PHYS-100C, Homework #5, due Monday, May 10th.

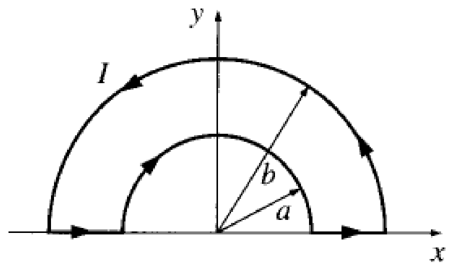

Figure 10.5

Problem 10.10 A piece of wire bent into a loop, as shown in Fig. 10.5, carries a current that increases linearly with time:

$$I(t) = kt.$$

Calculate the retarded vector potential **A** at the center. Find the electric field at the center. Why does this (neutral) wire produce an *electric* field? (Why can't you determine the *magnetic* field from this expression for **A**?)

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 [redacted] show that

$$\frac{\partial t_r}{\partial t} = \frac{\mathscr{r} c}{\boldsymbol{\mathscr{r}} \cdot \mathbf{u}}. \qquad (10.71)$$

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:* $\mathbf{A} = (\mu_0 \lambda_0 \omega a / 3\pi)\left\{\sin[\omega(t - a/c)]\,\hat{\mathbf{x}} - \cos[\omega(t - a/c)]\,\hat{\mathbf{y}}\right\}$]