

2015 ECNU Workshop on Geometry and Analysis on Manifolds

Workshop Introduction

There will be a workshop on geometry and analysis on manifolds held in the Department of Mathematics at East China Normal University from July 22 to July 24, 2015.

The purpose of the workshop is to disseminate current research development in differential geometry, geometric analysis and related fields to graduate students, postdoctoral fellows, and mathematicians who are interested in these topics. We hope to bring students and experts together in an inspiring environment, which facilitates the beginning and the continuing of research collaborations and dissemination.

The workshop has planned several talks each day from July 22 to July 24. Participants are encouraged to engage in informal discussions between and after the lectures. According to the participants' interests, some informal talks may be arranged on demand.

TIME: July 22th (Wednesday) – July 24th (Friday), 2015

LOCATION: Room 1414, Science Building A, East China Normal University, 3663 North Zhongshan Road, Shanghai, China. (华东师范大学理科大楼 A1414 室, 中山北路 3663 号)

REGISTRATION: July 21st, Yi Fu Lou, East China Normal University, 3663 North Zhongshan Road, Shanghai, China. (华东师范大学逸夫楼, 中山北路 3663 号)

RESTRAUNT: Qiu Lin Ge (秋林阁)

SPONSORS: East China Normal University

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Porfessor

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Linfeng ZHOU

Associate Professor

East China Normal University

Program of Workshop

July/22	
8:45-9:00	Opening
9:00-9:45	Weiping ZHANG Chern Institute of Mathematics
9:45-10:00	Coffee Break
10:00-10:45	Kenichi YOSHIKAWA University of Kyoto
10:45-11:15	Coffee Break
11:15-12:00	Fei HAN National University of Singapore
12:00-14:00	Lunch
14:00-14:45	Jie QING University of California, Santa Cruz
14:45-15:00	Coffee Break
15:00-15:45	Haizhong LI Tsinghua University
15:45-16:15	Coffee Break
16:15-17:00	Minchun HONG University of Queensland, Australia
17:00-17:15	Coffee Break
17:15-18:00	Qi Zhang University of California, Riverside
18:30	Dinner

July/23

9:00-9:45	Guoliang YU Texas A & M and Fudan Uni.
9:45-10:00	Coffee Break
10:00-10:45	Xiang TANG University of Washington, Saint Louis
10:45-11:00	Coffee Break
11:00-11:45	Siye WU Tsing Hua University, Taiwan
11:45-12:00	Photograph
12:00-13:00	Lunch
13:00-17:00	Free Discussion
18:30	Banquet

July/24

9:00-9:45	Xiaochun RONG Rutgers and CNU
9:45-10:00	Coffee Break
10:00-10:45	Gang LIU University of California, Berkeley
10:45-11:15	Coffee Break
11:15-12:00	Jiayong Wu Shanghai Maritime University
12:00-14:00	Lunch
14:00-14:45	Xiaonan MA University of Paris 7
14:45-15:00	Coffee Break
15:00-15:45	Huitao FENG Chern Institute of Mathematics
15:45-16:00	Coffee Break
16:00-16:45	Guihua GONG University of Puerto Rico
16:45-17:00	Coffee Break
17:00-17:30	Jianqing YU University of Science and Technology
17:30-18:00	Changliang WANG Univeristy of California, Santa Barabra

Abstracts of Workshop Talk

Talk1 Positive scalar curvature on foliations

Weiping ZHANG Chern Institute of Mathematics

Talk2 Analytic torsion for K3 surfaces with involution

Kenichi YOSHIKAWA University of Kyoto

Abstracts: In 2004, I introduced a holomorphic torsion invariant of K3 surfaces with involution and proved its automorphy viewed as a function on the moduli space. Very recently, its explicit formula is completely determined. It is expressed as the product of an explicit Borcherds lift and a classical Siegel modular form. In my talk, I will report this progress. This is a joint work with Shouhei Ma.

Talk3 Twisted elliptic genus on spin^c manifolds and modularity of Witten eta invariant on spin manifolds

Fei HAN National University of Singapore

Abstract: In this talk, I will review the twisted elliptic genus on spin^c manifolds and show how it can be applied to study modularity of the Witten eta invariant, a secondary invariant analogue of the elliptic genus on odd dimensional spin manifolds. I will also introduce Bunke's improvement of our modularity result. This represents our joint work with Professor Weiping Zhang.

Talk4 Scalar invariants of surfaces in conformal 3-sphere.

Jie QING University of California, Santa Cruz

Abstract: This is a report for the joint work with Changping Wang and Jingyang Zhong.

We are interested in establishing a fundamental theorem for surfaces in conformal 3-sphere and conformal 3-manifolds in general. To do so we regard 3-sphere as the projectivized positive light cone in Minkowski space-time of 5 dimension and, in the same spirit, as the conformal infinity of hyperbolic 4-space. We construct associated surfaces in Minkowski space-time as well as in hyperbolic 4-space and apply fundamental theorem for surfaces in (pseudo)- Riemannian geometry. We are looking to extend the use of ambient spaces of Fefferman and Graham to study the conformal geometry of submanifolds. With this approach, one may produce scalar invariants for surfaces in conformal manifolds.

Talk5 Renormalized volume coefficients and Gauss-Bonnet-Chern curvatures

Haizhong LI Tsinghua University, Beijing

Abstract: Abstract: The renormalized volume coefficients $v^{2k}(g)$ were introduced and studied by C. Fefferman, C. R. Graham, S.-Y. A. Chang- H. Fang and Han-Guo-Li etc. In this talk, we present our works, which include the variational formulas of the functional $\int_M v^{2k}(g)dv_g$ and their applications, and Kazdan-Warner type identity involving $v^{2k}(g)$ and Gauss-Bonnet-Chern curvatures $G_{2r}(g)$. When (M,g) is locally conformally flat, $v^{2k}(g)$ and $G_{2r}(g)$ are equal to k -th elementary symmetric function $\sigma_k(g)$ of the eigenvalue of the Schouten tensor A_g . In this case, our results reduce to known results.

Talk6 A parabolic gauge fixing theorem and its application to the Yang-Mills flow

Minchun HONG University of Queensland, Australia

Abstract: K. Uhlenbeck in 1982 established a gauge fixing theorem to obtain a compactness theorem, which has played an important role in Yang-Mills theory. In this talk, we establish a parabolic gauge fixing theorem and present a new proof of the for the Yang-Mills flow on a four dimensional manifold.

Talk7 A Li-Yau gradient bound under nearly optimal Ricci curvature condition

Qi Zhang University of California, Riverside

Abstract: We prove Li-Yau type gradient bound for the heat equation either on fixed manifolds or on Ricci flows. In the former case the curvature condition is $|\text{Ric}^-| \in L^p$ for some $p > n/2$, or $\int_M |\text{Ric}^-|^2(x,y) d^{2-n}(x,y) < \infty$, where n is the dimension of the manifold. In the later case, then one only needs scalar curvature being bounded. We will explain why the conditions are nearly optimal and give an application on extending Colding-Naber's result. The Li-Yau bound on the heat equation seems to be the first one allowing Ricci curvatures not bounded from below. This is joint work with Richard H. Bamler and Meng Zhu.

Talk8 Secondary invariants of elliptic operators and its applications to geometry

Guoliang YU Texas A & M and Fudan Uni.

Abstract: In this talk, I will introduce the higher rho invariants of elliptic differential operators and discuss its applications to geometry and topology of manifolds.

Talk9 An Analytic Grothendieck Riemann Roch Theorem

Xiang TANG University of Washington, Saint Louis

Abstract: In this talk, we will discuss an extension of the Boutet de Monvel Toeplitz index theorem to complex manifolds with isolated singularities. As an application, we will use this index theorem to study the Arveson-Douglas conjecture. This is joint work with R. Douglas and G. Yu.

Talk10 Non-orientable surfaces and electric-magnetic duality

Siye WU Tsing Hua University, Taiwan

Abstract: In this talk, I explain the role of non-orientable surfaces in twisted $N=4$ supersymmetric gauge theory in 4 dimensions whose compactification along orientable surfaces yields mirror symmetry and geometric Langlands program as studied by Kapustin and Witten. I relate the discrete electric and magnetic fluxes of 't Hooft in 4 dimensions to the topology of moduli spaces from 2 dimensions.

Talk11 Moduli Join Rigidity in Alexandrov Geometry

Xiaochun RONG Rutgers and CNU

Abstract: Alexandrov geometry was introduced by Burago-Gromov- Perelman in 1992, which is a synthetic geometry on a class of length metric spaces. A significant advantage is that many natural operations, such as gluing, quotient by isometries, join (e.g. cones and suspensions) are preserved. In this talk, we will discuss rigidity aspects of finite quotients of joint structures. This is a joint work with Yusheng Wang of Beijing Normal University.

Talk12 Gromov-Hausdorff convergence of Kähler manifolds and the finite generation conjecture

Gang LIU University of California, Berkeley

Abstract: We study the uniformization conjecture of Yau by using the Gromov-Hausdorff convergence. As a consequence, we confirm Yau's finite generation conjecture. More precisely, on a complete noncompact Kähler manifold with nonnegative bisectional curvature, the ring of polynomial growth holomorphic functions is finitely generated. We also prove that if M is a complete noncompact Kähler manifold with nonnegative bisectional curvature and maximal volume growth, then it is biholomorphic to an affine algebraic variety. During the course of the proof, we also confirm a conjecture of Ni Lei on the existence of polynomial growth holomorphic functions on complete Kähler manifolds with nonnegative bisectional curvature.

Talk13 Liouville theorems on smooth metric measure spaces

Jiayong Wu Shanghai Maritime University

Abstract: I will talk about local Harnack inequalities for positive solutions of the Δ_μ -heat equation, local Gaussian upper and lower bounds for the Δ_μ -heat kernel on complete smooth metric measure spaces with Bakry-Emery Ricci tensor bounded below. Our philosophy is to use the De Giorgi-Nash-Moser theory and avoid the argument of Li-Yau gradient estimate. As applications, we prove sharp Liouville theorems for L^p_μ -integrable Δ_μ -harmonic functions. This is joint work with Peng Wu.

Talk14 Equidistribution for zeros of holomorphic sections of singular Hermitian line bundles

Xiaonan MA University of Paris 7

Abstract: We explain the equidistribution of zeros of random holomorphic sections of powers of a semipositive singular Hermitian line bundle, with an estimate of the convergence speed.

Talk15 Chern forms of holomorphic Finsler vector bundles and Finsler-Einstein metrics

Huitao FENG Chern Institute of Mathematics

Abstract: In this talk, we will give two kinds of Chern forms expressed by a strongly pseudo-convex Finsler metric on a holomorphic vector bundle and explore some applications of them, which answers a problem of Faran to some extent; we also prove that a holomorphic Finsler-Einstein vector bundle over a closed Kaehler manifold is semistable by introducing an extended Donaldson functional, which solves a problem of Kobayashi.

Talk16 Noncommutative Geometry, Positive Scalar Curvature, and the Strong Novikov Conjecture

Guihua GONG University of Puerto Rico

Abstract: In this talk, I will give an introduction of non commutative geometry and present a geometrization of strong Novikov Conjecture for residually finite groups. This is a joint work with Q. Wang and G. Yu.

Talk17 On the Witten Rigidity Theorem for Toeplitz operators

Jianqing YU University of Science and Technology

Abstract: In this talk, we study the rigidity of Toeplitz operators associated to several Witten type operators on odd dimensional manifolds. An interesting consequence of our main result is that the Toeplitz-Rarita-Schwinger operator is rigid under certain mild topological conditions. This is joint work with Fei Han.

Talk18 An eigenvalue problem on compact manifolds with isolated conical singularities

Changliang WANG Univeristy of California, Santa Barabra

Abstract: I will talk about some work with Prof. Xianzhe Dai about generalizing Perelman's lambda-functional on compact manifolds with isolated conical singularities. This is essentially an eigenvalue problem and closely related to the asymptotic behavior of eigenfunctions near singularities.

