PHYS 100C, Homework #4, Due Thursday, May 6th, 8AM (in class)

Problem 10.13 A particle of charge q moves in a circle of radius a at constant angular velocity ω. (Assume that the circle lies in the xy plane, centered at the origin, and at time $t = 0$ the charge is at $(a, 0)$, on the positive x axis.) Find the Liénard-Wiechert potentials for points on the z axis.

Problem 10.17 Derive Eq. 10.63. First show that

$$\frac{\partial t_r}{\partial t} = \frac{\mathscr{r} c}{\boldsymbol{\mathscr{r}} \cdot \mathbf{u}}.$$

Problem 10.20 For the configuration in Prob. 10.13, find the electric and magnetic fields at the center. From your formula for **B**, determine the magnetic field at the center of a circular loop carrying a steady current I, and compare your answer with the result of Ex. 5.6

Problem 10.21 Suppose you take a plastic ring of radius a and glue charge on it, so that the line charge density is $\lambda_0 |\sin(\theta/2)|$. Then you spin the loop about its axis at an angular velocity ω. Find the (exact) scalar and vector potentials at the center of the ring. [*Answer:* $\mathbf{A} = (\mu_0 \lambda_0 \omega a / 3\pi) \left\{\sin[\omega(t - a/c)]\,\hat{\mathbf{x}} - \cos[\omega(t - a/c)]\,\hat{\mathbf{y}}\right\}$]

Problem 10.25 A particle of charge q is traveling at constant speed v along the x axis. Calculate the total power passing through the plane $x = a$, at the moment the particle itself is at the origin. [*Answer:* $q^2 v / 32\pi\epsilon_0 a^2$]

Problem 11.1 Check that the retarded potentials of an oscillating dipole (Eqs. 11.12 and 11.17) satisfy the Lorentz gauge condition. Do *not* use approximation 3.