Chapter 2 is the first of what will be five chapters on the kinematics of electromagnetism. This study of electro- and magneto- statics will comprise about half the material of the seminar. And we start with the most familiar electric field. “The Problem” that we are faced with (or, rather, electrodynamics is faced with) is stated in the first paragraph: Given a set of charges, find the electromagnetic fields. Many of the techniques introduced in this and later chapters help us with this problem.

This week will be the “problem solution” week. The day after seminar (Friday 10 Sept. for the Thurs section, Tuesday 14 Sept. for the Monday section) hand in solutions for comments. While there is wide leeway on the way to write up problems, at a minimum the solutions should satisfy the following: The write up cannot take much time (otherwise there is no hope in continuing this the rest of the semester); they should contain a statement of the problem and ought to be written out in full with explanations of the main logical steps. Keep your audience, you in three months, in mind.

Problems of note:

- 2.1 a superposition problem
- 2.2 a nice problem to see how to work with script **r**. Don’t forget the vector nature. What is the object in part (b) called? (The problem is nice because of the limits - a very, very useful technique.)
- 2.6 integration and limits
- 2.10 look for the easy way (there’s a trick)
- 2.11 Gauss’s law and spherical symmtery: This begins a series of important and basic (in the sense of fundamental) problems. You can also try the “alternate track” of 2.8, 2.12, 2.18, 2.21.
- 2.13 Gauss’s law and cylindrical symmetry
- 2.15 spherical symmetry, a bit more complicated
- 2.20 Use curls to weed out impossible electric fields. Choose your path so the integration is as easy as possible.
- 2.21 finding potential via integration
- 2.25 find the potential from the electric field
- 2.31 the work required to assemble charges
- 2.32 several ways of finding energy (if you like, try the fourth way in problem 2.33)
- 2.35 finding the induced charges
- 2.37 electrostatic pressure of a capacitor
- 2.49 the electrostatics of a “new force” (long and *optional*)
- 2.50 Which three inputs determine the field?
- Make up and solve your own problem

Notes on text:

- page 58 Griffiths very nicely states the goal: Given the sources, electrodynamics determines the fields and forces.
- page 66 If (1) “Field lines begin on positive charges and end on negative ones” and (2) Positive and negative charges “occur in exactly equal amounts,

to fantastic precision, ... " then how is it possible to have field lines extending to infinity?

- page 67 "infinite"?!?
- pages 68-9 You, of course, did this derivation the "other way." Note that the physics you have to invoke is different depending on the direction of your derivation, e.g. the total charge was already defined in Griffiths derivation while the density was already defined in yours.
- pages 70-76 absolutely core material
- pages 79-81 a very nice set of comments on the potential
- pages 88-90 boundary conditions!
- page 90 This section on energy is worth reading once and then reading again as he leaves some important comments to the end. Why does that surface term drop out?

Presentations:

- The characters and their relations: Griffiths has introduced a number of "new" objects $\mathbf{E}, V, \rho$ ... Describe in physical terms what these things are (be conservative in these definitions) then describe the mathematical relations.
- Gaussian surfaces: Use the arguement in the three situations including problems 2.11 and 2.13.
- Define electrostatic energy. Include careful discussions of the "inconsistency" between equations 2.45 and 2.42 and on where the energy is stored. Why does that surface term drop out? Consider presenting 2.34.
- Discuss conductors - properties and induced charges. Read the articles in the "By the way" footnote on page 98.
- Discuss boundary conditions of the $\mathbf{E}$ and V and the section 2.5.3