

Schedule for Young Geometric Analysts' Forum 2015

Monday(1.26)	Tuesday(1.27)	Wednesday(1.28)	Thursday(1.29)	Friday(1.30)
8:30-9:30 Damin Wu	8:30-9:30 Bing Wang	8:30-9:00 Juanru Gu	8:30-9:30 Bing Wang	8:30-9:00 Ling Yang
		9:10-9:40 Yong Wang		9:10-9:40 Shicheng Xu
<i>Tea break (20min)</i>	<i>Tea break</i>	<i>Tea break</i>	<i>Tea break</i>	<i>Tea break</i>
9:50-10:50 Jiakun Liu	9:50-10:50 Qirui Li	10:00-10:30 Bin Zhou	9:50-10:50 Xiaoyang Chen	10:00-11:00 Haomin Wen
11:00-11:30 Sheng Rao	11:00-11:30 Jian Ge	10:40-11:10 Hao Yin	11:00-11:30 Jianquan Ge	11:10-11:40 Chunqin Zhou
14:30-15:30 Man Chun Martin Li	14:30-15:30 Chen-Yu Chi	13:30-17:00 <i>Tourist</i>	14:30-15:30 Damin Wu	14:30-15:00 Yingyi Wu
				15:10-15:40 Xin Chen
<i>Tea break</i>	<i>Tea break</i>		<i>Tea break</i>	<i>Tea break</i>
15:50-16:50 Fei Han	15:50-16:50 Haotian Wu		15:50-16:20 Jing Mao	16:00-17:00 Woon Yin Paul Lee
17:00-17:30 Fang Wang	17:00-17:30 Pak Tung Ho		16:30-17:00 Chengjie Yu	
17:30-17:35 <i>Workshop Photo</i>				
19:00-21:00 Problem Section	Banquet 18:00-21:00		19:00-21:00 Sectional talks	

Young Geometric Analysts' Forum 2015

Monday, Jan. 26, 2015

8:30-9:30 **Fco lp'Y w**, University Connecticut

Title I: *Greens function and C^0 estimate of Monge-Ampere equation.*

Abstract: We construct on any complete Riemannian manifold a positive Greens function for the Laplacian minus one. The Greens function can be applied to derive a C^0 bound for the negatively curved Kähler-Einstein potential on quasi-projective manifolds. This is based on the joint work with Henri Guenancia.

9:30-9:50 Tea break

9:50-10:50 **Ucnp'Nkw**, University of Wollongong

Title: *The L^p -Minkowski Problem*

Abstract: In this talk we first give a brief introduction to the L^p -Minkowski problem. Then we focus on the uniqueness results and show that in dimension two, either when or when $0 < p < 1$ in addition to a pinching condition, the solution must be the unit ball. This partially answers a conjecture of Lutwak, Yang and Zhang about the uniqueness of the L^p -Minkowski problem in dimension two. Moreover, we give an explicit pinching constant depending only on p when $0 < p < 1$. This is a recent joint work with Yong Huang and Lu Xu.

11:00-11:30 **Uj gpi 'Tcq**, Wuhan University

Title: *Several special complex structures and their deformation properties*

Abstract: Using a generalized extension formula and an iteration method developed by Liu-Sun-Yau, we obtain several results on deformation invariance of Hodge numbers, especially Popovici-Ugarte's invariance of $(0, 1)$ -type Hodge numbers on sGG manifolds. Inspired by the works of Fu-Xiao and Popovici, we will describe the Gauduchon cone on any compact complex manifold. By use of this and Demailly's regularization, we obtain an inclusion of the limit of the Gauduchon cones of the general fibers of a complex analytic family of Kähler manifolds. This is a joint work with Quanting Zhao.

14:30-15:30 **O cp'bj wp'O ctvp'Nk**, Chinese University of Hong Kong

Title: *Some recent results on minimal surfaces with free boundary*

Abstract: Minimal surfaces with free boundary are solutions to a nonlinear geometric Neumann boundary value problem for minimal surfaces. Such minimal surfaces are naturally related to an extremal Steklov eigenvalue problem for surfaces with

boundary by the work of Fraser and Schoen. In this talk, we will discuss some recent results concerning the existence, regularity and the moduli space of minimal surfaces with free boundary.

15:30-15:50 Tea break

15:50-16:50 **HgkT cp**, National University of Singapore

Title: *Some Analytic Aspects of Elliptic Genera*

Abstract: Elliptic genera are important topological invariants taking values in modular forms. They are formally equivariant indices of Dirac operators on free loop spaces. In this talk, I will briefly explain these higher invariants, their generalizations (modular eta invariants) and some applications (for example, to positive curvature problems).

17:00-17:30 **Hepi 'Y cpi**, Shanghai Jiaotong University

Title: *Scattering Operators for Conformally Compact Einstein manifolds*

Abstract: On a conformally compact Einstein manifold, scattering operators are defined to be a family of conformally covariant pseudo-differential operators on the boundary, which provide a bridge to transfer the information between the interior Einstein metric and the boundary conformal geometry. Here I will mainly talk about the question about how to read the interior from the boundary.

19:00-21:00 Problem Section

Tuesday, Jan. 27, 2015

8:30-9:30 **Dlpi 'Y cpi**, University of Wisconsin-Madison

Title: *The Kähler Ricci flow on Fano manifolds (I)*

Abstract: As a generalization of Cheeger-Colding-Tian theory for non-collapsed Einstein manifolds, we develop the compactness of the moduli of non-collapsed Calabi-Yau spaces with mild singularities. Based on this compactness, we set up a structure theory for polarized Kähler Ricci flows with proper geometric bounds. As applications, we prove the Hamilton-Tian conjecture and the partial- C^0 -conjecture of Tian. This is a joint work with X.X. Chen.

9:30-9:50 Tea break

9:50-10:50 **S k w k N k**, Australian National University

Title: *Regularity of Convex Hypersurfaces with Vanishing Gauss Curvature*

Abstract: In this talk, we will discuss the regularity of convex hypersurfaces with vanishing Gauss curvature. This is equivalent to solving a homogeneous

Monge-Ampere equation, i.e., the right hand side is identically zero. The solution is the convex envelope of the boundary function, and its $C^{1,1}$ regularity was known by Trudinger-Urbas and Caffarelli- Nirenberg-Spruck. We will focus on the higher regularity under proper conditions. We will also present examples to show that one cannot expect C^2 solution if our conditions are violated.

11:00-11:30 **Ucp'I g**, Peking University

Title: *1/4-Pinched Contact Sphere Theorem*

Abstract: In this talk I will present a proof of 1/4-pinched sphere theorem, which says if the curvature of a contact 3-manifold with compatible Riemannian metric is 1/4-pinched, then the contact structure is universal tight. We also have some results for open manifolds. This is a joint work with Yang Huang.

14:30-15:30 **Ej gp-[wEj k** National Taiwan University

Title: *Log Canonical Multiplicity and Characteristic Indicatrix*

Abstract: Log canonical threshold (lct) is an important index measuring how singular an analytic subspace of a complex manifold is at a point. It appears in many aspects of complex analytic/algebraic geometry, such as the theory of multiplier ideal sheaves. In this talk, we will introduce an index accompanying lct and talk about its possible relation to multiplier ideal sheaves and to the global geometry of the ambient manifold.

15:30-15:50 Tea break

15:50-16:50 **J cqkcp'Y w**, University of Oregon

Title: *Neckpinch singularities in geometric flows*

Abstract: Geometric flows such as Ricci flow and mean curvature flow are nonlinear parabolic PDEs that tend to develop singularities in finite time. An interesting class of finite-time singularities are the so-called neckpinches. One may seek rigorous and detailed examples of neckpinch singularities in order to understand how fast the curvature can blow up and what geometric shapes a neckpinch can have. In this talk, we will survey results on the precise asymptotic profiles of neckpinch singularities in Ricci flow and mean curvature flow.

17:00-17:30 **RcmVwpi 'J q**, Sogang University

Title: *Results on curvature flow*

Abstract: In this talk, I will first talk about Q-curvature flow. Then I will talk about Yamabe flow and CR Yamabe flow, which were introduced to study the Yamabe problem and the CR Yamabe problem respectively. If time permits, I will also talk about the study of Nirenbergs problem by using the curvature flow method.

18:00-21:00 "*****" Deps wgv

Wednesday, Jan. 28, 2015

8:30-9:00 Lwεptw'I w, Mathematical Center Zhejiang University

Title: ***On rigidity problem in geometry and topology of submanifolds***

Abstract: We mainly discuss the geometric, topology and differential rigidity problem for submanifolds in space forms, and prove some rigidity theorems for compact submanifolds under Ricci curvature pinching condition.

9:10-9:40 [qpi 'Y cpi , Northeast Normal University

Title: ***The infinitesimal equivariant index formula in the noncommutative geometry framework***

Abstract: We establish an infinitesimal equivariant index formula in the noncommutative geometry framework. We compute the limit of the infinitesimal equivariant Chern-Connes character when the time goes to zero. Then we extend these theorems to the family case. We also define the infinitesimal equivariant eta cochain and prove its regularity and establish the noncommutative infinitesimal equivariant index formula for manifolds with boundary.

9:40-10:00 Tea break

10:00-10:30 Dlp"l j qw, Peking University

Title: ***Modified Futaki Invariant and Equivariant Riemann-Roch Formula***

Abstract: In this talk, we will discuss a new version of the modified Futaki invariant for a test configuration associated to the soliton action on a Fano manifold. Our version will naturally come from toric test configurations defined by Donaldson for toric manifolds. As an application, we show that the modified K-energy is proper for toric invariant Kähler potentials on a toric Fano manifold. Our method can be also used to study the conical Kähler-Ricci solitons on such a manifold. This is a joint work with Feng Wang and Xiaohua Zhu.

10:40-11:10 J cq'l lp, University of Science and Technology of China

Title: ***On the blow-up of harmonic maps***

Abstract: In this talk, we shall discuss the blow-up process of a sequence of harmonic maps with uniformly bounded (rescaled) energy. In particular, we review the construction of bubble tree, which is well known if the domain manifold is of dimension two and generalize it to the higher dimensional case.

13:30-17:00 """"Vqwt kv

Thursday, Jan. 29, 2015

8:30-9:30 **Dlpi 'Y cpi** , University of Wisconsin-Madison

Title: *The Kähler Ricci flow on Fano manifolds (II)*

Abstract: As a generalization of Cheeger-Colding-Tian theory for non-collapsed Einstein manifolds, we develop the compactness of the moduli of non-collapsed Calabi-Yau spaces with mild singularities. Based on this compactness, we set up a structure theory for polarized Kähler Ricci flows with proper geometric bounds. As applications, we prove the Hamilton-Tian conjecture and the partial- C^0 -conjecture of Tian. This is a joint work with X.X. Chen.

9:30-9:50 Tea break

9:50-10:50 **Zkq{ cpi 'Ej gp**, University of Macau

Title: *Curvature and Riemannian submersions*

Abstract: We will talk about the structure of Riemannian submersions from positively curved manifolds. In particular, we will discuss a diameter rigidity theorem and some nonexistence theorems.

11:00-11:30 **lkps wcp'I g**, Beijing Normal University

Title: *Singular Riemannian foliation, isoparametric foliation and exotic smooth structure*

Abstract: Singular Riemannian foliation (SRF) is a singular foliation where any geodesic perpendicular to one leaf intersects perpendicularly to each leaf. Isoparametric foliation is a SRF of codim 1 whose regular leaves have constant mean curvature. In this talk, we introduce our recent study about these, namely,

- 1) Classify closed simply connected 4-manifolds with SRF; 2) Establish 1-1 correspondence between SRF of codim 1 (or isoparametric foliation) in any homotopy sphere and in standard sphere;
- 3) Application to the existence of exotic smooth structures.

14:30-15:30 **Fco lp'Y w**, University Connecticut

Title II: *Hypersurfaces of nonnegative scalar curvature*

Abstract: We prove that if a closed hypersurface in Euclidean space has nonnegative scalar curvature, then the hypersurface is mean convex. Examples will be given to show that the same conclusion does not hold if the scalar curvature is replaced by the higher order mean curvatures. This is based on the joint work with Lan-Hsuan Huang.

15:30-15:50 Tea break

15:50-16:20 **Upi "O cq**, Harbin Institute of Technology at Weihai, China and Instituto Nacional de Matematica Pura e Aplicada, Brazil

Title: *Cheng-type isoperimetric inequalities and their applications*

Abstract: In this talk, we would like to give some Cheng-type isoperimetric inequalities for the first Dirichlet eigenvalue of the Laplacian and the P -Laplacian ($1 < p < \infty$) on complete n -manifolds ($n \geq 2$) with radial curvature bounded, which can be seen as a generalization of the classical Chengs eigenvalue comparison theorems. Moreover, some geometric applications will also be introduced. The talk is based on a joint-work with Prof. Pedro Freitas and Prof. Isabel Salavessa in CVPDE and another work of me in JMPA.

16:30-17:00 **Ej gpi llg'! w**, Shantou University

Title: *Steklov Eigenvalues on Annuli*

Abstract: In this talk, we will first survey some results about extremal problems for Steklov eigenvalues on surfaces. Then, we will present a recent joint work with Xu-Qian Fan and Luen-Fai Tam on the extremal values of all Steklov eigenvalues on annuli with rotationally conformal metrics. Finally, some open problems for extremal values of Steklov eigenvalues on surfaces are presented.

19:00-21:00 Sectional talks

Friday, Jan. 30, 2015

8:30-9:00 **Nlpi 'l cpi**, Fudan University

Title: *Submanifolds of constant Jordan angles*

Abstract: A new geometric concept, submanifolds in Euclidean space with constant Jordan angles (CJA), will be introduced, which is a generalization of constant angle curves and surfaces. By exploring the second fundamental form of submanifolds with CJA, we give a local existence result for CJA surfaces in 4-dimensional Euclidean space and make a complete classification for complete CJA surfaces. In conjunction with the algebraic properties of octonions, we can characterize the Lawson-Osserman cone from the viewpoint of Jordan angles, which is an important example of coassociative submanifolds and has a close relationship with the Bernstein problem for minimal submanifolds of higher codimension.

9:10-9:40 **Uj lej gpi 'Zw**, Capital Normal University

Title: *Geometric properties of "totally" conjugate cut points*

Abstract: We will talk about a small improvement of the well-known Lemma in Riemannian geometry by Klingenberg on the existence of geodesic loops, which has been widely used in injectivity radius estimate. Klingenberg's lemma says that for any local minimum point x_0 of the distance function $d(p, \cdot)$ in the cut locus C_p of p , either p and x_0 are conjugate along a minimal geodesic from p to x_0 , or there is a geodesic loop at p that smoothly goes through x_0 . We can show that if there is no geodesic loop, then they must be "totally" conjugate, that is, they are conjugate along any minimal geodesic connecting them. The proof is not direct, and it is necessary to consider a more general case. Some geometric applications will also be talked about.

9:40-10:00 Tea break

10:00-11:00 **Jianguo Li**, Max Planck Institute of Mathematics

Title: *Scattering rigidity versus lens rigidity*

Abstract: Scattering rigidity of a Riemannian manifold allows one to tell the metric of a manifold with boundary by looking at the directions of geodesics at the boundary. Lens rigidity allows one to tell the metric of a manifold with boundary from the same information plus the length of geodesics. There are a variety of results about lens rigidity but very little is known for scattering rigidity. I will discuss the subtle difference between these two types of rigidities and prove that they are equivalent for a large class of two-dimensional manifolds including all simple manifolds. In particular, this implies that two-dimensional simple manifolds (such as the disk) are scattering rigid since they are lens/boundary rigid (Pestov-Uhlmann, 2005).

11:10-11:40 **Erhan Wu**, Shanghai Jiaotong University

Title: *Brezis-Merle type concentration-compactness theorem for super Liouville equations*

Abstract: In this talk, I will consider the super Liouville equations which is a natural generalization of the Liouville equation. I will describe geometric and analytic aspects of the system. In particular, I will analyze the formation of singularities in detail. At last, I will show the Brezis-Merle type concentration-compactness theorem for this system.

14:30-15:00 **Yi Ma**, School of Mathematics Sciences, UCAS

Title: *Non-CSC HCMU metrics with conical and cusp singularities* (joint work with Qing Chen and Bin Xu)

Abstract: We consider on compact Riemann surfaces singular extremal metrics whose Gauss curvatures have nonzero umbilical Hessians, which are usually called HCMU metrics. The singular sets of these HCMU metrics consist of conical and cusp singularities, both of which are finitely many. We show that these metrics exist with the prescribed singularities if and only if so do certain meromorphic 1-forms on the

Riemann surfaces, which only have simple poles with real residues and whose real parts are exact outside their poles.

15:10-15:40 **Zhp'Ej gp**, Shanghai Jiaotong University

Title: *A probabilistic method for gradient estimates of some geometric flows*

Abstract: In general, gradient estimates are very important and necessary for deriving convergence results in different geometric flows, and most of them are obtained by analytic methods. In this paper, we will apply a stochastic approach to systematically give gradient estimates for some important geometric quantities under the Ricci flow, the mean curvature flow, the forced mean curvature flow and the Yamabi flow respectively. Our conclusion gives another example that probabilistic tools can be used to simplify proofs for some problems in geometric analysis.

The talk is based on a joint work with Li-Juan Cheng and Jing Mao.

15:40-16:00 Tea break

16:00-17:00 **RcwlY qqp'l lp'Ngg**, Chinese University of Hong Kong

Title: *Ricci curvature type lower bounds for sub-Riemannian structures on Sasakian manifolds*

Abstract: In this talk, we introduce a type of Ricci curvature lower bound for a natural sub-Riemannian structure on Sasakian manifolds and discuss various consequences under this condition.