

Abstract and titles of talks

Kazuo Akutagawa

Title: Yamabe constants of infinite coverings and a positive mass theorem

Abstract: The *Yamabe constant* $Y(M, C)$ of a given closed conformal manifold (M, C) is defined by the infimum of the normalized total-scalar-curvature functional E among all metrics in C . The study of the second variation of this functional E led O.Kobayashi and Schoen to independently introduce a natural differential-topological invariant $Y(M)$, which is obtained by taking the supreme of $Y(M, C)$ over the space of all conformal classes. This invariant $Y(M)$ is called the *Yamabe invariant* of M . For the study of the Yamabe invariant, the relationship between $Y(M, C)$ and those of its conformal coverings is important, the case when $Y(M, C) > 0$ particularly. When $Y(M, C) \leq 0$, by the uniqueness of unit-volume constant scalar curvature metrics in C , the desired relation is clear. When $Y(M, C) > 0$, such a uniqueness does not hold. However, Aubin proved that $Y(M, C)$ is strictly less than the Yamabe constant of any of its non-trivial *finite* conformal coverings, called *Aubin's Lemma*. In this talk, we generalize this lemma to the one for the Yamabe constant of any (M_∞, C_∞) of its *infinite* conformal coverings, under a certain topological condition on the relation between $\pi_1(M)$ and $\pi_1(M_\infty)$. For the proof of this, we also establish a version of positive mass theorem for a specific class of asymptotically flat manifolds with singularities.

Werner Ballmann

Title: Boundary value problems for Dirac operators

Gerard Besson

Title: An alternative proof of the geometrization for aspherical manifolds

Abstract: In this lecture, we discuss Perelman's work. We will explain our alternative proof of the geometrization for aspherical manifolds assuming results on the Ricci flow.

Mingliang Cai

Title: A positive mass theorem and some rigidity results for asymptotically hyperbolic manifolds

Abstract: We will present some scalar curvature and Ricci curvature rigidity results for asymptotically hyperbolic manifolds and a positive mass theorem for such manifolds.

Shu-Cheng Chang

Title: On the CR analogue of Li-Yau's eigenvalue estimate of a sublaplacian on a pseudohermitian 3-manifold

Abstract: In this talk, joint with H.-L. Chiu, we study a lower bound estimate of the first positive eigenvalue of the sublaplacian on a 3-dimensional pseudohermitian manifold with nonnegative CR Paneitz operator. By using the Li-Yau gradient estimate, we are able to get an effect lower bound estimate under a general curvature condition. Moreover, one can have the CR analogue of M. Obata's theorem on a closed pseudohermitian 3-manifold with free pseudohermitian torsion. The key step is a discovery of new CR version of Bochner formula which involving the CR Paneitz operator.

Jih-Hsin Cheng

Title: The mass and the Paneitz operator in 3-dimensional CR geometry

Abstract: I will report on an on-going project about the study of the mass in CR geometry. We will define an analogue of the ADM mass for an asymptotically Heisenberg 3-manifold, called p-mass. For a closed 3-dimensional pseudohermitian manifold M , we consider the Green function of the CR Laplacian. We can identify the first nontrivial coefficient of the Green function expansion with the p-mass of the blow-up asymptotically Heisenberg 3-manifold at a point. Through such a connection we can prove the existence of a minimizer in a positive CR Yamabe class if the p-mass is nonnegative and positive unless M is the standard pseudohermitian 3-sphere. Solving the b equation with decay boundary value at ∞ on an asymptotically Heisenberg 3-manifold, we can then express the p-mass as an integral formula. There is an extra term involving the CR Paneitz operator P , which does not appear in the formula of the ADM mass. So in addition to the condition that the Tanaka-Webster scalar curvature is nonnegative, we need nonnegativity of P to get nonnegativity of the p-mass. We will also discuss the situation of vanishing p-mass.

Yuxin Dong

Title: Chern type Theorems for graphs with parallel mean curvature

Abstract: In 1965, Chern proved that the only entire graphic hypersurface of constant mean curvature in Euclidean space must be minimal. In this talk, we will discuss some results which generalize Chern type result both for graphic submanifolds in Euclidean space and for spacelike submanifolds in pseudo-Euclidean space.

Hao Fang

Title: On new conformal curvature invariants

Kenji Fukaya

Title: Lagrangian Floer theory

Abstract: In this talk I want to report on joint work with Y.-G. Oh, H. Ohta and K. Ono on Floer homology of Lagrangian submanifold. I want to explain how the method of homological algebra and pseudo holomorphic curve together with chain level intersection theory provides a machinery to study Lagrangian submanifold of symplectic manifold.

Akito Futaki

Title: Complete Ricci-flat Kaehler metrics on the canonical bundles of toric Fano manifolds

Abstract: We prove the existence of complete Ricci-flat Kaehler metrics on the canonical bundles of toric Fano manifolds. This is an application of an existence result of toric Sasaki-Einstein metrics.

Yuxin Ge

Title: On the σ_2 -scalar curvature and its application

Abstract: In this talk, we establish an analytic foundation for a fully non-linear equation $\frac{\sigma_2}{\sigma_1} = f$ on manifolds with positive scalar curvature from conformal geometry. As application, we prove if a compact 3-dimensional manifold M admits a riemannian metric with positive scalar curvature and $\int \sigma_2 > 0$, then topologically M is a quotient of sphere. This is a joint work with G. Wang et C-S. Lin.

Ursula Hamenstaedt

Title: Minimal Reeb orbits on boundaries of convex domains in \mathbb{C}^2

Abstract: Using minimal surfaces we show that a periodic Reeb orbit of self-linking number -1 on the boundary of a compact convex domain in \mathbb{C}^2 is unknotted and bounds an embedded symplectic disc.

Qing Han

Title: Isometric embedding of 2-dim Riemannian metric in 3-space

Abstract: It is a classical problem whether a 2-dimensional Riemannian manifold admits an isometric embedding in Euclidean 3-space. In this talk, we will review known results and present some new ones.

Kengo Hirachi

Title: Q-curvature in CR geometry

Abstract: For 3-dimensional CR manifolds, the Q-curvature appears in the logarithmic term in the Szego kernel. I will generalize this relation to

higher dimensions by generalizing the notion of Q- curvature. This family of Q-curvatures is associated with non-linear CR invariant differential operators and is constructed by using the ambient metric.

Bernhard Leeb

Title: On convex sets in symmetric spaces of higher rank

John Lott

Title: Dimensional reduction and long-time behaviour of Ricci flow

Abstract: Perelman used Ricci flow to prove the geometrization conjecture. However, the precise long-time behaviour of a three-dimensional Ricci flow is largely unknown. I will give some convergence results under the assumption that the sectional curvatures decay as least as fast as the inverse of the time.

Zhiqun Lu

Title: On the DDVV conjecture

Abstract: We proved an algebraic inequality in submanifold geometry which relates the scalar curvature, the normal scalar curvature, and the second fundamental form of a 3-fold immersed in a space form.

Xiaohuan Mo

Title: On the non-Riemannian quantity H of a Finsler metric

Abstract: In my lecture, I will present non-Riemannian quantity H on a Finsler manifold in terms of flag curvature and Ricci scalar. In particular, I will show that all R-quadratic Finsler metrics have vanishing non-Riemannian invariant H generalizing result previously only known in the case of Randers metric.

Libin Mou

Title: Nonsmooth analysis on metric spaces and its applications

Abstract: This talk presents a nonsmooth analysis on metric spaces with convex tangent cones (such as Busemann G-spaces with curvatures bounded from above). Applications and unsolved problems will be discussed.

Frank Pacard

Title: Constant mean curvature surfaces in Riemannian manifolds

Abstract: I will report some results concerning the existence of constant mean curvature surfaces in Riemannian manifolds. These results give a partial description of some boundaries of the moduli space of constant mean curvature surfaces in a fixed Riemannian manifold.

Shengliang Pan

Title: On a new curve evolution problem in the plane

Xiaochun Rong

Title: Positively curved manifolds with abelian symmetry

Abstract: We will survey a recent development in the study of positively curved manifolds which admits an isometry abelian group action.

Viktor Schroeder

Title: Hyperbolic rank of metric spaces

Abstract: We discuss the hyperbolic rank, a quasi-isometry invariant of metric spaces first introduced by Gromov. The hyperbolic rank measures in some sense the amount of hyperbolicity of a metric space. One can compute the hyperbolic rank of certain standard spaces, e.g. symmetric spaces. It seems to be very difficult to compute the hyperbolic rank of certain singular spaces as for example euclidean buildings. We present some new results in this direction and discuss open problems.

Ravi Shankar

Title: Conjugate points in length spaces

Abstract: In this talk we present at least three new notions of conjugate point for complete, proper, compact inner metric spaces whose curvature is bounded above by a fixed real number k . We do this in order to generalize known classical theorems in Riemannian geometry like: the Klingenberg long homotopy lemma, the Rauch comparison theorem and an estimate on the injectivity radius in terms of a shortest closed geodesic. We will also present several open problems/questions for further study. This talk reports on joint work in progress with Christina Sormani (CUNY).

Yi-Bing Shen

Title: On a class of critical Riemannian-Finsler metrics

Abstract: As is well known, among Riemannian metrics on a compact n -manifold M there is an important class of metrics called Einstein metrics, which are the critical points of the normalized Einstein-Hilbert functional

$$\frac{1}{\text{Vol}^{1-2/n}(M)} \int_M R d\mu_M,$$

where R is the scalar curvature of the Riemannian metric, $d\mu_M$ is the volume element of M . An analogous functional in Finsler geometry is defined and its Euler-Lagrange equation is given. Some examples of critical metrics are given, where non-Riemannian critical metrics are related to Calabi-Yau metrics. Moreover, some rigidity theorems for a Finsler metric to be Riemannian are obtained.

Changping Wang

Title: Submanifolds in Lie sphere geometry and its sub-geometries

Guofang Wang

Title: Analytic Aspects of Sasakian geometry

Xue-Ping Wang

Title: Threshold resonances on manifolds with conical end

Abstract In this talk, I will give some properties of resonance at zero for Schroedinger operators on Riemannian manifolds with conical end. As an application, I will describe the asymptotic expansion in large time of the Schroedinger group without any cut-off in energy.

Shihshu Walter Wei

Title: p-Harmonic geometry, variational problems and quasi-regular mappings

Abstract: We'll study variational problems by using p-harmonic maps as catalysts that do not seem to work by employing ordinary harmonic maps (in which $p=2$). This approach is naturally connected to many other branches of mathematics. In particular, some results on topology, PDEs, minimal varieties, quasi-regular and quasi-conformal mappings will be discussed.

Jyh-Yang Wu

Title: Energy, variance and scalar curvature

Abstract: In this talk, we shall discuss two meanings about the scalar curvature. Following the idea of the path integral and the principle of classical-quantum duality, we shall derive a Newton equation for motion on curved space with quantum effect. The concept of variance of a random variable on a Riemannian manifold will also be reduced. It will be related with the scalar curvature.

Yuan-Long Xin

Title: Curvature estimates for minimal sub-manifolds of higher codimension

Abstract: We derive curvature estimates for minimal submanifolds in Euclidean space for arbitrary dimension and codimension via Gauss map. Thus, Schoen-Simon-Yau's results and Ecker-Huisken's results are generalized to higher codimension. In this way we improve Hildebrandt-Jost-Widman's result for Bernstein type theorem.

Yu Zheng

Title: On the uniform bounded estimations of some σ_k curvature flow of hypersurface