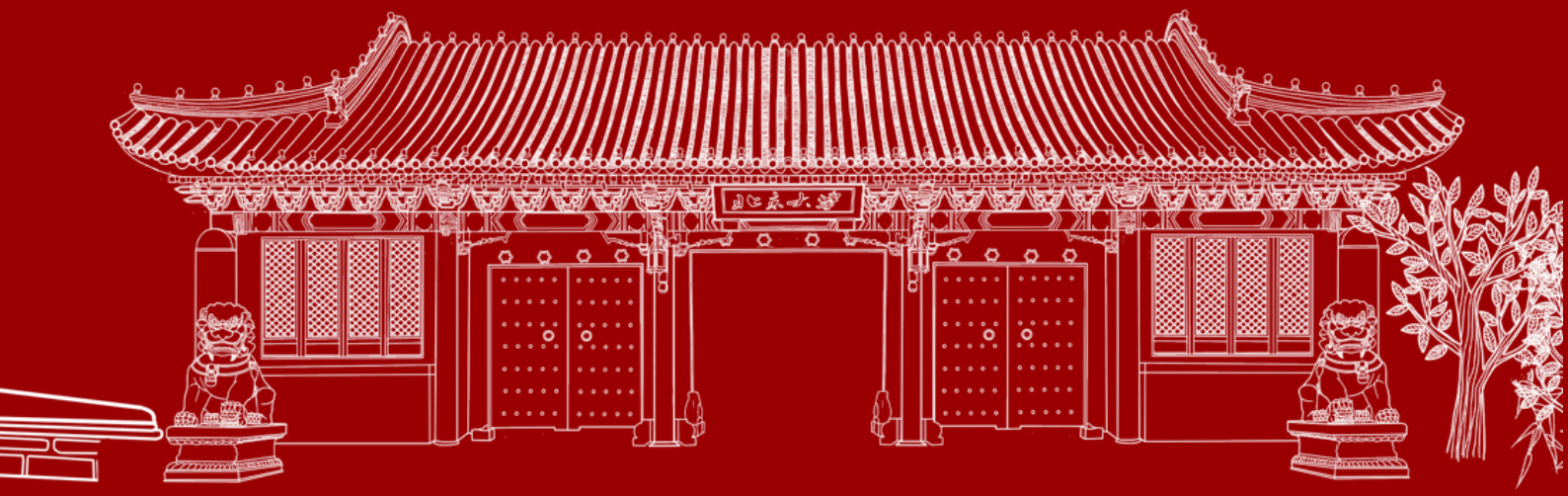
北京国际数学研究中心
BEIJING INTERNATIONAL CENTER FOR MATHEMATICAL RESEARCH

北京大学数学科学学院
School of Mathematical Sciences
Peking University

中国科学院数学与系统科学研究院
ACADEMY OF MATHEMATICS AND SYSTEMS SCIENCE,
CHINESE ACADEMY OF SCIENCES.

Advances in Mathematical Fluid Dynamics 2026



Beijing International Center for Mathematical Research, PKU
School of Mathematical Sciences, PKU
Academy of Mathematics and Systems Science, CAS

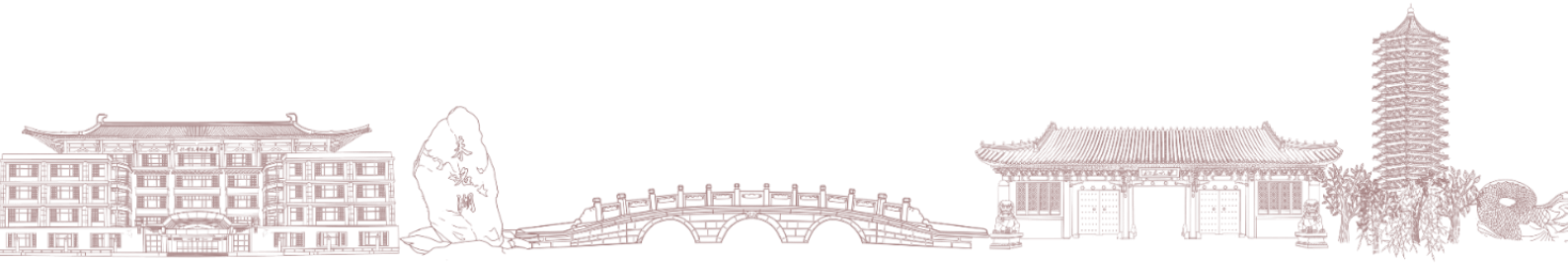
August 17-21 · Beijing

Organizing Committee

- De Huang (Peking University)
- Xiaoyutao Luo (Chinese Academy of Sciences)
- Jiajun Tong (Peking University)
- Dongyi Wei (Peking University)

Speaker List

- Siddhant Agrawal (University of Colorado Boulder)
- Tobias Barker (University of Bath)
- Yuan Cai (Fudan University)
- Michele Dolce (École Polytechnique Fédérale de Lausanne)
- Francisco Gancedo (Universidad de Sevilla)
- Eduardo García-Juárez (Universidad de Sevilla)
- Sameer Iyer (University of California, Davis)
- Francisco Mengual (Max Planck Institute for Mathematics in the Sciences)
- Evan Miller (University of Maine)
- Ryan Murray (North Carolina State University)
- Jaemin Park (Yonsei University)
- Xiao Ren (Fudan University)
- Feng Shao (Chinese Academy of Sciences)
- Changhui Tan (University of South Carolina)
- Bian Wu (Max Planck Institute for Mathematics in the Sciences)
- Fan Zheng (Instituto de Ciencias Matemáticas)

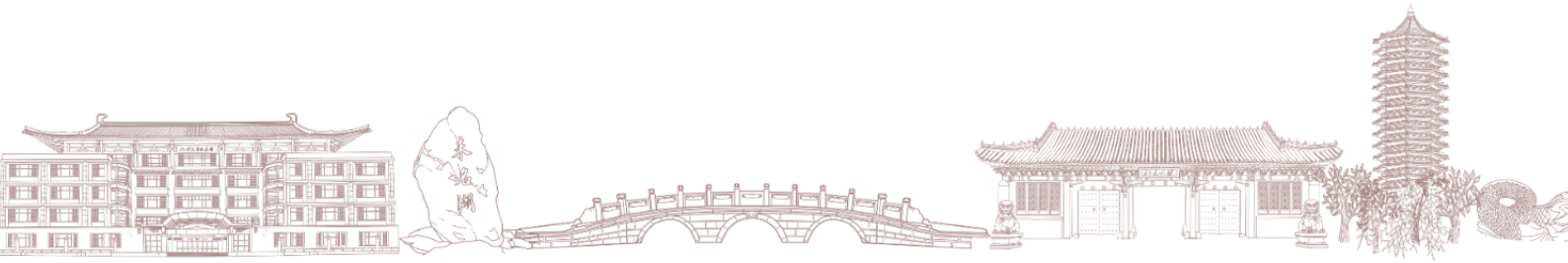


Timetable

Venue: Lecture Hall, Jiayibing Building, Jingchunyuan 82, BICMR

Time	August 17 Monday	August 18 Tuesday	August 19 Wednesday	August 20 Thursday	August 21 Friday
8:40 - 9:00	Opening	-	-	-	-
9:00 - 10:00	**Ryan Murray**	**Jaemin Park**	**Michele Dolce**	**Evan Miller**	**Bian Wu**
10:00 - 10:30	Tea Break				
10:30 - 11:30	**Francisco Mengual**	**Francisco Gancedo**	**Xiao Ren**	**Tobias Barker**	**Changhui Tan**
11:30 - 14:00	Lunch Break				
14:00 - 15:00	**Sameer Iyer**	**Eduardo García-Juárez**	Excursion	**Feng Shao**	Free discussion
15:00 - 15:30	Tea Break			Tea Break	
15:30 - 16:30	**Siddhant Agrawal**	**Yuan Cai**		**Fan Zheng**	

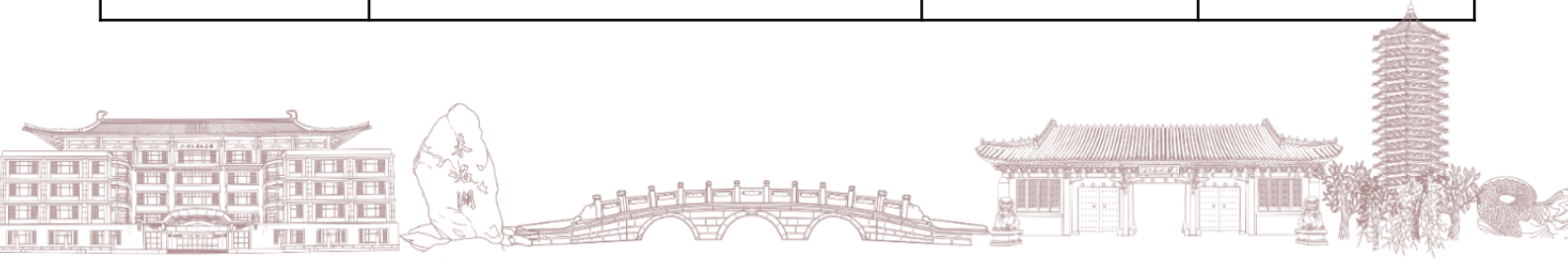
Conference banquet dinner: August 18 (Tuesday), starting at 18:00 at Shaoyuan Chinese Restaurant (by invitation only).



Schedule by Date

August 17, Monday

Time	Talk	Speaker	Chair
8:40-9:00	Opening		
9:00-10:00	Scale-Invariant Incompressible Euler: Attractors, singularity formation, and hints of Lp non-uniqueness	Ryan Murray	Zhifei Zhang
10:00-10:30	Group photo, Tea Break		
10:30-11:30	Unstable vortices and sharp nonuniqueness for the forced SQG equation	Francisco Mengual	Zhifei Zhang
Lunch Break			
14:00-15:00	Long-time dynamics near the Couette flow with boundaries	Sameer Iyer	Chao Wang
15:00-15:30	Tea Break		
15:30-16:30	Uniqueness of the 2D Euler equation on rough domains	Siddhant Agrawal	Chao Wang

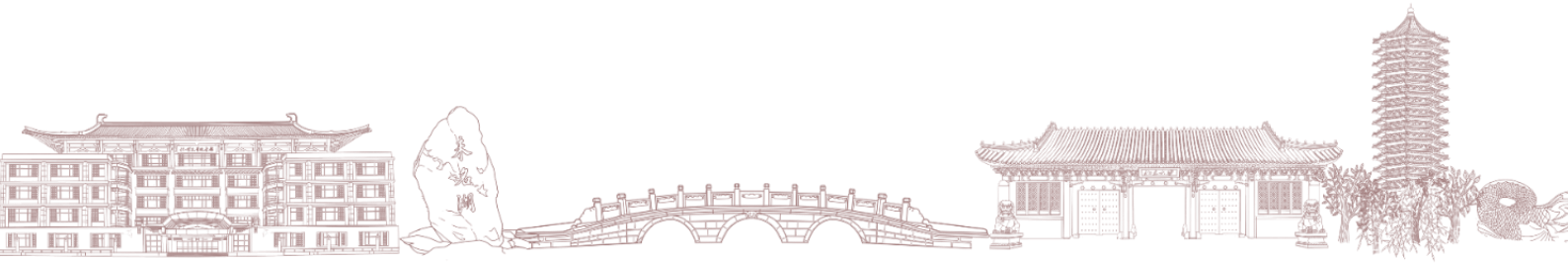


Schedule by Date

August 18, Tuesday

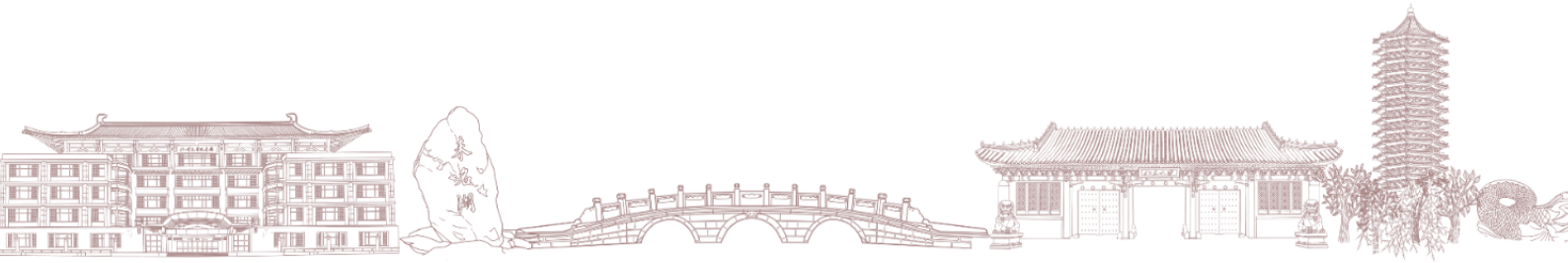
Time	Talk	Speaker	Chair
9:00-10:00	Stability of stratified density under incompressible flows	Jaemin Park	Jiajun Tong
10:00-10:30	Tea Break		
10:30-11:30	Stable and unstable interface dynamics for gravity Stokes flow	Francisco Gancedo	Jiajun Tong
Lunch Break			
14:00-15:00	Asymptotic stability for the 3D Peskin problem at critical regularity	Eduardo García-Juárez	Liutang Xue
15:00-15:30	Tea Break		
15:30-16:30	Global nonlinear stability of the 2D incompressible viscous non-resistive MHD under sheared magnetic field	Yuan Cai	Liutang Xue

Conference banquet dinner: August 18 (Tuesday), starting at 18:00 at Shaoyuan Chinese Restaurant (by invitation only).



Schedule by Date

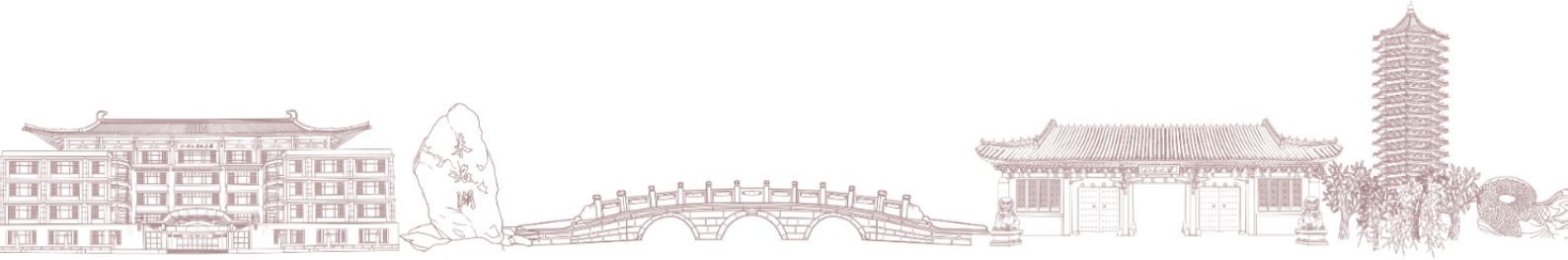
August 19, Wednesday			
Time	**Talk**	**Speaker**	**Chair**
9:00-10:00	Instability of the 2D Taylor-Green vortex	Michele Dolce	Xiaoyutao Luo
10:00-10:30	Tea Break		
10:30-11:30	Global 3D Euler flows with uniform rotation	Xiao Ren	Xiaoyutao Luo
Lunch Break			
13:00-17:00	Excursion, meet at the conference venue.		



Schedule by Date

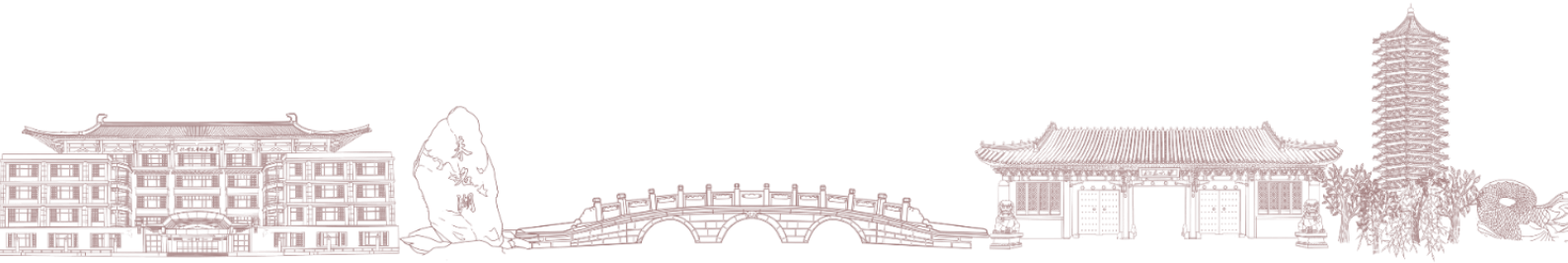
August 20, Thursday

Time	Talk	Speaker	Chair
9:00-10:00	Global regularity for axisymmetric, swirl-free solutions of the Euler equation in four dimensions	Evan Miller	De Huang
10:00-10:30	Tea Break		
10:30-11:30	On behaviour of the Navier-Stokes equations beyond the blow-up time and local anomalous dissipation	Tobias Barker	De Huang
Lunch Break			
14:00-15:00	Self-similar blow-up solutions of d-dimensional incompressible Euler equations with $C^{1,(1-2/d)-}$ velocity	Feng Shao	Guolin Qin
15:00-15:30	Tea Break		
15:30-16:30	Finite time singularities for 3D hypodissipative Navier-Stokes equations	Fan Zheng	Guolin Qin



Schedule by Date

August 21, Friday			
Time	**Talk**	**Speaker**	**Chair**
9:00-10:00	Anomalous dissipation and optimal regularity in scalar turbulence	Bian Wu	Xiaoqian Xu
10:00-10:30	Tea Break		
10:30-11:30	On the primitive equations with fractional horizontal dissipation	Changhui Tan	Xiaoqian Xu
Lunch Break			
14:00-16:30	Free discussion		

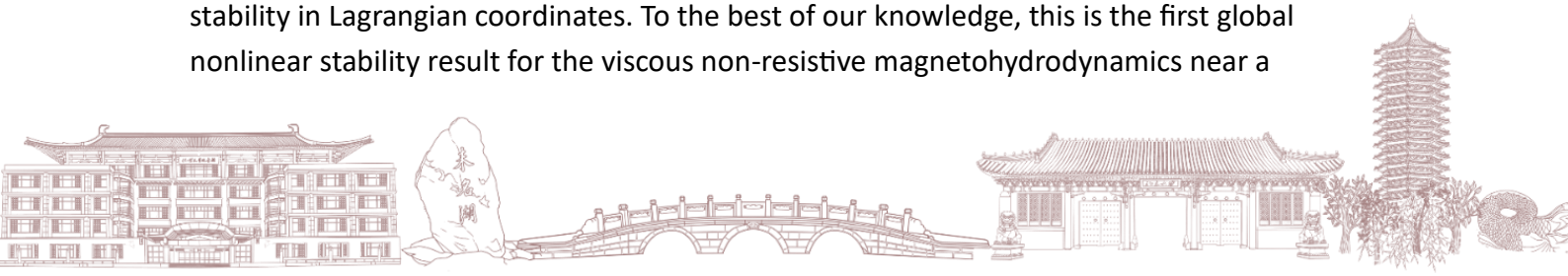


Abstract

Siddhant Agrawal (University of Colorado Boulder)
Title: Uniqueness of the 2D Euler equation on rough domains
Abstract: We consider the 2D incompressible Euler equation on a bounded simply connected domain. We give sufficient conditions on the domain so that for all bounded initial vorticity, the weak solutions are unique. Our sufficient conditions allow us to prove uniqueness for a large subclass of $C^{1,\alpha}$ domains and convex domains. Previously uniqueness for general bounded initial vorticity was only known for $C^{1,1}$ domains with possibly a finite number of acute angled corners. The fundamental barrier to proving uniqueness below the $C^{1,1}$ regularity is the fact that for less regular domains, the velocity near the boundary is no longer log-Lipschitz. We overcome this barrier by defining a new change of variable which we then use to define a novel energy functional. This is joint work with Andrea Nahmod.

Tobias Barker (University of Bath)
Title: On behaviour of the Navier-Stokes equations beyond the blow-up time and local anomalous dissipation
Abstract: In the first part, I will discuss quantitative classification of potentially singular 3D Navier-Stokes solutions at any given time in the region of potential blow-up times. The quantitative lower bounds prior to any potential blow-up time (and in the open vicinity of it) are in principle amenable to numerical testing. I will also discuss sufficient conditions for instantaneous blow-up to occur at a potential blow-up time (blow-up to the right).
In the second part, I will discuss results concerning absence of (interior) local anomalous dissipation in the 2D inviscid limit in the presence of boundaries. The implications for local balance laws for the limiting 2D Euler solution will also be discussed. The second part is joint work with Milton C. Lopes Filho and Helena J. Nussenzveig Lopes (Universidade Federal do Rio de Janeiro).

Yuan Cai (Fudan University)
Title: Global nonlinear stability of the 2D incompressible viscous non-resistive MHD under sheared magnetic field
Abstract: This talk addresses the two-dimensional incompressible viscous non-resistive magnetohydrodynamics in the periodic strip, in the presence of a smooth sheared background magnetic field which is bounded and away from zero. Under suitable even-odd symmetry assumptions on the initial perturbations, we show global-in-time nonlinear stability in Lagrangian coordinates. To the best of our knowledge, this is the first global nonlinear stability result for the viscous non-resistive magnetohydrodynamics near a

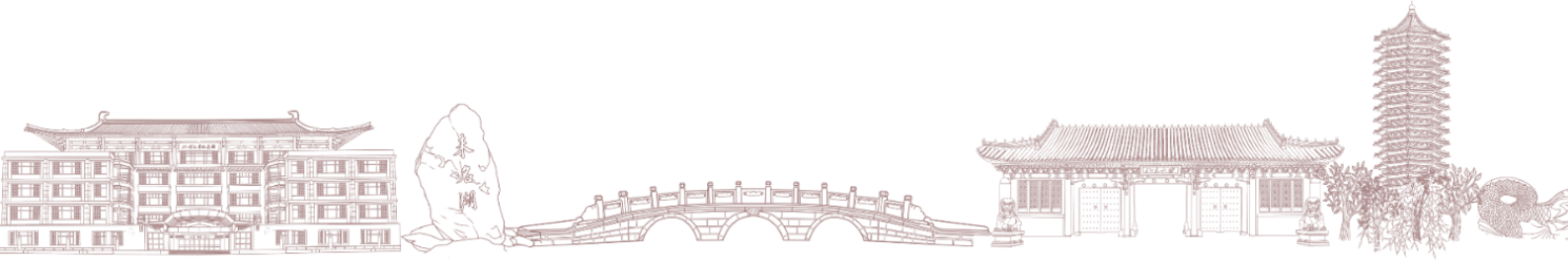


nonconstant sheared magnetic profile. These is based on joint work with Professor Bin Han and Na Zhao.

Michele Dolce (École Polytechnique Fédérale de Lausanne)
Title: Instability of the 2D Taylor-Green vortex
Abstract: The 2D Taylor-Green (TG) vortex is the prototypical example of an Euler steady state on T^2 possessing truly two-dimensional features, like elliptic and hyperbolic stagnation points. Its stream function, sin(x)sin(y), lives on the second Fourier shell, making it susceptible to large-scale destabilizing mechanisms. Despite the apparent simplicity of the steady state, a proof of its spectral instability has long remained elusive, and was only recently observed numerically. To solve this problem, I will introduce a new criterion to detect unstable eigenvalues for a wide class of linear Hamiltonian operators. We apply this to prove the stability of the TG vortex with respect to odd perturbations. In the subspace of functions even in both variables, we combine our criterion with a rigorous computer-assisted argument to locate two unstable eigenvalues. This fully characterizes the unstable spectrum of the TG vortex and implies nonlinear instability in velocity. This is a joint work with G. Cao-Labora, M. Colombo and P. Ventura.

Francisco Gancedo (Universidad de Sevilla)
Title: Stable and unstable interface dynamics for gravity Stokes flow
Abstract: We investigate the evolution of the interface between two incompressible fluids of different densities in the Stokes regime under the effect of gravity. We establish results on global-in-time regularity, stability, and instability.

Eduardo García-Juárez (Universidad de Sevilla)
Title: Asymptotic stability for the 3D Peskin problem at critical regularity
Abstract: The three-dimensional Peskin problem describes the motion of an elastic membrane immersed in an incompressible, viscous fluid, typically governed by the Stokes equations. The problem admits a contour dynamics formulation that leads to a nonlinear, nonlocal parabolic PDE. We study the well-posedness of the problem and the long-time behaviour of two-dimensional membranes in a three-dimensional fluid for initial interfaces with Lipschitz regularity, which is critical with respect to the natural scaling of the equation.



Sameer Iyer (University of California, Davis)

Title: Long-time dynamics near the Couette flow with boundaries

Abstract: I will present three types of results on the long time dynamics of the 2D Navier-Stokes equations and 2D Euler equations near the Couette flow on the channel with boundaries. The first (joint with J. Bedrossian, S. He, and F. Wang) prove uniform inviscid damping and enhanced dissipation for the 2DNSE with Navier boundary conditions, with Gevrey initial datum. The second (joint with J. Bedrossian, S. He, L. Li, and F. Wang) prove a Sobolev stability threshold for the Dirichlet boundary conditions, for nearly-Couette flows. The third (joint with S. He and W. Zhao) prove nonlinear inviscid damping for the 2D Euler equations near Couette with vorticity that can approach the boundary at a super-exponential rate.

Francisco Mengual (Max Planck Institute for Mathematics in the Sciences)

Title: Unstable vortices and sharp nonuniqueness for the forced SQG equation

Abstract: In this talk, we present a non-uniqueness result for the forced SQG equation in supercritical Sobolev spaces. A key step is the construction of smooth, compactly supported vortices exhibiting nonlinear instability. This is joint work with Á. Castro, D. Faraco, and M. Solera.

Evan Miller (University of Maine)

Title: Global regularity for axisymmetric, swirl-free solutions of the Euler equation in four dimensions

Abstract: In this talk, I will discuss a new global regularity result for axisymmetric, swirl-free solutions of the Euler equation in R^4. Around the same time, Shao, Wei, and Zhang proved global regularity for axisymmetric, swirl-free solutions of the Euler equation in R^d for d=4,5,6, using somewhat different methods. These results involve significant differences with the classical global regularity results for the three dimensional case, because the transported quantity ω/r^{d-2} may be unbounded even for smooth solutions in four and higher dimensions.

Ryan Murray (North Carolina State University)

Title: Scale-Invariant Incompressible Euler: Attractors, singularity formation, and hints of Lp non-uniqueness

Abstract: This talk will discuss a special class of scale-invariant solutions to the 2D Euler equation. Scale-invariant solutions describe the motion of certain classes of singularities of the Euler equations, and can be seen as one attempt to model certain coherent vortex structures. These solutions obey a non-linear scalar equation on the circle first identified by Elgindi and Jeong, and such solutions have local well-posedness for vorticities in Lp. Our

results 1) give a characterization of the attractors of this system for bounded vorticities, and 2) demonstrate finite-time blowup for specific data in Lp. The talk will also discuss work which constructs analytic extensions of such solutions which have vorticity belonging to Lp(R^2), and which offer potential avenues for constructing non-unique solutions. This is joint work with Tarek Elgindi and Ayman Rimah Said.

Jaemin Park (Yonsei University)

Title: Stability of stratified density under incompressible flows

Abstract: In this talk, I will discuss asymptotic stability in the incompressible porous media equation in a periodic channel. It is well known that a stratified density, which strictly decreases in the vertical direction, is asymptotically stable under sufficiently small, smooth perturbations. We achieve improvements in the regularity assumptions on the perturbation and in the convergence rate. We apply a similar idea to the Stokes transport system. Instead of relying on the linearized equations, we directly address the nonlinear problem, and the decay of solutions will be obtained from the gradient flow structure of the equation. This is a joint work with Roberta Biancini, Minjun Jo and Shan Wang.

Xiao Ren (Fudan University)

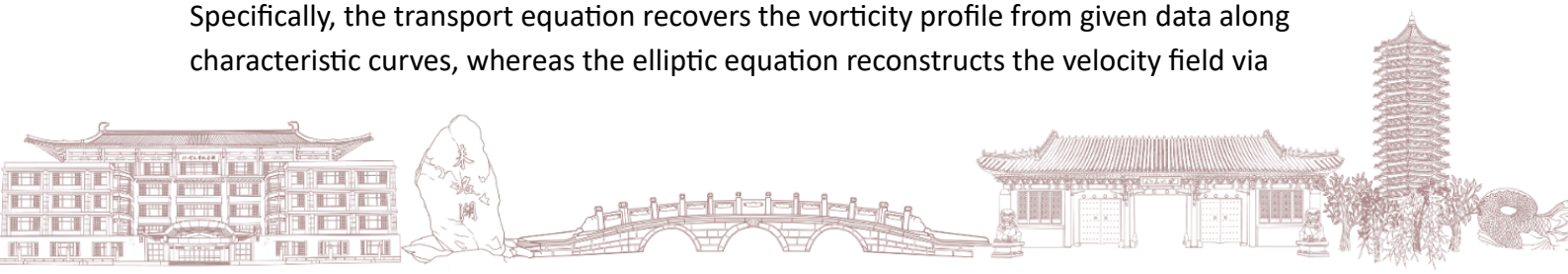
Title: Global 3D Euler flows with uniform rotation

Abstract: The Coriolis force induces a dispersive mechanism in 3D incompressible fluids called inertial waves, which are strongly anisotropic and degenerate. In this talk, we present the global well-posedness and scattering results for the Euler-Coriolis system. Equivalently, we establish the global stability of the uniformly rotating solution to the pure Euler equations. In the proof, we introduce precise asymptotics for the linear dispersion, a new inherent null structure of the nonlinearity, and a multiscale wave-packet decomposition. We will also discuss the convergence of Lagrangian trajectories. This is joint work with Prof. Gang Tian.

Feng Shao (Chinese Academy of Sciences)

Title: Self-similar blow-up solutions of d-dimensional incompressible Euler equations with $C^{1,(1-2/d)-}$ velocity

Abstract: We investigate self-similar blow-up solutions to the d-dimensional axisymmetric incompressible Euler equations without swirl for $d \geq 3$. For any $\alpha \in (0, \alpha_d)$, with $\alpha_d = 1 - 2/d$, we construct a self-similar blow-up solution whose initial velocity field satisfies $u_0 \in C^{1,\alpha}_{loc}(\mathbb{R}^d) \cap C^{\infty}(\mathbb{R}^d \setminus \{0\})$. Our construction relies on a fixed-point argument formulated for the self-similar profile system, which takes the form of a coupled elliptic-transport system. Specifically, the transport equation recovers the vorticity profile from given data along characteristic curves, whereas the elliptic equation reconstructs the velocity field via

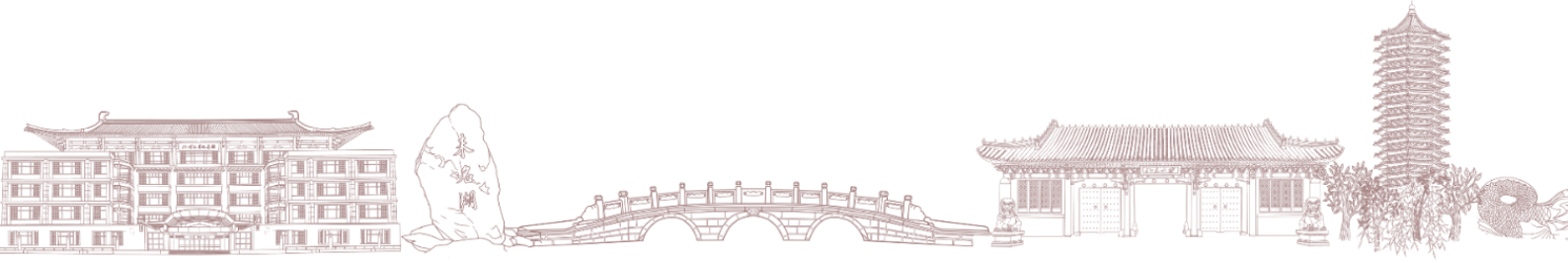


Newtonian potentials defined in an auxiliary $(d+4)$-dimensional space. The main challenge lies in selecting suitable function spaces that remain invariant under such nonlinear compositions, while simultaneously capturing the exact singular behavior near the origin and the symmetry axis. Furthermore, we prove a finite-codimensional stability result for the self-similar profiles thus obtained. As a consequence, after suitable truncation and correction of finitely many unstable modes, we obtain finite-energy blow-up solutions with initial velocity in $C^{1,\alpha}_{loc}(\mathbb{R}^d) \cap C^{\infty}(\mathbb{R}^d \setminus \{0\}) \cap L^2(\mathbb{R}^d)$ and with compactly supported initial vorticity. These solutions are asymptotically self-similar near the blow-up time.

Changhui Tan (University of South Carolina)
Title: On the primitive equations with fractional horizontal dissipation
Abstract: In this talk, I will introduce the primitive equations, also known as the hydrostatic Navier-Stokes equations, which model large-scale atmospheric and oceanic flows. The inviscid dynamics are notoriously ill-posed (worse than the Euler equations), while the introduction of horizontal viscosity yields global well-posedness, exhibiting better behavior than the Navier-Stokes equations. We investigate the two-dimensional primitive equations with fractional horizontal dissipation, examining ill-posedness, local well-posedness, and global well-posedness under varying strengths of dissipation. This is joint work with Elie Abdo, Quyuan Lin, and Zhuan Ye.

Bian Wu (Max Planck Institute for Mathematics in the Sciences)
Title: Anomalous dissipation and optimal regularity in scalar turbulence
Abstract: In the Kolmogorov–Obukhov–Corrsin theory of hydrodynamic turbulence, the anomalous dissipation postulate plays a central role. The theory predicts certain Hölder regularity for the scalar field. In this talk, I will present two results establishing both anomalous dissipation and the optimal Hölder regularity on scalar fields. These are joint works with Jan Burczak and László Székelyhidi.

Fan Zheng (Instituto de Ciencias Matemáticas)
Title: Finite time singularities for 3D hypodissipative Navier-Stokes equations
Abstract: The question of singularity formation in fluid dynamics remains one of the most challenging open problems in mathematical physics. In this talk, we present new results showing that solutions to 3D hypodissipative Navier--Stokes equations with smooth initial data and an external forcing that is integrable in $C^{1+\epsilon}$ can break down in finite time. The dissipation in the equation amounts to 0.1 orders of derivative, or $(-\Delta)^{0.046}$. I will also discuss extensions that allow for more dissipation and rougher forcing.



Logistics

Access to the PKU campus

Access to the campus has been granted to all the invited and registered participants during the conference. You may enter PKU from any gate by showing the security your ID card or passport, whichever provided to the organizing committee or used in registration. It could be the most convenient to enter through the Southeast Gate of PKU; see the map below. In case the security cannot verify your access, the following bilingual note could be helpful:

Hello, I am a visitor to BICMR and am here to attend a conference. Could you please check the regular visitor system for my information? Thank you.

If you have any questions, please contact the conference secretary, Mrs. Li, at +86 13693386427.

您好，我是北京大学北京国际数学研究中心的访客，来参加一场学术会议。您能在常客系统查找一下我的信息吗？谢谢您。

有问题请联系会议秘书李老师 +86 13693386427。

Direction to the conference room

The conference room, Lecture Hall, Jiayibing Building (甲乙丙楼报告厅), is located on the 2nd floor of Jia Yi Bing Building, which is the star symbol in the red circle A in the map.

The light blue line in the map shows the road from the Southeast Gate to Jia Yi Bing Building.

Conference catering

Lunch will be provided to all the invited and registered participants at the Shaoyuan Chinese Restuarant (勺园中餐厅), which lies in the red circle B in the map.

However, we do not provide dinner.

Most dining halls in the university need a University ID Card to buy meals, but there are still some restaurants accepting cash, credit cards, Alipay and Wechat Pay. For example:

- Shaoyuan Chinese Restaurant (勺园中餐厅) --- it is our lunch venue.
- Shaoyuan Western Restaurant (勺园西餐厅) --- it is lies on the northwest of the Shaoyuan hotel.
- 3W Coffee. It is on the basement floor of the No.2 Teaching Building. It serves burgers, sandwiches, noodles, pastas, pizza, coffee and drinks, etc. Good for working meals.
- PKU Faculty House (北京大学教师之家). It lies east to the Boya Pagoda. It serves similar kinds of food as 3W coffee. Great environment and good for working meals.
- The 4th Floor of Jiayuan Cafeteria (家园食堂四楼). You may find hotpot, bubble tea, and western-style food there.

Some nearby dining options outside the campus:

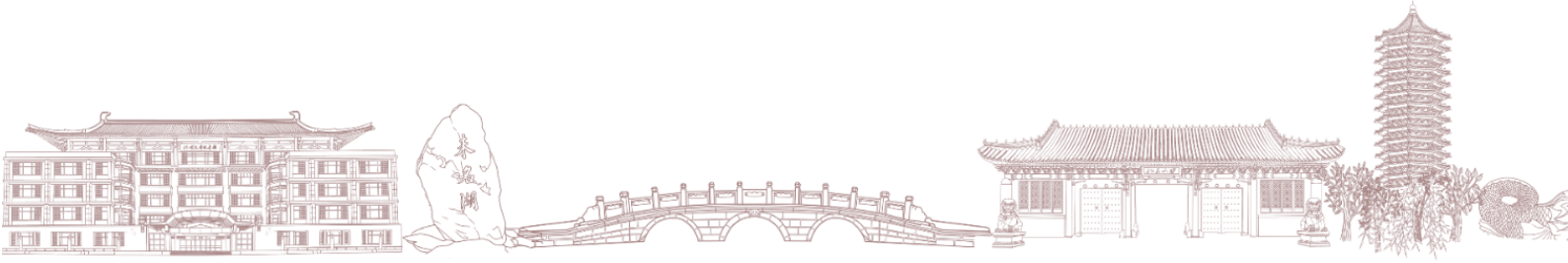
- Outside the Southwest Gate, there is Changchunyuan Food Street (畅春园食街) across the street.
- More choices in the neighborhood if you are willing to go farther away from the campus: Haidian Huangzhuang (海淀黄庄), Wudaokou (五道口), etc.

On-campus Wi-Fi

It is recommended to use the Wi-Fi *"eduroam"* on campus.

One may also connect to the Wi-Fi *"PKU"* and use the following public account.

ID: gsxzxguest28 Password: P20264BICMR

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