$$

were $\lambda = \left(\frac{h^2}{2\pi mk_BT}\right)^{1/2}$ is the thermal wave length and $g_n(A) = \frac{1}{\Gamma(n)}\int_0^\infty \frac{u^{n-1}}{Ae^u - 1}du$

Here, $\Gamma(n)$ is a gamma function.