Titles and Abstracts

1. Daniele Angella, Dipartimento di Matematica e Informatica "Ulisse Dini", Università degli Studi di Firenze, Italy

Title: Special Hermitian metrics on complex non-Kähler manifolds

Abstract: We investigate the existence of special metric structures on complex non-Kähler manifolds. In particular, we study an analogue of the Yamabe problem in the Hermitian setting, aimed at finding Hermitian metrics with constant scalar curvature with respect to the Chern connection on compact complex manifolds (joint work with Simone Calamai and Cristiano Spotti).

2. Jacob Bernstein, Johns Hopkins University, USA

Title: Surfaces of Low Entropy

Abstract: Following Colding and Minicozzi, we consider the entropy of (hyper)-surfaces in Euclidean space. This is a numerical measure of the geometric complexity of the surface. In addition, this quantity is intimately tied to to the singularity formation of the mean curvature flow which is a natural geometric heat flow of submanifolds. In the talk, I will discuss several results that show that closed surfaces for which the entropy is small are simple in various senses. This is all joint work with L. Wang.

3. Nelia Charalambous, University of Cyprus, Cyprus

Title: The Spectrum of the Laplacian on Forms

Abstract: The essential spectrum of the Laplacian on functions over a noncompact Riemannian manifold has been extensively studied. It is known that on hyperbolic space a spectral gap appears, whereas is has been conjectured that on manifolds with uniformly subexponential volume growth and Ricci curvature bounded below the essential spectrum is the nonnegative real line. Much less is known for the spectrum of the Laplacian on differential forms.

In our work we prove a generalization of Weyl's criterion for the essential spectrum of a self-adjoint and nonnegative operator on a Hilbert space. We use this criterion to study the spectrum of the Laplacian on k-forms over an open manifold. We first show that the spectrum of the Laplacian on 1-forms always contains the spectrum of the Laplacian on functions. We also study the spectrum of the Laplacian on k-forms under a continuous deformation of the metric. The results that we obtain allow us to compute the spectrum of the Laplacian on k-forms over asymptotically flat manifolds. This is joint work with Zhiqin Lu.

4. Xiaolong Han, California State University, Northridge, USA

Title: Global Harmonic Analysis on Compact Manifolds

Abstract: Harmonic analysis is the study of the basic harmonics and representation of functions and operators as superpositions of these harmonics. For example, on the torus, the harmonics are Fourier modes and functions can be written as Fourier series. On general compact manifolds, the harmonics are Laplacian eigenfunctions and they form an orthonormal basis. The analysis of Laplacian eigenfunctions has close relation to geometry of the manifold, particularly its global geometric structure (e.g. global symmetry of the torus); global harmonic analysis is the study of the relation between the Laplacian spectral analysis and global geometric structure of the manifold.

5. Zheng Huang, City University of New York, USA

Title: Minimal Surfaces in Hyperbolic Manifolds (and where to find them)

Abstract: Some recent results on closed minimal surfaces of negative Euler characteristic in hyperbolic manifolds will be discussed in this talk. This includes questions regarding existence, uniqueness and multiplicity. Much of the talk will be based on joint work with B. Wang.

6. Benling Li, Ningbo University, China

Title: Finsler Metrics with Special Geodesics

Abstract: Geodesics of a Finsler manifold are determined by the geodesic ODEs. In which, the important term is composed of geodesic coefficients (or spray coefficients). In this talk, we will discuss some special forms of the geodesic coefficients which are related to some Finsler metrics with special geometric properties.

7. Ovidiu Munteanu, University of Connecticut, USA

Title: The Poisson Equation on Complete Manifolds

Abstract: We consider the Poisson equation $\Delta u = \phi$ on a complete manifold. Sharp existence and uniqueness results are proved under natural geometric conditions. Our results can be generalized to the weighted Laplacian on a smooth metric measure space, which gives some interesting applications to the study of Ricci solitons in Ricci flow.

8. Guohuan Qiu, McGill University, Canada

Title: Classical Neumann Problems for Hessian Equations and Geometric Applications

Abstract: The classic Neumann problem for laplace equation has many geometric applications. For example, Reilly used its solution to give a new proof of Minkowski inequality. Recently, Xinan Ma and Guohuan Qiu, have proved the existence of the Neumann problems for Hessian equations in uniformly convex domain in Rn. Motivated from Reilly and Ma-Qiu's work, Chao Xia and I also find geometric applications about classical Neumann problems for Hessian equations. We will talk about how to

prove the existence of classical Neumann problems under the uniformly convex domain. Then we use the solution of the classical Neumann problem to give a new proof of a family of Alexandrov-Fenchel inequalities arising from convex geometry.

9. Julie Rowlett, Chalmers Technical University, Sweden & the University of Gothenburg, Sweden

Title: Eigenvalue and Heat Trace Asymptotics for Drifting Laplacians

Abstract: This talk is based on joint work with Nelia Charalambous, in which we consider the spectra of drifting (aka weighted or Bakry-mery) Laplace operators on Riemannian manifolds. We shall discuss eigenvalue estimates and Weyl's law in this setting. The proof of Weyl's law is via the short time asymptotic expansion of the heat trace, and so we will discuss this expansion. In this work, we assume only finite regularity of the weight function, and we shall see that the behavior of the short time asymptotics of the heat trace determines, and conversely is determined by the Sobolev regularity of the weight function. Finally, we shall also present isospectral results for these operators.

10. Shoo Seto, University of California, Santa Barbara

Title: Fundamental Gap for Convex Domains of the Sphere

Abstract: In this talk, we introduce the Laplacian eigenvalue problem and briefly go over its history. Then we will present a recent result which gives a sharp lower bound of the fundamental gap for convex domain of spheres motivated by the modulus of continuity approach introduced by Andrews-Clutterbuck. This is joint work with Lili Wang and Guofang Wei.

11. Jingzhou Sun, Shantou University, China

Title: Projective Embedding of Log Riemann Surfaces and K-stability

Abstract: I will report on a joint work with Song Sun. Given a smooth polarized Riemann surface (X, L) endowed with a hyperbolic metric ω with cusp singularities along a divisor D, we show the L^2 projective embedding of (X, D) defined by L^k is asymptotically almost balanced in a weighted sense. The proof depends on sufficiently precise understanding of the behavior of the Bergman kernel in three regions, with the most crucial one being the neck region around D. This is the first step towards understanding the algebro-geometric stability of extremal Kähler metrics with singularities.

12. Hung Tran, University of California at Irvine, USA

Title: Index of A Free Boundary Minimal Surface

Abstract: A FBMS in the unit Euclidean ball is a critical point of the area functional among all surfaces with boundaries in the unit sphere, the boundary of the ball. The Morse index gives the number of distinct admissible deformations which decrease the area to second order. In this talk, we explain how to compute the index from data of two simpler problems. The first one is the corresponding problem with fixed

boundary condition; the second is associated with the Dirichlet-to-Neumann map for Jacobi fields. We also discuss applications to a conjecture about FBMS with index 4.

13. Mao-Pei Tsui, National Taiwan University

Title: Stability and Uniqueness of Minimal Surface Systems

Abstract: It is well-known that the solution to the Dirichlet problem for the minimal surface system may not be unique. In this talk, we explain some recent results about the stability and uniqueness of minimal surface systems. This is joint work with Yng-Ing Lee and Yuan Shyong Ooi.

14. Luigi Vezzoni, Università degli studi di Torino, Italy

Title: The Calabi-Yau Problem on Fibrations and Generalized Monge-Ampère Equations

Abstract: The Calabi-Yau equation is a PDEs system whose study goes back to the celebrated Calabi conjecture proved by Yau on 1978. Recently, Donaldson has described how the equation could be generalized in a natural way to the setting of 2-forms on 4-manifolds. Donaldson's program, if carried out, would lead to many new and important results in symplectic geometry. Given a 4-dimensional compact symplectic manifold (M, Ω) together an $\Omega-$compatible almost-complex structure J, the Calabi-Yau equation consists in

$$(\Omega + d\alpha)^2 = \mathrm{e}^F \, \Omega^2 \,, \quad Jd\alpha = d\alpha$$

where $F \in C^\infty(M)$ is given and α is a unknown 1-form. In contrast to the Kähler case, it is not known if the equation in the almost-complex setting has always a solution. Important results about this problem have been obtained by Tosatti, Weinkove and Yau.

The talk focuses on the study of the Calabi-Yau equation in torus fibrations, when the initial datum F is invariant by the action of the fiber. It will be showed that in this case the equation reduces to a generalized Monge-Ampère equation on the basis having always a solution.

The last part of the talk will be about some resent advances on the problem in the Kodaira-Thurston manifold.

References

[1] E. Buzano, A. Fino and L. Vezzoni, The Calabi-Yau equation for T^2-bundles over a torus: the non-Lagrangian case, *Rend. Semin. Mat. Univ. Politec. Torino* **69** (2011), no. 3, 281–298.

[2] E. Buzano, A. Fino and L. Vezzoni, The Calabi-Yau equation on the Kodaira-Thurston manifold, viewed as S^1-bundle over a 3-torus, *J. Differential Geom.* **101** (2015), no. 2, 175–195.

[3] A. Fino, Y.Y. Li, S. Salamon and L. Vezzoni, The Calabi-Yau equation on 4-manifolds over 2-tori, *Trans. Amer. Math. Soc.* **365** (2013), no. 3, 1551–1575.

[4] L. Vezzoni, On the Calabi-Yau equation in the Kodaira-Thurston manifold, *Complex Manifolds* **3** (2016), 239–251.

15. Glen Wheeler, University of Wollongong, Australia

Title: Convergence Results for Fourth-order Flows of Immersed Curves with Boundary

Abstract: New results on gradient flows for length and elastic energy in L^2 and H^{-1} are described, natural fourth-order evolution equations for immersed curves commonly known as the curve diffusion flow and the elastic or curve-lengthening flow. These evolution equations classically display loss of compactness even in the boundaryless case in some circumstances, making their study traditionally interesting and challenging. In this talk we focus on how a novel method is used to upgrade subconvergence, obtained via an energy method combined with geometric arguments, to full convergence. The method is a derivation of a technique due to Novaga-Okabe and can be used to bypass a potentially much more complicated Llojasiewicz-Simon argument.

16. Yunhui Wu, Tsinghua University, China

Title: On Positive Scalar Curvature and Moduli of Curves

Abstract: In this talk, we will discuss the obstructions for complete positive scalar curvature metrics (including both Hermitian and Riemannian metrics) on the moduli of curves. For example, one result is that any finite cover of the moduli space of closed Riemann surfaces of genus g with $g \geq 2$ does not admit any Riemannian metric ds^2 of nonnegative scalar curvature such that $ds^2 \geq ds_T^2$, where ds_T^2 is the Teichmller metric; this is analogous to a well-known result of GromoCLawson and Schoen-Yau in the non-positively curved Riemannian metric setting in early 1980's. The Riemannian metric case is joint with Prof. Kefeng Liu at UCLA.

17. Ariel Yadin, Ben-Gurion University, Israel

Title: A Geometric Approach to Invariant Random Subgroups and Furstenberg Entropy

Abstract: Furstenberg entropy is an entropic quantity associated to a stationary action of a group on a probability space. Determining the possible values for the entropy of such actions is known as the *Furstenberg entropy realization problem*. This is a first step towards classifying stationary group actions.

One way to obtain stationary actions is via *invariant random subgroups*, or *IRS*s. These are random subgroups whose law is invariant to the ambient group conjugation. IRSs serve as a stochastic generalization of normal subgroups.

In this talk we focus on geometric and analytic constructions of IRSs. We provide a general tool for constructing a continuum of IRSs on a discrete group, via the definition of a "norm" on the group.

We apply this construction to obtain, among other results, the following theorem: Let G be a finitely generated free group, and let μ be any finitely supported probability measure on G. Then any *a-priori* possible entropy value can be realized through the action on some IRS. This generalizes a result of Bowen.

Joint work with Yair Hartman. All notions will be explained during the talk, no previous knowledge is assumed.

18. Wenjiao Yan, Beijing Normal University, China

Title: Isoparametric Foliation and its Applications

Abstract: This talk will give a survey on our recent works on isoparametric foliation and its several applications, including Yau's 100th problem, Yau's 34th problem, Besse problem and normal scalar curvature inequality on the focal submanifolds. The talk is based on joint work with J.Q.Ge and Z.Z.Tang.

19. Lingzhong Zeng, Jiangxi Normal University, China

Title: Classification of Isoparametric Hypersurfaces and Eigenvalues

Abstract: In this talk, we will provide a comprehensive survey of the classification of isoparametric hypersurfaces. Under the assumption of isoparametric condition, we investigate the eigenvalues of closed eigenvalue problems and some corresponding results are obtained. The partial work is jionted with Qing-Ming Cheng.

20. Jiuyi Zhu, Louisiana State University, USA

Title: Nodal Geometry of Steklov Eigenfunctions

Abstract: The eigenvalue and eigenfunction problem is fundamental and essential in mathematical analysis. The Steklov problem is an eigenvalue problem with its spectral parameter at the boundary of a compact Riemannian manifold. Recently the study of Steklov eigenfunctions has been attracting much attention. We consider the quantitative properties: Doubling inequality and nodal sets. We obtain the sharp doubling inequality for Steklov eigenfunctions on the boundary and interior of manifolds using delicate Carleman estimates. We can ask Yau's type conjecture for the Hausdorff measure of nodal sets of Steklov eigenfunctions on the boundary and interior of the manifold. I will describe some recent progress about this challenging direction. Part of work is joint with C. Sogge and X. Wang.