

MATH 241A Topics in Differential Geometry
Fall 2011, TR 2:00-3:15, SH 4519

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Introduction to Einstein Manifolds and the Ricci Flow

In this course we'll introduce the concepts of Einstein manifolds and Ricci flow and present some basic results in these two directions. The following is a list of topics on the plan:

1. Basic properties of the Einstein equation. Gauge fixing and ellipticity.
2. The total scalar curvature functional and its relation to Einstein metrics. Its first variation and second variation.
3. Decomposition of the Riemann curvature tensor.
4. Locally conformally flat manifolds. The conformal Laplacian. Introduction to the Yamabe problem.
5. Obata's theorem.
6. The total scalar curvature functional on asymptotically flat manifolds.
7. Topology of Einstein 4-manifolds.
8. Short time existence of the Ricci flow.
9. Perelman's entropy functional, the log entropy functional of Ye and non-collapsing of the Ricci flow.

We'll cover as many topics on the above list as time allows. The above list also serves as a guideline for further reading.

Suggested Reading

1. A. Besse, *Einstein Manifolds*, Springer.
2. J. Lee and T. Parker, *The Yamabe problem*, Bull. Amer. Math. Soc. **17**(1987), 37-91.
3. T. Aubin, *Some Nonlinear Problems in Riemannian Geometry*, Springer.
4. B. Chow and D. Knop, *The Ricci Flow: An Introduction*, Springer.