

Homework 12  
Due December 4, 2009

272:

1.- In the interstellar space in our Galaxy the magnetic field is believed to be generally of the order of magnitude of  $10^{-6}$  Gauss. The matter in this space is typically hydrogen atoms, about one per cubic centimeter, with thermal velocities of the order of 1000 m/s. How does the amount of energy stored in the magnetic field, in any given volume, compare with that stored as kinetic energy of matter?

272H (the previous problem and the following):

2.- The magnetic field inside a discharging capacitor (cylindrical symmetry) can in principle be calculated by summing the contributions from all elements of conduction current. That might be a long job. If we can assume symmetry about its axis, it is very much easier to find the field  $B$  at a point by using the integral form of the generalized Law of Ampere, including the displacement current, applied to a circular path through the point  $P$ . We need only the total current enclosed by this path. Use this to find the field at  $P$ , which is midway ( $2d=s$ ) between the capacitor plates and a distance  $r$  from the axis of symmetry.

