# Physics 507
# EM II: Classical Electrodynamics
# Fall 2007

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**Class:** Meyer 363, MWF 9:00-9:50 **plus 1 hour TBA**
**Office hours:** TBA

**Summary:**
This is a course in electrodynamics in which you will learn how the EM fields propagate, including how they radiate and interact with matter. Topics include using the Maxwell equations to describe propagation of free and guided waves, polarization, retarded potentials and radiation theory, scattering and dispersion theory, interference, and diffraction theory. We will discuss many applications, including antennas, diffraction gratings, resonators and guided waves. This course concentrates primarily on electrodyanamics rather than statics – many of the methods for solving the static equations will be discussed as examples in the mathematical physics class (PHGN511).

This class is combined with the undergraduate, senior-level advanced EM course, but we will cover several advanced topics (see below) by meeting for an extra hour weekly. You will be expected to do the same homeworks as the other students, plus an additional problem or two per assignments. The midterms will be the same, but the final will be different for those taking the graduate version.

I will provide handouts from various sources to supplement the reading from Heald.

Undergraduates are welcome to take the graduate version – it is sometimes recommended if you are going into the combined BS/MS program in Applied Physics. Students in 462 are welcome to come to the additional lectures if there are particular topics of interest.

**507 Extra topics**
- Multipole expansions
- Wave propagation in anisotropic media: tensor dielectric functions
- Introduction to Relativistic EM
- More rigorous approach to retarded fields
- Use of vector potential formulation to calculate radiating fields
- Bremsstrahlung and Cerenkov radiation
- Causality and the Kramers-Kronig dispersion relations
- Transfer equations for multilayer systems
- Antenna arrays
- Introduction to nonlinear optics
- Green's functions and diffraction
- Fresnel diffraction, transition to geometrical optics
- Variational approach to wave propagation