Physics 513, Autumn Quarter 2017
Electrodynamics: Homework Assignment 8
Due Nov. 22, 5:00pm, under the instructor's door room C503.

Due to the Thanksgiving holiday, this is a short problem set. Note the unusual due date, due time and turn-in location.

1. The last homework had a question involving a linear anisotropic dielectric. We asserted in class that such dielectric constants are symmetric tensors. Why is this so?

2. A capacitor is constructed from two circular plates of radius a with a small gap d. the centers of the plates are connected by a straight thin wire of resistance R. Charges $+Q$ and $-Q$ are then placed on the plates and a current begins to flow through the plates and wire. The gap is small so ignore fringe fields, and the inductance of the system is small but R is large so it is quasi-static (ignore the inductance of the system). The charge density on the plates is uniform but obviously decreases in time.
a. Find the charge on the plates as the current flows.) And find the current flowing through the wire. (This comes from RC circuit theory.)
b. Find the magnetic field between the plates as the current flows.
c. Something seems amiss: There are axial currents flowing through the wire and non-axial currents flowing through the plates. Why, therefore, is the magnetic field in (b) solely in the azimuthal direction?

3. Suppose a system has non-stationary currents **J** arising at some time, where the variation in **J** is so slow that magnetic effects are small. What is the characteristic time for stationary currents to reestablish themselves in terms of the conductivity and dielectric constant of the media? This is called the "relaxation time" of the system.

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