Syllabus
University of Maryland College Park
Physics 411 -- Intermediate Electromagnetics
Spring 2018

Professor: Daniel P. Lathrop
http://complex.umd.edu Office: 3319 A.V. Williams
Phone: 301-405-1594
E-mail: talk to me after lecture please, email is not effective given the volume.

Graduate Teaching Assistant: Landry Horimbere, use elms to email.
Landry is the main point of contact for the course by elms mail.
Undergraduate Teaching Assistant: TBD, use elms to contact by email.

Location and times: Monday 10:00am-10:50am KEB 1200 (Kim Engineering Building)
Tuesday-Thursday. 9:30am-10:45am PHY 1201 (Toll Physics Building)

Electromagnetics is likely the most useful branch of physics in the everyday practice of a working physicist. It allows an understanding, debugging, and inventing of some of the most useful things around us: the internet, cars, the power grid, lights, modern cooking, radar, the list is endless of what can be invented using EM. This course will cover the upper division theoretical approach to electromagnetic forces and fields, while emphasizing the usefulness of that knowledge in technology and in understanding nature. If at any point in the course you do not know how what we are discussing is useful and important, please ask! Moreover, if at any point you have any question at all, please ask! Lecture participation is graded via an in class sign in sheet.

Grading:

Homework	30%
Two in class midterms	15%+15%
Project	15%
Lecture participation	10%
Final	15%

Please work in groups to do the homework, and discuss strategies on each problem. The strategy of simply verbatim copying other's homework both violates UMCP honor code, and also ensures you cannot possibly pass the midterms and final. Ethics is the bedrock of trust. Trust is the bedrock of your future performance in teams who will rely on you.
Homework: Will be assigned on elms and due in class.
Late homework: Late homework turned after the due date is worth 50% of the points earned. After the solutions are distributed for that homework (usually one week later) late homework is not accepted.

Book: Griffiths Introduction to Electrodynamics 4th Edition, Cambridge University Press (international versions have errors and missing chapters, be aware).

Project:
Projects can be theoretical (analytical), computational, or experimental. The most important thing is to choose a project that you have interest in. Of course the project subject must be relevant to electrodynamics, and related either to things covered in lecture or in the the text. Projects subjects must be approved by Dr. Lathrop.

Project proposals are due at the second midterm April 5. The proposal is a single page, but must include: tentative project title, a one paragraph description of the project activity, desired project results, and a list of needed resources if any. The proposal counts for 10% of the project grade.

The final product will be a five page typed report due the last day of class May 10. Formatted as a research paper, it will include a title, abstract, introduction/background, project description, results, conclusion and references. The project will be turned in on elms. Figures and bibliography can be included in the 5 pages, and the text can be single or 1.5 line spaced with font size set at 12 point. If the project is experimental and has safety hazards they should be detailed in the proposal, together with safety mitigation plans. Those need to be approved by Dr. Lathrop prior to any experiments.

Random project suggestions (but come up with your own if you please):

A study of chaotic electron/ion orbits in a stellarator.
Construction of a working metal detector.
Reverse engineer cavity modes for a microwave oven.
Study of CD damage in a microwave oven (I suggest theoretical).
Study of discharging half-grapes in a microwave oven (could be theoretical, numerical or experimental).
Study of the shapes and patterns in a ferrofluid near a strong ferromagnet.
A study of plasma globe dynamics.
Construction of a B-dot lightning detector.
Construction of a hand-held optical fluorescence detector.
A theoretical comparison of surface/ionosphere resonance modes between the different planets.
A numerical model of large currents in the power grid due to geomagnetic storms.
Numerical study of the propagation of light in a nonlinear medium.
A design study of solar storm shielding for interstellar travel.
A design study of an electromagnetic cannon.
A design study for a magnetic field camera.

Tentative Schedule:

Week	Dates	Main Topics	Ch. in Griffiths
1	Jan. 25	Vector analysis and overview	Ch. 1
2	Jan. 29 - Feb. 1	Electric field	Ch. 2
3	Feb. 5-8	Electric field	Ch. 2
4	Feb. 12-15	Got any PDEs? (techniques)	Ch. 3
5	Feb. 19-22	Electric fields in matter	Ch. 4
6	Feb. 26-Mar. 1	Magnetic field	Ch. 5
7	Mar. 5	First Midterm	Sleep well. You will do well if you have done all the homework and attended all the lectures.
7	Mar. 6-8	Magnetic fields	Ch. 5
8	Mar. 12-15	Magnetic fields in matter	Ch. 6
9	Mar. 26-29	Faraday Induction	Ch. 7
10	Apr. 2-3	The flip side of induction	Ch. 8
11	Apr. 5	Second Midterm Project proposals due	Sleep well. You will do well if you have done all the homework and attended all the lectures.
11	Apr. 9-12	EM waves	Ch. 9
12	Apr. 16-19	EM waves	Ch. 9
13	Apr. 23-26	The Energy perspective	Ch. 10.1, 11
14	Apr. 30-May. 3	Radiation and antennas	Ch. 11
15	May. 7-10	Special relativity	Ch. 12
Final	May. 14 8-10am	Think calm thoughts	Sleep well, trust me me here, you will do well if you have done all the homework and attended all the lectures.