Answer on Question #66337, Physics / Mechanics | Relativity

a) Explain the following;
(1) Bose-Einstein condensation.
(2) Gibbs paradox.
(b) Derive planks law of blackbody radiation using Bose-Einstein statics. Using this law ,obtain
(i) Rayleigh- Jean law &
(ii) we install law.

Answer:

a)

Bose-Einstein condensation

A Bose-Einstein condensate is a group of atoms cooled to within a hair of absolute zero. When they reach that temperature the atoms are hardly moving relative to each other; they have almost no free energy to do so. At that point, the atoms begin to clump together, and enter the same energy states. They become identical, from a physical point of view, and the whole group starts behaving as though it were a single atom.

Gibbs paradox

When different ideal gases are mixed, the entropy increases by kNln2. Since this quantity does not depend on the kind of gases, it, he concludes, the same value should also be obtained for mixing identical gases. However, when mixing the same gases, nothing happens, in particular, there should be no age.

b) Photons are bosons and obey Bose statistics - Einstein. For these statistics, the average number of particles with this energy is equal to

$$n(\varepsilon) = 1/(e^{\varepsilon/\theta} - 1)$$

$$u(\varepsilon)\, d\varepsilon = \varepsilon n(\varepsilon)\, dN\, (\varepsilon)$$

The number of oscillators (per unit volume) of the electromagnetic field energy with this infinitesimal in the neighborhood

$$dN = \varepsilon^2\, d\varepsilon / \pi^2\, c^3\, h^3$$

Substituting the formula for the average number of bosons with this energy in this formula, we get the formula for Planck.

At low frequencies, where $\varepsilon h/kT << 1$ can be expanded through exhibitor $\varepsilon h/kT$

As a result, we find that

$$\exp(\varepsilon h/kT) - 1 = 1 + \varepsilon h/kT - 1 = \varepsilon h/kT$$

Then obtain the formula Rayleigh-Jeans

$$u(w, T) = kT\, w^2 / \pi^2\, c^3$$

$$f(w, T) = kT\, w^2 / 4\, \pi^2\, c^2$$

link:

https://en.wikipedia.org/wiki/Planck's_law

http://www.livescience.com/54667-bose-einstein-condensate.html