

Titles and Abstracts

14 juin 2008

Xiaodong CAO : Differential Harnack Inequalities in Geometric Flows

ABSTRACT : In this talk, we will talk about various differential Harnack estimates (also known as Li-Yau estimates) for geometric evolution equations. In particular, we will discuss the Harnack for the conjugate heat equation and forward conjugate heat equation under the Ricci flow.

Fernando CODÁ MARQUES : Recent developments on the Yamabe Problem

ABSTRACT : In this talk I will discuss recent results on the compactness properties of the full set of solutions to the Yamabe Problem and the effects of dimension. In collaboration with M. Khuri and R. Schoen we have proved compactness if $n \leq 24$, while S. Brendle found the first smooth counterexamples in dimensions $n \geq 52$. In a joint work with S. Brendle we were able to extend these counterexamples to the remaining dimensions $25 \leq n \leq 51$.

Klaus ECKER : Relation between an entropy functional and a Harnack inequality for mean curvature flow

ABSTRACT : We present a functional for mean curvature flow which resembles Perelman's W -entropy for Ricci flow and show its relation to a Hamilton Harnack type expression for the mean curvature of the evolving hypersurfaces. We also state a conjecture regarding the absence of local enclosed volume collapse in mean curvature flow.

David GLICKENSTEIN : Geometric flows on homogeneous spaces from a Riemannian groupoid perspective

ABSTRACT : We will look at convergence of geometric flows on homogeneous spaces, mostly taking examples from Ricci flow on three-dimensional left-invariant metrics on Lie groups and their quotients by lattices. In order

to probe the geometry, one may consider not only the limits of the flow, but also limits under rescalings of the metric. We will investigate the limits of different rescalings using the method of Riemannian groupoids. By using groupoids, we are able to capture certain types of degenerations of the homogeneous spaces, including collapse with bounded curvature. We will see this phenomenon by looking at specific examples in some detail.

Gerhard HUISKEN : Isoperimetric inequalities and Willmore energy

ABSTRACT : We use mean curvature flow and inverse mean curvature flow to prove isoperimetric inequalities in Riemannian and Lorentzian manifolds satisfying restrictions on their Ricci- or scalar curvature.

Tom ILMANEN : Networks evolving by curvature in the plane

ABSTRACT : We study the evolution of networks with triple junctions by their curvature vector. Both garden-variety and exotic singularities can occur, making it difficult to construct long-time solutions. We present new singularity criteria and give information on the structure of the singular set.

Bruce KLEINER : Local collapsing with a lower curvature bound

ABSTRACT : This will discuss joint work with John Lott, which gives a simplified treatment of the local collapsing theory needed for Perelman's proof of the Geometrization Conjecture. By making use of large-time estimates for the Ricci flow, the proof is based more on smooth convergence and the geometry of Riemannian manifolds of nonnegative curvature.

Dan KNOPF : Minimally invasive surgery for Ricci flow singularities

ABSTRACT : If a solution $(M, g(t))$ of Ricci flow develops a local singularity at a finite time T , then there is a proper subset S of M on which the curvature becomes infinite as time approaches T . Existing approaches to Ricci-flow-with-surgery, due to Hamilton and Perelman, require one to modify the solution in a small neighborhood of S by gluing in a highly curved but nonetheless nonsingular solution. This must be done with careful regard to the surgery parameters in order to preserve critical a priori estimates. In case the local singularity is a rotationally-symmetric neckpinch (in any dimension $n \geq 2$), we show that it is possible to restart Ricci flow (modified by diffeomorphisms) directly from the singular limit $g(T)$, without performing an intervening surgery or requiring ad hoc choices. The solution we obtain in this manner is, up to diffeomorphism, the unique rotationally-symmetric

forward evolution of $g(T)$ by Ricci flow, and we describe its asymptotics as it emerges from the singularity. (This is joint work with Sigurd Angenent and Cristina Caputo.)

Jorge LAURET : Ricci solitons on Lie groups

ABSTRACT : Several explicit examples of nilpotent Lie groups (all diffeomorphic to an Euclidean space) admitting nilsolitons (i.e. left invariant expanding Ricci solitons) are known, although a complete classification is only available up to dimension 6. Starting from one of such examples, one can easily construct expanding solitons on a (non-nilpotent) solvable Lie group by just taking an abelian algebra of symmetric derivations which commutes with Ric, the Ricci operator of the nilsoliton. The aim of the talk will be to give an idea of the proofs of the following facts :

1. Any left invariant expanding Ricci soliton on a solvable Lie group is isometric to one which is obtained by the construction above, and it is trivial if and only if the algebra of derivations contains D , where $\text{Ric} = cI + D$.
2. A solvable Lie group can admit at most one left invariant expanding Ricci soliton up to isometry.
3. If there exists a left invariant expanding Ricci soliton on a non-solvable Lie group, then there also exists an Einstein left invariant metric on a (possibly different) non-solvable Lie group (which would provide a counterexample to Alekseevskii's Conjecture).

Peng LU : Modified Shi's derivative estimate in Ricci flow

ABSTRACT : In this talk we will discuss an improvement of Shi's derivative estimate when we assume that the initial metric has better curvature control.

Aaron NABER : Noncompact Shrinking Solitons in dimension four.

ABSTRACT : We study and classify noncompact four dimensional shrinking solitons with nonnegative curvature. In the process we will prove some structure theorems for general shrinking solitons.

Andre NEVES : Translating solitons for Lagrangian mean flow

ABSTRACT : I will talk about the structure of translating solitons for LMCF. In particular, I will be focused on conditions that assure a translating soliton to be trivial. This is joint work with Tian.

Lei NI : Sharp logarithmic Sobolev inequality on gradient solitons

ABSTRACT : In this talk we shall prove sharp logarithmic Sobolev inequalities on gradient solitons. As a by-product we also show useful geometric estimates concerning the volume growth of the gradient solitons. The connection with the optimal transport and the c-theorem in the renormalization group flow shall also be discussed. (Jointly work with Jose Carrillo)

Yanir RUBINSTEIN : Multiplier ideal sheaves and the Ricci flow

ABSTRACT : We discuss classical and recent results concerning multiplier ideal sheaves and the limiting behavior of the continuity method, Ricci flow and the Ricci iteration on Fano manifolds.

Peter TOPPING : New applications of optimal transportation to Ricci flow

ABSTRACT : In the past few years, several optimal transportation results have been proved in the context of Ricci flow. In this talk I will describe how optimal transportation can lead to new Ricci flow results independent of optimal transportation itself. This is joint work with Esther Cabezas-Rivas.

Valentino TOSATTI : The Calabi-Yau equation on symplectic manifolds

ABSTRACT : We consider the problem of prescribing the volume form of a symplectic form compatible with a given almost-complex structure on a compact symplectic manifold. When the complex structure is integrable, and the manifold is therefore Kaehler, this is the celebrated Calabi conjecture that was solved by Yau 30 years ago. Donaldson has recently conjectured that in dimension 4 the equation is still solvable, and has shown that this would have striking consequences in symplectic topology. In a joint work with Ben Weinkove and Shing-Tung Yau we show that the necessary a priori estimates can be reduced to an integral estimate of a scalar function, and that the conjecture holds under a positive curvature condition.

Burkhard WILKING : On Ricci flow in high dimensions

ABSTRACT : We consider a very simple curvature condition : Given constant c and a dimension n we say that a manifold (M, g) satisfies the condition (c, n) is if the scalar curvature is bounded below by c times the norm of the Weyl curvature. We show that in each large even dimensions there is precisely one constant $c=c(n); c > 0$ such that this condition is invariant under the Ricci flow.

The condition behaves very similar to scalar curvature under conformal transformations and we indicate how this can be utilized to get a large source of examples. Finally we speculate what kind singularities should develop under the Ricci flow.

Zhou ZHANG : Kahler-Ricci flow over algebraic manifold of general type

ABSTRACT : One version of Kahler-Ricci flow has the possible change of Kahler class naturally under control. One can use it to study degenerate class. In addition to the classic study from PDE point of view, pluripotential theory argument, especially the original works by Kolodziej, brings even more life to this program. Kahler Ricci flow and families of complex manifolds