# Titles and Abstracts

## TOPOLOGICAL PROPERTIES AND COMPACTIFICATIONS OF MODULI SPACES OF RIEMANNIAN METRICS

**Wilderich Tuschmann**
Karlsruhe University

Consider a smooth manifold with a Riemannian metric satisfying some specific sort of geometric constraint like, for example, having positive scalar curvature, non-negative Ricci or negative sectional curvature, being Einstein, Kähler, Sasakian, etc.
A natural question to ponder is then what the 'space' of all such metrics does look like. Moreover, one can also study this question for the corresponding moduli spaces of metrics, i.e., quotients of the former by (suitable subgroups of) the diffeomorphism group of the manifold, acting by pulling back metrics.
These objects are customarily equipped with the topology of smooth convergence on compact subsets and the quotient topology, respectively. Their topological properties then provide the right means to measure 'how many' different metrics and geometries the given manifold actually does exhibit and since Teichmüller's and Weyl's early and seminal works in dimension two, the study of spaces of metrics and their moduli has been a topic of interest for differential geometers, global and geometric analysts, and topologists alike.
In my talk, after providing a short introduction to the subject with a focus on metrics with nonnegative curvature bounds, I will present a non-traditional metric approach to the study of moduli spaces via Gromov-Hausdorff convergence techniques which, in particular, also allows for the study of natural compactifications. Moreover, I will describe the moduli spaces of flat and certain Ricci flat metrics on closed manifolds in a new way via symmetric spaces and, given time permits, also discuss further results and applications arising from these descriptions.

## A higher order Sobolev inequality

**WANG,GUOFANG**
Freiburg University

In the talk I will propose a new type optimal Sobolev inequality and prove a special case as evidence. I will talk about possible approaches to prove the general case and difficulties.

## Mean curvature positivity and rational connectedness

**ZHANG,XI**
Nanjing University of Science and Technology

In this talk, we consider mean curvature positivity of holomorphic vector bundle. We will show that that the mean curvature positivity is equivalent to the HN-positivity. As its applications, We establish the correspondence between rational connectedness in algebraic geometry and mean curvature positivity in differential geometry. We also introduce our recent work on the rational connectedness of compact K\"ahler manifolds which extends Yau's conjecture to the quasi-positive case. These works are joint with Chao Li, Shiyu Zhang and Chuanjing Zhang.

## Qualitative behavior at the free boundary for harmonic map type problems

**ZHU,MIAOMIAO**
Shanghai Jiao Tong University

In this talk, we shall present some recent progress on the qualitative behavior at the free boundary for some conformally invariant geometric variational Lagrangians.

## Some results related to the Kazdan-Warner equations

**SUN,LINLIN**
Guangxi Normal University

The Kazdan-Warner equation on surface comes from the prescribed Gaussian curvature problem, and also appears in various contexts such as the abelian Chern-Simons-Higgs models. I shall talk about some results related to the Kazdan-Warner equations on surfaces or finite graphs, including the elliptic method and parabolic approach to the Kazdan-Warner equations on surfaces with sigh-changed prescribing function, as well as the topological method to the existence of Kazdan-Warner equations on surfaces or finite graphs. This talk is based on the joint works with Prof. Li Jiayu, WANG Liuquan, YANG Yunyan and ZHU Jingyong.

## A Willmore-type inequality for free boundary hypersurfaces in unbounded convex domains

**XIA,CHAO**
Xiamen University

We shall discuss a Willmore-type inequality for free boundary hypersurfaces in an unbounded convex domain, which says that the total curvature of the free boundary hypersurfaces is bounded

below by the asymptotic volume ratio of the domain. This Willmore inequality leads to a relative isoperimetric inequality.

## Minimal graphs over manifolds

**DING,QI**
Fudan University

We will talk about properties of minimal graphs over manifolds, including Liouville type theorems, Neumann-Poincare inequality, gradient estimates, asymptotic estimates, splitting theorems and so on.

## On a new Omori-Yau maximum principle for harmonic maps

**Renan Assimos**
Hannover University

By introducing a concept generalising several convexity notions we obtain a new Omori-Yau maximum principle for harmonic maps defined on a stochastically complete manifold. Some of the applications of this new maximum principle include conformal harmonic maps, an adaptation of a conjecture of Calabi, harmonic immersions with certain energy bounds, wedge theorems for minimal submanifolds of $\R^n$ and a walled halfspace theorem.

## Rigidity of of ancient solutions to the mean curvature flow in higher codimension

**QIU,HONGBING**
Wuhan University

In this talk, we shall discuss ancient solutions to the mean curvature flows. By carrying out refined curvature estimates, we prove better rigidity theorems of complete noncompact ancient solutions to the mean curvature flow in higher codimension under various Gauss image restriction. This is a joint work with professor Y. L. Xin.

## Three circle lemma and its applications in some geometric variational problems

**LIU,LEI**
Central China Normal University

In this talk, we will first recall the three circle lemma for harmonic functions and then give its applications in the blow-up analysis of some geometric variational problems, such as harmonic

maps, Dirac-harmonic maps and so on. Precisely, we will prove some energy identities in the blow-up process.

## Geometry of Landau-Ginzburg Models

**FAN,HUIJUN**
Peking University

An LG model (M, f) is given by a noncompact complex manifold M and the holomorphic function f defined on it, which is an important model in string theory. This talk gives a survey of my work on the study of differential geometric structure of a LG model since 2011. We starts with some examples, gives the geometric and topological information contained by a LG model, and then consider the Schrodinger equations and their deformation theory of a family of LG models. The output is the Hodge variation structures, Gauss-Manin connections, index theory and torsion invariants.

## Super Stable Maps and Super Gromov-Witten Invariants

**Enno Keßler**
Max Planck Institute for Mathematics in the Sciences

J-holomorphic curves or pseudoholomorphic curves are maps from Riemann surfaces to almost Kähler manifolds satisfying the Cauchy-Riemann equations. The moduli space of J-holomorphic curves has a natural compactification using stable maps. Moduli spaces of stable maps are of great interest because they allow to construct invariants of the target manifold and those invariants are deeply related to topological superstring theory.
In this talk, I want to report on a supergeometric generalization of J-holomorphic curves, stable maps and Gromov-Witten invariants where the domain is a super Riemann surface. Super Riemann surfaces have first appeared in superstring theory as generalizations of Riemann surfaces with an additional anti-commutative dimension. Super J-holomorphic curves are solutions to a system of partial differential equations on the underlying Riemann surface coupling the Cauchy-Riemann equation with a Dirac equation for spinors. I willexplain how to construct moduli spaces of super J-holomorphic curves and super stable maps in genus zero via super differential geometry and geometric analysis.
Motivated by the super moduli spaces I give an algebro-geometric proposal for super Gromov-Witten invariants satisfying generalized Kontsevich-Manin axioms.

## Nodal sets of solutions to Dirac equations

**WU,RUIJUN**
Beijing Institute of Technology

Motivated from some geometric problems, we study the nodal sets of solutions to general Dirac equations. We obtain a dimension estimate via approximating the solutions by harmonic spinors. Further under some growth condition we show that the nodal sets are stratified, using an adapted version of the frequency function for spinors.These generalize the previous well-known results for smooth solutions.
This is a joint work with W.Borrelli.

## Boundary regularity of harmonic maps from RCD spaces to CAT(0)-spaces

**ZHANG,HUICHUN**
Sun Yat-sen University

In this talk, we will introduce the boundary regularity for harmonic maps from RCD(K,N) spaces, a class of metric measure spaces with generalized Ricci curvature bounded from below, into non-postively curved space in the sense of Alexandrov spaces. This is a joint work with Xi-Ping Zhu.

## Graphs with nonnegative Ollivier Ricci curvature

**HUA,BOBO**
Fudan University

We study the class of graphs with nonnegative Ricci curvature in the sense of Ollivier, Lin-Lu-Yau, et al. We prove the number of ends is at most two for an infinite graph with nonnegative Ricci curvature. Moreover, we prove that the grid graph, a discrete analog of the Euclidean space, is rigid in the following sense: any nontrivial local perturbation of a grid graph produces negative Ricci curvature somewhere. The key tools are harmonic functions of linear growth. These are joint works with Florentin Muench and Haohang Zhang.

## Supersymmetric Generalized Seiberg-Witten Theory in Dimension 4

**JIANG,SHUHAN**
Max Planck Institute for Mathematics in the Sciences

In this talk, I will introduce a supersymmetric extension of the 4D generalized Seiberg-Witten functional, thereby establishing it as a cohomological field theory. I will discuss its connections to the 4D Super Yang-Mills theory. If time allows, I will also touch upon its perturbative quantization.

## Sobolev Spaces on Graphs and Their Applications

**ZHAO,LIANG**
Beijing Normal University

We consider Sobolev spaces and their several basic properties on locally finite graphs. Unlike the Euclidean case, since there is no exact concept of dimension on graphs, we introduce a space composed of vector-valued functions with variable dimensions to address this issue. As fundamental analytical tools, these results would be extremely useful for partial differential equations on graphs. We will discuss their applications in several nonlinear equations or systems on graphs.
The report is based on collaborative works with Han X.L., Shao M.Q., Yang Y.Y, etc.

## Existence and uniqueness of Dirac-harmonic maps

**ZHU,JINGYONG**
Sichuan University

As a commutative version of the supersymmetric nonlinear sigma model, Dirac-harmonic maps from Riemann surfaces were introduced almost twenty years ago. They are critical points of an unbounded conformally invariant functional involving two fields. As solutions to a coupled nonlinear elliptic system, the existence theory of Dirac-harmonic maps has already received much attention. In this talk, we present some results on the existence and the uniqueness of Dirac-harmonic maps based on the joint works with Professor Jürgen Jost.

## Isoperimetry and extremal eigenvalues of Cayley graphs

**LIU,SHIPING**
University of Science and Technology of China

We will discuss certain symmetry of the spectra of the normalized adjacency matrices of Cayley graphs in terms of their vertex/edge isoperimetry. This improves upon recent obtained estimates aiming at a quantitative version of an observation due to Breuillard, Green, Guralnick and Tao. We use spectral theory of signed graphs as a tool. This is based on joint works with Chunyang Hu and with Wenbo Li.

## Anisotropic Moser-Trudinger inequalities and the related inequalities

**ZHOU,CHUNQIN**
Shanghai Jiao Tong University

In this talk, I mainly introduce some ideas that be used to extend the classical Moser-Trudinger inequality to its anisotropic type. Similar arguments can be applied for establishing the anisotropic weighted Moser-Trudinger inequalities and the anisotropic Adams'inequality. These are joint works with Changliang Zhou, Tao Zhang and Tingzhi Cheng.

## Some Variational Results of the Generalized Seiberg-Witten Functional

**AI,WANJUN**
Southwest University

In this presentation, I will delve into the exploration of a generalized Seiberg–Witten functional, which unifies the classical Seiberg–Witten and Kapustin–Witten functionals. These gauge functionals, derived from quantum field theory, have demonstrated profound applications in various mathematical contexts. The talk will provide insights into the existence and regularity of critical points within this generalized framework. This work is a collaboration with Shuhan Jiang and Jürgen Jost.

## LIPSCHITZ REGULARITY OF HARMONIC MAPS FROMHEISENBERG GROUP INTO CAT(0) SPACE

**GUI,YAOTING**
Beijing International Center for Mathematical Research (BICMR)

We prove the local Lipschitz continuity of energy minimizing harmonic maps between singularspaces, more specifcally from the n-dimensional Heisenberg group into CAT(0) spaces, This is a jointwork with Renan Assiros and Jiirgen Jost.