MATH 8230, FALL 2009
SYMPLECTIC GEOMETRY

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Office hours: Wednesday, 3:30-4:50, 321C Boyd

Required textbook: *Introduction to Symplectic Topology*, 2nd ed., by Dusa McDuff and Dietmar Salamon, Oxford, 1998.

Other (entirely optional) references for the subject include (parts of) *Mathematical Methods of Classical Mechanics* by V. I. Arnold and *Lectures on Symplectic Geometry* by Ana Cannas da Silva. A more advanced book is *J-holomorphic Curves and Symplectic Topology* by McDuff and Salamon.

Topics: First, I hope to cover most of Chapters 1–7 of the textbook, to include:

- Motivation and examples from physics and differential topology
- Symplectic linear algebra and symplectic vector bundles
- Basics about symplectic manifolds and symplectic diffeomorphisms (Darboux's theorem, Hamiltonian vector fields, Lagrangian and other special submanifolds)
- Group actions, moment maps, and toric manifolds from the point of view of symplectic geometry
- Topological constructions of symplectic manifolds (symplectic structures on fiber bundles, blow-ups, Gompf's symplectic sum)
- Basics about almost complex structures and pseudoholomorphic curves

Time permitting, we'll then proceed to more advanced topics involving pseudoholomorphic curves, Hamiltonian dynamics, and/or Floer homology.

Grading: Grading will be based on homework assignments, to be given approximately once every two weeks.

Prerequisites: A basic familiarity with smooth manifolds. The material in Chapters 1, 2, and 4 of Warner's *Foundations of Differentiable Manifolds and Lie Groups* (*e.g.*, submanifolds, the calculus of vector fields and differential forms, and integration on manifolds) would suffice. I'll try to review the more subtle aspects of this material as it becomes necessary.