



# 北京理工大学

## 数学与统计学院学术报告

### 几何与PDE研讨会

**时间:** 2023年11月09日, **地点:** 腾讯会议: 368-151-026

时间	报告人	题目
09: 00- 09: 45	陈波 (华南理工大学)	The Schrodinger flow with Neumann boundary condition (带诺依曼边值条件的薛定谔流)
09: 50- 10: 35	高宸 (香港中文大学)	Prandtl Boundary Layers in An Infinitely Long Convergent Channel
10: 40- 11: 25	余渊洋 (清华大学)	Multiple normalized solutions for first order Hamiltonian systems
14: 00- 14: 45	廖家江 (北京航空航天大学)	Global exact controllability of the viscous and resistive MHD system in a rectangle
14: 50- 15: 35	李嘉旭 (香港中文大学)	Global Existence of Strong and Weak Solutions to 2D Compressible Navier-Stokes System in Bounded Domains with Large Data and Vacuum
15: 40- 16: 25	郭琪 (中国人民大学)	Nonrelativistic limit of solitary waves of nonlinear Dirac equations



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## 数学与统计学院学术报告

### The Schrodinger flow with Neumann boundary condition (带诺依曼边值条件的薛定谔流)

**报告人:** 陈波 华南理工大学

**时间:** 2023年11月09日, 09:00-09:45

**地点:** 腾讯会议: 368-151-026

**摘要:** The Schrodinger flow is a Hamiltonian geometric flow with deep physical backgrounds. In this talk, we show the existence of local regular solutions to the initial-Neumann boundary value problem of the Schrodinger flow for maps from 3-dimensional compact manifolds with boundary into the sphere  $S^2$  (i.e., Landau-Lifshitz equation). This is a recent joint work with Prof. Wang Youde. (薛定谔流是一个具有很强物理背景的几何哈密顿流。本次报告中,我们将证明从三维紧带边流形映到球面的薛定谔流(即朗道-李弗希兹方程)的诺依曼初边值问题局部正则解的存在性。这是最近和王友德教授合作的工作。)

**个人简介:** 陈波, 博士毕业于中国科学院数学研究所, 现为华南理工大学数学学院助理教授, 其主要从事具有物理背景的Yang-Mills-Higgs场和薛定谔流的研究, 相关研究成果发表在CMP, IMRN, Transactions of AMS, Pacific J. Math. 等期刊上。



# 北京理工大学

## 数学与统计学院学术报告

### Prandtl Boundary Layers in An Infinitely Long Convergent Channel

**报告人:** 高宸 香港中文大学

**时间:** 2023年11月09日, 09: 50-10: 35

**地点:** 腾讯会议: 368-151-026

**摘要:** This talk is about the large Reynold number limits and asymptotic behaviors of solutions to the 2D steady Navier-Stokes equations in an infinitely long convergent channel. We will show that for a general convergent infinitely long nozzle whose boundary curves satisfy curvature-decreasing and any given finite negative mass flux, the Prandtl's viscous boundary layer theory holds in the sense that there exists a Navier-Stokes flow with no-slip boundary condition for small viscosity, which is approximated uniformly by the superposition of an Euler flow and a Prandtl flow. Moreover, the asymptotic behaviors of the solution to the Navier-Stokes equations near the vertex of the nozzle and at infinity are determined by the given flux, which is also important for the constructions of the Prandtl approximation solution due to the possible singularities at the vertex and non-compactness of the nozzle. One of the key ingredients in our analysis is that the curvature-decreasing condition on boundary curves of the convergent nozzle ensures that the limiting inviscid flow is pressure favorable and plays crucial roles in both the Prandtl expansion and the stability analysis. It is joint work with Prof. Zhouping Xin.

**个人简介:** 高宸博士毕业于中国科学数学与系统科学研究院, 后于北大数学中心从事博士后研究工作, 如今在香港中文大学数学与科学研究所做博士后。高宸的研究兴趣集中于流体偏微分方程的边界层理论, 包括Prandtl边界层理论与Prandtl-Batchelor理论。

主办单位: 北京理工大学数学与统计学院  
School of Mathematics and Statistics, Beijing Institute of Technology



# 北京理工大学

## 数学与统计学院学术报告

### Multiple normalized solutions for first order Hamiltonian systems

**报告人:** 余渊洋 清华大学

**时间:** 2023年11月09日, 10:40-11:25

**地点:** 腾讯会议: 368-151-026

**摘要:** In this talk, we study the following first order Hamiltonian systems

$$\mathcal{J}u + M(t)u = |K(t)u|^{p-2}K(t)^T K(t)u + \lambda u, \quad t \in \mathbb{R} \quad (HS)$$

where  $u: \mathbb{R} \rightarrow \mathbb{R}^{2N}$ ,  $p \in (2, 4)$ ,  $\lambda \in \mathbb{R}$ , arises as the Lagrange multiplier and  $\mathcal{J}, M, K(t)$  are  $2N \times 2N$  real matrices with  $\mathcal{J}^{-1} = \mathcal{J}^T = -\mathcal{J}, M = M^T$ . Using the multiplicity theorem of Ljusternik-Schnirelmann together with variational methods, we show the existence of multiple normalized solutions for (HS). Moreover, we also obtain bifurcation results of this problem.

**个人简介:** 余渊洋, 中科院数学与系统科学研究院数学所博士, 清华大学博士后。主要从事非线性泛函分析和偏微分方程问题的研究, 对于Schrodinger方程和方程组, Dirac方程, 利用强不定泛函的临界点理论, 研究方程解的存在性、多解性、集中性、衰减性质以及正规化解的存在性等。已在包括Calc. Var PDE, Science China, J. Geom. Anal. 等国际知名期刊发表多篇学术论文。



# 北京理工大学

## 数学与统计学院学术报告

### Global exact controllability of the viscous and resistive MHD system in a rectangle

**报告人:** 廖家江 北京航空航天大学

**时间:** 2023年11月09日, 14:00-14:45

**地点:** 腾讯会议: 368-151-026

**摘要:** We consider the 2-D incompressible viscous and resistive magnetohydrodynamics (MHD) system in a rectangle, with controls on the lateral sides. The velocity satisfies Dirichlet boundary conditions, while the magnetic field follows perfectly conducting wall boundary conditions on the remaining, uncontrolled part of the boundary. We extend the small-time global exact null controllability result of Coron et al. in [Ann PDE 5(2):1-49, 2019] from Navier-Stokes equations to MHD equations, with a little help of distributed phantom forces, which can be chosen arbitrarily small in any given Sobolev spaces. Our analysis relies on Coron's return method, the well-prepared dissipation method, long-time nonlinear Cauchy-Kovalevskaya estimates and Badra's local exact controllability result.

**个人简介:** 廖家江, 北京航空航天大学副教授, 2020年博士毕业于中科院数学与系统科学研究院。研究方向为流体力学方程组, 包括边界层理论和控制问题。2022年获得了第四届全国PDE博士生论坛优秀论文奖。在ARMA、JDE、JMFM等国际著名期刊发表了多篇论文。主持国家自然科学基金青年基金项目1项。



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## 数学与统计学院学术报告

### Global Existence of Strong and Weak Solutions to 2D Compressible Navier-Stokes System in Bounded Domains with Large Data and Vacuum

**报告人:** 李嘉旭 香港中文大学

**时间:** 2023年11月09日, 14: 50-15: 35

**地点:** 腾讯会议: 368-151-026

**摘要:** The barotropic compressible Navier-Stokes system subject to the Navier-slip boundary conditions in a general two-dimensional bounded simply connected domain is considered. For initial density allowed to vanish, the global existence of strong and weak solutions is established when the shear viscosity is a positive constant and the bulk one proportional to a power of the density with the power bigger than one and a third. It should be mentioned that this result is obtained without any restrictions on the size of initial value. To get over the difficulties brought by boundary, on the one hand, Riemann mapping theorem and the pull-back Green's function method are applied to get a pointwise representation of the effective viscous flux. On the other hand, since the orthogonality is preserved under conformal mapping due to its preservation on the angle, the slip boundary conditions are used to reduce the integral representation to the desired commutator form whose singularities can be cancelled out by using the estimates on the spatial gradient of the velocity.

**个人简介:** 李嘉旭, 香港中文大学数学科学研究所研究助理, 2021年博士毕业于中国科学院数学与系统科学研究院。主要从事可压缩Navier-Stokes方程适定性方面的研究, 相关结果发表在ARMA等期刊。



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## 数学与统计学院学术报告

### Nonrelativistic limit of solitary waves of nonlinear Dirac equations

**报告人:** 郭琪 中国人民大学

**时间:** 2023年11月09日, 15: 40-16: 25

**地点:** 腾讯会议: 368-151-026

**摘要:** In this talk, we will discuss nonrelativistic limit of solitary waves of nonlinear Dirac equations. First, we will go over the physical background and geometric characteristics of Dirac operators. Then we will give the variational characterization of eigenvalues in gaps of the essential spectrum of Dirac operators. At last, we will explain how to study the Limit Problem of nonlinear Dirac equations by using spectral projections of Dirac operators.

**个人简介:** 郭琪, 2021年毕业于中国科学院数学与系统科学研究院, 同年加入中国人民大学从事博士后工作。主要研究方向为变分方法与临界点理论, 在 CVPDE, JDE, SIAM J. MATH. ANAL., J. MATH. PHYS. 等国际著名刊物上发表多篇论文。