

2021 不可压缩粘性流体方程的 数学理论研讨会

时间:7月29日	地点: 祥宇宾馆二楼祥庆厅
主持	杜力力(四川大学)
9:00-9:35	王超(北京大学) <i>The local well-posedness of water wave equations</i>
9:35-10:10	李思锐(贵州大学) <i>The uniaxial limit from the inertial Qian-Sheng's Q-tensor theory to the Ericksen-Leslie theory</i>
10:10-10:40	茶歇
主持	黄景炽(中山大学)
10:40-11:15	张鑫(同济大学) <i>On the solvability of some two-phase inhomogeneous incompressible flow with free interfaces</i>
11:15-11:50	翟翠丽(北京科技大学) <i>Long time behaviors of MHD waves</i>
12:00-13:30	午餐(自助餐)
主持	王超(北京大学)
14:30-15:05	李扬(安徽大学) <i>Some results for a compressible two-fluid model with algebraic pressure closure and large initial data</i>
15:05-15:40	赵文彬(北京大学) <i>Well-posedness of the free boundary problem for compressible Euler equations and the incompressible limit</i>
15:40-16:10	茶歇
主持	王伟(浙江大学)
16:10-16:45	李徽(浙江大学) <i>Stability of the Stokes immersed boundary problem with bending and stretching energy</i>
16:45-17:20	朱宁(北京大学) <i>The two-dimensional Boussinesq equations with horizontal dissipation</i>
18:00	晚餐(祥宇宾馆)

报告信息

(以下按照报告顺序排列)

The local well-posedness of water wave equations

王超 (北京大学)

In this talk, I will talk about the water wave equations in the corner domain. First, I will give the local well-posedness of the solution to the water-waves system when the contact angles are less than $\pi/16$. Second, I will give the priori estimates of the water-waves system with the contact angles less than $\pi/2$.

The uniaxial limit from the inertial Qian-Sheng's Q-tensor theory to the Ericksen-Leslie theory

李思锐 (贵州大学)

The Ericksen-Leslie model is widely used model for nematic liquid crystal flow. However, so far, most research works on the Ericksen-Leslie model consider the non-inertial form, except some very recent progresses. One important reason is the difficulty arising from the nonlinear hyperbolic-parabolic coupling structure of the inertial system. In this paper, we study its connection with the inertial Qian-Sheng's model. Precisely, we prove that, when the elastic coefficients tends to zero (also called the uniaxial limit), the solution to the inertial Qian-Sheng's model will converge to the solution to the full inertial Ericksen-Leslie system, which gives a rigorous justification of the uniaxial limit between these two models.

Our result extends the work [SIAM J. Math. Anal., 47 (2015),127-158.] to the full inertial form, and also based on a Hilbert expansion methods. However, there are some new and essential difficulties due to the nonlinear hyperbolic structure of the angular momentum equation. We deeply explore the cancellation and symmetric structure of this system, and use these structures to control the singular terms in the equation for remainders.

On the solvability of some two-phase inhomogeneous incompressible flow with free interfaces

张鑫 (同济大学)

In this talk, we shall discuss the solvability of some free boundary value problem of two-phase inhomogeneous Navier-Stokes system (INS) in the maximal $L_p - L_q$ regularity class. For convenience, we will focus on the case of some moving bounded

droplet of two immiscible viscous liquids. Firstly, we construct some local in time solution of (INS) with the variable density by the standard fixed point argument. Then by assuming the piecewise constant density, we can solve the long time issue of (INS). The global result is based on the decay property of the two-phase Stokes system. This is a joint work with Hirokazu Saito and Yoshihiro Shibata.

Long time behaviors of MHD waves

翟翠丽（北京科技大学）

We study the long-time behavior of the solution for the linearized ideal MHD around sheared velocity and magnetic field under Stern stability condition. We prove that the velocity and magnetic field will converge to sheared velocity and magnetic field as time approaches infinity. Moreover a new depletion phenomenon is proved: the horizontal velocity and magnetic field at the critical points will decay to 0 as time approaches infinity.

Some results for a compressible two-fluid model with algebraic pressure closure and large initial data

李扬（安徽大学）

In this talk, I will present two results on a compressible two-fluid model with algebraic pressure closure and large initial data. In one-dimensional space, we show existence, uniqueness and stability of global weak solutions. Furthermore, exponential decay of weak solution to the unique steady state will be given. In multi-dimensional space, we prove existence of infinitely many global weak solutions for inviscid fluids, by adapting the technique of convex integration. The results are based on joint works with Prof. Yongzhong Sun and Ewelina Zatorska.

Well-posedness of the free boundary problem for compressible Euler equations and the incompressible limit

赵文彬（北京大学）

In this talk, we consider the free boundary problem of the compressible Euler equations under the Taylor sign condition. In the Eulerian coordinates, we derive an evolution equation of the free surface and obtain the a priori estimates both on the surface and in the interior of the moving domain. After the construction of the solution, we also prove the incompressible limit. This is a joint work with Prof. WANG Wei and Prof. ZHANG Zhifei.

Stability of the Stokes immersed boundary problem with bending and stretching energy

李徽（浙江大学）

In this talk, we show stability results of hydrodynamics on the moving surface of an elastic string with bending and stretching energy immersed in a 2-D Stokes flow. We introduce the curve's tangent angle function and the stretching function to describe the different deformations of the elastic string. These two functions are defined on the arc-length coordinate and the material coordinate respectively. With the help of the fundamental solution of the Stokes equation, we reformulate the problem into a parabolic system which is called the contour dynamic system. Under the non-self-intersecting and well-stretched assumptions on initial configurations, we establish the local well-posedness of the free boundary problem in Sobolev space. When the initial configurations are sufficiently close to the equilibrium state (i.e. an evenly parametrized circle), we prove that the solutions can be extended globally and the global solutions will converge to the equilibrium state exponentially as $t \rightarrow +\infty$.

The two-dimensional Boussinesq equations with horizontal dissipation

朱宁（北京大学）

The Boussinesq equations concerned here model geophysical flows such as atmospheric fronts and ocean circulations. In addition, they play an important role in the study of Rayleigh-Benard convection. Mathematically the 2D Boussinesq equations serve as a lower-dimensional model of the 3D hydrodynamics equations. This talk presents recent developments about the regularity and stability results for 2D Boussinesq equations. In particular, we detail the global existence and uniqueness of strong solutions to the 2D anisotropic Boussinesq system for rough initial data with striated regularity. In addition, we also consider the vortex patch problem or temperature patch problem associated with these models. Finally, we will show the stability result for Boussinesq system with horizontal dissipation.