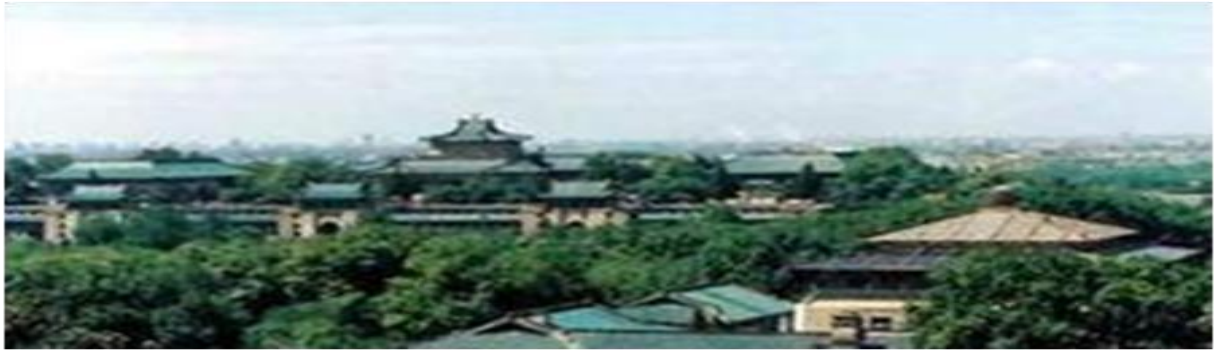
International Conference on PDEs from Fluids

Program Book

Oct. 25-28,2018

Wuhan University, Wuhan, China



Quick information

Conference Venue:

Oct. 26 morning section: 1st floor, Northeast Building,

School of Mathematics and Statistics (SMS), Wuhan University.

Oct. 26 afternoon-Oct.28 morning: 6th floor, Junyi Dynasty Hotel (君宜王朝酒店)

Accommodation: Junyi Dynasty Hotel (君宜王朝酒店)

Breakfast: 5th floor, Junyi Dynasty Hotel (君宜王朝酒店)

Lunch and Dinner (except Oct.27 Banquet): 5th floor, Junyi Dynasty Hotel (君宜王朝酒店)

Banquet (Oct. 27): Jiangnan Xiaoguanyuan restaurant (江南小观园)

Shuttle Bus Information

Shuttle bus between Junyi Dynasty Hotel and conference venue is available at 08:00 am on Oct. 26.

Conference Schedule

Oct. 25th, Thursday, Afternoon
Registration

Oct. 26th, Friday, Morning Session(1st Floor, East Building,SMS,WHU)	
	Chair: Hua Chen
08:30 – 08:40	Opening Ceremony (1st Floor)
08:40 – 09:20	Dongho Chae
09:20 – 10:00	Zhifei Zhang
10:00 – 10:40	Group Photo, Tea break
	Chair: Zhifei Zhang
10:40 – 11:20	Yoshiyuki Kagei
11:20 – 12:00	Ning Jiang
Lunch (12:15)	
Oct.26th, Friday, Afternoon Session (6th Floor, Junyi Dynasty Hotel)	
	Chair: Hideo Kozono
14:30 – 15:10	Guilong Gui
15:10 – 15:50	Yasunori Maekawa
15:50 – 16:20	Tea break
	Chair: Liqun Zhang
16:20 – 17:00	Weixi Li

17:00 – 17:40	Senjo Shimizu
May 17th, Friday, Evening	
Dinner (18:00)	

Oct. 27th, Saturday, Morning Session (6th Floor, Junyi Dynasty Hotel)	
	Chair: Dongho Chae
08:30 – 09:10	Hideo Kozono
09:10 – 09:50	Tao Luo
09:50 – 10:20	Tea break
	Chair: Tao Luo
10:20 – 11:00	Seung-Yeal Ha
11:00 – 11:40	Liqun Zhang
Lunch (12:00)	
Oct. 27th, Saturday, Afternoon Session (6th Floor, Junyi Dynasty Hotel)	
	Chair: Seung-Yeal Ha
14:30 – 15:10	Yaguang Wang
15:10 – 15:50	Hailiang Li
15:50 – 16:20	Tea break
	Chair: Weike Wang
16:20 – 17:00	Mikhail Korobkov
17:00 – 17:40	Zhong Tan

Oct. 27th, Saturday, Evening
Banquet (18:00)

Oct. 28th, Sunday, Morning Session (6th Floor, Junyi Dynasty Hotel)	
	Chair: Yoshiyuki Kagei
08:30 – 09:10	Chunpeng Wang
09:10 – 09:50	Hiroyuki Tsurumi
09:50 – 10:20	Tea break
	Chair: Huijiang Zhao
10:20 – 11:00	Hideyuki Miura
11:00 – 11:40	Feng Xie
Lunch (12:00)	

Abstracts

On the Type I blow-up for the incompressible Euler equations

Dongho Chae

Chung-Ang University

Abstract: In this talk we discuss the Type I blow up and the related problems in the 3D Euler equations. We say a solution v to the Euler equations satisfies Type I condition at possible blow up time T_* if $\lim\sup_{t\nearrow T_*} (T_*-t) \|\nabla v(t)\|_{L^\infty} <+\infty$. The scenario of Type I blow up is a natural generalization of the self-similar(or discretely self-similar) blow up.

We present some recent progresses of our study regarding this. We first localize previous result that ``small Type I blow up" is absent. After that we show that the atomic concentration of energy is excluded under the Type I condition. This result, in particular, solves the problem of removing discretely self-similar blow up in the energy conserving scale, since one point energy concentration is necessarily accompanied with such blow up. We also localize the Beale-Kato-Majda type blow up criterion. Using similar local blow up criterion for the 2D Boussinesq equations, we can show that Type I and some of Type II blow up in a region off the axis can be excluded in the axisymmetric Euler equations. These are joint works with J. Wolf.

Global stability of the inhomogeneous plasma slab of the compressible MHD

equations with vacuum

Guilong Gui

Northwest University

Abstract: Consideration in this talk is the effect of the inhomogeneous plasma slab on the motions of vacuum singularity for 2D compressible viscous non-resistive MHD system. It is shown that, for small perturbations of an inhomogeneous MHD equilibrium configuration in slab, there exists a unique global-in-time strong solution to the vacuum free boundary problem of the 2D compressible MHD system

Mathematical challenges for the collective dynamics of many-body systems

Seung-Yeal Ha

Seoul National University

Abstract: Self-organization of complex many-body systems has received lots of attention in scientific disciplines such as applied mathematics, biology, control theory of multi-agent system, statistical physics due to many recent applications in cooperative robot system, unmanned aerial vehicles such as drones and sensor networks etc. In this talk, we will review several mathematical modelings and their analysis on the study of collective dynamics of classical and quantum many-body systems.

Global well-posedness of parabolic-hyperbolic Erichsen-Leslie liquid crystal model

Ning Jiang

Wuhan University

Abstract: We consider the parabolic-hyperbolic Ericksen-Leslie's system for liquid crystal, which is a coupling of Navier-Stokes (compressible or incompressible) equations with wave map (to S^2) type equations. Under some natural assumptions on the Leslie coefficients, we prove the global well-posedness in the context of classical solutions for small data. These are joint works with Yi-Long Luo, Shao-Jun Tang, and Jiaxi Huang and Lifeng Zhao respectively.

Title: TBA

Yoshiyuki Kagei

Kyushu University

Abstract: TBA.

On boundary value problem for steady Navier--Stokes system in 2D exterior domains

Mikhail Korobkov

Fudan University and Sobolev Institute of Mathematics

Abstract: We study solutions to stationary Navier--Stokes system in two dimensional exterior domains. We study existence of these solutions and their asymptotical problems.The talk is based on the recent joint papers with K.Pileckas and R.Russo, where the uniform boundedness and uniform convergence at infinity for arbitrary solution with finite Dirichlet integral were established. Here no restrictions on smallness of fluxes are assumed, etc.

Harmonic vector fields in L^r on 3D exterior domains

Hideo Kozono

Waseda University

Abstract: In this talk, we characterize the space of harmonic vector fields in L^r on the 3D exterior domain with smooth boundary. There are two kinds of boundary conditions. One is such a condition as the vector fields are tangential to the boundary, and another is such one as those are perpendicular to the boundary. In bounded domains both harmonic vector spaces are of finite dimensions and characterized in terms of topologically invariant quantities which we call the first and the second Betti numbers. These properties are

closely related to characterization the null spaces of solutions to the elliptic boundary value problems associated with the operators div and rot. We shall show that, in spite of lack of compactness, spaces of harmonic vector fields in L^r on the 3D exterior domain are of finite dimensions and characterized similarly to those in bounded domains. It will be also clarified a significant difference between interior and exterior domains in accordance with the integral exponent $1 < r < \infty$. This is based on the joint work with Profs. Matthias Hieber, Aoton Seyferd, Senjo Shimizu and Taku Yanagisawa.

Behaviors of Navier-Stokes(Euler)-Fokker-Planck equations

Hailiang Li

Capital Normal University

Abstract: We consider the pointwise space-time behaviors of global solutions to the initial value problems for the multi-dimensional compressible Navier-Stokes(Euler)-Fokker-Planck equations, which is used to simulate the two phase motion of particle-liquid mixture through the relaxation mechanism. It is shown that due to the micro-macro coupling effects, the sound wave type propagation of the NSFP or EFP system for two-phase fluids is observed with the wave speed determined by the

two-phase fluids. This phenomena can not be observed for the pure Fokker-Planck equation and the Euler equation with frictional damping.

Gevrey smoothing effect for the spatially inhomogeneous Boltzmann equations without cut-off

Weixi Li

Wuhan University

Abstract: In this talk we study the Gevrey regularization effect for the spatially inhomogeneous Boltzmann equation without angular cutoff. This equation is partially elliptic in the velocity direction and degenerates in the spatial variable. We consider the nonlinear Cauchy problem for the fluctuation around the Maxwellian distribution and prove that any solution with mild regularity will become smooth in Gevrey class at positive time, with Gevrey index depending on the angular singularity. Our proof relies on the symbolic calculus for the collision operator and the global subelliptic estimate for the Cauchy problem of linearized Boltzmann operator.

Singular Limits for Viscous Plasma with Boundaries

Tao Luo

City University of Hong Kong

Abstract: The quasi-neutral limit of the Navier-Stokes-Poisson system modeling a viscous olasma with vanishing viscosity coefficients in the half-space is proved under a Navier-slipboundary condition for velocity and Dirichlet boundary condition for electric potential. This is achieved by establishing the nonlinear stability of the approximation solutions involving the strong boundary layer, due to the break-down of the quasineutrality near the boundary. This is a joint work with Qiangchang Ju and Xin Xu.

Asymptotic stability of physically reasonable solutions in a two-dimensional exterior domain

Yasunori Maekawa

Kyoto University

Abstract: The flow past an obstacle is a fundamental object in fluid mechanics. In 1967 R. Finn and D.R. Smith proved the existence and uniqueness of a stationary solution that they called "the physically reasonable solution" to the Navier-Stokes equations in a two-dimensional exterior domain modeling this type of flows, when the Reynolds number is sufficiently small. The asymptotic behavior of this solution at infinity in space has been studied in details and is well understood by now.

In this talk we discuss the stability of the small physically reasonable solution and we show its asymptotically stability with respect to small and suitably localized initial perturbations.

Local energy weak solutions for the Navier-Stokes equations in the half-space

Hideyuki Miura

Tokyo Institute of Technology

The purpose of this talk is to prove the existence of global in time local energy weak solutions to the Navier-Stokes equations in the half-space R^3_+. Such solutions are sometimes called Lemarie-Rieusset solutions in the whole space R^3. The main tool in our work is an explicit representation formula for the pressure, which is decomposed into a Helmholtz-Leray part and a harmonic part due to the boundary. We also explain how our result enables to reprove the blow-up of the scale-critical L3(R^3_+) norm obtained by Barker and Seregin for solutions developing a singularity in finite time.

Characterization of initial data in the homgeneous Besov space for solutions in the Serrin class of the Navier-Stokes equations

Senjo Shimizu

Kyoto University

Abstract: In this talk, we consider the Cauchy problem of the Navier-Stokes equations in $\mathbb R^n$ with initial data a in the homogeneous Besov space $\dot B^{-1+\frac np}_{p,q}(\mathbb R^n)$ for $n<p<\infty$ and $1 \leqq q \leqq \infty$. We show that the Stokes flow $e^{t\Delta}a$ can be controlled in $L^{\alpha, q}(0, \infty; \dot B^0_{r, 1}(\mathbb R^n))$ for $\frac 2\alpha + \frac nr =1$ with $p \leqq r \leqq \infty$, where $L^{\alpha, q}$ denotes the Lorentz space.

As an application, the global existence theorem of mild solutions for the small initial data is established in the above class which is slightly stronger than Serrin's. Conversely, if the global solution belongs to the usual Serrin class $L^{\alpha, q}(0, \infty; L^r(\mathbb R^n))$ for r and α as above with $1 < q \leqq \infty$, then the initial data a necessarily belongs to $\dot B^{-1+\frac {n}{r}}_{r,q}(\mathbb R^n)$. Moreover, we prove that such solutions are analytic in the space variables. Our method for the proof of analyticity is based on a priori estimates of higher derivatives of solutions in $L^p(\mathbb R^n)$ with H\"older continuity in time $(0, \infty)$. This is a joint work with Prof. Kozono (Waseda and Sendai, Japan) and Dr. Okada (Kyoto, Japan).

Title: TBA

Zhong Tan

Xiamen University

Abstract: TBA.

Well-posedness and ill-posedness of the stationary Navier-Stokes equations in scaling invariant Besov spaces

Hiroyuki Tsurumi

Waseda University

Abstract: We consider the stationary Navier-Stokes equations in $\mathbb{R}^n$ for $n\geq3$ in the scaling invariant Besov spaces. Recently, Kaneko-Kozono-Shimizu (2017) proved that for every small external force in $\dot B^{-3+\frac{n}{p}}_{p,q}$, there exists a unique solution in $\dot B^{-1+\frac{n}{p}}_{p,q}$, provided $1\leq p<n$ and $1\leq q\leq \infty$. It is also known that such solutions continuously depend on external forces in each topology.

In this study, we show that if $n<p\leq\infty$ and $1\leq q\leq \infty$, or $p=n$ and $2<q\leq \infty$, then some sequence of external forces converging to zero in $\dot B^{-3+\frac{n}{p}}_{p,q}$ can admit a sequence of solutions which never converges to zero in $\dot B^{-1}_{\infty,\infty}$, especially in $\dot B^{-1+\frac{n}{p}}_{p,q}$. Our result may be regarded as showing the borderline case between well-posedness and ill-posedness of this equation.

Regular Subsonic-sonic Flows in General Nozzles

Chunpeng Wang

Jilin University

Abstract. This talk concerns subsonic-sonic potential flows in general two dimensional nozzles. For finitely long symmetric nozzles, we formulate the subsonic-sonic flow problem by prescribing the flow angle at the inlet and the outlet. It is shown that this problem admits a unique Lipschitz continuous subsonic-sonic flow, and the sonic points of the flow must occur at the wall or the throat. More importantly, the location of sonic points is classified completely.

Existence of weak solutions to a fluid-structure interaction problem in 3D

Yaguang Wang

Shanghai Jiaotong University

Abstract: In this talk, we shall study a nonlinear fluid-structure interaction (FSI) problem in which the fluid is decribed by the three dimensional Navier-Stokes equations, and the elastic structure is modeled by the nonlinear plate equation which is a generalization of Kircho, von Kármán and Berger plate models. The coupling of the fluid and the structure is given in a form of kinematic and dynamic boundary conditions, describing the continuity of the

velocity (no-slip) and the action-reaction principle at the fluid-structure interface. The existence of a weak solution is obtained by designing a hybrid approximation scheme that deals with the nonlinearities both in the fluid and the structure. We combine time-discretization and operator splitting to create two sub-problems, one piece-wise stationary for the fluid and one in a Galerkin basis for the plate. A sufficient condition, guaranteeing the convergence of approximate solutions to the weak solution, is obtained
on number of time discretization sub-intervals in every step in a form of dependence with number of Galerkin basis functions, corresponding eigenvalues and nonlinearity order in the nonlinear plate. This talk is based on a joint work with Srdjan Trifunovic.

Stability of Boundary Layer and Magnetic Effects

Feng Xie

Shanghai Jiaotong University

Abstract: In this talk we will discuss the effects of magnetic field on the stability of boundary layer, which include the local well-posedness theory, validity of Prandtl ansatz for boundary layer expansion, and the long-time existence of solutions etc. By comparing with the classical boundary layer theory of pure hydrodynamics, it shows that some suitable magnetic fields have the stabilizing effects on stability of the boundary layer for both

local-in-time and long time stability.

Continuous Weak Solutions Of Boussinesq Equations

Liqun Zhang

Academy of Mathematics and Systems Science

Chinese Academy of Sciences

Abstract: The Boussingesq equations was introduced in understanding the coupling nature of the thermodynamics and the fluid dynamics. We prove the existence of continuous periodic weak solutions of the Boussinesq equations which either satisfies the prescribed kinetic energy or some other property. In particular, we recently prove the similar results for when the temperature has diffusions in the model.

These are jointed works with Tao tao and also Luo Tianwen.

Inviscid damping for the beta-plane equation

Zhifei Zhang

Peking University

Abstract: TBA.

Participants

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