M392C (58135): Topics in Geometry and Physics I

Professor: Dan Freed, RLM 9.162.

Lectures: Tuesday, Thursday 11:00–12:30, RLM 10.176. I expect you to attend lectures *and take notes*. The course will move quickly so you will need to study your notes.

Office Hours: For this week office hours will be today (Thursday) 1:30–3:00. Regular office hours are Tuesdays 10:00–11:00 and Wednesdays 2:00–3:30. *Office hours are an important part of the course.* I hope to see many of you there often.

Texts: There is no text for the course. I plan to write notes and also will post readings and pointers to the literature.

Very Tentative Syllabus: Notions of space, Lie groups, Riemannian manifolds, symplectic manifolds, Lagrangian mechanics, electromagnetism, geometry of connections, Clifford algebras and spinors, Dirac operators, fermionic fields, classical field theories.

Class Website: `www.ma.utexas.edu/~dafr/M392C/`. I will post notes and readings there. Please feel free to make suggestions of useful material you have found.

Prerequesites: I expect you to be familiar with smooth manifolds, differential forms, Frobenius theorem, elementary Lie groups, and elementary Riemannian geometry. See the "summer reading" section on the website.

Homework: There is none formally due, but there will be plenty to do. I will post some problem sets, and you can and should find plenty of problems of your own from the lectures and from other materials. *I urge you to immediately form study groups and to discuss the problems and lectures together.* Office hours are a time that many of you will come by to discuss the problems and the class in general.

Projects and Grades: Those of you who are registered for the course will work in groups of one or two on a project, typically a report on a journal article. At the end of the semester each group will hand in a (joint) paper. The due date, to be determined, will be a few weeks before the end of the semester. At that point I will have each project read by another student, who will make comments, and you will have a chance to submit a revised version. I am very open about the topics and will suggest some as we go along. Before starting on a project, please come talk to me about the topic. Please get started by the end of October at the latest. Grades are based on the projects.

Seminars: I encourage you to at least sample the weekly geometry and topology seminars. The main Geometry Seminar is Thursdays at 3:30. Speakers are mostly from outside UT Austin. They are encouraged to be expository during the first hour, and this usually makes that seminar more accessible. the Topology seminar is Monday at 2:00. There is a regular Geometry and String Theory seminar on Wednesdays at 12:00. Finally the internal GADGET lunch seminar is Tuesdays at 12:30. There are also "junior" seminars organized by graduate students in both geometry and topology. I highly recommend the seminars of the high energy physics group as well. You shouldn't expect to understand everything at a research seminar, or even in some cases to understand very much. But only by attending seminars will you learn about a field: its problems, techniques, style, priorities, personality and personalities, etc. *I cannot urge you strongly enough to sample all of our many departmental seminars and attend every colloquium.* These include regular seminars in topology, analysis, algebra and number theory, etc. They will provide a major part of your mathematical growth as a graduate student.