香港數學學會

The Hong Kong Mathematical Society

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THE HONG KONG MATHEMATICAL SOCIETY ANNUAL GENERAL MEETING 2019

25 May 2019 (Saturday)
9:30am- 5:15pm

Hong Kong Polytechnic University

Schedule of Events

Venue: Lecture room Y301, PolyU

9:30am -- 10:30am **HKMS Distinguished Lecture by Benoit Perthame (Sorbonne-Université)**

10:30am – 10:50am **Coffee Break**

10:50am – 11:40am **Plenary Lecture 1 by Wei-Ping Li (Hong Kong University of Sciences and Technology)**

11:40am – 12:00pm **Award Presentation Ceremony**

12:00am -- 12:15pm **HKMS Member's meeting**

12:15pm -- 2:00pm **Lunch (Student/Staff Restaurant at PolyU, 4/F of the Communal Building)**

Venue: Lecture room Y301, PolyU

2:00pm - 2:50pm **Plenary Lecture 2 by Jie Shen (Purdue University)**

2:50pm – 3:15pm **Coffee Break**

Venue: Y412, Y416, Y417, PolyU

3:15pm – 5:45pm **Invited talks (Parallel Sessions)**

Title and Abstracts

Venue: Lecture room Y301, PolyU
Distinguished lecture
Chair: Tong Yang

9:30am-10:30am: Benoit Perthame (Sorbonne-Université)
Title: Mathematical models of living tissues
Abstract: The mechanical modeling of living tissues has attracted much attention in the last decade. Applications include tissue repair and growth models of solid tumors. In this latter case, these models are calibrated on medical images and help to predict the evolution of the disease, to decide of treatment scheduling and of the optimal therapy. They are also used to understand the biological effects that permit tumor growth. These models contain several levels of complexity, both in terms of the biological and mechanical effects, and therefore in their mathematical description. The number of scales, from molecules to the organ and entire body, explains partly this complexity. Here, the analysis of the incompressible limit, and the associated free boundary problem, is mathematically challenging. In this talk, I shall give a general presentation of the field. Departing from the simplest (and irrealistic) model of cell division moving by pressure forces, I will include several additional biological effects and explain the consequences in terms of qualitative behavior of solutions.

Venue: Lecture room Y301, PolyU
Plenary lecture 1
Chair: Jun Zou

10:50am – 11:40am: **Wei-Ping Li (Hong Kong University of Sciences and Technology)**
Title: Higher genus Gromov-Witten invariants via NMSP
Abstract: Higher genus Gromov-Witten invariants of compact Calabi-Yau threefolds are studied extensively by mathematicians and physicists. These GW invariants are conjectured to have some inner structures, called BCOV Feynman summation rule. We will talk about the recent work of using N-mixed-spin-P-fields (NMSP for short) and Givental's R-matrix technique to solve this conjecture.

Venue: Lecture room Y301, PolyU
Plenary lecture 2
Chair: Xiaoping Wang

2:00pm – 2:50pm: Jie Shen (Purdue University)
Title: Structure preserving schemes for complex nonlinear systems
Abstract: Many complex nonlinear systems have intrinsic structures such as energy dissipation or conservation, and/or positivity/maximum principle preserving. It is desirable, sometimes necessary, to preserve these structures in a numerical scheme. I will first present a new approach to deal with nonlinear terms in a large class of gradient flows and Hamiltonian systems. The approach is not restricted to specific forms of the nonlinear part of the free energy or Hamiltonian. It leads to linear and unconditionally energy stable schemes which only require solving decoupled linear equations with constant coefficients. Hence, these schemes are extremely efficient and very accurate when combined with higher-order BDF schemes. However, this approach, in general, will not preserve positivity or maximum principle. I will then present a strategy to construct efficient energy stable and positivity preserving schemes for certain nonlinear evolution systems, such as the Poisson-Nernst-Planck (PNP) equation and Keller-Segel equation, whose solutions remain to be positive.

Parallel Session 1: Statistics and Machine learning
Chair: Can Yang
Venue: Y412, PolyU

3:15pm – 3:45pm: XIA Dong (HKUST)
Title: Representation of singular vectors and confidence regions
Abstract: Spectral methods are prevalent and powerful in low-rank statistical and machine learning models. In this talk, I will introduce a neat representation formula of the singular vectors for low rank matrix perturbation model which holds for any deterministic perturbations. The formula enables us to delve into more precise analysis of spectral methods under general settings. In particular, I will show the CLT for singular vectors of matrix perturbation model with i.i.d. Gaussian noise and propose confidence regions.

3:45pm – 4:15pm: YANG Can (HKUST)
Title: Learning Deep Generative Models via Variational Gradient Flow and Its Application
Abstract: Learning the generative model, i.e., the underlying data generating distribution, based on large amounts of data is one of the fundamental tasks in machine learning and statistics. Recent progresses in deep generative models have provided novel techniques for unsupervised and semi-supervised learning, with broad application varying from image synthesis, semantic image editing, image-to-image translation to low-level image processing. However, statistical understanding of deep generative models is still lacking, e.g., why the logD trick works well in training generative adversarial networks (GAN). In this talk, we introduce a general framework, variational gradient flow (VGrow), to learn a deep generative model to sample from the target distribution via combing the strengths of variational gradient flow on probability space, particle optimization and deep neural network. The proposed framework is applied to minimize the f-divergence between the evolving distribution and the target distribution. We prove that the particles driven by VGrow are guaranteed to converge to the target distribution asymptotically. Connections of our proposed VGrow method with other popular methods, such as VAE, GAN and flow-based methods, have been established in this framework, gaining new insights of deep generative learning. We also evaluated several commonly used f-divergences, including Kullback-Leibler, Jensen-Shannon, Jeffrey divergences as well as our newly discovered "logD" divergence which serves as the objective function of the logD-trick GAN. Besides the above theoretical understanding, we emphasize the practical issues in training GAN. Through a systematic design of the generator and the discriminator, much of the efforts on parameter tuning can be avoided. Using a pre-defined network structure rather than case-by-case parameter tuning, VGrow can generate high-fidelity images in a stable and efficient manner. Its results on those benchmark data sets (e.g., CIFAR10, CelebA) show Its competitive performance with state-of-the-art GANs. We have also applied VGrow to the portrait data from The Wikipedia Art Project, generating realistic portraits without extra editing. This is a joint work with Yuan Gao, Yuling Jiao, Yao Wang, Gefei Wang, Yang Wang and Shunkang Zhang.

4:15pm-4:45: Guo Xin (PolyU)
Title: On semi-supervised learning with summary statistics
Abstract: Nowadays the extensive collection and analyzing of data is stimulating widespread privacy concerns, and therefore is increasing tensions between the potential sources of data and researchers. A privacy-friendly learning framework can help to ease the tensions, and to boost data-related research. We propose a new algorithm, LESS (Learning with Empirical feature-based Summary statistics from Semi-supervised data), which uses only summary statistics instead of raw data. The selection of empirical features serves as a trade-off between prediction precision and the protection of privacy. We show that LESS achieves the minimax optimal rate of convergence, in terms of the size of the labeled sample. LESS extends naturally to the applications where data are separately held by different parties. Compared with existing literature on distributed learning, LESS removes the restriction of minimum sample size on single data sources.

Parallel Session 2: Analysis and Applications of PDEs
Chair: Zhian Wang
Venue: Y416, PolyU

3:15pm – 3:45pm: Shuangqian Liu (Jian University)
Title: The dilute gas ow in a finite channel
Abstract: The motion of the particles in the dilute gas can be described by the Landau equation or the non-cutoff Boltzmann equation. It is known that it is quite hard to construct the global well-posedness in Sobolev space for the initial boundary value problems of the kinetic equations in general bounded domains due to the formation of singularity of solutions. In this talk, firstly, we will discuss how to establish the global existence in some sharp regularity space for both the Landau equation and the non-cutoff Boltzmann equation with either the inflow boundary condition or the specular reflection boundary condition in a finite channel, secondly, we will show the solutions tend to the equilibrium around a global Maxwellian with the time sub-exponential decay rates, thirdly, we will present the regularity of the initial data or boundary data can be propagated from the boundary into the interior of the channel along the tangential direction. This is a partly joint work with R. Duan, S. Sakamoto and R. Strain.

3:45pm-4:15: Anthony Suen (EdUHK)
Title: Small parameter limit for a class of active scalar equations
Abstract: We study a general class of active scalar equations which depend on some viscosity parameters $\varespilon$ and ν. We discuss the wellposedness of the equations in different scenarios and address the convergence of solutions as ε or ν vanishes.

4:15pm-4:45: Wei Xiang (CityU)
Title: Uniqueness of regular shock reflection
Abstract: We will talk about our recent results on the uniqueness of regular reflection solutions for potential flow equation in a natural class of self-similar solutions. The approach is based on a nonlinear version of method of continuity. An important property of solutions for the proof of uniqueness is the convexity of the free boundary.

4:45pm – 5:15pm: Yong Yu (CUHK)
Title: Debye layer limit in charge conserving Poisson-Boltzmann equation
Abstract: The Poisson-Boltzmann equation is a useful equation to understand physiological interfaces, polymer science, electron interactions in a semiconductor, or more. The charge conserving Poisson-Boltzmann equation is a non-local version of the standard Poisson-Boltzmann equation, which provides us with equilibrium solutions to Poisson-Nernst-Planck equation under no flux boundary condition. In this talk we will quantitatively discuss the so-called Debye layer phenomenon in charge conserving Poisson-Boltzmann equation. Under the neutrality assumption, we provide a novel and explicit formula to evaluate the limiting electric potential inside the physical domain as a small parameter approaching to zero. In fact due to the non-local term in charge conserving Poisson-Boltzmann equation, the limiting value of electric potential inside the physical domain is not a-priorily known. Our formula reveals the crucial relationships between the limiting electric potential inside the physical domain and the Dirichlet data of the electric potential prescribed on the physical boundary. This is a joint work with Chia-Yu Hsieh.

Parallel Session 3: Geometric Topology
Chair: Zhongtao Wu
Venue: Y417, PolyU

3:15pm – 3:45pm: Ziming MA (CUHK)
Title: Geometry of Maurer-Cartan equation near degenerated Calabi-Yaus
Abstract: In this talk, we give an alternative way (without scattering diagram) to prove the famous unobstructedness result by Gross-Siebert about the smoothing of maximally degenerated Log Calabi-Yau varieties X satisfying Hodge-deRham degeneracy property for cohomology of X. This would provide linkage between Kontsevich-Katzarkov-Pantev Hodge theoretic viewpoint and the Gross-Siebert's program. This is a joint work with Kwokwai Chan and Naichung Conan Leung.

3:45pm-4:15: Hanwool BAE (CUHK)
Title: Ring structure of wrapped Floer homology of real Lagrangians in A_k-type Milnor fibers
Abstract: Lagrangian Floer homologies and their ring structures are generally difficult to compute. But the wrapped Floer homologies of real Lagrangians in A_k-type Milnor fibers were computed by Kim, Kwon and Lee by using Morse-Bott spectral sequence recently. In this talk, I will introduce an open string analogue of Seidel representation and then will use it to compute the ring structure on the wrapped Floer homology of real Lagrangians. This is a joint work with Myeonggi Kwon.

4:15pm-4:45: Xian'an JIN (Xiamen University)
Title: The generalized Yamada polynomial of virtual spatial graphs
Abstract: Knot theory can be generalized to virtual knot theory and spatial graph theory. In 2007, Fleming and Mellor combined and generalized them to virtual spatial graph theory in a combinatorial way. In this talk, we shall generalize the classical Yamada polynomial for spatial graphs to obtain the generalized Yamada polynomial for virtual spatial graphs via their diagrams. Then we prove that it can be normalized to be a rigid vertex isotopic invariant of virtual spatial graphs and to be a pliable vertex isotopic invariant for virtual spatial graphs with maximum degree at most 3. We also consider the connection and difference between the generalized Yamada polynomial and the Dubrovnik polynomial of a classical link. That is, the generalized Yamada polynomial specializes to a version of the Dubrovnik polynomial for classical links such that it can be used to sometimes detect the non-classicality of virtual links.
This is joint work with Qingying Deng and Louis H. Kauffman.

4:45pm – 5:15pm: Yong HOU (Southern University of Science and Technology)
Title: On the classification of Kleinian groups with respect to Hausdorff dimensions
Abstract: I will discuss the result of sharp bounds on Hausdorff dimensions that implies every purely Kleinian groups is a classical Schottky group.

PolyU Campus Map

Meeting Venue:
Block Y (Lee Shau Kee Building)