



华南数学应用与交叉研究中心  
South China Research Center for Applied  
Mathematics and Interdisciplinary Studies

CAMIS-SCNU  
Conference

# 椭圆型偏微分方程线上学术研讨会

## Brochure 会议手册

South China Research Center for Applied Mathematics  
and Interdisciplinary Studies (CAMIS), South China Normal University  
华南师范大学华南数学应用与交叉研究中心

**Guangzhou, China**  
**4.9-4.10, 2021**

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# 1. 会议信息

## (1) 主办单位

华南师范大学华南数学应用与交叉研究中心

## (2) 资助

华南师范大学、粤港澳应用数学中心项目、国家自然科学基金项目

## (3) 会议时间

报告时间：2020年4月9日-10日（周五、周六上午）

离会时间：2020年4月10日（周六下午）

## (4) 会务联系：

梁文静（会务；13622866875 jczx1@m.scnu.edu.cn）

陈纯洁（财务；13533007372）

黄凯华（会务；13719046746）

## (5) 线上共享

会议主题：椭圆型偏微分方程线上学术研讨会

会议时间：2021.4.9-2021.4.10 8:00-18:00

重复周期：每天

点击链接入会，或添加至会议列表：<https://meeting.tencent.com/s/MJxIWeCwYwSZ>

会议ID：**966 1750 5744**

会议密码：**112113**

## (6) 会议组织委员会

辛周平 ( 香港中文大学 & 华南师范大学 )

王筱平 ( 香港科技大学 & 华南师范大学 )

包维柱 ( 新加坡国立大学 & 华南师范大学 )

丁时进 ( 华南师范大学 )

鲁建 ( 华南师范大学 )

## (7) 报告表

**线上报告: 腾讯会议 会议 ID: 966 1750 5744 密码: 112113**

时间	4.9 ( 周五 )		4.10 ( 周六 )	
	报告人	主持人	报告人	主持人
8:20-8:30	开幕式	辛周平		
8:30-9:15	曹道民		黄耿耿	王筱平
9:15-10:00	保继光	王学锋	熊金钢	黄 勇
10:00-10:45	陈世炳	李嘉禹	孙伟	屈长征
10:45-11:30	陈化	简怀玉	章志飞	丁时进
11:30-12:15	陈传强	包维柱		
12 : 15-14 : 00 ( 午休 )				
14:00-14:45	王志张	彭双阶		
14:45-15:30	李奇睿	邓引斌		
15:30-16:15	周斌	刘艳楠		
16:15-17:00	孙俊	杨孝平		

## 2.会议日程

日期	时间	活动	场地
4.9	8:20-8:30	开幕式：辛周平教授	腾讯会议： <b>966 1750 5744</b> 密码： <b>112113</b>
	8:30-9:15	主持人：辛周平	
		二维不可压缩欧拉方程及相关问题的一些结果 <b>曹道民</b>	
	9:15-10:00	主持人：王学锋	
		<i>Extensions of Bernstein Theorem for Fully Nonlinear Geometric PDEs</i> <b>保继光</b>	
	10:00-10:45	主持人：李嘉禹	
		<i>On the four vertex theorem for space curves.</i> <b>陈世炳</b>	
	10:45-11:30	主持人：简怀玉	
		<i>Upper bound estimates of eigenvalues for Hormander operators on non-equiregular sub-Riemannian manifolds</i> <b>陈化</b>	
	11:30-12:15	主持人：包维柱	
<i><math>C^{1,\alpha}</math> regularity of convex hypersurfaces with prescribed curvature measures</i> <b>陈传强</b>			
12 : 15-14 : 00 ( 午休 )			
14:00-14:45	主持人：彭双阶		
	<i>Entire spacelike constant <math>\sigma_k</math> curvature hypersurfaces with prescribed boundary data at infinity</i> <b>王志张</b>		
14:45-15:30	主持人：邓引斌		
	<i>Convex hypersurfaces in the sphere with prescribed Gauss curvature</i> <b>李奇睿</b>		

	15:30-16:15	主持人：刘艳楠 <i>Solvability of a class of singular fourth order equations of Monge-Ampere type</i> 周斌	
	16:15-17:00	主持人：杨孝平 <i>Holomorphic curves in Kahler surface</i> 孙俊	
4.10	8:30-9:15	主持人：王筱平 <i>The uniqueness and regularity of some degenerate Monge-Ampere equations</i> 黄耿耿	腾讯会议： <b>966 1750 5744</b> 密码： <b>112113</b>
	9:15-10:00	主持人：黄勇 <i>Compactness for conformally invariant elliptic PDEs</i> 熊金钢	
	10:00-10:45	主持人：屈长征 <i>Interior gradient estimates for prescribed curvature equations</i> 孙伟	
	10:45-11:30	主持人：丁时进 <i>Linear stability of the shear flow near Couette</i> 章志飞	
	11:30	离会	

### 3. Abstract & Title

#### *Extensions of Bernstein Theorem for Fully Nonlinear Geometric PDEs*

保继光 (北京师范大学)

In this talk, I introduce the advances in Bernstein Theorem for mean curvature equations, Monge-Ampere equations and Lagrangian mean curvature equations, completed by my collaborators and myself.

#### *$C^{1,\alpha}$ regularity of convex hypersurfaces with prescribed curvature measures*

陈传强 (宁波大学数学与统计学院)

In this talk, we discuss the  $C^{1,\alpha}$  regularity for convex solutions to the  $k$ -curvature and  $k$ -Hessian equations, which generalize the corresponding results of Monge-Ampere equation and Optimal transport problem. This is a joint work with Xujia Wang and Yating Wu.

#### *二维不可压缩欧拉方程及相关问题的一些结果*

曹道民 (广州大学 / 中国科学院数学与系统科学研究院)

报告人将报告新近对二维不可压欧拉方程所得到的一些研究结果，特别地将介绍二维不可压欧拉方程的涡对行波解 (travelling vortex pairs)、旋转对称解的构造。对推广的面拟地转方程 (generalized surface quasi-geostrophic equation)，我们也得到相应的结果。报告人主要介绍的结果来源于和赖善发、詹伟城及和秦国林、詹伟城、邹昌君合作的论文。

#### *Upper bound estimates of eigenvalues for Hörmander operators on non-equiregular sub-Riemannian manifolds*

陈化 (武汉大学数学与统计学院)

We shall report some results on closed eigenvalue problem and Dirichlet eigenvalue problem of self-adjoint Hörmander operators on non-equiregular sub-Riemannian manifolds. By Rayleigh-Ritz formula and the subelliptic heat kernel estimates, we establish the upper bounds of eigenvalues which depend on the volume of subunit ball and the measure of the manifold. Under a certain condition, we obtain the explicit upper bounds of eigenvalues which have the polynomially growth in  $k$  with the optimal order related to the non-isotropic dimension of the manifold.

#### *On the four vertex theorem for space curves*

陈世炳 (中国科学技术大学)

The classical four vertex theorem describes a fundamental property of simple closed planar curves. It has been extended to space curves, namely a smooth, simple closed curve in  $\mathbb{R}^3$  has at least four points with vanishing torsion if it lies on a convex surface. More recently, Ghomi extended this property to curves lying on locally convex surfaces. In this talk we will discuss an interesting approach using the regularity theory of Monge-Ampere equations. This is based on a joint work with Xu-Jia Wang and Bin Zhou.

***The uniqueness and regularity of some degenerate Monge-Ampere equations***

黄耿耿 (复旦大学)

In this talk, we mainly focus on the following Monge-Ampere equation:

$$\det D^2 u = (-u)^p, \text{ in } \Omega$$
$$u = 0, \quad \text{on } \partial\Omega$$

$\Omega$  is a bounded smooth uniformly convex domain in  $\mathbb{R}^n$ . We will discuss some regularity results of this degenerate Monge-Ampere equation and the uniqueness of the least energy solutions.

***Convex hypersurfaces in the sphere with prescribed Gauss curvature***

李奇睿 (浙江大学)

Convex hypersurfaces in the sphere with prescribed Gauss curvature was studied by many authors under the assumption of barriers or certain symmetry. We show the existence of solutions to the problem without such assumption. Multiple solutions are also discussed.

***Holomorphic curves in Kahler surface***

孙俊 (武汉大学)

Existence of holomorphic curves in Kahler surface is a fundamental problem in differentiable geometry. In this talk, we will propose two ideas approaching to this problem. One is using the symplectic mean curvature flow; while the other is using variational method combined with continuity method. The work is joint with Xiaoli Han and Jiayu Li.

***Interior gradient estimates for prescribed curvature equations***

孙伟 (上海科技大学)

In this talk, we shall talk on interior gradient estimates for admissible solutions to general prescribed Weingarten curvature equations.

***Entire spacelike constant  $\sigma_k$  curvature hypersurfaces with prescribed boundary data at infinity***

王志张 (复旦大学数学科学学院)

In this paper, we investigate the existence and uniqueness of convex, entire, spacelike hypersurfaces of constant  $\sigma_k$  curvature with prescribed lightlike directions  $\mathcal{F}$  and perturbation  $q$  on  $\mathcal{F}$ . We prove that given an closed set  $\mathcal{F}$  in the ideal boundary at infinity of hyperbolic space and a perturbation  $q$  that satisfies some mild conditions, there exists a complete entire spacelike constant  $\sigma_k$  curvature hypersurface  $M_u$  with prescribed lightlike directions  $\mathcal{F}$  satisfying when  $\frac{x}{|x|} \in \mathcal{F}$ , as  $|x| \rightarrow \infty$ ,  $u(x) - |x| \rightarrow q \left( \frac{x}{|x|} \right)$ . This result is new even for the case of constant Gauss curvature. We also prove that when the Gauss map image is a half disc  $\bar{B}_1^+$  and the perturbation  $q \equiv 0$ , if a CMC hypersurface  $M_v$  satisfies  $|v(x) - V_{\bar{B}_1^+}(x)|$  is bounded, then  $v(x)$  is unique.

***Compactness for conformally invariant elliptic PDEs***

熊金钢 (北京师范大学)

I will talk about the compactness of positive solutions of some elliptic PDEs from the conformal geometry. I will review the classical proof for the second order equations and indicate new analysis for higher orders.

***Solvability of a class of singular fourth order equations of Monge-Ampere type***

周斌 (北京大学)

We study the solvability of the second boundary value problem for a class of highly singular fourth order equations of Monge-Ampere type. They arise in the approximation of convex functionals subject to a convexity constraint using Abreu type equations. Both the Legendre transform and partial Legendre transform are used in our analysis. In two dimensions, we establish global solutions to the second boundary value problem for highly singular Abreu equations where the right hand sides are of  $q$ -Laplacian type for all  $q > 1$ . We show that minimizers of variational problems with a convexity constraint in two dimensions that arise from the Rochet-Chone model in the monopolist's problem in economics with  $q$ -power cost can be approximated in the uniform norm by solutions of the Abreu equation for a full range of  $q$ .

***Linear stability of the shear flow near Couette***

章志飞 (北京大学)

In this talk, I will introduce the linear stability for the 3-D linearized Navier-Stokes equations around the shear flow, which is close to the Couette flow. This is a key ingredient solving the transition threshold conjecture for 3-D Couette flow.