

第七届非线性偏微分方程理论及应用 研讨会



2023年11月9日-13日

河南·郑州

郑州轻工业大学 数学与信息科学学院



第七届非线性偏微分方程理论及应用研讨会

日程安排

日期	事项	
11月9、10日	会议注册 地点:光华大酒店一楼大厅	
11月11日	学术报告 地点:光华大酒店三楼月亮厅	
	开幕式、合影 8:30-9:00	
	时间	报告人 报告题目
	主持人:王金环(辽宁大学)	
	9:10-9:40	白学利 Optimization of total population in logistic model with nonlocal dispersals and heterogeneous environments
	9:40-10:10	庄梦迪 The rigorous derivation of Vlasov equations with local alignments from moderately interacting particle systems
	茶歇: 10:10-10:30	
	主持人:姬瑞红(成都理工大学)	
	10:40-11:10	赵相东 Boundedness to a chemotaxis model with sublinear sensitivity and logistic source
	11:10-11:50	王艳青 Energy equality in the (compressible) Navier-Stokes system
	午休: 11:50-14:30	
	主持人:赵围围(海南大学)	
	14:30-15:00	李岩 Variational structure and two-dimensional subsonic jet flows for compressible Euler system with general incoming flows
	15:00-15:30	杨金戈 Vortex solutions for pseudo-relativistic Hartree equations
	茶歇: 15:30-15:50	
	主持人:曹欣茹(东华大学)	
	15:50-16:20	郑斯宁 Gravity field and gravitational potential energy
16:20-16:50	李怀军 问题提出融入课堂教学的困境与突破	
16:50-17:30	自由发言	
11月12、13日	学术交流、离会	



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报告题目与摘要

Optimization of total population in logistic model with nonlocal dispersals and heterogeneous environments

白学利（西北工业大学）

In this talk, we investigate the issue of maximizing the total equilibrium population with respect to resources distribution $m(x)$ and diffusion rates d under the prescribed total amount of resources in a logistic model with nonlocal dispersals. Furthermore, we provide an equivalent characterization about the combination of resource distribution and diffusion rate such that the corresponding total population could reach the optimal order \sqrt{d} as d goes to infinity.

Boundedness to a chemotaxis model with sublinear sensitivity and logistic source

赵相东（辽宁师范大学）

We consider a parabolic-elliptic chemotaxis model for describing a complicated biased movement of cells towards higher concentration of chemical signals produced by the cells themselves. The interplay of the sublinear sensitive chemotactic mechanism and the self-limiting growth mechanism involved in logistic source possibly leads to some complex dynamic behaviors. We mainly report the boundedness of classical solution to this model in dimension two.

The rigorous derivation of Vlasov equations with local alignments from moderately interacting particle systems

庄梦迪（辽宁大学）

In this paper we give a rigorous derivation of the mean field limit for a interacting particle model in d dimensions ($d \geq 2$). For stochastic initial data, we prove that in the probability sense, the solution of the interacting particle model with properly cut-off converges to the solution of the characteristics of the cut-off Cucker-Smale model with strong local alignment.



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Energy equality in the (compressible) Navier-Stokes system

王艳青（郑州轻工业大学）

In this talk, first, we present a new energy conservation criteria via a combination of velocity and its gradient for weak solutions of the general compressible Navier-Stokes equations. This helps us to improve the recent results due to Nguyen-Nguyen-Tang [Nonlinearity 32 (2019)] and Liang [Proc. Roy. Soc. Edinburgh Sect. A (2020)]. Second, it is shown that classical Lions's condition for energy balance in the incompressible fluid is also valid for the weak solutions of the isentropic compressible Navier-Stokes equations allowing vacuum. This is an improvement of corresponding results obtained by Yu in [32, Arch. Ration. Mech. Anal., 225 (2017)], and our criterion via the gradient of the velocity partially answers a question posed by Liang in [18, Proc. Roy. Soc. Edinburgh Sect. A (2020)].

Variational structure and two-dimensional subsonic jet flows for compressible Euler system with general incoming flows

李岩（上海交通大学）

In this talk, we show the well-posedness of compressible subsonic jet flows for two-dimensional steady Euler system with general incoming horizontal velocity as long as the flux is larger than a critical value. One of the key observations is that the stream function formulation for two-dimensional compressible steady Euler system enjoys a variational structure even when the flows have nontrivial vorticity, so that the framework developed by Alt, Caffarelli and Friedman can be adapted to study the jet problem, which is a Bernoulli type free boundary problem. The regularity of the free boundary can be obtained even when the vorticity of the flows is large. Furthermore, the uniqueness of the solution and the existence of a critical mass flux are also established. This is a joint work with Wenhui Shi, Lan Tang and Chunjing Xie.



Vortex solutions for pseudo-relativistic Hartree equations

杨金戈（南昌工程学院）

We introduce k -vortex solutions of a pseudo-relativistic Hartree equation. Such solutions are obtained as minimizers of the associated functional. We show that there is a threshold value such $N_c(k) > 0$ that the functional admits a nonnegative minimizer u_N if $0 < N < N_c(k)$, and there exists no minimizer if $N \geq N_c(k)$. Moreover, We discuss the stability of the vortex solution and the limiting behavior of the minimizer as $N \rightarrow N_c(k)_-$.

Gravity field and gravitational potential energy

郑斯宁（大连理工大学）

We deal with the gravitational field and the gravitational potential energy. It is well known from the Newton's law of universal gravitation that the universal gravity $F(r) = -\frac{GMm}{r^2}$, where r is the distance between the two mass points m and M with $M \gg m$. Moreover, the mass point possesses gravitational potential energy $E(r) = -\frac{GMm}{r}$, for which $E(\infty) = 0$, while the source center $r = 0$ is a singular point where both the gravity and the gravitational potential energy should be $-\infty$. Obviously, the Earth in the real world is a solid ball, rather than a mass point, and the center of the Earth is not a singular point. Let the Earth be a uniform ball B_{R_0} with radius R_0 and density 1. Then the mass $M = \frac{4}{3}\pi R_0^3$. It is learned from the physics and the calculus that outside the Earth with $r \geq R_0$ the gravity of the Earth can be treated as a mass point with mass M , while inside the Earth with $r < R_0$ the gravity is just due to the smaller ball with radius r and mass $\frac{4}{3}\pi r^3$. This implies that the contribution of the other part of the Earth with $B_{R_0} \setminus B_r$ to the gravity would be zero. A simple computation shows that the gravitational potential energy is a negative monotonic function. In particular, the gravitational potential energy at the Earth center equals two-thirds of those at the surface of the Earth, i.e., $E(0) = -\frac{3}{2}\frac{GMm}{R_0} = \frac{3}{2}E(R_0)$. Notice that the difference of potential energy between any two fixed positions is invariant, independent of the definition of zero potential energy. For example, it is always true that $E(R_0) - E(0) = \frac{1}{2}[E(\infty) - E(R_0)]$ under any choice of zero potential energy. It is shown in this paper that the concept of negative energy introduced in physics is natural and reasonable.

问题提出融入课堂教学的困境与突破

李怀军（河南师范大学）

问题提出是数学课程标准“四能”目标的重要组成部分，是生成数学核心素养的必要准备。在融入课堂教学中，易陷入问题情境创设困难、问题提出指导不系统、问题提出评价与教学目标疏离的困境。这与教师对问题提出融入课堂教学的认识不够深入有关：缺乏“问题提出是序列认知活动”“问题情境内蕴召唤结构”“有价值的问题提出取决于对问题质量的认识”的全面认识。为使问题提出有效融入课堂教学，教师可将知识生长点内隐于背景创设问题情境，以促进问题提出为旨向构建“四维”质量评价标准，使策略指导贯穿问题提出全过程。



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不為則難