4. Moments of the Maxwell distribution function:

The Maxwell distribution function is given by

$$f(\mathbf{v}) = n_0 \left(\frac{m}{2\pi k_B T}\right)^{3/2} \exp\left(-\frac{mv^2}{2k_B T}\right)$$

By integrating over velocity space compute the particle number density n, the kinetic energy density $\frac{m}{2}\langle v^2\rangle$, and the integral used to derive the collision frequency $\langle v^3\rangle$, where the brackets indicate averages determined by the velocity space integration.

Help: It is useful to represent the velocity in the integration in spherical coordinates.

5. Plasma properties:

Consider an ordinary fluid with a continuity equation $\partial n/\partial t + \nabla \cdot (\mathbf{v}n) = 0$. The number of particles in an arbitrary volume is $N = \int_V n d^3 r$. Show that the number of particles changes only due to particle flux trough the surface of the volume V.

6. Lorentz equation of motion

A particle with the mass m and the electric charge e is moving in homogeneous magnetic and electric fields: $\mathbf{B} = B\mathbf{e}_z$ and $\mathbf{E} = E\mathbf{e}_y$. Determine a solution of the equations of motion for the initial conditions $\mathbf{r}\,(t=0) = 0$ and $\mathbf{v}\,(t=0) = v_0\mathbf{e}_x$. For what value of v_0 is the gyro-velocity 0?

Please turn in the solutions to the homework on Friday, 3/23/12