B.Sc. (Hons) Physics,
Class: VI Sem, Sec.-A
Paper: Statistical Mechanics
Teacher: Dr. Arpita Vajpayee

As we have finished "Quantum Theory of Radiation", now we shall start the next unit i.e. "Bose-Einstein Statistics". Following topics will be discussed in this week:

1) B-E distribution law
2) Thermodynamic functions of a strongly degenerate Bose gas
3) Bose Einstein Condensation
4) Properties of liquid helium (qualitative description)

Please read the above mentioned topics.

I am available for discussion on the class WhatsApp group at the time of our scheduled class according to the timetable. You can post your doubts/queries on this group. E-books have already been shared on the class WhatsApp group.

Numerical problems:

Q-1) Seven Bosons are arranged in two compartments. The first compartment has 8 cells and the second compartment has 9 cells of equal size. What is the total number of microstates corresponding to macrostate (3,4)?

Q-2) Three particles are to be distributed in four energy levels a, b, c and d. Calculate all possible ways of this distribution when particles are (i) Bosons (ii) Classical particles.

Q-3) Consider a system of N Bosons occupying volume V. At high enough temperature T, the system behaves like a classical ideal gas, such that the pressure of the system is proportional to T. If the temperature is such that the system is strongly degenerate, given that a certain fraction of atoms is in the ground state (and does not contribute to pressure), what power of temperature do you expect the pressure to be proportionate to? Explain.

Q-4) Calculate the average number of photons in an enclosure of 22.4 litre at 273K.

Please send your solutions by e-mail.

Assignment problem:

A-1) Consider a system of N weakly interacting non-relativistic Bosons cofined to a two-dimensional region of area A. Repeating the standard analysis in three dimensions, test whether Bose-Einstein condensation occurs in this system at a non-zero temperature.