

NON-LINEAR DIFFUSION AND GEOMETRIC FLOWS

We will discuss models of *degenerate* or *singular* nonlinear parabolic equations and related geometric flows. A brief outline of the lectures is:

- (1) **Part I - Degenerate Diffusion and Free-boundary Regularity:** We will discuss the *optimal regularity* of solutions to degenerate diffusion and related free-boundary problems. The equations under consideration include the porous medium equation, the Gauss curvature flow and Harmonic mean curvature flow.

- (2) **Part II - Singular Diffusion and classification of entire solutions:** After a brief introduction to fast diffusion equations we will discuss the existence, uniqueness and singularity formation on the *Ricci flow* on surfaces. The last two lectures will be devoted to recent results on the classification of *ancient solutions* of the *curve shortening* flow, the Ricci flow on S^2 and the *Yamabe flow* on S^n .