2022年偏微分方程新进展学术会议

会议手册

南京大学　南通大学

江苏·南通

2022年1月14日–17日

"2022年偏微分方程新进展"学术会议

江苏·南通，2022 年 1 月 14 日-17 日

　　为加强偏微分方程领域的学术交流与合作，在江松院士和辛周平教授的指导下，我们定于2022年1月14日至17日在南通大学举办"2022年偏微分方程新进展"学术会议。我们根据疫情防控的形势，采取线上线下相结合的形式组织这次会议。

　　此次会议由南京大学数学系和南通大学理学院联合主办，旨在为偏微分方程领域的专家学者提供一个交流最新研究进展和研究方向的平台，促进相互之间的交流与合作，推动偏微分方程领域的发展。

学术委员会（按姓氏拼音字母为序）

主席：　江　松　　北京应用物理与计算数学研究所
　　　　辛周平　　香港中文大学

成员：

　　陈　化　武汉大学
　　邓引斌　华中师范大学
　　黄飞敏　中国科学院院数学与系统科学研究院
　　李从明　上海交通大学
　　王维克　上海交通大学
　　王晓明　南方科技大学
　　徐超江　南京航空航天大学
　　杨　彤　香港城市大学
　　杨孝平　南京大学
　　尹会成　南京大学
　　尹景学　华南师范大学
　　张　平　中国科学院院数学与系统科学研究院
　　朱长江　华南理工大学

组织委员会（按姓氏拼音字母为序）：

主席：陈玉娟　　南通大学

成员：

　　黎野平 (南通大学)　栗付才 (南京大学)　陆海华 (南通大学)

　　殷　容 (南通大学)　郁胜旗 (南通大学)　张志朋 (南京大学)

会议主办单位：南京大学、南通大学

会议报到时间：　2022年1月14 日

报到时间：2022年1月14日14：00-20：00

报到地点：文景国际大酒店一楼大厅

　　　　　　　　（江苏省南通市崇川区世纪大道55号）

住宿地点：文景国际大酒店

会议报告和交流时间：　2022年1月15日 –17日

线上会议腾讯会议：　　　1月15日：　781-714-355　　密码：220115

　　　　　　　　　　　　1月16日：　673-171-505　　密码：220116

　　　　　　　　　　　　1月17日：　153-682-931　　密码：220117

线下会议地址：文景国际大酒店三楼得仁厅

会议资助：国家自然科学基金、南通大学理学院

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　　　　　　　　　　　　　　"2022年偏微分方程新进展"学术会议组委会

　　　　　　　　　　　　　　　　　　2022年1月8日

会议日程安排

日期	时间	内容	地点
1月14日	14:00 — 20:00	报到	文景国际大酒店一楼大厅
1月15日上午	8：30 — 8：50	开幕式	文景国际大酒店三楼得仁厅（用餐地点另行通知）
	8：50 — 9：00	合影	
	9：00 — 11:50	学术报告	
1月15日下午	12:00 — 14:00	午餐	
	14:00 — 17:30	学术报告	
	17:30 — 20:00	晚宴	
1月16日上午	8：20 — 11:50	学术报告	
1月16日下午	12:00 — 14:00	午餐	
	14:00 — 17:30	学术报告	
	17:30 — 20:00	晚餐	
1月17日上午	8：20 — 11:50	学术报告	
	11:50 — 12:00	闭幕式	
1月17日下午	12：00 —14:00	午餐	
	14:00 —	自由讨论、离会	

线上会议：

1月15日：腾讯会议：781-714-355　　密码：220115

1月16日：腾讯会议：673-171-505　　密码：220116

1月17日：腾讯会议：153-682-931　　密码：220117

学术报告日程安排一览

时 间	2022年1月15日		2022年1月16日		2022年1月17日	
	报告人	主持人	报告人	主持人	报告人	主持人
8：20 — 9：00	8:30-9:00 开幕式		黄飞敏	辛周平	曹道民	朱长江
9：00 — 9：40	张平	江松	梅茗	李海梁	李竞	王晓明
9：40 — 10:20	王德华	尹会成	潘荣华	谭忠	段仁军	徐超江
10:20 — 10:30	茶歇					
10:30 — 11:10	罗涛	陈化	章志飞	王亚光	喻洪俊	杨彤
11:10 — 15:00	王益	李从明	郝成春	姚正安	温焕尧	丁时进
					11:50-12:00 闭幕式	
12:00 — 14:00	午餐				自由活动、离会	
14:00 — 14:40	张立群	杨孝平	李亚纯	麻希南		
14:40 — 15:20	李维喜	楼元	孙永忠	周焕松		
15:20 — 16:00	谢峰	周忆	刘双乾	王维克		
16:00 — 16:10	茶歇					
16:10 — 16:50	赵会江	尹景学	高洪俊	邓引斌		
16:50 — 17:30	谢春景	王术	李进开	彭双阶		
17:30 — 20:00	晚餐					

线上会议：

1月15日：腾讯会议：781-714-355　　密码：220115

1月16日：腾讯会议：673-171-505　　密码：220116

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学术报告日程安排

2022年1月15日 （腾讯会议：781-714-355　　密码：220115）			
时　间	内容		主持人
8：30 — 8：50	开幕式		
8：50 — 9：00	合影		
时　间	报告人	题目	主持人
9：00 — 9：40	张平 中科院数学与系统科学研究院	Enhanced dissipation for the third component of 3D anisotropic Navier-Stokes equations	江松 北京应用物理与计算数学研究所
9：40 — 10:20	王德华 美国匹兹堡大学	Euler equations and transonic flows	尹会成 南京大学
10:20 — 10:30	茶歇		
10:30 — 11:10	罗涛 香港城市大学	On the Free Boundary Problem of 3-D Full Compressible Euler Equations Coupled With a Nonlinear Poisson Equation	陈化 武汉大学
11:10 — 11:50	王益 中科院数学与系统科学研究院	Stability of viscous shock and rarefaction waves to the baratropic Navier-Stokes equations	李从明 上海交通大学
12:00 — 14:00	午餐		
14:00 — 14:40	张立群 中科院数学与系统科学研究院	On the Steady Prandtl Boundary Layer Expansions	杨孝平 南京大学
14:40 — 15:20	李维喜 武汉大学数学与统计学院	Gevrey well-posedness of the hyperbolic Prandtl equations	楼元 上海交通大学
15:20 — 16:00	谢峰 上海交通大学	Vanishing Viscosity Limit for Compressible MHD Equations and Related Topics	周忆 复旦大学
16:00 — 16:10	茶歇		
16:10 — 16:50	赵会江 武汉大学	Global solutions to two types of radiation models	尹景学 华南师范大学
16:50 — 17:30	谢春景 上海交通大学	Analysis of steady solutions for the incompressible Euler system in an infinitely long nozzle	王术 北京工业大学
17:30 — 20:00	晚餐		

学术报告日程安排

2022年1月16日　（腾讯会议：673-171-505　　密码：220116）			
时间	报告人	题目	主持人
8：20 — 9：00	黄飞敏 中科院数学与系统科学研究院	The time asymptotic expansion for the compressible Euler equation	辛周平 香港中文大学
9：00 — 9：40	梅茗 Champlain 学院 & McGill 大学	Subsonic / supersonic / transonic steady-states of Euler-Poisson equations for semiconductors with sonic boundary	李海梁 首都师范大学
9：40 — 10：20	潘荣华 乔治亚理工大学	Isentropic Approximation	谭忠 厦门大学
10:20 — 10:30	茶歇		
10:30 — 11:10	章志飞 北京大学	Long-time behavior of Alfven waves in a flowing plasma	王亚光 上海交通大学
11:10 — 11:50	郝成春 中科院数学与系统科学研究院	Well-posedness of Linearized Incompressible Ideal MHD with Closed Free Surfaces	姚正安 中山大学
12:00 — 14:00	午餐		
14:00 — 14:40	李亚纯 上海交通大学	The strong trace property and the Neumann problem for stochastic conservation laws	麻希南 中国科学技术大学
14:40 — 15:20	孙永忠 南京大学	On asymptotic stability of Boussinesq equations without thermal conduction	周焕松 武汉理工大学
15:20 — 16:00	刘双乾 华中师范大学	The Navier-Stokes-Vlasov-Fokker-Planck system in bounded domains	王维克 上海交通大学
16:00 — 16:10	茶歇		
16:10 — 16:50	高洪俊 东南大学	Well-posedness and wave-breaking for the stochastic rotation-two-component Camassa-Holm system	邓引斌 华中师范大学
16:50 — 17:30	李进开 华南师范大学	Global well-posedness of the anisotropic primitive equations	彭双阶 华中师范大学
17:30 — 20:00	晚餐		

学术报告日程安排

2022年1月17日　（腾讯会议：153-682-931　密码：220117）			
时 间	报告人	题目	主持人
8 :20 — 9 :00	曹道民 中科院数学与系统科学研究院	Existence and stability of smooth traveling circular pairs for gSQG equation	朱长江 华南理工大学
9 :00 — 9 :40	李竞 南昌大学&中科院数学与系统科学研究院	Some recent results on compressible Navier-Stokes equations	王晓明 南方科技大学
9 :40 — 10:20	段仁军 香港中文大学	On smooth solutions to the thermostated Boltzmann equation with deformation	徐超江 南京航空航天大学
10:20 — 10:30	茶歇		
10:30 — 11:10	喻洪俊 华南师范大学	Stability of wave patterns for the Landau equation	杨彤 香港城市大学
11:10 — 11:50	温焕尧 华南理工大学	Some recent progress on global well-posedness and large time behavior for an Oldroyd-B model	丁时进 华南师范大学
11:50 — 12:00	闭幕式		
12:00 — 14:00	午餐		
14:00 —	自由讨论、离会		

会议报告题目与摘要

Existence and stability of smooth traveling circular pairs for gSQG equation

曹道民，中国科学院数学与系统科学研究院

The Lamb dipole is well-known for 2D Euler incompressible flow. In this talk, I will introduce some results of the existence and stability of travelling vortex pairs for the generalized surface quasi-geostrophic equation, which is the analogue of the Lamb dipole. This is based on a joint work with Guolin Qin, Weicheng Zhan and Changjun Zou.

On smooth solutions to the thermostated Boltzmann equation with deformation

段仁军，香港中文大学

We concern a kinetic model of the thermostated Boltzmann equation with a linear deformation force described by a constant matrix. The collision kernel under consideration includes both the Maxwell molecule and general hard potentials with angular cutoff. We construct the smooth steady solutions via a perturbation approach when the deformation strength is su_ciently small. The steady solution is a spatially homogeneous non Maxwellian state and may have the polynomial tail at large velocities. Moreover, we also establish the long time asymptotics toward steady states for the Cauchy problem on the corresponding spatially inhomogeneous equation in torus, which in turn gives the non-negativity of steady solutions.

Well-posedness and wave-breaking for the stochastic rotation-two-component Camassa-Holm system

高洪俊，东南大学

We study the global well-posedness and wave-breaking phenomenon for the stochastic rotation-two-component Camassa-Holm (R2CH) system. First, we find a Hamiltonian structure of the R2CH system and use the stochastic Hamiltonian to derive the stochastic R2CH system. Then, we establish the local well-posedness of the stochastic R2CH system by the dispersion-dissipation approximation system and the regularization method. We also show a precise blow-up criterion for the stochastic R2CH system. Moreover, we prove the global existence of the stochastic R2CH system occurs with high probability. At last, we consider transport noise case and establish the local well-posedness and another blow-up criterion.

Well-posedness of linearized incompressible ideal MHD with closed free surfaces

郝成春，中国科学院数学与系统科学研究院

In this talk, I review some results of free boundary problem of incompressible ideal MHD in a bounded domain with closed free surfaces based on the joint works with Prof. T. Luo, especially the well-posedness for the linearized system. We expressed the magnetic field in terms of the velocity field and the deformation tensors in the Lagrangian coordinates, and substituted the magnetic field into the momentum equation to get an equation of the velocity in which the initial magnetic field serves only as a parameter. Then, we linearized this equation with respect to the position vector field whose time derivative was the velocity, and obtained the local-in-time well-posedness of the solution by using energy estimates of the tangential derivatives and the curl with the help of Lie derivatives and the smooth-out approximation.

The time asymptotic expansion for the compressible Euler equation with damping

黄飞敏，中科院数学与系统科学研究院

In 1992, Hsiao and Liu showed that the solution to the compressible Euler equations with damping time-asymptotically converges to the diffusion wave of the porous media equation. In this talk, we proposed a time-asymptotic expansion around the diffusion wave and rigorously justify the expansion by the approximate Green function method with the help of energy estimates.

Global well-posedness of the anisotropic primitive equations

李进开, 华南师范大学

The motion of the large-scale atmospheric and oceanic flows is governed by the primitive equations (PEs), which are derived from the Navier-Stokes equations by using the Boussinesq and hydrostatic approximations. The strong horizontal turbulent mixing, which creates the horizontal eddy viscosity, leads us to consider the PEs with horizontal viscosity. It will be shown that the 3D PEs with horizontal viscosity admits a unique global strong solution, for arbitrary sufficient smooth initial data, as long as one still has the horizontal or vertical thermal diffusivity.

Some recent results on compressible Navier-Stokes equations

李竞，南昌大学&中国科学院数学与系统科学研究院

We investigate the barotropic compressible Navier-Stokes equations with slip boundary conditions in a three-dimensional (3D) simply connected bounded   domain, whose smooth boundary has a finite number of two-dimensional connected components. For any adiabatic exponent bigger than one, after obtaining some new estimates on boundary integrals related to the slip boundary condition, we prove that both the weak and classical solutions to the initial-boundary-value problem of this system exist globally in time provided the initial energy is suitably small. Moreover, the density has large oscillations and contains vacuum states. Finally, it is also shown that for the classical solutions, the oscillation of the density will grow unboundedly in the long run with an exponential rate provided vacuum appears (even at a point) initially. This is the first result concerning the global existence of classical solutions to the compressible Navier-Stokes equations with density containing vacuum states initially for general 3D

bounded smooth domains. This is a joint work with Prof. Guocai Cai (Xiamen Univ.)

Gevrey well-posedness of the hyperbolic Prandtl equations

李维喜，武汉大学

We study the two and three dimensional Prandtl equations of degenerate hyperbolic type, and established without any structural assumption the Gevrey well-posedness with Gevrey index ≤ 2. Compared with the classical parabolic Prandtl equations, the loss of the derivatives, caused by hyperbolic property, can't be overcame by virtue of the classical cancellation mechanism that developed for the parabolic counterpart. The main tool is the combination of the abstract Cauchy-Kowalewski problem Theorem in the Gevrey setting and a straightforward energy method without involving any cancellation mechanism.

The strong trace property and the Neumann problem for

stochastic conservation laws

李亚纯，上海交通大学

In this talk the well-posedness of the Neumann problem for stochastic conservation laws with multiplicative noise is considered. As a crucial point in order to prove the uniqueness of the kinetic solution we establish a new strong trace theorem for stochastic conservation laws. Existence of kinetic solutions is proved through the vanishing viscosity method and the detailed analysis of the corresponding stochastic parabolic problem is also made here for the first time, as far as the authors know.

The Navier-Stokes-Vlasov-Fokker-Planck system in bounded

domains

刘双乾，华中师范大学

This talk is concerned with the initial boundary value problem of the Vlasov-Fokker-Planck equation coupled with either the incompressible or compressible Navier-Stokes equations in a bounded domain. We will show the unique global existence and the exponential convergence rate to the equilibrium state under the

Maxwell boundary condition for the incompressible case and specular reflection boundary condition for the compressible case, respectively. For the compressible model, to overcome the lack of regularity due to the coupling with the kinetic equation in bounded domain, an essential $L^{\frac{10}{3}}$ estimate is analyzed so that the a priori estimate can be closed by applying the $\CS_\CL^p$ theory developed by Guo et al. [Arch. Ration. Mech. Anal. 236(3): 1389--1454 (2020)]. This is a joint work with Prof. H.-L. Li and Prof. T. Yang.

On the free boundary problem of 3-D full compressible Euler equations coupled with a nonlinear Poisson equation

罗涛，香港城市大学

For the problem of full compressible Euler Equations with variable entropy coupled with a nonlinear Poisson equation in three spatial dimensions with a general free boundary not restricting to a graph, we identify a stability condition for the electric potential of which the outer normal derivative is positive on the free surface besides the Taylor sign condition for the pressure to obtain a priori estimates on the Sobolev norms of the fluid variables and bounds for geometric quantities of free surface. This talk is based on a joint work with K. Trivisa and H. Zeng.

Subsonic / supersonic / transonic steady-states of Euler-Poisson equations for semiconductors with sonic boundary

梅茗，加拿大 Champlain 学院&加拿大 McGill 大学

In this talk, I will present a series of studies on the structure of steady-states to Euler-Poisson equations for semiconductors subjected to the sonic boundary, a critical case of boundary setting. Based on the subsonic/supersonic/transonic properties of the doping profile, we give the criteria on the structure of steady-states: in which cases there exist subsonic solutions, supersonic solutions, shock transonic solutions, smooth transonic solutions, and the number of these solutions, and in which cases there are no physical solutions.

Isentropic approximation

潘荣华，美国乔治亚理工大学

In the study of compressible flows, the isentropic model was often used to replace the more complicated full system when the entropy is near a constant. This is based on the expectation that the corresponding isentropic model is a good approximation to the full system when the entropy is sufficiently close to the constant. We will discuss the mathematical justification of isentropic approximation in Euler flows and in Navier-Stokes-Fourier flows. This is based on the joint work with Y. Chen, J. Jia, and L. Tong.

On asymptotic stability of Boussinesq equations without thermal conduction

孙永忠， 南京大学

We consider the motion of viscous incompressible fluid under the action of gravitation/buoyancy modeled by the Boussinesq equations in the absence of thermal conduction. Under suitable initial and boundary conditions we show global existence and decay rates of solutions to the perturbed system with small initial data. This in turn implies asymptotic stability of the specific stationary solution. We will also present some related results and discuss some unsolved problems. This is a joint work with Lihua Dong.

Euler equations and transonic flows

王德华，美国匹兹堡大学

In this talk, we will consider the Euler equations of gas dynamics and applications in transonic flows. First the basic theory of Euler equations will be reviewed. Then we will present the results on the transonic flows past obstacles, transonic flows in the fluid dynamic formulation of isometric embeddings, and the transonic flows in nozzles. We will discuss global solutions and stability obtained through various techniques and approaches.

Stability of viscous shock and rarefaction waves to the

baratropic Navier-Stokes equations

王益，中科院数学与系统科学研究院

First, we will talk about the time-asymptotic stability of composite wave consisting of both viscous shock and rarefaction waves to 1D baratropic Navier-Stokes equations, which solves an open problem proposed by Matsumura-Nishihara since 1992. The main difficulty is due to the incompatibility of the standard anti-derivative method, used to study the stability of viscous shock and the direct energy method used for rarefaction wave. Instead of the anti-derivative techniques, our proof uses the a-contraction with the time-dependent shifts to control the compressibility of viscous shock in the original perturbation framework for the stability of rarefactions. Then we will talk about the recent development on the stability of viscous shock on the multi-dimensional baratropic Navier-Stokes equations.

Some recent progress on global well-posedness and large time behavior for an Oldroyd-B model

温焕尧，华南理工大学

In this talk, I will introduce our recent progress on the global well-posedness and large time behavior for an Oldroyd-B model in the whole space R^3. The main results cover the inviscid case or the case without diffusive term of extra stress tensor.

Analysis of steady solutions for the incompressible Euler system in an infinitely long nozzle

谢春景，上海交通大学

Stagnation point in flows is an interesting phenomenon in fluid mechanics. It induces many challenging problems in analysis. We first derive a Liouville type theorem for Poiseuille flows in the class of incompressible steady inviscid flows in an infinitely long strip, where the flows can have stagnation points. With the aid of this Liouville type theorem, we show the uniqueness of solutions with positive horizontal velocity for steady Euler system in a general nozzle when the flows tend to the horizontal velocity of Poiseuille flows at the upstream. Finally, this kind of flows are

proved to exist in a large class of nozzles. This is a joint work with Congming Li and Yingshu Lv.

Vanishing Viscosity Limit for Compressible MHD Equations and Related Topics

谢峰 上海交通大学

In this talk we first review briefly the classical Prandtl boundary layer expansions method in the analysis of structure of fluids with the high Reynolds number in a domain with boundaries. The vanishing viscosity limit can be regarded as a direct consequence of Prandtl boundary layer asymptotic expansions. Then, we consider the related vanishing viscosity limit of solutions to the initial boundary value problem of compressible MHD Equations with the no-slip boundary conditions on velocity. Some other related models and topics are also discussed in this talk.

Stability of wave patterns for the Landau equation

喻洪俊，华南师范大学

In this talk, we will introduce recent works on the stability of wave patterns (rarefaction wave, contact discontinuity and their fluid limit) for the Landau equation with physically realistic Coulomb interactions.

On the steady Prandtl boundary layer expansions

张立群，中科院数学与系统科学研究院

We consider the zero-viscosity limit of the 2D steady Navier-Stokes equations in $(0,L)\times\R^+$ with non-slip boundary conditions. By estimating the stream-function of the remainder, we justify the validity of the Prandtl boundary layer expansion in shear Euler flow with some monotonicity assumptions on the solution of Prandtl's systems and some non-shear Euler flow cases. This is a jointed work with Gao Chen.

Enhanced dissipation for the third component of 3D anisotropic

Navier-Stokes equations

张平，中科院数学与系统科学研究院

In this paper, we study the decay rates for the global small smooth solutions to 3D anisotropic incompressible Navier-Stokes equations. In particular, we prove that the horizontal components of the velocity field decay like the solutions of 2D classical Navier-Stokes equations. While the third component of the velocity field decays as the solutions of 3D Navier-Stokes equations. We remark that such enhanced decay rate for the third component is caused by the interplay between the divergence free condition of the velocity field and the horizontal Laplacian in the anisotropic Navier-Stokes equations.

Long-time behavior of Alfven waves in a flowing plasma

章志飞 北京大学

In this talk, we consider the long-time behavior of the linearized MHD equations around a steady flowing plasma. We confirm the following physical phenomenon: there will be a generation of a magnetic island if magnetic shear exceeds flow shear, while the magnetic island will be destroyed if flow shear exceeds magnetic shear.

Global solutions to two types of radiation models

赵会江，武汉大学

In this talk, we are concerned with the construction of global smooth solutions to both a viscous radiative and reactive gas motion and a radiation hydrodynamic model. For the first model, we focus on the global existence of smooth non-vacuum solutions to a viscous radiative and reactive gas motion with large initial data, while for the second model, we concentrate on the construction of global radially symmetric solutions to a multidimensional radiation hydrodynamic model with small initial perturbation.

交通篇

出发 ＼ 到达	文景国际大酒店
南通汽车客运东站	1、公交车：步行 98 米至客运东站公交站乘坐 86 路公交车至新城小区东公交站，步行 361 米到达。 2、出租车：6 公里左右。
南通西站\南通站	**南通西站：** 1、出租车：25 公里左右。 2、公交车：南通西站公交站乘坐游 2 路公交车经 22 站至市行政中心西公交站下车，步行 483 米到达。 **南通站：** 1、出租车：18 公里左右。 2、公交车：乘坐 45 路公交车经过 24 站到达曹公祠公交站，步行 564 米到达。
南通兴东国际机场	1、出租车：20 公里左右。 2、公交车：633 路（末班 18:30）乘坐 10 站到市信访局公交站下车，步行 570 米到达。