

This course will cover some topics in quasi-conformal maps, Teichmüller theory and hyperbolic 3-manifolds. In the first part of the course we will aim to be reasonably detailed and the material should be accessible to anyone who has completed standard first year graduate courses. We will begin by developing some basics about quasi-conformal maps: geometric and analytic definitions, compactness theorems, extremal length, the measurable Riemann mapping theorem (Glutsyk's proof via Fourier series), Schwarzian derivatives. The end goal of the first part of the course will be to explain how the Bers embedding gives a canonical complex structure on Teichmüller space.

In the second part of the course we will discuss hyperbolic 3-manifolds. In particular the Bers embedding identifies Teichmüller space with a family of quasi-fuchsian hyperbolic 3-manifolds. Hyperbolic 3-manifolds can be studied from many different points of view; our approach will be via differential geometry. Our main goal will be to define and study Krasnov-Schlenker's notion of renormalized volume. This will define a smooth function on the Bers embedding and we will see how studying this function reveals geometric information about the hyperbolic manifolds. The material here will be more advanced and we'll black box a certain amount of background material on hyperbolic 3-manifolds.