Workshop on Nonlinear Partial Differential Equations X

Nov. 20-Nov.22, 2020

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 “mini-workshop on nonlinear partial differential equations” on Nov. 20-Nov. 22, 2020. We will invite some experts to share ideas and results on recent research, and discuss current challenging issues.

**Organizing Committee:**
Congming Li, Shanghai Jiao Tong University
Mijia Lai, Shanghai Jiao Tong University
Yuanyuan Lian, Shanghai Jiao Tong University
Leyun Wu, Shanghai Jiao Tong University
Chunqin Zhou, Shanghai Jiao Tong University

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2. Schedule

| Time       | Event                                                                 |
|------------|----------------------------------------------------------------------|
| Nov. 21, Saturday |
| Forenoon: On-line |
| Zoom ID: 9604720712, PIN: 20201121 |
| 8: 50-9: 00 | Opening ceremony |
| **Chair:** Yuhua Sun |
| 9: 00-10: 00 | Speaker: Wenxiong Chen  
Title: Asymptotic method of moving planes for fractional parabolic equations |
| 10: 00-10: 10 | Tea break |
| 10: 10-11: 10 | Speaker: Hao Fang  
Title: Boundary compactness for conic sigma_2 Yamabe problem |
| 11: 20-13: 20 | Lunch |
| **Afternoon: Off-line** |
| Room 901, No. 6 Building, Science Buildings |
| **Chair:** Genggeng Huang |
| 13: 30-14: 20 | Speaker: Kai Zhang  
Title: Boundary Lipschitz regularity and the Hopf lemma for fully nonlinear elliptic equations |
| 14:30-15:20 | Speaker: Jian Lu  
Title: Non-uniqueness of solutions to a class of Monge-Ampere type equations |
| 15: 30-15: 50 | Tea break |
| **Chair:** Jian Lu |
| 15: 50-16: 40 | Speaker: Jun Wang  
Title: Existence, bifurcation, orbital stability and Liouville theorems results for elliptic system with quadratic nonlinearity |
3. Titles and Abstracts

Asymptotic method of moving planes for fractional parabolic equations

Speaker: Wenxiong Chen (Yeshiva University)

In this talk, we will consider nonlinear parabolic fractional equations

\[
\frac{\partial u}{\partial t} + (-\Delta)^s u = f(t, u(x, t)).
\]

We develop a systematical approach in applying an asymptotic method of moving planes to investigate qualitative properties of positive solutions for fractional parabolic equations. To this end, we derive a series of needed key ingredients such as narrow region principles, and various asymptotic maximum and strong maximum principles for antisymmetric functions in both bounded and unbounded domains. Then we illustrate how these new methods can be employed to obtain asymptotic radial symmetry and monotonicity of positive solutions in a unit ball and on the whole space. Namely, we show that no matter what the initial data are, the solutions will eventually approach to radially symmetric functions.
We hope that the ideas and methods introduced here can be conveniently applied to study a variety of nonlocal parabolic problems with more general operators and more general nonlinearities.

Spectrum of the Lame operator and application to the mean field equation

Speaker: Zhijie Chen (Tsinghua University)

In this talk, I will introduce some recent results on the spectrum of the classical Lame operator. Some applications to the mean field equation with singularities on flat tori will also be given.

Boundary compactness for conic sigma_2 Yamabe problem

Speaker: Hao Fang (The University of Iowa)

In this talk, we discuss the boundary compactness for the constant sigma_2 metric on conic 4-spheres. The Yamabe problem for conic 2-spheres has been studied by Troyanov, Luo-Tian, Chen-Li and its corresponding moduli space is well defined. In a previous work with M. Lai, we have established its boundary compactness. In a similar setting, we discuss the sigma_2 Yamabe problem for conic 4-spheres where the moduli space has more delicate non-linear behavior. In a joint work with W. Wei, we establish the boundary compactness using a delicate version
of the isoperimetric inequality.

Non-uniqueness of solutions to a class of Monge-Ampere type equations

Speaker: Jian Lu (South China Normal University)

We consider a class of Monge-Ampere type equations defined on the unit sphere in the Euclidean space. These equations arise from the modern Brunn-Minkowski theory about convex geometry, and they may be degenerate or singular in different situations. We will mainly talk about some recent progress about the non-uniqueness of solutions to these equations. This is based on a joint work with Qi-Rui Li and Jiakun Liu.

Existence, bifurcation, orbital stability and Liouville theorems results for elliptic system with quadratic nonlinearity

Speaker: Jun Wang (Jiangsu University)

In this talk we first introduce the recent results on the existence, bifurcation and orbital stability for elliptic system with quadratic nonlinearities. On the other hand, we give the Liouville type results, universal estimates and periodic solutions for the nonhomogeneous parabolic system with quadratic nonlinearities. This work is jointed with Aleks Jevnikar, Junping Shi and Wen Yang.
Boundary Lipschitz regularity and the Hopf lemma for fully nonlinear elliptic equations

Speaker: Kai Zhang (Northwestern Polytechnical University)

In this talk, we study the boundary regularity for viscosity solutions of fully nonlinear elliptic equations. We use a unified, simple method to prove that if the domain $\Omega$ satisfies the exterior $C^{1,\text{Dini}}$ condition at $x_0 \in \partial \Omega$, the solution is Lipschitz continuous at $x_0$; if $\Omega$ satisfies the interior $C^{1,\text{Dini}}$ condition at $x_0$, the Hopf lemma holds at $x_0$. Moreover, the $C^{1,\text{Dini}}$ conditions are optimal. The key idea is that the curved boundaries are regarded as perturbations of a hyperplane.

4. List of Participants

| Name       | Affiliation               |
|------------|---------------------------|
| 陈文雄     | Yeshiva University       |
| 陈志杰     | 清华大学                  |
| 方浩       | The University of Iowa    |
| 黄耿耿     | 复旦大学                  |
| 鲁建       | 华南师范大学             |
| 吕英妹     | 复旦大学                  |
| 孙玉华     | 南开大学                  |
| 王俊       | 江苏大学                  |
| 王小龙     | 东华理工大学             |
| 张凯       | 西北工业大学             |
| 姓名   | 学校         |
|--------|--------------|
| 张涛   | 烟台大学     |
| 周长亮 | 东华理工大学 |
| 来米加 | 上海交通大学 |
| 李从明 | 上海交通大学 |
| 李振杰 | 上海交通大学 |
| 廉媛媛 | 上海交通大学 |
| 王芳   | 上海交通大学 |
| 王飞   | 上海交通大学 |
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| 谢春景 | 上海交通大学 |
| 谢峰   | 上海交通大学 |
| 杨帆   | 上海交通大学 |
| 杨雄锋 | 上海交通大学 |
| 郑骋   | 上海交通大学 |
| 周春琴 | 上海交通大学 |
| 卓然   | 上海交通大学 |
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| 徐美清 | 上海交通大学 |
| 王丽丹 | 上海交通大学 |
| 周辉煌 | 上海交通大学 |