Introduction to Symplectic Geometry and Topology

Ely Kerman

Fall 2013, TR 11:00-12:20

Roughly speaking, symplectic geometry is the study of symplectic manifolds and the natural objects defined there on. These spaces arise in many different mathematical settings. They are the natural setting for classical mechanical systems, and include rich families of manifolds of independent interest such as Kähler manifolds. Symplectic topology is the study of global symplectic phenomena which can be described in the language of differential topology, but which can only be proved using (hard) symplectic tools.

In the first part of this course we will cover foundational material in symplectic geometry. The topics will include: symplectic linear algebra, examples and constructions of symplectic manifolds and lagrangian submanifolds, Normal Neighborhood Theorems (Moser’s Method), symplectic reduction, and Hamiltonian dynamical systems (classical mechanics).

In the second part of this course we will discuss the statements, implications and proofs of some of the beautiful theorems in the field with a bias towards results in symplectic topology. Possible theorems to be discussed are: Delzant’s classification of toric symplectic manifolds, Arnold’s Conjecture for Hamiltonian diffeomorphisms, and Gromov’s Nonsqueezing Theorem.

Prerequisite. Math 518 or permission of the instructor.

Grading. Grades will be based on class participation and a 5-10 page survey paper to be written on a topic of particular interest to the student. (You don’t need to come in with a particular symplectic interest. A list of recommended topics will also be provided.)