

# Titles and Abstracts

<http://ims.nju.edu.cn/conference/2013/>

2013.6.17-21

**Xiaodong Cao** (Cornell University, USA)

**Title:** Curvature behavior at singularity time of Ricci flow

**Abstract:** In this talk, we will first survey some known result about curvature behavior at the first finite-singularity time under the Ricci flow. Then we will discuss some recent development in this direction and their applications.

**Binglong Chen** (Sun Yat-sen University, China)

**Title:** Local version of log improvement of curvature pinching estimate

**Abstract:** In this talk, I will discuss the local version of Hamilton-Ivey pinching estimate in 3-d Ricci flow, and I will concentrate on the difficult part of the estimate involving a log term of the curvature.

**Xuezhang Chen** (Nanjing University, China)

**Title:** Conformal curvature flows on  $S^n$

**Abstract:** In this talk, we will present a brief review of our joint work on conformal curvature flows on  $S^n$ , including scalar curvature flow and Q-curvature flow with positive/sign changing curvature candidates. Some problems in progress related to the above work will also be mentioned. We think such conformal flow approaches and techniques used in our work still seem hopeful.

**Xianzhe Dai** (University of California, Santa Barbara, USA)

**Title:** Degeneration of Analytic Torsion via Eguchi-Hanson Instanton

**Fuquan Fang** (Capital Normal University, China)

**Title:** Reflection groups, non-negative curvature and Tits geometry

**Abstract:** A reflection in a euclidean space (sphere) is one of the fundamental notions of symmetry of geometric figures. It plays a central role in Killing and Cartan's work on Lie algebra in 19th century. Reflections groups on a hyperbolic space is important in hyperbolic geometry, and the first example goes back to F. Klein and Poincare. In this talk I will present (i) A complete classification of reflection groups and the equivariant structures of complete non negatively curved manifolds. (ii) A complete classification of positively curved

polar manifolds of cohomogeneity at least 2, which is achieved partially based on Tits geometry. This is a joint work with Karsten Grove and G. Thorbergsson.

**Jixiang Fu** (Fudan University, China)

**Title:** Limiting behavior of a class of Hermitian-Yang-Mills metrics.

**Abstract:** I will talk about the limiting behavior of Hermitian-Yang-Mills metrics on a class of rank two slope-stable vector bundles over a product of two elliptic curves with respect to a family of Kahler metrics approaching a large Kahler metric limit. The method involves the construction of a family of Hermitian metrics and comparison of these metrics with normalized Hermitian-Yang-Mills metrics.

**Bo Guan** (Ohio State University, USA)

**Title:** The asymptotic Plateau problem in hyperbolic space

**Abstract:** We shall give a survey on our work in recent years on the problem of finding complete hypersurfaces of constant Weingarten curvature in hyperbolic space with prescribed asymptotic boundary at infinity. The problem reduces to a highly nonlinear and degenerate elliptic equation. We make full use of the geometric information in order to solve the equation.

**Changfeng Gui** (University of Connecticut and Hunan University)

**Title:** Even Symmetry of Axially Symmetric Solutions of the Allen-Cahn Equation

**Abstract:** In this talk, we will discuss the even symmetry in the direction of the axis for axially symmetric solutions of Allen-Cahn equation. The dimension of the space will play an important role in the proof, which is based on the asymptotic behavior of nodal sets of such solutions and the moving plane method.

**Elton P. Hsu**, (Northwestern University, USA and University of Science and Technology of China)

**Title:** Brownian Motion, Volume Growth and Conservation of the Heat Kernel on a Riemannian Manifold

**Abstract:** The heat kernel on a Riemannian manifold is the minimal fundamental solution of the heat equation associated with the Laplace-Beltrami operator. The heat kernel is said to be conserved if it integrates to 1. Since the heat kernel can also be interpreted as the transition density function of a Riemannian Brownian motion on the manifold, a manifold whose heat kernel is conserved is also called stochastically complete. It has been observed long time ago that stochastic completeness is related to the volume growth rate of the manifold. In this talk I will discuss a probabilistic method for proving a recent sharp volume growth condition for stochastic completeness.

**Zheng Huang** (The City University of New York, USA)

**Title:** Stability of the volume preserving mean curvature flow in hyperbolic space

**Abstract:** By introducing a global forcing term into the mean curvature flow (MCF) equation, the volume preserving mean curvature flow (VPMCF) fixes the enclosed volume as it evolves. Huisken initiated the study of this flow and proved that, in Euclidean space, it converges to a round sphere of the same enclosed volume if the initial hypersurface is strictly convex. We study the stability of this flow in hyperbolic space. In particular, we prove that if the initial hypersurface is hyperbolically mean convex, and is close to a sphere in the  $L^2$ -sense, the VPMCF will exist for all time and converge exponentially to a round sphere. This is joint work with Longzhi Lin of Rutgers University.

**Huaiyu Jian** (Tsinghua University, China)

**Title:** The optimal regularity for a class of fully nonlinear singular elliptic equations

**Abstract:** We will prove the optimal boundary regularity for a large class of nonlinear elliptic equations with singular terms near the boundary, including the singular Monge-Ampere equation describing affine hyperbolic spheres. As a result, we obtain the Bernstein theorem and the higher regularity of the boundary of the affine hyperbolic sphere. This talk is based the works with Xu-Jia Wang at ANU.

**Jiayu Li** (University of Science and Technology of China)

**Title:** Convergence of Hermitian-Yang-Mills flows

**Longzhi Lin** (Rutgers University, USA)

**Title:** Uniformity of harmonic map heat flow at infinite time

**Abstract:** The theory of harmonic maps and harmonic map heat flows has been a classic and intensely researched field of PDE and geometric analysis. We will discuss an energy convexity along the harmonic map heat flow with small initial energy and fixed boundary data on the unit 2-disk. In particular, this gives an affirmative answer to a question asking whether such harmonic map heat flow converges uniformly in time strongly in the  $W^{1,2}$ -topology, as time goes to infinity, to the unique limiting harmonic map.

**Peng Lu** (University of Oregon, USA)

**Title:** Shrinking Ricci solitons

**Abstract:** Shrinking Ricci solitons (shrinkers) are models of Ricci flow singularities. Koiso's example in dimension 4 is a compact non-Einstein example. For the purpose of the singularity analysis of Ricci flow we are interested in complete noncompact shrinkers. Shrinkers from blowing-up singularities is

locally noncollapsing, however we do not know if it has bounded curvature. In this talk we survey some properties of shrinkers.

**Li Ma** (Henan Normal University, China)

**Title:** Yamabe flow and Myers type theorem

**Abstract:** We discuss the singularity types of the Yamabe flow. There are three type of singularities, which may result in ancient, entire, eternal solitons of Yamabe flow. We shall discuss the classification result of Yamabe solitons. Then we discuss Ma-Cheng's version of Myers type theorem for locally conformally flat manifolds.

**Xinan Ma** (University of Science and Technology of China)

**Title:** The spacetime convexity of the levels sets of heat equation.

**Abstract:** We study the heat equation with initial boundary value problem in convex ring in  $R^n$ . We first establish a constant rank theorem for the second fundamental form of the spacetime convex level sets of the solution of heat equation. Then we use the deformation process to get the proof the theorem. This is a joint work with Chen Chuanqiang (USTC) and Paolo Salani(Firenze).

**Weimin Sheng** (Zhejiang Univesity, CHina)

**Title:** Variational structure of  $\sigma_k$  on manifolds with boundary

**Abstract:** In this talk, I will consider the  $k$ -Yamabe problem on manifolds with boundary. We investigate the problem under the assumption of variational instead of Locally Conformally Flat. In particular, we show that on the manifold of dimension  $n > 4$  with umbilic boundary, the 2-Yamabe problem is solvable.

**Yuguang Shi** (Peking University, China)

**Title:** Some geometric problems of conformally compact Einstein manifolds

**Abstract:** A conformally compact Riemannian manifolds is a natural generalization of hyperbolic space. In recent years there are growing interests in the study of from mathematics and physics. In this talk, I will give a survey on some geometric problems in this direction, including rigidity result on conformally compact Einstein manifolds; existence of conformally compact Einstein manifolds with prescribed conformal structure on infinity boundary. I will also discuss generalization of Einstein-Hilbert functional in context of conformally compact manifolds.

**Weiping Zhang** (Nankai University, China)

**Title:** Eta invariant and closed geodesics

**Zhenlei Zhang** (Captial Normal University, China)

**Title:** On the partial  $C^0$  estimate of a Kahler-Ricci flow

**Abstract:** The partial  $C^0$  estimate on Kahler-Einstein manifolds plays

a key role in Tian's program solving the existence problem of Kahle-Einstein metrics on a Fano manifold. In this talk we will prove an analogous estimate to the Kahler-Ricci flow, under the regularity assumption of the limit space. The proof follows from the work of Tian and Donaldson-Sun. Some applications will also be discussed. This is a joint work with professor Tian.

**Yu Zheng**, (East China Normal University)

**Title:** On the study of eigenvalue problems related with the Ricci flow

**Feng Zhou**, (East China Normal University)

**Title:** Entire solutions for a semilinear elliptic equations with negative exponent

**Abstract:** We study positive entire solutions for the equation  $\Delta u = K(x)u^{-p}$  in the whole space which arises in the modeling of electrostatic micro-electromechanical system (MEMS) and in the study of thin films. We first study positive radially symmetric entire solutions of the equation when  $K(x)$  is a radially symmetric function, then some properties of positive nonradial solutions are obtained. We classify the entire solutions for more general functions  $K(x)$ . This is a joint work with Z.M.Guo and X.Huang.

**Xi-Ping Zhu** (Sun Yat-sen University, China)

**Title:** Ricci curvature on Alexandrov spaces

**Abstract:** This talk is concerned with metric geometry. Alexandrov spaces are those metric spaces with the concept of sectional curvature. In this talk, we will discuss how to develop geometric analysis on Alexandrov spaces. After introducing Ricci curvature on Alexandrov spaces, we will give the gradient estimate, sharp eigenvalue estimate, Cheeger-Gromoll splitting theorem and maximal diameter theorem on Alexandrov spaces.

**Xiaohua Zhu** (Peking University, China)

**Title:** On the structure of spaces with Bakry-Émery Ricci curvature bounded below

**Abstract:** In this talk, I will discuss the structure of limit space for a sequence of Riemannian manifolds with Bakry-Émery Ricci curvature bounded from below in Gromov-Hausdorff topology. We will extend the techniques established by Cheeger and Colding for Riemannian manifolds with Ricci curvature bounded from below to our case. We prove that each tangent space at a point of the limit space is a metric cone. We also analyze the singular structure and the regularities of limit space.