

NAME(S):

Fourth Matlab Exercise for Physics 622

Winter quarter 2008

This time we're going to study the Fermi-Dirac and Bose-Einstein distributions and the relation between particle number, N , and chemical potential, μ .

$$f(E) = \frac{1}{e^{\beta(E-\mu)} \pm 1}.$$

Plot this for various values of β and μ to gain a feeling for its shape and try to understand the differences between the distributions in terms of the difference in statistics.

To get a feel for the relation between particle number and chemical potential, we will use the ideal gas again and results from the book:

$$N = \int_0^\infty \frac{g(E)dE}{e^{\beta(E-\mu)} \pm 1} = \frac{(2S+1)V}{\lambda_{th}^3} \left[\mp Li_{3/2}(\mp e^{\beta\mu}) \right]$$

$Li_{3/2}(z)$ is a polylogarithm. Use Google and Matlab help to see if you can plot this function. There is a Matlab code to compute a related function, the dilogarithm, on the course web site. If you can plot this function, next study N as a function of μ .