# Waves and Fields (PHYS 195): Week 11

Spring 2009 v1.0

**Intro:**

*This week we will see that wiggles of the electro-magnetic field are waves! While the full derivation of this phenomenon will have to wait for Phys 295, we'll study the dynamics of "one dimensional" magnetic and electric fields. The rest of the semester we'll study wave-like properties of light including intensity, interference, diffraction, and polarization.*

**Reading:**

- Wednesday: Motor theory (HRW 28.9), solenoids (posted notes), and forces between wires.
- Friday: HRW 30.2 "From Faraday to Light" (We will skip the rest of Chapter 30, and Chapters 31-32.)
- Monday: HRW 33

**Due Monday, April 20**

**Physics Topics:**

- Dynamics of E and B fields - qualitatively
- Ray tracing
- Mirrors
- Images
- Snell's law

**Problems:**

(1) Four 90 Ω light bulbs are connected in series. What is the total resistance? What would be the resistance if they were connected in parallel? After generalizing your results to $n$ bulbs, each with the same resistance $R$, consider a string of party lights. If one bulb burns out, what happens in each case (series and parallel)? On the basis of this would you recommend selling strings of lights in series or parallel?
(2) HRW 28.28
(3) HRW 28.39
(4) HRW 28.49
(5) HRW 28.53
(6) HRW 28.54
(7) HRW 29.5
(8) Using the expression we derived in class on Wednesday, April 15, for the magnetic field of a solenoid on the axis of symmetry, find the expression for the magnetic field as a function of $z$ far away from the solenoid, when $z \gg R$.

**Lab:**

Snell's Law

**A look ahead...**

Next week we study mirrors and lenses