天元數學國際交流中心
Tianyuan Mathematics Research Center

Elliptic PDE workshop

Workshop Handbook

Organizers

Xi-Nan Ma

University of Science and Technology of China

Quoc-Hung Nguyen and Guohuan Qiu

Academy of Mathematics and Systems Science, Chinese Academy of Sciences

8–14 November 2026

Kunming, China

Tianyuan Mathematics Research Center



The Tianyuan Mathematics Research Center (TYMRC) was established in July 2023. It is supported by the Chinese Academy of Sciences, the National Natural Science Foundation of China, the Chinese Mathematical Society, the Academy of Mathematics and Systems Science, and local authorities in Kunming. The Center hosts research workshops in mathematics and its applications.

The Center is on the shore of the Chaishitan Reservoir in Yiliang County, Kunming. Surrounded by mountains on three sides, the site lies at an elevation of about 1,700 metres. Kunming Changshui International Airport is approximately 90 kilometres away, about an hour and a half by car.

Facilities include a 100-seat lecture hall, a medium-sized seminar room, four small meeting rooms, 21 seminar and work rooms, a library and reading room, and a café. The guest residence has 56 rooms, a self-service laundry and a shared lounge.

Center website tianyuan.amss.ac.cn

Conference Information

Workshop themes

The workshop brings together researchers working on fully nonlinear elliptic equations and geometric PDEs. The programme includes interior and global estimates for Hessian and curvature equations, Monge–Ampère boundary value problems, and rigidity and classification results. Two talks examine the role of a quaternionic Monge–Ampère equation in a proposed proof of Sogge's local smoothing conjecture.

Dates and venue

Check-in Sunday, 8 November 2026

Talks Monday, 9 November to Friday, 13 November 2026

Departure Saturday, 14 November 2026

Venue Tianyuan Mathematics Research Center, Chaishitan Reservoir, Yiliang County, Kunming, Yunnan, China

Travel and practical information

The Center provides accommodation and meals and arranges transfers between the Center and Kunming Changshui International Airport or the railway station. Please enter your arrival and departure details, including flight or train numbers and times, in the conference system by 5 November.

Conference system tianyuanpm.amss.ac.cn

Lunch is scheduled for 12:00–13:00 and dinner for 18:00–20:00 on each talk day. All times in this handbook are Beijing time (UTC+8). The Center is some distance from the nearest hospital. Please bring any personal medicines you will need during your stay.

Workshop contact

Guohuan Qiu · qiugh@amss.ac.cn

Schedule I

Sunday, 8 November	Registration and check-in
Saturday, 14 November	Departure

Monday, 9 November			
Time	**Speaker**	**Title of talk or activity**	**Chair**
08:55–09:00	Opening Ceremony		Xi-Nan Ma
09:00–10:00	Xi-Nan Ma	The Dirichlet problem for quaternionic Monge–Ampère equations on flat quaternionic quotients	Shujun Shi
10:00–10:40	Morning tea		
10:40–11:40	Doanh Pham	Majorization results for hyperbolic polynomials	Ngo Quoc Anh
12:00–13:00	Lunch break		
14:30–15:10	Jin Yan	Global Curvature Estimates for σ_k-Curvature Equations with $k \geq n/2$	Zhizhang Wang
15:10–15:50	Afternoon tea		
15:50–16:30	Jiahuan Li	Uniqueness for the planar Ginzburg–Landau problem with identity boundary data (A solution to Brezis' Open Problem 2.1)	Jin Yan
16:35–17:15	Yang Zhou	A Reading of the Proof of Sogge's Local Smoothing Conjecture	Jingyong Zhu
18:00–20:00	Dinner		

Schedule II

Tuesday, 10 November			
Time	**Speaker**	**Title of talk or activity**	**Chair**
09:00–10:00	Marie-Françoise Bidaut-Véron	A quasilinear elliptic equation with absorption term and Hardy potential	Laurent Véron
10:00–10:40	Morning tea & Group Photo		
10:40–11:40	Laurent Véron	Isolated singularities of solutions of an equation of Gelfand-Hamilton-Jacobi type	Marie-Françoise Bidaut-Véron
12:00–13:00	Lunch break		
14:30–15:30	Guohuan Qiu	Interior Estimates for Hessian and Curvature Equations	Chuanqiang Chen
15:30–16:10	Afternoon tea		
16:10–17:10	Yuzhou Fang	Regularity for nonlocal double phase problems	Weisong Dong
18:00–20:00	Dinner		

Schedule III

Wednesday, 11 November			
Time	**Speaker**	**Title of talk or activity**	**Chair**
09:00–10:00	Quoc-Hung Nguyen	Regularity and nonlinear potential theory: from the p-Laplacian to k-Hessian equations	Guohuan Qiu
10:00–10:15	Morning tea		
10:15–11:15	Jingchen Hu	Interior Estimates and Liouville Theorems for Complex Monge–Ampère Equations	Yanjun Liu
11:20–12:00	Hanzhang Yin	Gauduchon metrics on noncompact manifolds	Heming Jiao
12:00–13:00	Lunch break		
15:10–15:50	Afternoon tea		
18:00–20:00	Dinner		

Schedule IV

Thursday, 12 November			
Time	**Speaker**	**Title of talk or activity**	**Chair**
09:00–10:00	Bo Wang	A Serrin-type over-determined problem for two dimensional Monge–Ampère equation in the exterior domain	Jiuzhou Huang
10:00–10:40	Morning tea		
10:40–11:40	Lichun Liang	A Liouville theorem for solutions of the quadratic Hessian equation with periodic data	Wangzhe Wu
12:00–13:00	Lunch break		
14:30–15:10	Guanyu Tao	Complete Classification of Positive Solutions to the Planar Isotropic L_p Dual Minkowski Problem	Jian Lu
15:10–15:50	Afternoon tea		
15:50–16:30	Yilu Liu	The Relative Isoperimetric Inequality in the Three-Dimensional Cube	Qianzhong Ou
16:35–17:15	Hang Yang	Rigidity for a Robin Overdetermined Problem	Bin Deng
17:15–17:55	Free discussion		
18:00–20:00	Dinner		

Schedule V

Friday, 13 November			
Time	**Speaker**	**Title of talk or activity**	**Chair**
09:00–10:00	Bin Deng	Compactness and Noncompactness for the σ_2-Yamabe Equation	Wei Zhang
10:00–10:40	Morning tea		
10:40–11:20	Yutian Zhou	Constant Rank Theorems in Hyperbolic Space	Bin Deng
12:00–13:00	Lunch break		
15:10–15:50	Afternoon tea		
18:00–20:00	Dinner		

Talk Abstracts

Monday, 9 November

The Dirichlet problem for quaternionic Monge–Ampère equations on flat quaternionic quotients

09:00–10:00 **Xi-Nan Ma** · University of Science and Technology of China

The OpenAI preprint on October 27 claims a proof of Sogge's local smoothing conjecture. A crucial analytic ingredient is the solvability of the Dirichlet boundary value problem for a quaternionic Monge–Ampère equation. It is a variant of the Ma–Zhu theorem from Zhu's 2017 thesis, supervised by Ma. We are very upset to see that OpenAI did not respect the human rule. By rewriting a proof which is not easy for us to check, OpenAI could avoid saying that it comes directly from the results we developed ten years ago. Today, we try to clarify this fact.

Majorization results for hyperbolic polynomials

10:40–11:40 **Doanh Pham** · Peking University

Determinant majorization inequalities compare Gårding–Dirichlet operators with the Monge–Ampère operator and have important applications in recent work on fully nonlinear PDEs. In this talk, I will present a determinant majorization result for hyperbolic polynomials on Euclidean Jordan algebras, which generalizes the previous work of Harvey and Lawson. Majorization for the Hessian operators will also be discussed.

Global Curvature Estimates for σ_k-Curvature Equations with $k \geq n/2$

14:30–15:10 **Jin Yan** · Institute of Mathematics, Chinese Academy of Sciences

In this talk, we present global curvature estimates for closed, star-shaped, k-convex hypersurfaces satisfying $\sigma_k(\kappa) = f(X, \nu)$ for $n/2 \leq k < n$, where f is a general positive right-hand side. We also establish the corresponding global-to-boundary estimates for Euclidean Hessian equations. These results answer a question posed by Guan–Li–Li in this range of k and are new for $n/2 \leq k \leq n-3$. The key ingredient is a new concavity inequality for the elementary symmetric function σ_k, which controls the spectral quadratic form arising from the second variation of $\log \lambda_{max}$. The proof is based on an easy–hard decomposition of the spectral variables: the easy region is handled by an optimal constrained concavity estimate for σ_k, while the hard region is treated using Gårding-root coordinates and the concavity of the ordered partial sums of the inverse roots.

Talk Abstracts

Monday, 9 November

Uniqueness for the planar Ginzburg–Landau problem with identity boundary data (A solution to Brezis' Open Problem 2.1)

15:50–16:30 Jiahuan Li · University of Science and Technology of China

We consider the planar Ginzburg–Landau equation on the unit disk with identity boundary data. For every positive parameter, every classical Euler–Lagrange solution, and every H^1 weak solution with the prescribed trace, is the positive radial vortex. No minimality, stability or nondegeneracy assumption is imposed. After scaling to a disk of radius R, the proof uses two radius regions. For $0 < R \le 4$, one fixed matrix and cubic calibration yields a global nonlinear coercivity inequality. For $R \ge 4$, one finite radial reference and one continuous multiplier exclude every displaced zero through the same relative-moment dual inequality. The arithmetic subdivisions and internal estimates of these two families are explicit; exact polynomial and outward-rounded interval checks control their full continuous parameter sets.

A Reading of the Proof of Sogge's Local Smoothing Conjecture

16:35–17:15 Yang Zhou · University of Science and Technology of China

I will give an expository account of OpenAI's paper *Local smoothing for the Euclidean wave equation*. The paper studies local smoothing estimates for the Euclidean half-wave propagator. Its proof uses the Ma–Zhu theorem on the existence of solutions to a quaternionic Monge–Ampère equation, as presented in J. Y. Zhu's 2017 thesis (see also J. Y. Zhu, *Israel J. Math.* **214** (2016), 597–619). I will outline the proof and explain how this auxiliary equation is used in the argument.

Talk Abstracts

Tuesday, 10 November

A quasilinear elliptic equation with absorption term and Hardy potential

09:00–10:00 **Marie-Françoise Bidaut-Véron** · University of Tours, France

Here we study the positive solutions of the equation

$$-\Delta_p u+\mu\frac{u^{p-1}}{|x|^p}+|x|^\theta u^q=0\,,\ x\in\mathbb{R}^N\setminus\{0\},$$

where $\Delta_p u=\mathrm{div}\left(|\nabla u|^{p-2}\nabla u\right)$ and $1<p<N$, $q>p-1$, $\mu,\theta\in\mathbb{R}$. We give a complete description of the existence and the asymptotic behaviour of the solutions near the singularity 0 or in an exterior domain. We show that the global solutions in $\mathbb{R}^N\setminus\{0\}$ are radial and give their expression according to the position of the Hardy coefficient μ with respect to the critical exponent $\mu_0=-\left(\frac{N-p}{p}\right)^p$. Our method consists in proving that any nonradial solution can be compared to a radial one, then making an exhaustive radial study by phase-plane techniques. Our results are optimal, extending the known results when $\mu=0$ or $p=2$. They exhibit phenomena of nonuniqueness when $\theta+p=0$, and the existence of locally constant solutions when, in addition, $p>2$.

This is joint work with Huyuan Chen (Fudan University, Shanghai).

Isolated singularities of solutions of an equation of Gelfand-Hamilton-Jacobi type

10:40–11:40 **Laurent Véron** · Denis Poisson Institute, University of Tours

We study the behaviour of solutions of $-\Delta u+a\,e^{bu}=m|\nabla u|^q$ in a punctured domain $\Omega\setminus\{0\}$ of $\mathbb{R}^2$ in the range $q>1$ and $m,a,b>0$. We prove a series of a priori estimates depending on q, b, and the sign of $q-2$, and we give a precise description of the behaviour of solutions near an isolated singularity. The results are to be compared with those concerning the Chandrasekhar–Hamilton–Jacobi equation $-\Delta u=e^{bu}-m|\nabla u|^q$ in dimension $N\geq 3$.

Joint work with Li Yimei, *Calculus of Variations and Partial Differential Equations* **64** (7), 235 (2025).

Talk Abstracts

Tuesday, 10 November

Interior Estimates for Hessian and Curvature Equations

14:30–15:30 **Guohuan Qiu** · Academy of Mathematics and Systems Science, Chinese Academy of Sciences

I will report on our recent progress on interior second-derivative estimates for Hessian quotient equations and the graphical scalar curvature equation. For Hessian quotient equations, we introduce a new nonlinear comparison function that leads to interior Hessian estimates in arbitrary dimensions for adjacent and gap-two quotients. For the graphical scalar curvature equation, we develop a geometric two-point maximum principle and a two-surface Pogorelov estimate. These tools yield interior curvature estimates for admissible solutions of the constant graphical scalar curvature equation in every dimension.

Regularity for nonlocal double phase problems

16:10–17:10 **Yuzhou Fang** · Harbin Institute of Technology

The double phase equation was introduced by V. V. Zhikov in the 1980s to characterize the features of strongly anisotropic materials in the context of homogenization. C. De Filippis and G. Palatucci first considered the nonlocal version of such an equation. This talk mainly focuses on the gradient regularity of solutions to this nonlocal problem.

Talk Abstracts

Wednesday, 11 November

Regularity and nonlinear potential theory: from the p-Laplacian to k-Hessian equations

09:00–10:00 **Quoc-Hung Nguyen** · Academy of Mathematics and Systems Science, Chinese Academy of Sciences

I will discuss regularity and potential estimates for nonlinear elliptic equations, beginning with the p-Laplace equation. For smooth right-hand sides, solutions may fail to be twice differentiable across their critical set, yet suitable nonlinear functions of their gradients enjoy higher regularity. In joint work with Le Xuan Truong, we show that if $Du \in C^{0,\alpha}_{loc}$, with $0<\alpha<1$ and $\alpha \le 1/(p-1)$, then any positively homogeneous map Φ, smooth away from the origin and of degree $m > \ell/\alpha$, satisfies $\Phi(Du) \in C^{\ell}_{loc}$. The proof combines intrinsic rescaling, Schauder estimates, and extension across the critical set [1].

I will then present joint work with Nguyen Cong Phuc on nonlinear potential theory for p-Laplace type equations with measure data, including the strongly singular regime. Topics include comparison estimates, pointwise potential bounds for solutions and gradients, and weighted good-λ and Muckenhoupt–Wheeden inequalities. These estimates connect the regularity of solutions to the concentration of the data and yield applications to equations with nonlinear gradient sources [2, 3, 4].

Finally, I will survey Rongxun He's recent preprint on gradient estimates for k-Hessian equations with measure data. This work develops Wolff potential bounds for gradients and establishes $C^{1,\alpha}$ and $W^{2,1+\varepsilon}$ interior regularity for the 2-Hessian equation when the density is bounded above and below by positive constants. I will highlight connections with the p-Laplace theory and briefly discuss the documented role of AI assistance in developing the proofs [5].

References

[1] Q.-H. Nguyen and L. X. Truong, *Higher Regularity of Homogeneous Gradient Compositions for p-Laplace-Type Equations*, manuscript.

[2] Q.-H. Nguyen and N. C. Phuc, *A comparison estimate for singular p-Laplace equations and its consequences*, Arch. Ration. Mech. Anal. **247** (2023), article 49. doi:10.1007/s00205-023-01884-7. arXiv:2202.11318.

[3] Q.-H. Nguyen and N. C. Phuc, *Pointwise gradient estimates for a class of singular quasilinear equation with measure data*, J. Funct. Anal. **278** (2020), no. 5, article 108391, 35 pp. arXiv:1902.04414.

[4] Q.-H. Nguyen and N. C. Phuc, *Good-λ and Muckenhoupt–Wheeden type bounds in quasilinear measure datum problems, with applications*, Math. Ann. **374** (2019), 67–98. doi:10.1007/s00208-018-1744-2. arXiv:1807.04850.

[5] R. He, *Gradient Estimates for Hessian Equations with Measure Data*, preprint (2026). arXiv:2610.38846.

Talk Abstracts

Wednesday, 11 November

Interior Estimates and Liouville Theorems for Complex Monge–Ampère Equations

10:15–11:15 **Jingchen Hu** · Sichuan University

I will discuss interior second-derivative estimates and their applications to the rigidity of entire solutions of the complex Monge–Ampère equation $det\left(u_{i\bar{j}}\right)=1$ on $\mathbb{C}^n$. First, I will present a Pogorelov-type interior estimate and the resulting convex Liouville theorem. I will then turn to Gábor Székelyhidi's conjecture, which predicts the same rigidity for solutions with upper and lower quadratic bounds.

Gauduchon metrics on noncompact manifolds

11:20–12:00 **Hanzhang Yin** · Harbin Institute of Technology

It is well known that every Hermitian conformal class on a compact connected complex manifold contains a Gauduchon metric, unique up to scaling. In our recent work, we prove that every Hermitian conformal class on a connected noncompact complex manifold contains a Gauduchon metric. We also give some necessary and sufficient conditions for uniqueness of such Gauduchon metrics up to scaling. In addition, we will present some preliminary work on the Gauduchon conjecture on noncompact manifolds, including the study of Gauduchon metrics with prescribed volume form on certain noncompact complex surfaces.

Talk Abstracts

Thursday, 12 November

A Serrin-type over-determined problem for two dimensional Monge–Ampère equation in the exterior domain

09:00–10:00 **Bo Wang** · Beijing Institute of Technology

In this talk, I will report on recent work with Zhihui Zhang. We consider the Monge–Ampère equation in an exterior domain in $\mathbb{R}^2$ with prescribed asymptotic behaviour at infinity and Dirichlet–Neumann conditions on its interior boundary. We obtain both rigidity and stability results.

A Liouville theorem for solutions of the quadratic Hessian equation with periodic data

10:40–11:40 **Lichun Liang** · Chongqing Normal University

In this talk, we discuss a Liouville theorem for the quadratic Hessian equation with a smooth, positive, periodic right-hand side. We prove that every entire convex solution is the sum of a quadratic polynomial and a periodic function. This generalizes the classical Liouville result for the 2-Hessian equation with constant right-hand side.

Complete Classification of Positive Solutions to the Planar Isotropic L_p Dual Minkowski Problem

14:30–15:10 **Guanyu Tao** · Institute of Mathematics, Chinese Academy of Sciences

This talk focuses on the planar isotropic L_p dual Minkowski problem, a significant PDE in convex geometry whose positive solutions correspond to the support functions of strictly convex bodies containing the origin. Previous works have reduced the classification of these solutions to the analysis of a period integral, demonstrating that the exact number of nonconstant solutions corresponds to the number of intersections between this integral and the levels π / k. However, due to the complexity and nonmonotonicity of the period integral, obtaining a complete classification for every parameter pair $(p, q) \in \mathbb{R}^2$ has remained an open problem.

In this presentation, we introduce a new parametrization for the associated period integral. By establishing a new convolution representation with a parameter E, we bypass the limitations of the original integral to directly analyze its global shape. We will characterize the regions where the period is strictly increasing or strictly decreasing. Furthermore, we will prove that in the remaining nonmonotone parameter regions, the integral possesses a unique nondegenerate maximum.

By combining this complete global profile with endpoint limits and rigorous upper bound estimates, we can exactly determine these intersection points for any given parameter. Consequently, we present the exact number, up to rotations, of nonconstant positive C^2 solutions in the entire (p, q)-plane, achieving a complete classification.

Talk Abstracts

Thursday, 12 November

The Relative Isoperimetric Inequality in the Three-Dimensional Cube

15:50–16:30 **Yilu Liu** · University of Science and Technology of China

We determine the sharp relative isoperimetric profile of the three-dimensional unit cube and classify all minimizing sets, including the equality cases at both transition volumes. The classification involves three standard geometric models, namely corner eighth-balls, edge quarter-cylinders, and coordinate slabs. In this talk, I will outline the main ideas of the proof, including reflection arguments, topological considerations, and variational stability inequalities. This is joint work with Bin Deng and Jiahuan Li.

Rigidity for a Robin Overdetermined Problem

16:35–17:15 **Hang Yang** · Hunan University

We study a Robin overdetermined problem arising from the stationarity of Robin torsional rigidity under a volume constraint. Unlike the classical Serrin problem, the overdetermined boundary condition involves the unknown boundary trace of the solution, its tangential derivative, and the boundary curvature. We prove that, for every positive Robin parameter, the only stationary domains among bounded simply connected planar domains with $C^{2,\alpha}$ boundary are disks.

Talk Abstracts

Friday, 13 November

Compactness and Noncompactness for the σ_2-Yamabe Equation

09:00–10:00 **Bin Deng** · Wuhan University

We present recent results on compactness and noncompactness for the σ_2-Yamabe equation. On a closed connected manifold whose conformal class contains a strictly Γ_2^+-admissible metric, we establish C^∞-compactness of the positive solution set of the normalized equation in dimensions $5 \le n \le 26$, provided the manifold is not conformally equivalent to the round sphere. For each $n \ge 27$, we construct a fixed, non-locally conformally flat metric on S^n for which the equation admits a sequence of admissible solutions exhibiting two-bubble blow-up, showing that the dimension bound is sharp. The talk will outline the blow-up analysis and geometric rigidity underlying the compactness proof, which surprisingly needs no positive mass theorem, as well as the gluing construction and finite-dimensional reduction used to establish noncompactness. The talk is based on work with Han Lu, Zikai Ye, and Juncheng Wei.

Constant Rank Theorems in Hyperbolic Space

10:40–11:20 **Yutian Zhou** · Hunan University

We consider a tensor that is not Codazzi but becomes a Codazzi tensor after a conformal change. Using this observation, we establish a hyperbolic counterpart of the Euclidean constant rank theorem.

Participant Directory

Confirmed participants · 1–22 of 46

Participant	Institution
Ngo Quoc Anh	Vietnam National University, Hanoi
Marie-Françoise Bidaut-Véron	University of Tours
Chuanqiang Chen	Ningbo University
Na Chen	University of Science and Technology of China
Bin Deng	Wuhan University
Weisong Dong	Tianjin University
Kaicheng Fan	Qufu Normal University
Yuzhou Fang	Harbin Institute of Technology
Jingchen Hu	Sichuan University
Jiuzhou Huang	Nanjing University of Science and Technology
Heming Jiao	Harbin Institute of Technology
Jiahuan Li	University of Science and Technology of China
Huabin Li	University of Science and Technology of China
Weizhao Liang	University of Science and Technology of China
Lichun Liang	Chongqing Normal University
Yanjun Liu	Chongqing Normal University
Zhiyuan Liu	Qufu Normal University
Yilu Liu	University of Science and Technology of China
Xi-Nan Ma	University of Science and Technology of China
Dongjing Ma	Qufu Normal University
Xinqun Mei	Peking University
Quoc-Hung Nguyen	Academy of Mathematics and Systems Science, Chinese Academy of Sciences

Participant Directory

Confirmed participants · 23–46 of 46

Participant	Institution
Khanh Nguyen	Chinese Academy of Sciences
Qianzhong Ou	Yunnan Normal University
Doanh Pham	Peking University
Haocheng Qian	University of Science and Technology of China
Guohuan Qiu	Academy of Mathematics and Systems Science, Chinese Academy of Sciences
Shujun Shi	Harbin Normal University
Guanyu Tao	Institute of Mathematics, Chinese Academy of Sciences / University of Chinese Academy of Sciences
Laurent Véron	Laboratoire de Mathématiques et Physique Théorique
Bo Wang	Beijing Institute of Technology
Zhizhang Wang	Fudan University
Zhehui Wang	Great Bay University
Wangzhe Wu	Ningbo University
Shuning Xu	University of Science and Technology of China
Jin Yan	Academy of Mathematics and Systems Science, Chinese Academy of Sciences
Hang Yang	Hunan University
Hanzhang Yin	Harbin Institute of Technology
Bao Yu	University of Science and Technology of China
Ruijia Zhang	Sun Yat-sen University
Wei Zhang	Lanzhou University
Yutian Zhou	Hunan University
Qi Zhou	Lanzhou University
Yang Zhou	University of Science and Technology of China
Xiao Zhou	University of Science and Technology of China
Jingyong Zhu	Sichuan University