Homework 7, due 4-30

1. Consider a charge Q moving with angular velocity ω along a circle of radius r. Calculate the radiation damping coefficient γ_r defined by $-dW/dt = \gamma_r W$ where W is the energy of the moving charge. Perform the calculation in dipole approximation

   (a) Using the result for the retarded vector potential show that the electric dipole field is given by

   $$\vec{H} = \frac{1}{rc}\ddot{\vec{p}}(t - r/c) \times \hat{r}, \qquad \vec{E} = \vec{H} \times \hat{r}.$$

   (b) Use the time averaged Poynting flux to determine the energy loss. Compare to the kinetic energy of the rotor and calculate γ_r.

2. Consider a time-dependent charge distribution $\rho(r, t)$. Using the retarded potential Φ show that there is no electric monopole radiation (This problem really is very simple!).

3. Consider a thin foil of a material with index of refraction n between two media with index of refraction n_1 and n_2. A plane EM wave of frequency ω is incident on the interface. The wave vector $\vec{k}$ makes a right angle with the foil. For what value of n will there be perfect transmission through the interface, i.e. the intensity of the reflected wave is zero?