Warm-Up Week: Abstracts

August 6, 2018

Vladimir Bogachev: Topology and geometry of spaces of measures

We shall discuss some basic topological and metric properties of spaces of measures connected with weak convergence. A standard fact is that the space of probability measures on a complete separable metric space can be equipped with diverse complete separable metrics (such as Prohorov or Kantorovich) generating the weak topology. However, the whole space of signed bounded measures with the weak topology is not metrizable in nontrivial cases in spite of the fact that the Kantorovich norm is defined on the whole space. This phenomenon will be discussed in detail along with a number of elementary examples (such as measures on $\mathbb{N}$, $[0,1]$ and $\mathbb{R}$), which turn out rather subtle in the case of signed measures. The lecture does not assume any special knowledge except for some basic concepts related to metric spaces and measures, but even at this level there are interesting questions for future research.

Xicheng Zhang: Levy processes and its heat kernels

In this lecture I will present some basic knowledge about the Levy process. Then I will focus on the heat kernel estimates for a class of α-stable like processes.

Wei Liu: Stochastic 3D Leray-alpha Model with Fractional Dissipation

In this talk, we will present some recent results (e.g. well-posedness, Large deviation principle and ergodicity) concerning stochastic 3D Leray-alpha model with general fractional dissipation. This model is the stochastic 3D Navier-Stokes equations regularized through a smoothing kernel of order θ_1 in the nonlinear term and a θ_2-fractional Laplacian. The main results can be applied to the classical stochastic 3D Leray-alpha model, stochastic 3D hyperviscous Navier-Stokes equation and stochastic 3D critical Leray-alpha model as our special cases.

Viorel Barbu: Stochastic differential equations versus deterministic differential equations

The deterministic Cauchy problem associated to time independent m-accretive nonlinear operators in Banach spaces is well posed and this provide an unifying treatment of existence theory for most boundary value problems in mathematical physics. The situation is different for stochastic differential equations driven by Gaussian processes for which a complete existence theory exists in a few cases only. In this talk we shall try to explain this gap and how to fill it by a new concept of solution based on variational arguments.

Alexey Naumov: Random matrices and high-dimensional inference

Let $X_1, ..., X_n$ be an independent identically distributed sample in $\mathbb{R}^p$ with zero mean and unknown covariance matrix Σ. The problem of recovering Σ and its spectral projectors from these observations naturally arises in many applications. In the first part of the talk, I will give an overview of the recent results and techniques on covariance matrix estimation based on the matrix Bernstein inequality, Sudakov-Fernique's inequality, Stein's lemma etc. In the second part of the talk, we will discuss estimation of the spectral projectors and data-driven procedures for building sharp confidence sets. The talk will be partially based on the joint results with F. Goetze, V. Spokoiny and V. Ulyanov.

Giuseppa Alfano: Structured random matrices and wireless communications

This talk discusses the (many) connections between random matrix theory and wireless communications, focusing in a first part on the definition of a list of metrics beyond the celebrated log-determinant, quantifying the data rate over a multi-antenna wireless channel or a multi-mode optical fiber. The second half of the talk is devoted to the detailed introduction of open problems in the spectral characterization of structured random matrices, adopted as channel models in 5G and 6G systems, and also recently proposed in diffusion problems, statistical inference and machine learning.

Lucian Beznea: Classical and recent results on the existence of invariant measures for Markov processes

First, we shall review the classical Krylov-Bogolyubov result and the Doeblin condition for the existence of invariant (equilibrium) distributions of a Markov process. Then we present some recent developments on this topic, obtained jointly with Iulian Cîmpean and Michael Röckner.

Iulian Cimpean: Ergodicity of continuous time Markov processes with applications to SDEs and Monte Carlo simulations

We aim to discuss several results concerning (sub)geometric rates of convergence for continuous time Markov processes towards their equilibrium distributions, mainly via Lyapunov functions and small sets. We shall present some examples arising from SDEs, with special attention for the Langevin equation and its applications to Monte Carlo simulation.