几何/拓扑青年研讨会

Geometry/Topology Young Researcher Workshop

2025 年 12 月 17–19 日

December 17–19, 2025

中国科学院数学与系统科学研究院

Academy of Mathematics and Systems Science, CAS

会议地点：中科院数学所教室南楼 N820

Venue: AMSS, South Building, Room N820

会议组织人：王健，王晋民，何思奇

Organizers: Jian Wang, Jinmin Wang, Siqi He

日程安排 / Schedule

时间/Time	内容/Program
12 月 17 日 / Dec 17	
全天 / All day	签到 / Registration
12 月 18 日 / Dec 18	
10:00–11:00	陈家煌 Jiahuang Chen (AMSS)
11:10–12:10	严大燊 Dashen Yan (Stony Brook)
14:00–15:00	伊泽霖 Zelin Yi (Tongji)
15:10–16:10	严泽田 Zetian Yan (UCSB)
16:20–17:20	沙泽浩 Zehao Sha (USTC)
12 月 19 日 / Dec 19	
10:00–11:00	谷世杰 Shijie Gu (Northeastern)
11:10–12:10	李明阳 Mingyang Li (Stony Brook)
14:00–15:00	Kotaro Kawai (BIMSA)
15:10–16:10	王志涵 Zhihan Wang (Cornell)

报告信息 / Titles and Abstracts

12 月 18 日 / Dec 18

Examples of critical Z/2 eigensections

陈家煌 Jiahuang Chen（AMSS） **10:00–11:00**

Abstract:

The Z/2 harmonic 1-forms, introduced by Clifford Taubes, are higher dimensional analogues of quadratic differentials and arise naturally in various gauge-theoretic and differential geometric problems. Critical Z/2 eigensections are viewed as flat models for Z/2 harmonic 1-forms.

In this talk, we will first define Z/2 eigensections, and then present the construction of a family of critical Z/2 eigensections. This is joint work with Siqi He.

Non-degenerate $\mathbb{Z}_2$-harmonic 1-forms on $\mathbb{R}^n$ and their geometric applications

严大燊 Dashen Yan（Stony Brook） **11:10–12:10**

Abstract:

The $\mathbb{Z}_2$-harmonic 1-forms arises in various compactification problems in gauge theory, deformation problem in special holonomy and calibrated geometry, including those involving flat $\mathrm{PSL}(2,\mathbb{C})$ connections, Fueter sections, branched deformations of special Lagragians and Donaldson's branched maximal sections into indefinite spaces.

In this talk, I will describe a recent construction of a family of non-degenerate $\mathbb{Z}_2$-harmonic 1-forms on $\mathbb{R}^3$ and describe their relation to Lawlor's neck, a family of special Lagrangian in $\mathbb{C}^n$. We will also discuss a gluing construction, in which these examples are glued to a regular zero of a harmonic 1-form on a compact manifold and explain its potential application to G_2 geometry.

Deformation of Clifford algebras and the local index theory

伊泽霖 Zelin Yi（Tongji） **14:00–15:00**

Abstract:

The process of deforming pseudodifferential operators to their symbols is captured by geometric construction of tangent groupoid. Alain Connes used this construction to streamlined the proof of Atiyah-Singer index theorem. In this talk, we shall discuss the extension of Connes' method to local index theory.

Uniqueness of the asymptotic limits for Ricci-flat manifolds with linear volume growth

严泽田 Zetian Yan（UCSB） **15:10–16:10**

Abstract:

Under natural assumptions on curvature and cross section, we establish the uniqueness of asymptotic limits and the exponential convergence rate for complete noncollapsed Ricci-flat manifolds with linear volume growth, which are known to only admit cylindrical asymptotic limits. In dimension four, these assumptions hold automatically, yielding unconditional uniqueness and convergence. In particular, our results show that all asymptotically cylindrical Calabi–Yau manifolds converge exponentially to their asymptotic limits, thereby answering affirmatively a question by Haskins–Hein–Nordström. In dimension four our result strengthens those of Chen–Chen, who proved exponential convergence for ALH instantons.

The 2-systole on compact Kähler surfaces with positive scalar curvature

沙泽浩 Zehao Sha（USTC） **16:20–17:20**

Abstract:

In this talk, I will discuss my recent work on systolic inequalities on compact Kähler surfaces with positive scalar curvature (PSC). For a compact Kähler surface (X, ω) with PSC, I will explain how to prove the sharp inequality

$$\min_X S(\omega)\,\mathrm{Syst}_2(\omega) \leq 12\pi$$

with equality if $(M, \omega) \cong_{\mathrm{iso}} (\mathbb{CP}^2, \omega_{\mathrm{FS}})$. Using the classification of PSC Kähler surfaces by Minimal models, we determine the optimal constant in each case and describe the corresponding rigid models. If time permits, I will introduce an independent analytic argument on non-rational PSC Kähler surfaces, adapting Stern' s level set method to the Kähler setting.

12 月 19 日 / Dec 19

Topological regularity of Busemann spaces of nonpositive curvature

谷世杰 Shijie Gu (Northeastern) **10:00–11:00**

Abstract:

CAT(0) spaces, which generalize nonpositively curved Riemannian manifolds, have been extensively studied. Busemann nonpositive curvature (BNPC) is a weaker notion that admits non-Riemannian Finsler examples but it hasn't received nearly as much attention. In this talk, I will try to close this gap by introducing a topological regularity theory for BNPC spaces that parallels and extends the results known for CAT(0) spaces.

A key motivation comes from a question that Gromov asked back in 1981: does there exist a BNPC topological manifold that is not homeomorphic to Euclidean space? For dimension 4, we show the answer is no, by proving that any globally BNPC topological 4-manifold is homeomorphic to $\mathbb{R}^4$. This resolves the last open case of the problem. This is joint work with Tadashi Fujioka.

Poincare-Einstein 4-manifolds with complex geometry

李明阳 Mingyang Li (Stony Brook) **11:10–12:10**

Abstract:

Poincare-Einstein manifolds are important objects in geometric analysis and mathematical physics, while constructing them beyond the perturbative method remains challenging. In this talk, I will present a large-scale, non-perturbative construction that yields infinite-dimensional families of such manifolds in the presence of complex geometric structures. The approach reduces the Einstein equation to a Toda-type system. Joint work with Hongyi Liu.

Weighted calibration

Kotaro Kawai (BIMSA) **14:00–15:00**

Abstract:

In this talk, I will introduce weighted calibration, which is a generalization of calibration by Harvey and Lawson. An interesting example appears when a manifold admits a calibration and a calibrated distribution. Then a weighted calibration can be obtained by taking a certain type of (formal) adiabatic limit. There is a similar correspondence in the connection side via the Fourier-Mukai transform which gives the "mirror" correspondence. This talk is based on joint work with Tommaso Pacini (University of Turin).

Existence of genus 2 minimal surfaces in 3-spheres

王志涵 Zhihan Wang (Cornell) **15:10–16:10**

Abstract:

In the past decades, we have witnessed rapid development in the construction of minimal surfaces with controlled topology by Simon-Smith min-max theory. In this talk, I'll discuss the existence of a number of genus 2 minimal surfaces in a 3-sphere with a positive-Ricci-curved metric. This is based on the recent work joint with Adrian Chu and Yangyang Li.

实用信息 / Practical Information

- **会议地点 / Venue:** 会议地点：中科院数学所教室南楼 N820 (Venue: AMSS, South Building, Room N820).
- **地址 / Address:** 北京市中关村东路 55 号，中国科学院数学与系统科学研究院（AMSS, CAS）。
- **联系人 / Contact:** 会议组织人：王健，王晋民，何思奇 (Organizers: Jian Wang, Jinmin Wang, Siqi He).