PHYS 436 **Bonus Problems 2** **April 19, 2017**

Each problem is worth five points. Show all your work, written neatly, with your answer clearly indicated.

1. The z-component of the electric field in a rectangular wave guide is of the form

$$E_z = E_0 \sin\left(\frac{\pi x}{a}\right)\sin\left(\frac{2\pi y}{b}\right)e^{i\omega t - ikz}$$

a. Find the ratio of the maximum charge density on the plane x = 0 to the maximum charge density on the plane y = 0.

b. Find the ratio of the maximum surface current on the x = 0 plane to the maximum surface current on the y = 0 plane.

c. Assuming there is non-zero pressure on the waveguide walls, find the ratio of the maximum time-averaged pressure on the x = 0 plane to the maximum time-averaged pressure on the y = 0 plane.

d. Does the pressure on the wave guide walls tend to push the walls together or pull the walls apart?

2. The radiation emitted by a rotating electric dipole can be analyzed as two linear dipoles, oscillating along *x* and *y* with equal amplitudes, *p*0, and 90° phase difference.

a. What radiation pattern (intensity and polarization as a function of propagation direction) is obtained when the phase difference is 180°? You should choose a coordinate system that makes your description as simple as possible.

b. Is there a phase difference for which no radiation is emitted? If so, what is it?