



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

# 流体偏微分方程及其相关课题国际会议 International Conference on Partial Differential Equations in Fluids

## 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**  
**November 07-11, 2019**

Address: Zhong Shan Avenue West 55, Tianhe District, Guangzhou 510631, China  
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# 1. Useful Information

## (1) Timetable

Time	November 8 <sup>th</sup> (Friday)	November 9 <sup>th</sup> (Saturday)	November 10 <sup>th</sup> (Sunday)
CHAIR	Zhouping XIN	Weike WANG	Weizhu BAO
8:15-8:50	8:40-8:50 Opening remarks	Tong YANG	Yi ZHOU
8:50-9:25	Chaojiang XU	Xingbin PAN	Piotr B. MUCHA
CHAIR	Changjiang ZHU	Yinbin DENG	Zhong TAN
9:25-10:00	Matthias HIEBER	Xiaoming WANG	Zhaoyang YIN
10:00-10:20	Coffee break &. Photos	Coffee break	Coffee break
CHAIR	Hua CHEN	Zhenhua GUO	Xinan MA
10:20-10:55	Daoyuan FANG	Shu WANG	Yi WANG
10:55-11:30	Chunpeng WANG	Zhifei ZHANG	Chunjing XIE
CHAIR	Zhen LEI	Feimin HUANG	Huijiang ZHAO
11:30-12:05	Xiaoding SHI	Lili DU	Yong LV
12:05-14:00	Lunch	Lunch	Lunch
CHAIR	Yachun LI	Quansen JIU	Huansong ZHOU
14:00-14:35	Zhengan YAO	Feng ZHOU	Tao LUO
14:35-15:10	Runzhang XU	Shangkun WENG	Beixiang FANG
CHAIR	Chunlai MU	Xiangao LIU	Yongsheng LI
15:10-15:45	Zhian WANG	Jun LI	Xiaojing XU
15:45-16:15	Coffee break	Coffee break	Coffee break
CHAIR	Hailiang LI	Xiaoping WANG	Shuangjie PENG
16:15-16:50	Renjun DUAN	Weixi LI	Yuelong XIAO
16:50-17:25	Hongjun YU	Chengjie LIU	Xulong QIN
CHAIR	Jing LI	Jianwen ZHANG	Jinkai LI
17:25-18:00	Shuangqian LIU	Lingbing HE	Jian LU
18:00-20:00	Dinner	Banquet	Dinner

## (2) Address

① **Accommodation:** Huashi Hotel (华师大厦酒店) & Hanpudun Hotel (汉普敦酒店)

② **Hotel Address:**

★ Huashi Hotel (华师大厦酒店):

Zhongshan Avenue West No. 69, Tianhe District, Guangzhou 510631, China

广州市中山大道西 69 号华师大厦酒店 (原华师粤海酒店)

★ Hanpudun Hotel (汉普敦酒店):

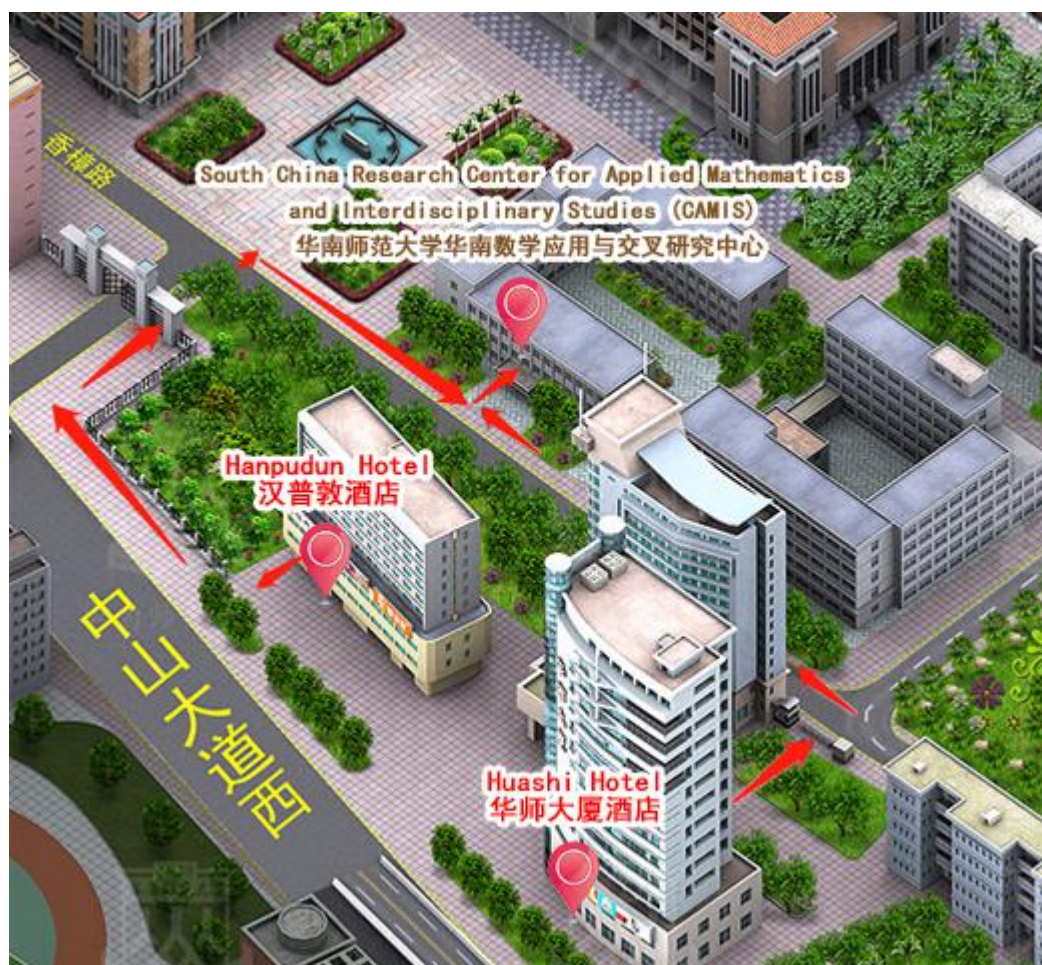
Hanpudun Hotel, No. 61-65 Zhong Shan Avenue West, Tianhe District, Guangzhou 510631, China

广东省广州市天河区中山大道西 61-65 号汉普敦酒店 邮编: 510631

③ **Talk venue:** 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

## (3) Map: Huashi Hotel & Hanpudun Hotel -- CAMIS



## 2. Programme

Date	Time	Activity	Venue	
<b>Nov. 07<sup>th</sup></b> <b>(Thurs. )</b>	8:00-18:00	Registration	The hall of CAMIS	
<b>Nov. 8<sup>th</sup></b> <b>(Fri. )</b>	8:40-8:50	Opening remark by <b>Prof. Zhouping XIN</b>	Room 111 of CAMIS	
	Session 1. Chairman: <b>Prof. Zhouping XIN</b>			
	8:50-9:25	<i>Full analytic smoothing effect of non linear Landau equation</i> <b>Prof. Chaojiang XU</b>		
	Session 2. Chairman: <b>Prof. Changjiang ZHU</b>			
	9:25-10:00	<i>Analysis of the Q-tensor model for liquid crystal flows</i> <b>Prof. Matthias HIEBER</b>		
	10:00-10:20	Coffee break &. Photos		
	Session 3. Chairman: <b>Prof. Hua CHEN</b>			
	10:20-10:55	<i>On the large data problems for the incompressible Navier-Stokes equations</i> <b>Prof. Daoyuan FANG</b>		
	10:55-11:30	<i>Smooth transonic flows in de Laval nozzles</i> <b>Prof. Chunpeng WANG</b>		
	Session 4. Chairman: <b>Prof. Zhen LEI</b>			
	11:30-12:05	<i>Nonlinearly Exponential Stability of Compressible Navier-Stokes System with Degenerate Heat-Conductivity</i> <b>Prof. Xiaoding SHI</b>		
	12:05-14:00	Lunch		Huashi Hotel
	Session 5. Chairman: <b>Prof. Yachun LI</b>			
	14:00-14:35	<i>Some Applied Mathematical Problems in the Industry of Guangdong-Hong Kong-Macao Great Bay Area</i> <b>Prof. Zhengan YAO</b>		
	14:35-15:10	<i>Global well-posedness of coupled parabolic systems</i> <b>Prof. Runzhang XU</b>		
	Session 6. Chairman: <b>Prof. Chunlai MU</b>			
15:10-15:45	<i>Boundary spike/layer solutions of chemotaxis models</i> <b>Prof. Zhian WANG</b>			
15:45-16:15	Coffee break			
Session 7. Chairman: <b>Prof. Hailiang Li</b>				
16:15-16:50	<i>Compressible fluid approximation for rarefied gases in bounded domains</i> <b>Prof. Renjun DUAN</b>			
16:50-17:25	<i>The Euler limit of the relativistic Boltzmann equation</i> <b>Prof. Hongjun YU</b>			

	Session 8. Chairman: <b>Prof. Jing LI</b>			
	17:25-18:00	<i>Global mild solutions of the Landau and non-cutoff Boltzmann equations</i> <b>Prof. Shuangqian LIU</b>		
	18:00-20:00	Dinner	Huashi Hotel	
Nov. 09 <sup>th</sup> (Sat.)	Session 1. Chairman: <b>Prof. Weike WANG</b>			
	8:15-8:50	<i>Prandtl equation in Gevrey function space</i> <b>Prof. Tong YANG</b>		
	8:50-9:25	<i>The new developments on some old problems of superconductivity and liquid crystals</i> <b>Prof. Xingbin PAN</b>		
	Session 2. Chairman: <b>Prof. Yinbin DENG</b>			
	9:25-10:00	<i>Convection in a coupled free-flow porous media flow system</i> <b>Prof. Xiaoming WANG</b>		
	10:00-10:20	Coffee break		
	Session 3. Chairman: <b>Prof. Zhenhua GUO</b>			
	10:20-10:55	<i>The global smooth solution problem of the 3D incompressible Euler and Navier-Stokes equations in spherical coordinates</i> <b>Prof. Shu WANG</b>		
	10:55-11:30	<i>Linear stability of pipe Poiseuille flow at high Reynolds number regime</i> <b>Prof. Zhifei ZHANG</b>		
	Session 4. Chairman: <b>Prof. Feimin HUANG</b>			
	11:30-12:05	<i>Incompressible impinging jet flow with gravity</i> <b>Prof. Lili DU</b>		
	12:05-14:00	Lunch		Huashi Hotel
	Session 5. Chairman: <b>Prof. Quansen JIU</b>			
	14:00-14:35	<i>On conformal curvature equations with prescribed nonpositive curvature</i> <b>Prof. Feng ZHOU</b>		
	14:35-15:10	<i>Axisymmetric transonic shock flow in an axisymmetric perturbed nozzle</i> <b>Prof. Shangkun WENG</b>		
	Session 6. Chairman: <b>Prof. Xiangao LIU</b>			
15:10-15:45	<i>Almost global solutions of 3D quasilinear hyperbolic equations in exterior domain with Neumann boundary conditions</i> <b>Prof. Jun LI</b>			
15:45-16:15	Coffee break			

	Session 7. Chairman: <b>Prof. Xiaoping WANG</b>			
	16:15-16:50	<i>Well-posedness in Gevrey function space for the three-dimensional Prandtl equations</i> <b>Prof. Weixi LI</b>		
	16:50-17:25	<i>Uniform regularity for the MHD equations with transverse magnetic field</i> <b>Prof. Chengjie LIU</b>		
	Session 8. Chairman: <b>Prof. Jianwen ZHANG</b>			
	17:25-18:00	<i>On the compressible Navier-Stokes equations in the whole space: from non-isentropic flow to isentropic flow</i> <b>Prof. Lingbing HE</b>		
	18:00-20:00	Banquet		Huashi Hotel
	Session 1. Chairman: <b>Prof. Weizhu BAO</b>			
	8:15-8:50	<i>Finite time blowup for MHD and elastodynamics with small disturbances</i> <b>Prof. Yi ZHOU</b>		
8:50-9:25	<i>Compressible flow initiated by a characteristic function</i> <b>Prof. Piotr B. MUCHA</b>			
Session 2. Chairman: <b>Prof. Zhong TAN</b>				
9:25-10:00	<i>Recent results on well-posedness of polymeric fluid models</i> <b>Prof. Zhaoyang YIN</b>			
10:00-10:20	Coffee break			
Session 3. Chairman: <b>Prof. Xinan MA</b>				
10:20-10:55	<i>Stability and vanishing viscosity limit of planar rarefaction wave to the multi-dimensional compressible Navier-Stokes equations</i> <b>Prof. Yi WANG</b>			
10:55-11:30	<i>Uniform structural stability of Hagen-Poiseuille flows in a pipe</i> <b>Prof. Chunjing XIE</b>			
Nov. 10 <sup>th</sup> (Sun. )	Session 4. Chairman: <b>Prof. Huijiang ZHAO</b>			
	11:30-12:05	<i>Homogenization of Stokes equations in perforated domains: a unified approach</i> <b>Prof. Yong LV</b>		
	12:05-14:00	Lunch		Huashi Hotel
	Session 5. Chairman: <b>Prof. Huansong ZHOU</b>			
	14:00-14:35	<i>Some Results on Ideal MHD Free Boundaries</i> <b>Prof. Tao LUO</b>		
	14:35-15:10	<i>On Uniqueness of Steady Transonic Shocks in Two--Dimensional Compressible Euler Flows</i> <b>Prof. Beixiang FANG</b>		
	Session 6. Chairman: <b>Prof. Yongsheng LI</b>			
	15:10-15:45	<i>Global small solution and decay to some fluid mechanics systems</i> <b>Prof. Xiaojing XU</b>		

15:45-16:15	Coffee break	
Session 7. Chairman: <b>Prof. Shuangjie PENG</b>		
16:15-16:50	<i>Some topics on the boundary problems of MHD equations</i> <b>Prof. Yuelong XIAO</b>	
16:50-17:25	<i>Asymptotic behavior to the equations of magnetohydrodynamics for perfect flows</i> <b>Prof. Xulong QIN</b>	
Session 8. Chairman: <b>Prof. Jinkai LI</b>		
17:25-18:00	<i>Existence and non-uniqueness of solutions to a class of Monge-Ampere type equations</i> <b>Prof. Jian LU</b>	
18:00-20:00	Dinner	Huashi Hotel

### Organizing Committee

Zhouping XIN (辛周平) (Chair)	The Chinese University of Hong Kong & CAMIS
Xiaoping WANG (王筱平)	Hong Kong University of Science and Technology & CAMIS
Weizhu BAO (包维柱)	National University of Singapore & CAMIS
Shijin DING (丁时进)	South China Normal University
Jinkai LI (李进开)	South China Normal University

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Chunjie CHEN (陈纯洁)	jczx5@m.scnu.edu.cn, 13533007372, 86-20-85210015

### 3. Abstract & Title

#### *Incompressible impinging jet flow with gravity*

Lili DU (杜力力) (Sichuan University)

In this talk, we will discuss some well-posedness results on the steady two-dimensional free-surface flows of an inviscid and incompressible fluid emerging from a nozzle, falling under gravity and impinging onto a horizontal wall. More precisely, for any given atmosphere pressure and any appropriate incoming total flux, we establish the existence of two-dimensional incompressible impinging jet with gravity. The two free surfaces initiate smoothly at the endpoints of the nozzle and become to be horizontal in downstream. By transforming the free boundary problem into a minimum problem, we establish the properties of the flow region and the free boundaries. Moreover, the asymptotic behavior of the impinging jet in upstream and downstream is also obtained. This is a joint work with Jianfeng Cheng and Zhouping Xin.

#### *Compressible fluid approximation for rarefied gases in bounded domains*

Renjun DUAN (段仁军) (The Chinese University of Hong Kong)

I will talk about two recent results on the mathematical justification of the compressible viscous fluid approximation of solutions to the Boltzmann equation in bounded domains when the Knudsen number is small. The first result is concerned with the situation where the diffusive reflection boundary condition is considered and the fluid equations are solved under the non-slip boundary conditions. The second result is focused on a specific case of the one-dimensional heat transfer for a steady rarefied gas flow between two parallel plates with diffusive reflection boundaries of different temperatures where the temperature difference is small but does not depend on the Knudsen number, and we show the existence of steady solutions by taking the approximation of fluid equations with slip boundaries together with the Knudsen layer equations. The works are joint with Shuangqian Liu (Central China Normal University), Tong Yang (City University of Hong Kong) and Zhu Zhang (City University of Hong Kong).

#### *On the large data problems for the incompressible Navier-Stokes equations*

Daoyuan FANG (方道元) (Zhejiang University)

In this talk, we will show some recent results on the 3D incompressible Navier-Stokes equations, which were obtained by our group during these years. We will show the large data existence of the solution for the generalized N-S equations, partial large data problems of the incompressible N-S equations, and so on.



## ***On Uniqueness of Steady Transonic Shocks in Two--Dimensional Compressible Euler Flows***

Beixiang FANG (方北香) (Shanghai Jiao Tong University)

In the famous book “Supersonic Flow and Shock Waves” by R. Courant and K. O. Friedrichs, it is indicated the existence of some special transonic shock solutions for the 2-D steady full Euler system. For instance, the transonic shock in supersonic flow past a wedge, the normal transonic shock in a straight duct, etc. The existence is obtained under assumptions that the solution is piecewise constant. In this talk, we will show that for the transonic shock solutions of wedge case, the special solutions are unique under some assumptions weaker than the piecewise constant assumption, which mainly include piecewise  $C^1$  smooth, full subsonic flow field behind the shock front, as well as appropriate conditions on the tip of wedge and at infinity of the downstream subsonic flow. This talk is based on a joint work with Li LIU and Hairong YUAN.

## ***On the compressible Navier-Stokes equations in the whole space: from non-isentropic flow to isentropic flow***

Lingbing HE (何凌冰) (Tsinghua University)

The present talk aims at the mathematical derivation of the equations for the isentropic flow from those for the non-isentropic flow for perfect gases in the whole space. Suppose that the following things hold for the entropy equation: (1). both conduction of heat and its generation by dissipation of mechanical energy are sufficiently weak; (2). initially the entropy is around a constant. Then the solution to the non-isentropic compressible Navier-Stokes equations can be approximated by the solution to the associated isentropic compressible Navier-Stokes equations equipped with the same initial data. We also derive the asymptotic expansion for the solutions to these two equations.

## ***Analysis of the Q-tensor model for liquid crystal flows***

Matthias HIEBER (Technische Universität Darmstadt)

In this talk we investigate the Beris-Edwards Q-tensor model for liquid crystal flows in the case of non vanishing tumbling and aligning effects and prove in particular global strong well-posedness results for this set of equations in the three dimensional setting.

## ***Almost global solutions of 3D quasilinear hyperbolic equations in exterior domain with Neumann boundary conditions***

Jun LI (李军) (Nanjing University)

In this talk, we introduce the recent result on the almost global existence of smooth small-amplitude solutions to 3-D quasilinear hyperbolic equations in exterior domains with Neumann boundary conditions. When the smooth initial data is  $O(\varepsilon)$  size with suitable compatible conditions, the lower bound of the lifespan is proved to be  $\exp(1/\varepsilon)$  order, which is coincided with the case in Minkowski space. This work is jointed with Dr. Meng Yuan.

### ***Well-posedness in Gevrey function space for the three-dimensional Prandtl equations***

Weixi LI (李维喜) (Wuhan University)

In the paper, we study the three-dimensional Prandtl equations without any monotonicity condition on the velocity field. We prove that when one tangential component of the velocity field has a single curve of non-degenerate critical points with respect to the normal variable, the system is locally well-posed in the Gevrey function space with Gevrey index in  $]1, 2]$ . The proof is based on some new observation of cancellation mechanism in the three space dimensional system in addition to those in the two-dimensional setting.

### ***Uniform regularity for the MHD equations with transverse magnetic field***

Chengjie LIU (刘成杰) (Shanghai Jiao Tong University)

In this talk, we discuss the inviscid limit of MHD equations in the half space without the resistivity. With the non-slip boundary conditions for the velocity and the transverse magnetic field at the boundary, we prove that there is an time interval independent of the viscosity such that the solution of MHD equations is uniformly bounded in a conormal Sobolev space and has one normal derivative bounded in  $L^\infty$ . It shows that no boundary layers appear, and we obtain the inviscid limit to the ideal MHD system.

### ***Global mild solutions of the Landau and non-cutoff Boltzmann equations***

Shuangqian LIU (刘双乾) (Jinan University&. Central China Normal University)

The motion of the particles in the dilute gas can be described by the Landau equation or the non-cutoff Boltzmann equation. It is known that it is very difficult to construct the global well-posedness in Sobolev space for the initial boundary value problems of the kinetic equations in general bounded domains due to the formation of singularity of solutions. In this talk, firstly, we will discuss how to establish the global existence in some sharp regularity space for both the Landau equation and the non-cutoff Boltzmann equation with either the inflow boundary condition or the specular reflection boundary condition in a finite channel, secondly, we will show the solutions tend to the equilibrium around a global Maxwellian with the time sub-exponential decay rates, thirdly, we will present the regularity of the initial data or boundary data can be propagated from the boundary into the interior of the channel along the tangential direction. This is partly joint work with R. Duan, S. Sakamoto and R. Strain.

### ***Existence and non-uniqueness of solutions to a class of Monge-Ampere type equations***

Jian LU (鲁建) (South China Normal University)

We have studied a class of Monge-Ampere type equations, which relate to the Orlicz-Brunn-Minkowski theory. These equations are fully nonlinear partial differential equations defined on the unit sphere in Euclidean space. They may be degenerate or singular in different cases. We will talk about some recent results about existence and non-uniqueness of solutions to

these equations.

***Some Results on Ideal MHD Free Boundaries***

Tao LUO (罗涛) (City University of Hong Kong)

In this talk, I will present some results joint with Chengchun Hao on Ideal MHD Free Boundaries which are closed surfaces or curves. The results discussed include a priori estimates, ill-posedness when Taylor sign condition fails and well-posedness of a linearized problem under Taylor sign condition.

***Homogenization of Stokes equations in perforated domains: a unified approach***

Yong LV (吕勇) (Nanjing University)

We consider the homogenization of the Stokes equations in a domain perforated with a large number of small holes which are periodically distributed. G. Allaire gave a systematic study on this problem. In this paper, we introduce a unified proof for different sizes of holes for the homogenization of the Stokes equations by employing a generalized cell problem inspired by L. Tartar.

***Compressible flow initiated by a characteristic function***

Piotr B. MUCHA (University of Warsaw)

In this joint work with Raphael [1], we address a question concerning a motion of the perfect gas in the regime of two dimensional compressible Navier-Stokes system. We show the following fact: "A flow initiated by an arbitrary velocity vector field (possibly large in  $H^1$ ) and an initial density given as a characteristic function of a measurable set exists uniquely, globally in time, provided that the bulk/volume viscosity is large enough. "A key point of our analysis is the regularity of the density. Its features allow us to call it ripped, since it can be rough – just bounded, and vacuum may persist on merely measurable sets. The result is based on the so-called shift regularity technique and analysis of solutions with respect to streamlines. The main results give brand new information concerning regularity of solutions for general pressure laws. As an added value of our considerations we obtain rigorous justification of passing from the compressible Navier-Stokes system to the inhomogeneous incompressible one, even for densities with vacuum. References [1] Raphael Danchin, Piotr B. Mucha: Compressible Navier-Stokes equations with ripped density. arXiv: 1903.09396

***The new developments on some old problems of superconductivity and liquid crystals***

Xingbin PAN (潘兴斌) (East China Normal University)

Ginzburg-Landau equations for superconductivity and Landau-de Gennes equations for liquid crystals will be studied in this talk, and we will revisit some long standing open problems

and introduce some recent developments. The following contexts will be included: (i) Ginzburg-Landau equation and surface superconductivity: are there any undiscovered solutions? (ii) Macroscopic quantum effects in superconductivity: Little-Parks experiment; (iii) Meissner state and nonlinear Maxwell equations; (iv) Landau-de Gennes equations and liquid crystals: problems of curl minimization and divergence minimization.

***Asymptotic behavior to the equations of magnetohydrodynamics for perfect flows***

Xulong QIN (秦绪龙) (Sun Yat-sen University)

Both the global existence and asymptotic behavior of classical solutions are first established for the planar magnetohydrodynamic(MHD) equations with large data in a unified way. This can be viewed as an analog of the classical work by Kazhikhov-Shelukhin for the Navier-Stokes equations to the MHD equations. Moreover, the exponential convergence of solutions to equilibria is also obtained for generic initial data.

***Nonlinearly Exponential Stability of Compressible Navier-Stokes System with Degenerate Heat-Conductivity***

Xiaoding SHI (施小丁) (Beijing University Of Chemical Technology)

In this talk, we will consider the large-time behavior of strong solutions to the one-dimensional, compressible Navier-Stokes system for a viscous and heat conducting ideal polytropic gas, when the viscosity is constant and the heat conductivity is proportional to a positive power of the temperature. Both the specific volume and the temperature are proved to be bounded from below and above independently of time. Moreover, it is shown that the global solution is nonlinearly exponentially stable as time tends to infinity. Note that the conditions imposed on the initial data are the same as those of the constant heat conductivity case [Kazhikhov-Shelukhin, J. Appl. Math. Mech. 41(1977); Kazhikhov, Boundary Value Problems for Hydrodynamical Equations, 50(1981)] and can be arbitrarily large. Therefore, our result can be regarded as a natural generalization of the Kazhikhov's ones for the constant heat conductivity case to the degenerate and nonlinear one.

***Smooth transonic flows in de Laval nozzles***

Chunpeng WANG (王春朋) (Jilin University)

In this talk, we introduce recent joint works with Professor Zhouping Xin on smooth transonic flows in two dimensional de Laval nozzles. We consider smooth transonic potential flows whose sonic points are all exceptional. For such a smooth transonic flow, its sonic curve must be located at the throat of the nozzle and the flow is governed by a quasilinear elliptic-hyperbolic mixed type equation with degeneracy at the sonic state. It is shown that the existence of such a smooth transonic flow is determined by the geometry and the height of the nozzle at the throat.

***The global smooth solution problem of the 3D incompressible Euler and Navier-Stokes equations in spherical coordinates***

Shu WANG (王术) (Guangzhou University & Beijing University Of Technology)

We investigate the globally stabilizing effects of the geometry of the domain at which the flow locates and of the geometry structure of the solution in studying the regularity issue on the three-dimensional incompressible Navier-Stokes and Euler system. We establish the global existence and uniqueness of the smooth solution or the strong solutions to the Cauchy problem for the three-dimensional incompressible Navier-Stokes and Euler system, and, also, to the initial boundary value problem for the 3D Navier-Stokes equations in spherical coordinates for a class of the smooth large initial data. The related problems on the axisymmetric Navier-Stokes equations are surveyed and some results on the singularity formation and global regularity of an axisymmetric model for the 3D incompressible Euler and Navier-Stokes equations will also be reviewed.

***Convection in a coupled free-flow porous media flow system***

Xiaoming WANG (王晓明) (Southern University of Science and Technology)

We show that the Principle of Exchange of Stability holds for convection in a layer of fluids overlaying a porous media with proper interface boundary conditions and suitable assumption on the parameters. The physically relevant small Darcy number regime as well as the dependence of the convection on various parameters will be discussed. A theory on the dependence of the depth ratio of the onset of deep convection will be put forth together with supporting numerical evidence. A decoupled uniquely solvable, unconditionally stable numerical scheme for solving the system will be presented as well.

***Stability and vanishing viscosity limit of planar rarefaction wave to the multi-dimensional compressible Navier-Stokes equations***

Yi WANG (王益) (Chinese Academy of Sciences)

The talk is concerned with our recent developments on the time-asymptotic stability and the vanishing viscosity limit of the planar rarefaction wave to the multi-dimensional (2D/3D) compressible Navier-Stokes equations (including both isentropic and full non-isentropic cases). Remark that the hyperbolic waves are crucially introduced to recover the physical viscosities of the inviscid planar rarefaction wave profile, in order to rigorously justify the vanishing viscosity limit in both 2D and 3D cases. Moreover, different scaled spatial and time variables are needed for the limit process in 2D and 3D cases, respectively.

***Boundary spike/layer solutions of chemotaxis models***

Zhian WANG (王志安) (The Hong Kong Polytechnic University)

In this talk, we shall report some progress made on boundary spike or layer solutions of

chemotaxis models with physical boundary conditions: zero-flux and Dirichlet mixed boundary conditions based on some real experiment. We exploit a variety of questions such as the existence and stability of boundary spike/layer solution, the effect of boundary curvature on the boundary-layer profile and so on.

***Axisymmetric transonic shock flow in an axisymmetric perturbed nozzle***

Shangkun WENG (翁上昆) (Wuhan University)

In this talk, I will discuss the structural stability result of the spherical symmetric transonic shock solutions under the axisymmetric perturbation of the nozzle wall and also the supersonic incoming flow including the swirl component. The key issue is to find an invertible Lagrangian transformation to flatten the trajectories and kill the singularity on the axis simultaneously.

***Some topics on the boundary problems of MHD equations***

Yuelong XIAO (肖跃龙) (Xiangtan University)

In this talk, we talk about the applicability of the common boundary conditions which are used in physical and mechanical systems in bounded domains. Some related topics are also discussed.

***Uniform structural stability of Hagen-Poiseuille flows in a pipe***

Chunjing XIE (谢春景) (Uniform structural stability of Hagen-Poiseuille flows in a pipe)

We discuss the recent progress on nonlinear structural stability of Hagen-Poiseuille flows, in particular, the uniform stability of these flows with respect to the mass flux. The key ingredient of the analysis is the linear structural stability of Hagen-Poiseuille flows in a pipe. This linear problem closely relates to dynamical stability of Hagen-Poiseuille flows. The stability of other shear flows in a nozzle will also be addressed.

***Full analytic smoothing effect of non linear Landau equation***

Chaojiang XU (徐超江) (Nanjing University of Aeronautics and Astronautics)

In this talk, we present a new results about the analytic smoothing effect for the Cauchy problem of non linear inhomogeneous Landau equation. For the initial datum in  $H^{\{3/2+\}_x}(L^2_v)$ , we prove that the solution of Cauchy problem is full analytic for positive time.

***Global well-posedness of coupled parabolic systems***

Runzhang XU (徐润章) (Harbin Engineering University)

The initial boundary value problem of a class of reaction-diffusion systems (coupled parabolic systems) with nonlinear coupled source terms is considered in order to classify the initial data for

the global existence, finite time blowup and longtime decay of the solution. The whole study is conducted by considering three cases according to initial energy: low initial energy case, critical initial energy case and high initial energy case. For the low initial energy case and critical initial energy case the sufficient initial conditions of global existence, long time decay and finite time blowup are given to show a sharp-like condition. And for the high initial energy case the possibility of both global existence and finite time blowup is proved first, and then some sufficient initial conditions of finite time blowup and global existence are obtained respectively.

***Global small solution and decay to some fluid mechanics systems***

Xiaojing XU (许孝精) (Beijing Normal University)

In this talk, I shall introduce the stability and large-time behavior problems on perturbations near the trivial solution to some fluid mechanics systems. These systems do not involve dissipation terms. These stability problems are extremely difficult, partially due to the lack of dissipation. The energy method and classical approaches can no longer provide information on the large-time behavior of these partially dissipated systems. We will presents a new approach that take into account of the special structure of the linearized system. The linearized parts of the systems here both obey a degenerate damped wave type equations. By representing the nonlinear system in an integral form and carefully crafting the functional setting for the initial data and solution spaces, we are able to establish the long-term stability and global (in time) existence and uniqueness of smooth solutions of the nonlinear systems focused here. Simultaneously, we also obtain exact decay rates for various derivatives of the perturbations.

***Prandtl equation in Gevrey function space***

Tong YANG (杨彤) (City University of Hong Kong)

We will present a recent work with Wei-xi Li and Nader Masmoudi on the well-posedness for the three space dimensional Prandtl equation in Gevrey function space.

***Some Applied Mathematical Problems in the Industry of Guangdong-Hong Kong-Macao Great Bay Area***

Zhengan YAO (姚正安) (Sun Yat-sen University)

We will discuss some mathematical problems proposed by some companies in the Guangdong-Hong Kong-Macro Great Bay Area: China Southern Airlines, Shenzhen City meteorological station, Huawei, Gree, and Tencent, and seek for the solutions.

***Recent results on well-posedness of polymeric fluid models***

Zhaoyang YIN (殷朝阳) (Sun Yat-sen University)

In this talk, we will talk about our recent results on well-posedness of the FENE dumbbell model and the Doi-Edwards polymer model and some interesting problems. These are joint works with Wei Luo.

***The Euler limit of the relativistic Boltzmann equation***

Hongjun YU (喻洪俊) (South China Normal University)

In this talk we discuss about the existence and uniqueness theorems of the solutions to the relativistic Boltzmann equation for analytic initial fluctuations on a time interval independent of the Knudsen number  $\epsilon > 0$ . As  $\epsilon \rightarrow 0$ , we prove that the solution of the relativistic Boltzmann equation tends to the local relativistic Maxwellian, whose fluid-dynamical parameters solve the relativistic Euler system and the convergence rate is obtained. As a by-product, an existence theorem for the relativistic Euler system without the assumption of the non-vacuum fluid states is obtained.

***Linear stability of pipe Poiseuille flow at high Reynolds number regime***

Zhifei ZHANG (章志飞) (Peking University)

TBA

***On conformal curvature equations with prescribed nonpositive curvature***

Feng ZHOU (周风) (East China Normal University)

We present some existence results about the conformal curvature equations in higher dimension space. We are looking for solutions with logarithmic growth at infinity for nonpositive curvature functions. We present also a more general condition for the existence of solutions for Gaussian curvature equation and we give an explicit example for which we prove the existence of new type solutions with different remainder term at infinity. This is based on joint works with H. Y. Chen, X. Huang and D. Ye.

***Finite time blowup for MHD and elastodynamics with small disturbances***

Yi ZHOU (周忆) (Fudan University)

We refine the test function method of Sideris and develop a plane wave method to reprove finite blow up for the ideal compressible Euler equations with small data. Then we use our method to obtain certain results of finite time blow up for MHD and elastodynamics with small data.



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