Electrodynamics I: Assignment 9
Due no later than December 7 at 4:00 pm Pacific time.
On-line submission instructions:

1. **Scan your solutions as a single PDF file**
2. **Name your file HW9-*lastname.*pdf**
3. **Attach your file to an email…**
4. **… with subject line HW9-*lastname* …**
5. **… and send the email to ljrosenberg@phys.washington.edu**

1. Show that the monopole term in the vector potential 1/r expansion (Jackson eqn 5.51) vanishes for stationary, spatially-bounded currents.

2. A capacitor consisting of two parallel circular plates of radius *a* with a small gap *d*. The centers of the plates are connected by a straight, thin wire of resistance *R*. Charges +*Q* and –*Q* are then placed on the plates and a current begins to flow through the plates and wire. The gap is small so ignore fringe fields, and the inductance of the system is small, but *R* is large so it's quasi-static (ignore the inductance of the system). The charge density on the plates is uniform but obviously decreases in time.
a. Find the charge on the plates as the current flows. And find the current flowing through the wire. (This comes from *RC* circuit theory.)
b. Find the magnetic field between the plates as the current flows.
c. Something seems amiss: There are axial currents flowing through the wire and non-axial currents flowing along the plates. Why, therefore, is the magnetic field in (b) solely in the azimuthal direction?

3. Suppose a system has non-stationary currents **J** arising at some time, where the time variation in **J** is so slow that magnetic effects are small. What's the characteristic time for currents to reestablish themselves as stationary currents, in terms of the conductivity and dielectric constant of the media? This is called the "relaxation time" of the system.

4. A spherical capacitor consists of concentric conducting spheres of inner and outer radii R_i and R_o. The space between the spheres contains a weakly-conducting dielectric of conductivity σ. Charge is placed on the spheres and current therefore flows from one conductor to the other. Use the Lorentz condition (Jackson eqn 6.14) to find the magnetic field between the conductors.