2012 REGS Mini-course
on
Geometric Structures on Surfaces

Instructors: Jayadev Athreya and Chris Leininger
Where: 443 AH
When: 10:30am-11:30am MWF (lectures) and 1-2pm M-F (problems);
June 11-22 and July 9-20

This mini-course will consist of two units. Surfaces and geometric structures on them will tie these two units together.

Both units will be suitable for all REGS participants, including REGS0 students.
The subject matter of the mini-course will be self-contained but will serve as useful preparation for the July 23-August 3 GEAR Junior Retreat and August 6-10 GEAR Retreat to be held on campus. Both units will include 3 lectures per week, as well as many exercises filling in the details of lectures.

Unit 1: Mapping class groups of surfaces (Chris Leininger) After a brief review of some surface topology, we will define the mapping class group of a surface. To study this group we will review some classical hyperbolic geometry and construct hyperbolic structures on surfaces. We use this to study actions of the mapping class group on two important spaces: the Teichmuller space of all hyperbolic structures on the surface and the set of all simple closed curves (with some extra structure). Basic understanding of complex analysis and Riemannian manifolds would be helpful but not necessary.

Unit 2: Flat Surfaces, Billiards, and Moduli Spaces. (Jayadev Athreya) Starting with some elementary Euclidean geometry in the plane, we will explore to what extent this plane geometry can be transferred to closed surfaces such as the g-holed torus. We will investigate the relation between the resulting singular flat metrics on the surfaces and the dynamics of billiards. We will show how tools from the theory of complex or hyperbolic geometry on surfaces (i.e Teichmuller theory) can be used. The background needed will be some familiarity with basic topology and analysis. It will be useful, though not strictly needed, to have some familiarity with measure theory and complex analysis.

For more information, including advice about prerequisites, contact either instructor.