MATH 555: NONLINEAR ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS (PDE).

INTRODUCTION TO NONLINEAR DISPERSIVE EQUATIONS.

Course description. The Fourier analytic theory of constant coefficient linear/nonlinear dispersive equations will be introduced. We focus mostly on the semilinear Schrödinger equation but the methods presented are applicable to a large class of dispersive partial differential equations and systems. Examples include the Korteweg de Vries equation, the nonlinear Wave equation and the Zakharov system to name a few. The goal is to study the Cauchy problem for semilinear dispersive PDE. We study both problems of local nature (local existence of solutions, uniqueness, regularity, smoothing effects) and problems of global nature (finite time blow-up, global existence and asymptotic completeness of solutions). Although I intend to present an introduction to this vast field of research, many recent developments will be covered.

Prerequisites. A graduate class in PDE would be very useful. Knowledge of distributions and Sobolev spaces is not necessary as I will cover these topics in class when needed. In general every student which is comfortable with the material of Math 553 will not have a problem following the class.

Requirements. There is no exam for this class, but each student will contribute to a presentation on a special topic in the theory of dispersive equations at the end of the semester.

Textbook. I will follow my own notes. Two useful reference books are

1. Nonlinear Dispersive Equations, Local and Global Analysis, by Terence Tao. CBMS (Conference Board of the Mathematical Sciences), AMS, No. 106.

2. Semilinear Schrödinger equations, by Thierry Cazenave. CLN (Courant Lecture Notes), AMS, No. 10.

In terms of covered material, I will present most of the topics included in the first three chapters of T. Tao's book.

Scheduled meeting times. 10:00 am - 10:50 am, MWF, Altgeld Hall 445.