2016, Gerhard Huisken, University of Tübingen

April 6-8, 2016, KTH, Stockholm

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Abstracts

Lecture 1: Geometric heat equations

Wednesday, April 6, 1.15-2.15 pm
Lecture hall D3, Lindstedtsvägen 5

Starting from the linear heat equation the lecture introduces geometric heat equations such as the curve shortening flow, the mean curvature flow of hypersurfaces and the Ricci flow of Riemannian metrics. It is shown how these quasi-linear parabolic systems can be used to deform geometric objects into more uniform, recognizable shapes, leading to classification results such as the proof of the Poincaré conjecture. Particular emphasis will be on the necessary interplay between geometric concepts and analytical estimates.

Coffee is served between 12.45 and 1.15 outside the lecture hall.

Lecture 2: Mean curvature flow with surgery

Thursday, April 7, 1.15-2.15 pm
Lecture hall D3, Lindstedtsvägen 5

The lecture studies hypersurfaces moving in direction of their mean curvature vector, a flow governed by a system of quasi-linear parabolic equations of second order. This non-linear deformation exhibits on the one hand the characteristic smoothing properties of the heat equation while exhibiting certain singularities due to the reaction-diffusion type properties of the flow. We show how the structure of singularities can be controlled with suitable a priori estimates obtained with techniques from PDE theory, allowing the circumvention of singularities by surgery in certain cases. It will become apparent that some of this behavior in mean curvature flow is similar to the behavior of Ricci flow discovered in the work of Hamilton and Perelman.

Lecture 3: Embedded mean-convex hypersurfaces in 3-manifolds

Friday, April 8, 10.15-11.15 am
Lecture hall D3, Lindstedtsvägen 5

The lecture describes recent work with S. Brendle on embedded surfaces of positive mean curvature that move by mean curvature in a general Riemannian 3-manifold. We prove a general long-time existence and convergence result for a flow interrupted only by finitely many surgeries. As an application we construct canonical sweep-outs by 2-surfaces for asymptotically flat 3-manifolds arising as time-slices in Lorentzian manifolds that model isolated gravitating systems in General Relativity.