(AST 462) Problem Set 1, Due Feb 4

1. Derive the plasma frequency (Read Shu or Choudhuri on this.) and discuss its relationship to the magnetohydrodynamic (MHD) approximation of plasma physics.

2.

a) Using the definition of $n = \int f d^3u$, and the thermodynamic definition of entropy for an ideal monatomic gas, show that the collisional Boltzmann equation derived in class demonstrates that entropy increases. (Read about Boltzmann H-Theorem in Choudhuri)

b) Explain whether the result of (a) is expected or unexpected given that we considered the collisions to be elastic, and thus each are reversible Hamiltonian systems. Explain the apparent paradox how it can be resolved.

3. Derive equation 20 of the notes. (An exercise in basic moment integration and the formal averaging process.)