PDE II: Syllabus

Structure

- The meetings will be online at the scheduled time, on Zoom. You should have access to the Canvas site, though which there will be a link to the Zoom meetings.
- I encourage you to have your camera on, but you don't have to. You should have access to a microphone at least, though.
- I will give out some problems occasionally for you to try. You do not need to submit solutions, but you can discuss them with me.
- Office hours are by arrangement. Just send me an email.
- There will be a presentation towards the end of class. Your grade will be based on that.

Goals

Here is what this course will attempt to accomplish:

- Discuss a variety of PDE commonly studied today.
- Discuss the typical questions PDE research tends to ask and answer.
- Give an overview of modern approaches to PDE, and the tools used to study them.
- Give examples of the more widely used techniques in some detail.
- Arm you with the background and cultural/folklore knowledge to navigate current PDE research.

More specifically, the following topics will likely be covered, subject to student interest:

- Elliptic equations:
  - Divergence/nondivergence form, general approaches and philosophy.
  - Regularity theory: Schauder theorems and bootstrapping generally, De Giorgi-Nash-Moser, ABP/Krylov-Safonov, Cordes-Nirenberg.
  - Calderon-Zygmund theory (from a PDE perspective).
  - Boundary value problems, regularity up to the boundary, methods to construct solutions, etc.
  - Weak solutions, (possibly) viscosity solutions.
  - Nonlinear equations.
  - Related topics, e.g. homogenization, nodal sets, nonlocal equations.
- Dispersive equations:
  - General philosophy.
  - Standard estimates in Lebesgue, Sobolev spaces.
  - Local well-posedness for some examples.
  - Further topics: global well-posedness, long-time behavior, normal forms, etc.