Workshop on Nonlinear Partial Differential Equations XVI Jointed with Hangzhou Dianzi University

Aug. 22-Aug. 23, 2022

1. Workshop Information

Announcement:

In order to enhance the communications among the mathematicians on the subject of partial differential equations, geometric analysis and related topics, we plan to hold "Workshop on nonlinear partial differential equations XVI" on Aug. 22-Aug. 23, 2022. We will invite some experts to share ideas and results on recent research, and dis-cuss current challenging issues.

Arrangement:

Aug. 22: Registration
Aug. 23: Workshop
Aug. 24: Departure

Organizing Committee:

Congming Li, Shanghai Jiao Tong University
Yuan Lou, Shanghai Jiao Tong University
Yang Wang, Hangzhou Dianzi University
Meiqing Xu, Shanghai Jiaotong University
Ran Zhuo, Hanghuai University

Venues:

浙江省杭州市西湖区三台山路 278 号，浙江宾馆，主楼二楼春晓厅

Contact Us

Yang Wang
ywang@hdu.edu.cn
Meiqing Xu
xmq157@sjtu.edu.cn
Ran Zhuo
zhuoran1986@126.com

2. Schedule

Tuesday, Aug. 23	
Morning Session	
8: 50-9: 00	Opening ceremony
Chair: Congming Li	
9:00-9:45	Speaker: **Youshan Tao (Shanghai Jiaotong University)** Title: Taxis-driven formation of hotspots in a cross-diffusion model for virus infection
9:45-10:15	Tea break
Chair: Xiangxing Tao	
10:15-11:00	Speaker: **Long Wei (Hangzhou Dianzi University)** Title: Qualitative studies of some equations with wave breaking
Chair: Ran Zhuo	
11:10-11:55	Speaker: **Yunfeng Geng (Hangzhou Dianzi University)** Title: Coexistence of a single prey and multiple predators in hybrid models
Lunch	
Afternoon Session	
Chair: Yang Wang	
14:40-15:25	Speaker: **Yuanyuan Lian (Shanghai Jiao Tong University)** Title: Boundary H\"{o}lder regularity for elliptic equations on Reifenberg flat domains
15:25-15:55	Tea break
Chair: Long Wei	
15:55-16:40	Speaker: **Chenkai Liu (Shanghai Jiao Tong University)** Title: Dirichlet problem for the fractional Laplacian
Chair: Yunfeng Geng	
16:50-17:35	Speaker: **Kai Zhang (Shanghai Jiao Tong University)** Title: Boundary regularity for elliptic equations
Banquet	

3. Titles and Abstracts

Coexistence of a single prey and multiple predators in hybrid models

Yunfeng Geng (Hangzhou Dianzi University)

The question of whether and how two or more competing predators can coexist on a single limiting prey has a long tradition in ecological theory. Many species are annual breeders who, between reproductive events, continuously consume prey and may die. Their prey often reproduces continuously or has short, overlapping generations. An accurate model for such life cycles needs to represent both, the discrete- and the continuous-time processes in the community. We build on a recent seasonal hybrid model for one prey and one predator, and we extend it by introducing multiple predators. In our model, the predation is linear functional response but predators reproduction can be linear or nonlinear. When two or more predators reproduction satisfy linear functions, there is no positive equilibrium generically. When at most one predator reproduction has linear function and the others with non-linear reproduction, we derive precise conditions for the unique positive equilibrium state to exist and for mutual invasion to occur at equilibria. Higher growth rate of prey generally allows more predators to stably coexist. Our explicit formulas allow us to select the optimal parameters to generate communities of many coexisting predators. Complex patterns of coexistence arise, including bistability of equilibrium and non-equilibrium coexistence.

Boundary H\"{o}lder Regularity for Elliptic Equations on Reifenberg Flat Domains

Yuanyuan Lian (Shanghai Jiao Tong University)

In this talk, we investigate the boundary H\"{o}lder regularity for elliptic equations on Reifenberg flat domains. We will prove that for any $0<\alpha<1$, there exists $\delta>0$ such that the solution is C^{α} at $x_0\in \partial \Omega$ provided that Ω is δ-Reifenberg flat at x_0 (see \Cref{d-re}). In particular, for any $0 < \alpha < 1$, if $\partial \Omega$ is C^1 and $u=g$ on $\partial \Omega$ with $g\in C^{\alpha}(x_0)$, then $u\in C^{\alpha}(x_0)$. A similar result for the Poisson equation has been proved by Lemenant and Sire \cite{MR3156895}, where the Alt-

Caffarelli-Friedman's monotonicity formula is used. Besides the generalization to general elliptic equations, our method is simple. In addition, even for the Poisson equation, our result is stronger than that of Lemenant and Sire.

Dirichlet problem for the fractional Laplacian

Chenkai Liu (Shanghai Jiao Tong University)

In our recent work, we study Dirichlet type problems of fractional Laplace (Poisson) equations. We construct the Green's function and the Poisson kernel. We then provide a somewhat sharp condition for the existence and uniqueness. We also show that the solution under such condition must be given by our Green's function and Poisson kernel. In doing these, we establish several basic and useful properties of the Green's function and Poisson kernel. Based on these, we obtain some further a priori estimates of the solutions. Surprisingly those estimates are quite different from the ones for the local type elliptic equations such as Laplace equations. These are basic properties to the fractional Laplace equations and can be useful in the study of related problems.

Taxis-driven formation of hotspots in a cross-diffusion model for virus infection

Youshan Tao (Shanghai Jiao Tong University)

This lecture reports a recent joint work with Michael Winkler (Paderborn), and it concerns a three-component chemotaxis model which accounts for spatially heterogeneous dynamics of viral infection. In contrast to the classical Keller-Segel type systems, the considered attractant is produced in an inherently nonlinear mechanism. We develop an approach capable of detecting taxis-driven blow-up in this complex model, as known virus hotspot formation phenomena observed in biological experiments.

Qualitative studies of some equations with wave breaking

Long Wei (Hangzhou Dianzi University)

In this talk, we investigate the qualitative properties of some equations with wave breaking, among which, conserved quantities and differential inequalities are important tools. We first discuss how to find the conserved quantities and use them to study the properties of the equations. And then, some Riccati-type inequalities are studied and applied to analyze the blow up of solutions.

Boundary regularity for elliptic equations

Kai Zhang (Shanghai Jiao Tong University)

In this talk, we introduce some boundary pointwise regularity results for elliptic equations, including boundary Holder regularity, boundary Lipschitz regularity, boundary C^{1,a} regularity and boundary C^{2,a} regularity etc. This talk is a combination of our several work in recent years.

4. List of Participants

Name	Affiliation	Sign Up
白志豪	杭州电子科技大学	
戴圣丹	杭州电子科技大学	
邓重阳	杭州电子科技大学	
冯晓萌	杭州电子科技大学	
耿云凤	杭州电子科技大学	
韩斌	杭州电子科技大学	
韩广国	杭州电子科技大学	
郝乙行	杭州电子科技大学	
胡海艳	杭州电子科技大学	
黄耿耿	复旦大学	
黄林	杭州电子科技大学	
金波	杭州电子科技大学	
来米加	上海交通大学	
李从明	上海交通大学	
李水木	上海交通大学	
李振杰	上海交通大学	
廉媛媛	上海交通大学	
梁警琦	上海交通大学	
林梓楠	杭州电子科技大学	
刘宸恺	上海交通大学	
楼元	上海交通大学	
罗川疆	杭州电子科技大学	
吕英姝	上海交通大学	
满娟娟	杭州电子科技大学	
秦凯凯	杭州电子科技大学	
邱慧	杭州电子科技大学	
覃森	杭州电子科技大学	

陶祥兴	浙江科技学院	
陶有山	上海交通大学	
童常青	杭州电子科技大学	
王芳	上海交通大学	
王阳	杭州电子科技大学	
魏龙	杭州电子科技大学	
夏水燕	杭州电子科技大学	
谢春景	上海交通大学	
谢强军	杭州电子科技大学	
徐美清	上海交通大学	
杨帆	上海交通大学	
虞静	杭州电子科技大学	
张凯	上海交通大学	
张雨薇	杭州电子科技大学	
郑骋	上海交通大学	
周春琴	上海交通大学	
卓然	黄淮学院	