SITE Research Center online conference from June 13 to 17, 2021 on

Long Time Behavior and Singularity Formation in PDEs — Part III

The below Programme Schedule of talks is given in Gulf Standard Time (GST). For your convenience, here are the equivalent times in other time zones:

- *1.00pm GST - Mecca 12.00pm noon | Paris 11.00am | New York 5.00am | Tokyo 6.00pm | Beijing 5.00pm*
- *2.00pm GST - Mecca 1.00 pm | Paris 12.00pm | New York 6.00am | Tokyo 7.00pm | Beijing 6.00pm*
- *4.30pm GST - Mecca 3.30pm | Paris 2.30pm | New York 8.30am | Tokyo 9.30pm | Beijing 8.30pm*
- *5.30pm GST - Mecca 4.30pm | Paris 3.30pm | New York 9.30am | Tokyo 10.30pm | Beijing 9.30pm*
- *9.30pm GST - Mecca 8.30pm | Paris 7.30pm | New York 1.30pm | Tokyo 2.30am | Beijing 1.30am*

Sunday, June 13

4.30 – 4.35 pm: opening remarks by **Sehamuddin Galadari,** by Senior Vice Provost of Research; Managing Director, Research Institute; Professor of Biology, New York University of Abu Dhabi

4.35 – 5.35 pm: **Diogo Gomes**, Professor of Applied Mathematics and Computational Science, King Abdullah University of Science and Technology

- Title: Displacement convexity and mean-field games
- Abstract: In the theory of mean-field games (MFGs), a priori estimates play a crucial role to prove the existence of classical solutions. In particular, uniform bounds for the density of players' distribution and its inverse are of utmost importance. Here, inspired by previous results in the optimal transport theory, we investigate a priori bounds for a first-order planning problem with a non-vanishing potential and establish a displacement-convexity property. Using Moser's iteration method, we show that if the potential satisfies a certain smallness condition, then a displacement-convexity property holds. This property enables Lq bounds for the density. In the one-dimensional case, the displacement-convexity property also gives Lq bounds for the inverse of the density. Finally, using these Lq estimates and Moser's iteration method, we obtain L1 estimates for the density of the distribution of the players and its inverse. We conclude with an application of our estimates to prove the existence and uniqueness of solutions for a first-order mean-field planning problem.

9.30 – 10.30 pm: **Aynur Bulut**, Assistant Professor, Department of Mathematics, Louisiana State University

- Title: Quantitative blow-up criteria for defocusing energy-supercritical NLS
- Abstract: In this talk, we describe recent work on quantitative bounds for the defocusing Nonlinear Schrodinger equation in the energy-supercritical regime. In particular, inspired by a recent breakthrough construction of finite-time blow-up solutions for the defocusing equation, we establish a blow-up criteria below the scaling invariant threshold. This gives the first generic

result distinguishing potential defocusing blow-up phenomena from many of the known examples of blow-up in the focusing setting. The main tools involved include delicate refinements of induction on scales arguments due to Bourgain and Tao, combined with an interpolation argument which allows to break the scaling threshold.

Monday, June 14

1.00 - 2.00 pm: **Ping Zhang**, Professor and Director, Academy of Mathematics and Systems Science, Chinese Academy of Sciences

- Title: Global existence and decay of solutions to Prandtl system with small analytic and Gevrey data
- Abstract: In this paper, we prove the global existence and the large time decay estimate of solutions to Prandtl system with small initial data, which is analytical in the tangential variable. The key ingredient used in the proof is to derive sufficiently fast decay-in-time estimate of some weighted analytic energy estimate to a quantity, which consists of a linear combination of the tangential velocity with its primitive one, and which basically controls the evolution of the analytical radius to the solutions. Our result can be viewed as a global-in-time Cauchy-Kowalevsakya result for Prandtl system with small analytical data, which in particular improves the previous result in \cite{IV16} concerning the almost global well-posedness of two-dimensional Prandtl system. Finally I'll present our recent result concerning the global wellposedness with small Gevrey data. This is a partially joint work with N. Liu; M. Paicu; C. Wang and Y. Wang. Short CV. Ping Zhang is now professor and director of the institute of mathematics, The Chinese Academy of Sciences. His research interest is mainly on the global solutions of incompressible viscouse fluid system. So far, he has published more than 110 papers on the related filed.

4.30 – 5.30 pm: **Van Tien Nguyen**, Research Associate, NYU Abu Dhabi

- Title: Singularities in the Keller-Segel system
- Abstract: The talk will give an update on the study of singularities in the Keller-Segel system in the two dimensional case (L^1-critical) as well as in the higher dimensional cases (L^1-supercritical).

5.30 – 6.30 pm: **Salim Messaoudi**, Professor of Mathematics, University of Sharjah

- Title: General Decay in Viscoelasticity: Overview and recent development
- Abstract: Since the Pioneer work of Dafermos in the 70's, a considerable development took place in the study of viscoelatic problems and various results concerning existence and long-time behavior have been established. In this talk, we intend present some important results in the subject.

Tuesday, June 15

1.0 – 2.00 pm: **Kenji Nakanishi**, Professor, Research Institute for Mathematical Sciences, Kyoto University

- Title: Global dynamics around two-solitons for the damped nonlinear Klein-Gordon equation
- Abstract: This is joint work with Kenjiro Ishizuka (Kyoto). For the damped nonlinear Klein-Gordon equation on R, to which the full soliton resolution was proven by Cote, Martel and Yuan (ARMA 2021), we classify all initial data in a neighborhood of each 2-soliton into 5 sets of global dynamics, where the 2-soliton manifold appears like a corner joint for two pieces of the 1-soliton manifold, therewith separating the rest into the two sets of decaying solutions and blow-up.

4.30 – 5.30 pm: **Valeria Banica**, Professor of Mathematics, Sorbonne Université

- Title: Growth of the energy for the binormal flow
- Abstract: In this talk Valeria will present a result of blow up of a density energy associated to the binormal flow, a classical model for the dynamics of vortex filaments in Euler equations. This is a joint work with Luis Vega.

9.30 – 10.30 pm: **Juhi Jang**, Professor, Department of Mathematics, University of Southern California

- Title: Dynamics of Newtonian stars
- Abstract: A classical model to describe the dynamics of Newtonian stars is the gravitational Euler-Poisson system. The Euler-Poisson system admits a wide range of star solutions that are in equilibrium or expand for all time or collapse in a finite time or rotate. In this talk, I will discuss some recent progress on those star solutions with focus on expansion and collapse. The talk is based on joint works with Yan Guo and Mahir Hadzic.

Wednesday, June 16

1.0 – 2.00 pm: **Noriko Mizoguchi**, Tokyo Gakugei University

- Title: Classification of GBU and RBC behaviors in the viscous Hamilton-Jacobi equation
- Abstract: Whereas the viscous Hamilton-Jacobi equation has viscosity solutions globally in time, GBU (gradient blow-up) may occur in finite time. Focusing on algebraic structure in GBU and recovery of boundary condition (RBC), the behavior of solutions is classified.

4.30 – 5.30 pm: **Changzhen Sun**, PhD candidate, University of Paris-Saclay

- Title: Uniform regularity and low Mach number limit for the viscous fluids in a domain with boundaries
- Abstract: We will talk about the propagation of uniform (w.r.t the Mach number) high order regularity and the incompressible limit for compressible Navier-Stokes equations in a domain

with fixed or free boundaries. These are joint works with profs. Nader Masmoudi and Frederic Rousset.

5.30 – 6.30 pm: **Weiren Zhao**, Assistant Professor of Mathematics, NYU Abu Dhabi

- Title: Long time behavior of MHD waves
- Abstract: Weiren will talk about the long time behavior of linearized MHD equations around sheared magnetic and velocity field. Three interesting phenomena: linear damping, depletion and magnetic island will be introduced in this talk.

Thursday, June 17

2.00 – 3.00 pm: **Hatem Hajri**, Research Scientist

- Title: Adversarial examples and stability of neural networks
- Abstract: Neural networks are being deployed in a wide variety of situations, such as vision, autonomous driving, defense, and more. Recent works have shown that these models are very unstable and vulnerable to input perturbations. In this talk, we review how unstability of neural networks is put in evidence by the construction of adversarial examples. In a second part, we present few approaches that have been proposed to target more stable and reliable networks in real life applications. Despite the progress made, results are still far from being satisfactory for humans. Some challenges will be discussed.

5.30 – 6.30 pm: **Abdessamad Tridane**, Associate Professor Mathematical Sciences, College of Science, UAE University

- Title: Mathematical modeling of the COVID-19 in the UAE
- Abstract: The aim of this talk is to present different approaches to modeling the COVID-19 in the UAE. The goal is to forecast the needs of the public health resource, the impact of the blue-collar population on the dynamic of the disease, and the effect of the COVID-19 on the population with comorbidities.

9.30 – 10.30 pm: **Mimi Dai**, Associate Professor, Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago

- Title: Dyadic models for the magnetohydrodynamics
- Abstract: Dyadic models for the magnetohydrodynamics (MHD) are introduced to gain insights towards better understanding of the MHD turbulence. In the ideal case, infinitely many fixed points exhibiting Onsager's scaling are found. Stability of the fixed points will be discussed. Brief bio: I am an associate professor in mathematics at the University of Illinois at Chicago. My research objective is simply to understand some elegant and peculiar phenomena in fluids, with a focus on MHD in recent days. I have been thinking about these problems from the angle of an analyst. Such restriction certainly has limitations to discover the hidden structures of the MHD. Therefore, I am also seeking to understand and study fluids problems from some different angles.