Course: Ricci flow and the Poincare Conjecture

Instructor: David Glickenstein

Description: We will explore the recent proof of the Poincare Conjecture using Ricci flow, to the extent we can in one semester. The Ricci flow is a differential equation which evolves one geometry into another in an effort to produce a very symmetric geometry. It was introduced by R. Hamilton in 1982 with instant successes, including classifying 3D manifolds with positive Ricci curvature. For 20 years it was suggested by Yao and Hamilton that the flow could be used to solve the Poincare Conjecture and Thurston's Geometrization Conjecture, two of the most important open questions in low dimensional topology. G. Perelman's new contributions in 2002-2003 were sufficient to finish the proof, though much work needed to be done to fill in all of the details. I do not expect we will finish the entire proof in one semester, but we can hopefully see both the overall ideas and some of the specifics which go into the proof. These will involve elements of Riemannian geometry, topology, differential equations, and analysis.

Text: We will try following Terrence Tao's lecture notes: http://wordpress.com/tag/285g-poincare-conjecture/, and supplement when necessary from other recent references such as the books by Chow-Knopf, Chow-Lu-Ni, Morgan-Tian, Topping, the paper by Cao-Zhu, and the notes of Kleiner-Lott.

Prerequisites: It would help to have taken a course in Riemannian geometry. I will not assume any knowledge of partial differential equations, though any knowledge of elliptic and parabolic equations wouldn't hurt.