Physics 709 Syllabus

Physics 709 is the third part of a three-quarter sequence intended for first-year physics graduate students. The principal text is J. D. Jackson, *Classical Electrodynamics*, second edition, (Wiley, New York, 1975), supplemented by my course notes. They will be available on the web www.physics.uc.edu/∼jarrell.

Physics 709 has as its primary topic electromagnetic radiation and the related phenomena of scattering and diffraction. First, wave guides will be discussed (Chaps. 8,9,13, and 14). Then radiation is treated using elementary techniques involving the Green's function for the Helmholtz wave equation. An elementary multipole expansion is developed. Scattering and scalar diffraction are then studied with various geometries. Next, the various mechanisms, e. g., Cherenkov radiation, by which a charged particle can lose energy when traversing a material are explored. There follows an investigation of radiation by accelerated charged particles with emphasis on highly relativistic particles and on synchrotron radiation in particular. Finally, we will discuss radiation reaction and self-field effects.

Grading

The grade will be based upon a presentation and the homework. Approximately one homework set will accompany each set of notes. The homework will be due one week after the corresponding note set is completed. **No late homeworks will be accepted**. The presentation/talk and the homework will each account for 1/2 of the grade.

As indicated above, instead of taking a final exam you make a presentation during final weeks of the course composed of a half-hour talk and an accompanying written set of notes of six pages or less. The presentations must be relevant to what you have learned (or are learning) in this three-quarter course, must be relevant to the research presently being done at UC, and the presentation of the talk will be limited to one half hour of class time. Possible topics include (subject to change):

1. Terrahertz reflectivity experiments using strip-line cavities.
2. Optical waveguides in semiconductors.
3. Poisson's equation in a modulated doped quantum well.
4. Alternative gradient focusing in synchrotrons.
5. Cherenkov and synchrotron radiation as a particle detector.
6. Synchrotrons as high intensity light sources (LANCE) and associated experiments.
7. Free-electron laser (especially tuning and mode selection).
8. Dispersion (or even localization) of radiation in photonic crystals.

You may choose one of these, or much better **come up with your own topic**. The advantage of presenting a talk is that you are in more control of your final grade, in that you pick the topic and decide how much time to devote to preparation. You must decide on the topic of your presentation before the end of the 6th week of the course (please send me an email with the topic title and a short description).

Important Times, Dates, and Places

Class Time and Location	MWF 1:00–1:50, Rm. 312b
Last Day to Withdraw	November 16
Veteran's Day	Monday, November 12
Thanksgiving	Thurs. & Fri., Nov. 22 & 23
Last Day of Classes	December 2
Exam Week	December 3 - 9