Workshop on Geometric Variational Problems

January 18–24, 2026

Organizers: Jiayu Li (University of Science and Technology of China)

Ruijun Wu (Beijing Institute of Technology)

Jie Zhou (Capital Normal University)

几何变分问题研讨会

2026 年 1 月 18 日-24 日

召集人：李嘉禹（中国科技大学）

吴瑞军（北京理工大学）

周　杰（首都师范大学）

一、会议日程安排

2026 年 1 月 19 日星期一			
时间	**报告人**	**报告题目**	**主持人**
9:00-9：50	朱苗苗	Analysis aspects in geometric variational problems	李嘉禹
09:50-10:10	**休息**		
10:10-11:00	徐甜	Singular solutions for the spinorial Yamabe equation	
11:10-12:00	桂耀挺	Boundary reguylarity of sub-elliptic harmonic maps from Carnot groups	
12:00-14:00	**午餐/午休**		
14:00-14:50	陈学长	Polyharmonic Poisson kernels and Green functions of general order conformal boundary operators in upper half space	徐兴旺
14:50-15:10	**休息**		
15:10-16:00	朱晓宝	Kazdan-Warner problem and some related topics	
16:10-17:00	孙林林	Toda 系统	
17:40-20:00	**晚餐**		
2026 年 1 月 20 日星期二			
时间	**报告人**	**报告题目**	
9:00-9：50	邓宇星	Rigidity of positively curved steady Ricci solitons on manifolds and orbifolds	殷浩
09:50-10:10	**休息**		
10:10-11:00	刘佳伟	Limit behavior of the conical Kähler-Ricci flow with change in the cone angle	
11:10-12:00	李玉巧	Mass of C^0-asymptotically hyperbolic spaces via the normalized Ricci-DeTurck flow	
12:00-14:00	**午餐/午休**		
14:00-14:50	刘世平	Equiangular lines via nodal domains	周春琴
14:50-15:10	**休息**		
15:10-16:00	孙俊	On Type II singularities of Lagrangian and symplectic mean curvature flows	
16:10-17:00	赵亮	GEGCN: Advancing Graph Learning with Discrete Ricci Flow	
17:40-20:00	**晚餐**		
2026 年 1 月 21 日 星期三			
时间	**报告人**	**报告题目**	

9:00-9：50	殷浩	On the existence of Yang-Mills connections in dimension four	刘磊
09:50-10:10	**休息**		
10:10-11:00	艾万君	Blow-up Analysis for α-Yang–Mills–Higgs Fields on Surfaces	
11:10-12:00	陈波	Kato inequalities and applications	
12:00-14:00	**午餐/午休**		
下午	**自由活动**		
17:40-20:00	**晚餐**		
2026 年 1 月 22 日 星期四			
时间	**报告人**	**报告题目**	
9:00-9：50	周春琴	On super Liouville equations	郭玉霞
09:50-10:10	**休息**		
10:10-11:00	刘磊	Super-Liouville equation with a spinorial Yamabe type term	
11:10-12:00	沈伟明	The Monge-Ampere equation in convex polytope	
12:00-14:00	**午餐/午休**		
14:00-14:50	郭玉霞	Multiple Boundary Peak Solution for Critical Hamiltonian System with Neumann boundary	陈学长
14:50-15:10	**休息**		
15:10-16:00	朱超娜	Existence of prescribing scalar curvature problem on the negative Yamabe case	
16:10-17:00	温洋	Instability of Yang-Mills Connections on \delta-Pinched Riemannian Manifolds	
17:40-20:00	**晚餐**		
2026 年 1 月 23 日 星期五 （研讨活动）			
时间	**报告人**		
9:00-10：00	周志强	harmonic maps in higher dimensions	周杰
10:00-10:30	**休息**		
10:30-11:30	周志强		
12:00-14:00	**午餐/午休**		
14:00-15:00	张富平	stationary nonlinear Dirac equations	吴瑞军
15:00-15:30	**休息**		
15:30-16:30	张富平		
17:40-20:00	**晚餐**		

二、报告题目与摘要

报告人：艾万君

题目：Blow-up Analysis for α-Yang–Mills–Higgs Fields on Surfaces

摘要：We study the blow-up behavior of α-Yang–Mills–Higgs fields on closed surfaces. For any sequence with uniformly bounded α-energy, we establish both the energy identity and the neck lessness property, namely, the absence of energy loss and the connectedness between the weak limit and all bubbles. These results extend the corresponding compactness theorems for α harmonic maps and α-Dirac–harmonic maps to the gauge-theoretic setting. A key ingredient of the analysis is a newly derived conservation law together with a Pohozaev-type identity, which enables precise control of the concentration phenomena. This is joint work with Jiayu Li and Miaomiao Zhu.

报告人：陈波

题目：Kato inequalities and applications

摘要：Kato inequalities are fundamental analytical tools in geometric analysis. In this talk, we introduce a new improved Kato inequality and explore its applications to the study of harmonic maps and Yang–Mills–Higgs fields. This is based on joint work with Professor Chong Song.

报告人：陈学长

题目：Polyharmonic Poisson kernels and Green functions of general order conformal boundary operators in upper half space

摘要：Abstract: In the upper half space, we derive explicit formulas of Poisson kernels and Green functions for m-harmonic equation with boundary conditions, which consist of a 'proper' composition of general order conformal boundary operators. As applications, we establish a comparison principle and a generalized Caffarelli-Gidas-Spruck type classification theorem . This generalizes our joint work with Shihong Zhang when m=2. This talk is based on a joint project in progress.

报告人：邓宇星

题目：Rigidity of positively curved steady Ricci solitons on manifolds and orbifolds

摘要：Steady Ricci solitons are important examples of type II singularity models. In higher dimensions, singularity models can be steady Ricci solitons on orbifolds. In this talk, we will review some rigidity theorems on positively curved steady Ricci solitons on manifolds. We will also classify positively curved noncollapsed steady Ricci solitons on orbifolds that dimension reduce to quotients of spheres. This talk is based on the paper at arXiv:2504.14525.

报告人：桂耀挺

题目：Boundary reguylarity of sub-elliptic harmonic maps from Carnot groups

摘要：We study both interior and boundary regularity of harmonic maps from Heisenberg group into CAT(0) space. THis is a joint work with Renan Jost, Li-Jost, 王冰

报告人：郭玉霞

题目：Multiple Boundary Peak Solution for Critical Hamiltonian System with Neumann boundary

摘要：We consider the following elliptic system with Neumann boundary:

\begin{equation*} \begin{cases} -\Delta u + \mu u=v^p,\;\;\; &\hbox{in } \Omega,\\ -\Delta v + \mu v=u^q,\;\;\; &\hbox{in } \Omega,\\ \frac{\partial u}{\partial n} = \frac{\partial v}{\partial n} = 0, &\hbox{on } \partial\Omega,\\ u>0,v>0, &\hbox{in } \Omega, \end{cases}
\end{equation*}

where $\Omega \subset \R^N$ is a smooth bounded domain, μ is a positive constant and (p,q) lies in the critical hyperbola:

$$ \dfrac{1}{p+1} + \dfrac{1}{q+1} =\dfrac{N-2}{N}. $$

By using the Lyapunov-Schmidt reduction technique, we establish the existence of infinitely many solutions to above system. These solutions have multiple peaks that are located on the boundary $\partial \Omega$. Our results show that the geometry of the boundary $\partial\Omega,$ especially its mean curvature, plays a crucial role on the existence and the behaviour of the solutions to the problem.

报告人：李玉巧

题目： Mass of C^0-asymptotically hyperbolic spaces via the normalized Ricci-DeTurck flow

摘要：We define a mass function on asymptotically hyperbolic manifolds with continuous metrics via the normalized Ricci–DeTurck flow.

This definition coincides with the classical mass for C^2 metrics. We also introduce the scalar curvature lower bound for continuous metrics -- a key component in establishing the well-definedness of the C^0 mass.

报告人：刘佳伟

题目：Limit behavior of the conical Kähler-Ricci flow with change in the cone angle

摘要：In this talk, I will recall some results on conical Kähler-Ricci flow, and then talk about its limit behavior as the cone angle tends to 0. More precisely, as the cone angle tends to zero, the conical Kähler-Ricci flow converges to a unique Kähler-Ricci flow, which is smooth outside the divisor and admits cusp singularity along the divisor. This is a joint work with Professor Xi Zhang.

报告人：刘磊

题目： Super-Liouville equation with a spinorial Yamabe type term

摘要：In this talk, we study the super-Liouville equation with a spinorial Yamabe type term, a natural generalization of Liouville equation, super-Liouville equation and spinorial Yamabe type equation. We establish some refined qualitative properties for such a blow-up sequence. In particular, we show energy identities not only for the spinor part but also for the function part. Moreover, the local masses at a blow-up point are also computed. A new phenomenon is that there are two kinds of singularities and local masses due to the nonlinear spinorial Yamabe type term, which is different from super-Liouville equation.

报告人：刘世平

题目： Equiangular lines via nodal domains

摘要： Courant‘s nodal domain theorem proved in 1920s is a fundamental result in the spectral theory of elliptic operators. Its discrete counterpart has attracted lots of attention. In this talk, I will explain how the equiangular line problem is related to discrete nodal domains. I will present an eigenvalue multiplicity estimate in terms of maximum degree and cyclomatic number of a graph. The proof relies on a construction of eigenfunctions of trees with a large number of nodal domains. This leads to interesting applications to equiangular line problems. Our approach further leads to a new proof of the Lemmens-Seidel conjecture. This is based on joint works with Chuanyuan Ge (Fuzhou University).

报告人：沈伟明

题目：The Monge-Ampere equation in convex polytope

摘要： I will talk about the existence and regularity of solutions for the Monge-Ampere equation in convex polyhope. This is based on joint works with Genggeng Huang.

报告人：孙俊

题目：On Type II singularities of Lagrangian and symplectic mean curvature flows

摘要：In this talk, we will first collect the known results on singularity analysis for Lagrangian and symplectic mean curvature flows. Then we will talk about our recent results on Type II singularities, especially on translating solitons for such flows. This talk is based on joint work with Xiaoli Han and Jiayu Li, and with Xiang Li and Yong Luo.

报告人：孙林林

题目： Toda 系统

摘要：我将简要汇报如何用热流来处理 Toda 系统。我们成功建立了 Toda 系统热流的的局部存在性、整体存在性及整体收敛性理论。作为一个推论，我们证明了只有一个临界情形时，当 Jost-Lin-Wang 条件（单个方程时，即 Ding-Jost-Li-Wang 条件）成立时，存在合适的初值，使得 Toda 系统热流收敛。

报告人：温洋

题目： Instability of Yang-Mills Connections on \delta-Pinched Riemannian Manifolds

摘要： Lawson and Simons proposed a conjecture stating that no stable minimal submanifolds exist in compact, simply connected Riemannian manifolds with 1/4-pinched curvature. Techniques inspired by their approach have been applied to study the stability of harmonic maps and Yang-Mills connections. In this talk, I will establish a curvature pinching condition under which there exist no weakly stable Yang-Mills connections on such manifolds.

报告人：徐甜

题目： Singular solutions for the spinorial Yamabe equation

摘要： In this talk, we share our recent progress on constructing singular solutions to the critical Dirac equation on spheres. More precisely, first we construct solutions admitting two points singularities that we call Delaunay-type solutions because of their similarities with the Delaunay solutions constructed for the singular Yamabe problem. Then we construct another kind of singular solutions admitting a great circle as a singular set. These solutions are the building blocks for singular solutions on a general Spin manifold.

报告人：殷浩

题目： On the existence of Yang-Mills connections in dimension four

摘要： In this survey talk, we review results on the existence of Yang-Mills connections from the first known example to the best of my knowledge.

报告人：赵亮

题目： GEGCN: Advancing Graph Learning with Discrete Ricci Flow

摘要： Graph Neural Networks (GNNs) often fail to capture the intrinsic geometry and long-range dependencies in graphs, particularly on heterophilic networks. To address this, we present the Geometric Evolution Graph Convolutional Network (GEGCN). Our key innovation is a structured integration of discrete Ricci flow with deep learning, which can successfully capture the multi-scale information of the graph. Experiments demonstrate that GEGCN achieves state-of-the-art performance, with particularly significant gains on heterophilic benchmarks. This work validates the great power of modeling geometric evolution and establishes a new paradigm for graph representation learning.
The report is based on a jointwork with Ma, Yang and Zhao.

报告人：张富平

题目： stationary nonlinear Dirac equations

摘要: In this discussion, we first introduce the application of the variational method to handle a class of nonlinear Dirac equations and obtain the existence results of nontrivial solutions. Inspired by the above-mentioned literature, we utilize the variational method and perturbation approach to obtain the existence of nontrivial periodic solutions for a class of nonlinear Dirac equations.

报告人：周春琴

题目： On super Liouville equations

摘要： In this talk I will talk about the super Liouville equations on the compact Riemann surfaces. We will introduce the blowup analysis and existence of nontrivial solutions by variational methods.

报告人：周志强

题目： Harmonic maps in higher dimensions

摘要： Itroduce the Energy identity for higher dimensional harmonic maps into spheres by Fanghua Lin and Riviere.

报告人：朱超娜

题目： Existence of prescribing scalar curvature problem on the negative Yamabe case
摘要：The problem of prescribing conformally the scalar curvature on a closed manifold of negative Yamabe invariant is always solvable if the function to be prescribed is strictly negative, while sufficient and necessary conditions are known in the case that function is non-positive. Still in the case of a negative Yamabe invariant, Rauzy showed solvability, if the function to be prescribed is not too positive. In this talk we will review these results variationally, show the existence of minimizability under smallness assumptions on K+ =max{K,0} and talk what happens when the relevant arguments fail to apply. At last, we will construct a function, for which saddle point solutions to the conformally prescribed scalar curvature problem still exist. In collaboration with Martin Mayer.

报告人：朱苗苗
题目：Analysis aspects in geometric variational problems
摘要：In this talk, we shall firstly give an overview of some analysis aspects in geometric variational problems and then present some recent progress.

报告人：朱晓宝
题目：Kazdan-Warner problem and some related topics
摘要：In this talk, we shall firstly introduce some progresses on Kazdan-Warner problem, especially the existence result when the prescribed function can change signs. Then we would like to present some related topics which including existence for Toda system and mean field equation. These results are partially joint work with Prof. Linlin Sun (孙林林) at Xiangtan University.

研讨内容及科学意义

微分几何中很多几何量和几何方程具有变分结构，例如调和映照方程、Yamabe 方程、极小曲面和 CMC 曲面方程、Yang-Mills-Higgs 方程，以及数学物理中很多方程本身就是作用泛函的临界点方程。因此从变分的角度来研究这些几何方程是自然且必要的。同时，上述几种方程在结构和处理方式上有许多共同点，比如，解的存在性的几何限制、弱解正则性、局部变分结构、紧性的缺失和补偿、利用热流寻找解、孤立子解等。对这些问题的研究极大促进了微分几何和数学物理的发展。

近年来，受益于现代非线性变分理论，上述领域取得了很多新的成果。比如调和映照的 Morse 理论方面、形变 Hermitian-Yang-Mills 方程的稳定性方面、Yang-Mills-Higgs 方程和 Kapustin-Witten 方程可解性方面都有较大进展，预定数量曲率方程与无穷远临界点理论的结合、几何测度论在极小曲面和 CMC 曲面中的应用、强不定变分理论在超对称变分问题中的应用，都给出了相关方面的一系列新结论。

我们将围绕调和映照、预定数量曲率方程和平均曲率方程、Yang-Mills-Higgs 方程和规范场论中的变分问题、超对称模型中的运动方程等方面开展研讨会，主要关注这些问题的变分理论方面的异同点。计划邀请相关专家学者来介绍其最新的成果和进展，深入讨论这些新方法和新结论，梳理其内在结构并明确其适用范围，并探讨这些方法在其他变分问题上的拓展和应用，集思广益，提出相关问题的解决思路，以便于几何变分领域的进一步发展。