Math 280: Topics In Hyperbolic Geometry

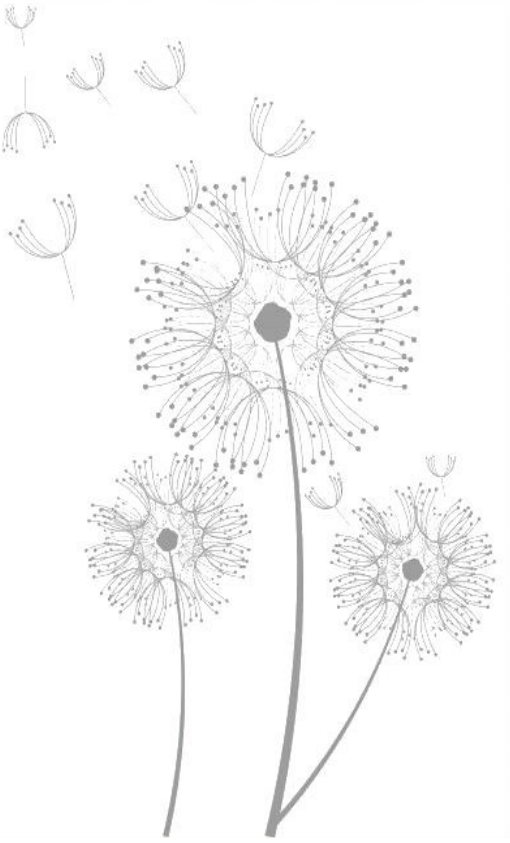
Instructor: Anastasiia Tsvietkova

Where: MSB 2112

When: Spring Quarter, Tuesday and Thursday, 10:40-12:00

In 1976, W. Thurston suggested the Geometrization Conjecture that allowed studying manifolds from a new perspective: using geometry. In particular, Thurston demonstrated that many 3-manifolds have hyperbolic metrics or can be decomposed into pieces with hyperbolic metric. Soon it was noticed that hyperbolic manifolds formed the largest and the least understood class of 3-manifolds. Such manifolds will be the main subject of the course.

We will start by looking at 2-dimensional hyperbolic space and its properties, since many geometric techniques used here can be carried to 3-dimensional hyperbolic space. Then we will proceed to discussing 3-dimensional hyperbolic geometry, hyperbolic 3-manifolds with finite volume, and related topics. The topics may include the Geometrization Conjecture and eight possible geometries for 3-manifolds, Mostow-Prasad rigidity, geometric triangulations of hyperbolic 3-manifolds, hyperbolic volume and other geometric invariants, hyperbolic Dehn surgery, SnapPea algorithm for computing hyperbolic structure of a 3-manifold, Menasco's decomposition of a link complement into two ideal polyhedra, intrinsic geometry of hyperbolic links and related open questions.



Suggested papers/lecture notes:

W. Thurston, The Geometry and Topology of Three-Manifolds, Chapters 1-4 and 7,

http://library.msri.org/books/gt3m/

P. Scott, Geometries of 3-manifolds, Chapters 4-6

J. Weeks, Computation of hyperbolic structures in knot theory

P. Callahan, A. Reid, Hyperbolic structures on knot complements

W. Menasco, Polyhedra representation of link complements

C. Adams, Hyperbolic knots