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2024 年流体非线性偏微分方程专题研讨会 II

2024 Workshop on Nonlinear Partial Differential Equations in Fluids II

2024 年 5 月 13 日 (数学科学学院东楼二楼阶梯报告厅)		
时间	报告人及报告题目	主持人
08:30—11:30	自由讨论	
11:30—14:30	午餐	
15:00—15:50	Rayleigh-Taylor instability and beyond 潘荣华 (Georgia Institute of Technology)	丁时进
15:50—16:05	茶歇	
16:05—16:55	Local existence and uniqueness of solution to the two-dimensional inhomogeneous Prandtl equations by energy method 高金城 (中山大学)	朱长江
16:55—17:45	Zero dissipation limit of the compressible Navier-Stokes equations to piecewise smooth solutions with interacting shocks 马世香 (华南师范大学)	秦绪龙
晚餐		
2024 年 5 月 14 日 (数学科学学院西楼 114 室)		
09:00—09:50	Asymptotic stability of rarefaction wave and boundary layer for outflow problem on the viscous vasculogenesis model 刘青青 (华南理工大学)	温焕尧
09:50—10:05	茶歇	
10:05—10:55	Stabilization effect of temperature, magnetic field and the viscoelastic stress tensor on the inviscid compressible fluids 翟小平 (广东工业大学)	黄 锐
10:55—11:45	Ill-posedness of the Kelvin-Helmholtz problem for incompressible MHD fluids 解斌强 (广东工业大学)	李进开
11:45—14:30	午餐	
14:30—17:30	自由讨论	

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报告题目及摘要

Local existence and uniqueness of solution to the two-dimensional inhomogeneous Prandtl equations by energy method

高金城

(中山大学)

In this paper, we consider the local existence and uniqueness result for the inhomogeneous Prandtl equations in dimension two by energy method. First of all, for the homogeneous case, the local-in-time well-posedness theory of unsteady Prandtl equations was obtained by [Alexandre, Wang, Xu, Yang, J. Am. Math. Soc., 28(3), 745-784 (2015)] and [Masmoudi, Wong, Comm. Pure Appl. Math., 68(10), 1683-1741 (2015)] independently by energy method without any transformation. However, for the inhomogeneous case, the appearance of density will create some new difficulties for us to overcome the loss of tangential derivative of horizontal velocity. Thus, our first result is to overcome the loss of tangential derivative such that one can establish the local-in-time well-posedness result for the inhomogeneous Prandtl equations by energy method. Secondly, for the homogeneous case, the local-in-x well-posedness in higher regular space for the steady Prandtl equations was obtained by [Guo, Iyer, Comm. Math. Phys., 382 (3), 1403-447 (2021)] by energy method since they firstly found the good quantity (called `quotient'). With the help of this quotient, our second result is to establish the local-in-x well-posedness in higher regular Sobolev space for the steady inhomogeneous Prandtl equations.

Asymptotic stability of rarefaction wave and boundary layer for outflow problem on the viscous vasculogenesis model

刘青青

(华南理工大学)

In this talk, we are concerned with the outflow problem on a simplified viscous vasculogenesis model in the half-line $\R_{+}$. Firstly, we establish the global-in-time asymptotic stability of the rarefaction wave. Secondly, we obtain the unique existence

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and decay property of the boundary layer by using stable manifold theorem. Moreover, the asymptotic stability and convergence rates of solution towards boundary layer are obtained. The appearance of concentration makes the stationary problem more difficult than Navier-Stokes equations or Navier-Stokes-Poisson equations.

Zero dissipation limit of the compressible Navier-Stokes equations to piecewise smooth solutions with interacting shocks

马世香

(华南师范大学)

In this talk, we will investigate the zero dissipation limit problem for the one-dimensional compressible Navier-Stokes equations. We show that if the solution of the inviscid Euler system is piecewise smooth with interacting shocks, there exists a family of smooth solutions to the compressible Navier-Stokes equations which converges to the inviscid solution away from the shock discontinuities.

Rayleigh-Taylor instability and beyond

潘荣华

(Georgia Institute of Technology)

It is known in physics that steady state of fluids under the influence of uniform gravity is stable if and only if the convection is absent. In the context of incompressible fluids, convection happens when heavier fluids is on top of lighter fluids, known as Rayleigh-Taylor instability. However, in real world, heat transfer plays an important role in convection of fluids, such as the weather changes, and or cooking a meal. In this context, the compressibility of the fluids becomes important. Indeed, using the more realistic model of compressible flow with heat transfer, the behavior of solutions is

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much closer to the real world and more complicated. We will discuss these topics in this lecture, including some on-going research projects.

Ill-posedness of the Kelvin-Helmholtz problem for incompressible MHD fluids

解斌强

(广东工业大学)

In this talk, we will consider the ill-posedness of the well-known Kelvin-Helmholtz problem of incompressible ideal magnetohydrodynamics (MHD) equations. We prove the linear and nonlinear Kelvin-Helmholtz instability under the condition that violates the Syrovatskij stability condition.

Stabilization effect of temperature, magnetic field and the viscoelastic stress tensor on the inviscid compressible fluids

翟小平

(广东工业大学)

Solutions to the compressible Euler equations in all dimensions have been shown to develop finite-time singularities from smooth initial data such as shocks and cusps. There is an extraordinary list of results on this subject. However, when the fluids are coupled with the temperature on the ideal inviscid compressible heat conductive fluids with radial symmetrical data, or the magnetic field on the inviscid compressible Hall-MHD equations, or the viscoelastic stress tensor on the compressible Oldroyd-B model, we can rule out finite-time blowup and establish the global existence of strong and stable solutions. In addition, we obtain the explicit large-time decay rates of the solutions.