

645. Graduate Partial Differential Equations II *Spring 2014 Syllabus*

Professor: Robert Strain (strain at math.upenn.edu)

Course Web Page: <http://www.math.upenn.edu/~strain/13ma644/>

Class schedule: MW @ 12:00 - 1:30PM in DRL 4C8.

First class, last class: January 15, April 28.

Course description: This course will look at the basic properties of fundamental non-linear partial differential equations from mathematical physics. Our goal will be to study a variety of methods for proving existence, uniqueness, and further important properties of solutions to a few representative examples of popular equations. We will look at a few famous proofs of these types of results in partial differential equations. All details will be proved along the way. The philosophy of the course is to teach the main techniques of partial differential equations in the context of understanding deep theorems. The only prerequisite is Math 644 (or its equivalent).

A semi-ambitious list of topics to be covered (subject to change):

- The Vlasov-Poisson equation from Plasma Physics. (1st topic)
- Fluid dynamical models such as the Navier-Stokes equations and the Euler Equations.
- Contour Dynamics Equations as in Vortex Patches, the surface quasi-geostrophic equation, and the Muskat problem.
- The Boltzmann equation and Kinetic theory.

Homework: Regularly, posted on the course website within Canvas. Collaboration between students is encouraged, but you must write your own solutions, understand them and give credit to your collaborators. (To be precise, put a list of the students with whom you collaborated on your homework.) *Late homework will not be accepted.*

Your lowest homework score will be dropped.

Grading: Based upon homework and class participation.

Textbook: References will be provided throughout the course both in class and on Canvas.