Huai-Dong Cao, Lehigh University

Title: Linear stability of compact Ricci shrinkers and positive Einstein manifolds

Abstract: Positive Einstein manifolds and shrinking Ricci solitons are fixed points of Hamilton's Ricci flow as a dynamical system and model the formation of Type I singularities. They are also critical points of Perelman's ν-entropy. In this talk, we shall discuss their linear stability, with respect to the ν-entropy, and the first eigenvalue of the Laplace operator/Lichnerowicz Laplacian. It is based on prior joint works with R. Hamilton and T. Ilmanen, C. He, and M. Zhu.

Bing-Long Chen, Sun Yat-sen University

Title: Local regularity of spacetimes under Ricci curvature and Lie derivative conditions

Abstract: In this talk, we will derive a local first order estimate for any four dimensional spacetime, in terms of local bounds of the Ricci curvature and Lie derivative of the Lorentzian metric with respect to a timelike vector field. Higher order estimates can also be obtained provided more covariant derivatives of the Ricci curvature and Lie derivative of the metric are bounded.

Jixiang Fu, Fudan University

Title: On higher direct images of pluricanonical bundles

Abstract:Given a fibration between two projective manifolds, we discuss the effective generation of the higher direct images of its pluricanonical bundles. Our results are related to two questions proposed by Popa-Schnell. This is a joint work with Jingcao Wu.

Akito Futaki, Tsinghua University

Title: Deformations of Fano manifolds with weighted solitons

Abstract: We consider weighted solitons on Fano manifolds which include Kaehler-Ricci solitons, Mabuchi solitons and base metrics which induce Calabi-Yau cone metrics outside the zero sections of the canonical line bundles (Sasaki-Einstein metrics on the associated U(1)-bundles). We show that all the members M_t of the Kuranishi family of a Fano manifold M_0 with a weighted soliton have weighted solitons if and only if the dimensions of T-equivariant automorphism groups of M_t are equal to that of M_0, and also if and only if the T-equivariant automorphism groups of M_t are all isomorphic to that of M_0, where the weight functions are defined on the moment polytope of the Hamiltonian T-action.

Mark Gross, University of Cambridge

Title: Open FJRW theory

Abstract: I will describe joint work with Tyler Kelly and Ran Tessler. FJRW (Fan-Jarvis-Ruan-Witten) theory is an enumerative theory of quasi-homogeneous

singularities, or alternatively, of Landau-Ginzburg models. It associates to a potential W:C^n -> C given by a quasi-homogeneous polynomial moduli spaces of (orbi-)curves of some genus and marked points along with some extra structure, and these moduli spaces carry virtual fundamental classes as constructed by Fan-Jarvis-Ruan. Here we specialize to the case W=x^r+y^s and construct an analogous enumerative theory for disks. We show that these open invariants provide perturbations of the potential W in such a way that mirror symmetry becomes manifest. Further, these invariants are dependent on certain choices of boundary conditions, but satisfy a beautiful wall-crossing formalism.

Hans-Joachim Hein, University of Münster

Title: Liouville theorems and Evans-Krylov estimates in singular geometries

Abstract: A classical idea going back at least to work of Leon Simon (1997) is that Liouville theorems for solutions to elliptic or parabolic PDEs are equivalent to Schauder-type regularity estimates. In this talk I will survey some recent developments of this idea concerning the regularity of the complex Monge-Ampère equation with respect to singular reference metrics. The talk is partly based on joint work with V. Tosatti and M.-C. Lee and work of my former student J. Klemmensen.

Conan Nai Chung Leung, The Chinese University of Hong Kong

Title: 3d mirror symmetry is mirror symmetry

Abstract: 3d mirror symmetry is a mysterious duality for certian pairs of hyperkähler manifolds, or more generally complex symplectic manifolds/stacks. In this paper, we will describe its relationships with 2d mirror symmetry. This could be regarded as a 3d analog of the paper "Mirror Symmetry is T-Duality" by Strominger, Yau and Zaslow which described 2d mirror symmetry via 1d dualities.

Tian-Jun Li, University of Minnesota

Title: Symplectic topology of algebraic surfaces

Abstract: A symplectic structure on a smooth manifold is a closed and non-degenerate 2-form. Every algebraic surface admits symplectic structures. It is now abundantly clear that the smooth manifold zoo of symplectic 4-manifolds is much bigger than that of the algebraic surfaces. However, symplectic 4-manifolds and algebraic surfaces still share some basic common features. In this talk, we will discuss some symplectic topological aspects of algebraic surfaces.

Kefeng Liu, University of California, Los Angeles

Title:Automorphic cohomology, Penrose transformation, and geometry of non-classical flag domains

Abstract: I will present my recent joint works with Yang Shen on the geometry and representation theory aspects of non-classical flag domains.

We prove several conjectures of Griffiths about the the structures of automorphic cohomology on compact quotients of non-classical flag domains.

We construct new complex structures on non-classical flag domains $D=G_\R/V$ with $G_\R$ of Hermitian type and their compact quotients. As applications, we give new examples of compact smooth manifolds on which there are two complex structures with very different geometric properties.

Building on these works, we construct Penrose transformations of the cohomology groups of homogeneous line bundles on flag domains $D = G_\R / T$ and identify conditions under which the Penrose transformation of the automorphic cohomology groups on compact quotients of flag domains is an isomorphism. As applications we prove that the higher automorphic cohomology groups of certain homogeneous line bundles are isomorphic to the groups of automorphic forms on the Hermitian symmetric domain.

Tristan Rivière, ETH Zürich

Title: Area Variations for Lagrangian and Legendrian Immersions, Analytical Challenges and Geometric Motivations

Abstract: TBA

Antoine Song, California Institute of Technology

Title: Harmonic maps, renormalized energy and random matrices

Abstract: I will discuss a new geometric concentration phenomenon for equivariant harmonic maps from surfaces to Euclidean spheres. Specifically, for any unitary representation of the fundamental group of a Riemann surface S, one can associate a renormalized energy and an equivariant harmonic map from the universal cover of S to a unit sphere. The main result of this talk is that when the unitary representation is chosen at random, with high probability, the renormalized energy is close to an explicit constant and the shape of the harmonic map is close to a unique limit shape.

Song Sun, Zhejiang University

Title: Geometry of gravitational instantons

Abstract: A gravitational instanton is a complete Ricci-flat 4 manifold with finite energy. This notion was first introduced by Hawking to study Euclidean quantum gravity and has been extensively studied in mathematics and physics for several decades. Most work so far focuses on the case when there is a special geometry (hyperkahler or conformally Kahler) which links to complex geometry. By far we have a relatively satisfactory understanding of these special gravitational instantons. In this talk we will discuss constructions of gravitational instantons when complex geometry is absent. These are related to questions of Gibbons and Yau on the Riemannian version of the black hole uniqueness conjecture. Based on joint work with Mingyang Li (UC Berkeley).

Weiping Zhang, Nankai University

Title: Lichnerowicz theorem revisited

Abstract: A famous theorem of Lichnerowicz states that if a closed spin manifold admits a Riemannian metric of positive scalar curvature, then its Hirzebruch A-hat genus vanishes. We will describe some recent advances arising from this classical result.

Fangyang Zheng, Chongqing Normal University

Title: Some recent progress in non-Kähler geometry

Abstract: In this talk, we will give a brief introduction to the field of non-Kähler geometry, which is a subarea of complex geometry. We will also discuss some recent development on Hermitian space form problem, Fino-Vezzoni Conjecture, etc.

Xiangyu Zhou, Academy of Mathematics and Systems Science, Chinese Academy of Sciences

Title: L^2 estimates for \dbar equations and bundles with singular positive curvature

Abstract: In this talk, we first recall some basic properties of multiplier ideal sheaves associated to pseudoeffective line bundles (or psh functions), including Guan-Zhou's solution of Demailly's strong openness conjecture, then present Deng-Ning-Wang-Zhou's characterization of Nakano positivity via solving \dbar equations with L^2 estimates, which is a converse proposition of Hörmander-Demailly's L^2 existence theorems. This gives a connection between differential geometry and differential equation via several complex variables. As an application of the characterization, we give an affirmative answer to Lempert's problem (Liu-Yang-Zhou), which asks whether the limit metric of an increasing sequence of hermitian metrics with Nakano semi positive curvature on holomorphic vector bundles is still Nakano semi-positive. As another application, one may define singular metric of positive curvature in the sense of Nakano on holomorphic vector bundles. Finally, we present recent results on the strong openness of the multiplier submodule sheaves (vector bundle version of multiplier ideal sheaves) by Liu-Xiao-Yang-Zhou and Le Poiter type isomorphism theorem between cohomology of the vector bundles twisted with the multiplier submodule sheaves and cohomology of the associated line bundles twisted with the multiplier ideal sheaves (Liu-Liu-Yang-Zhou).

Xi-Ping Zhu, Sun Yat-sen University

Title: Boundary regularity of harmonic maps between singular spaces

Abstract: In this talk, we discuss the boundary regularity for harmonic maps between singular metric spaces. In 1983, Schoen-Uhlenbeck established boundary regularity for energy-minimizing maps between smooth manifolds, assuming

$C^{2,\alpha}$-regularity on both the boundary and the data. A natural problem is to study the qualitative boundary behavior of harmonic maps with rough boundary and/or non-smooth boundary data.

For the special case when u is a harmonic function on $\Omega\subset \mathbb R^n$, this problem has been widely researched. For example, the Wiener criterion ensures that a harmonic function is continuous up to the boundary. Jerison-Kenig (1981) established the $W^{1,p} $ regularity ($1<p<\infty$) when $\partial\Omega$ is Lipschitz and satisfies an exterior ball condition. While the classical examples of Hardy-Littlewood (in 1932) show that the gradient $|\nabla u|(x)$ may be logarithmic growth as x approaches the boundary $\partial \Omega$ when the boundary data u_0 is Lipschitz continuous.

Recently, in a joint work with Hui-Chun Zhang, we obtained the sharp gradient estimates near boundary for harmonic maps from $RCD(K, N)$ metric measure spaces into $CAT(0)$ metric spaces.