Electrodynamics I: Assignment 4
Due no later than November 2 at 4:00 pm Pacific time.
On-line submission procedure:

1. **Scan your solutions as a single PDF file**
2. **Name your file HW4-*lastname.*pdf**
3. **Attach your file to an email…**
4. **… with subject line HW4-*lastname* …**
5. **… and send the email to ljrosenberg@phys.washington.edu**

1. The potential from a circular ring of charge was done in lecture and is outlined in Jackson section 3.3. Now place that ring concentric with and completely within a grounded conducting spherical shell. Find the potential inside the shell. You could, I suppose, follow the Green's function path of Jackson section 3.10, But there's a simpler path on considering the superposition of the ring's potential and the potential due to the shell's surface charge vanishes on the sphere.

2. Consider a cone of half-angle θ_0. (θ_0 is the angle between the cone axis inside the cone and the cone surface). The cone surface has a fixed potential $\Phi(r)|_s = Ar^3$ with A a constant and r the distance from the cone apex. Find the potential inside the cone.

3. Variant of Jackson problem 3.9. A right-circular cylindrical shell of radius R has its axis coincident with the z-axis and its ends at z=0 and z=L. The potential of the end faces is zero and the potential of the cylindrical surface is a constant Φ_0. Find the electrostatic potential inside the cylinder. You'll probably want to choose the periodic coordinate in the z-direction, meaning that separation constant has the opposite-from-usual sign, and the Bessel functions become modified Bessel functions (Jackson equations 3.100-101). You might exploit the great simplification afforded by the extra condition that the

electrostatic potential on the cylindrical surface is constant instead of being an arbitrary function of ϕ and z.

4. Spherical harmonics. Consider a conductor consisting of a spherical shell. But the shell has holes; some parts of the shell are removed and brought to infinity. The remaining conducting parts of the shell are kept at potential Φ_0. For every point on the remaining conducting parts, find the difference in surface charge between the inside and outside surfaces. You might be surprised by the answer.