数学中心光华青年学者论坛

Shanghai Center for Mathematical Science

December 7 - December 8

Program Schedule

December 07

9:00	**Registration**
9:30	Lin Liu (Harvard)
10:20	 + Group Photo
10:40	Yulan Qing (Toronto)
11:35	Weiyan Chen (Minnesota)
15:00	Changliang Wang (MPI)
15:50	
16:20	Si'an Nie (Academy)
18:00	**Banquet**

December 08

9:30	Zaoli Chen (Cornell)
10:20	
10:35	Shuxing Li (Simon Fraser)
11:30	Meng Wu (Oulu)

End

Title and Abstract

Lin Liu

Title: Nearly Assumption-Free Inference for Causal Inference with Machine Learning

Abstract: In the era of big data and AI, applications of black-box machine learning in causal analysis will become the rule rather than the exception. Before we have a completely understanding on the theory of black-box machine learning, even the state-of-the-art causal effect estimates -- the double machine learning (DML) estimators -- may have bias so large that prohibits valid inference. Invalid inference of causal effect estimates can have severe consequence when causal analysis may eventually change how treatment is prescribed to patients or how policy is changed to the society. In this talk, we describe a nearly assumption-free procedure which can either detect mis-coverage of the confidence interval associated with the DML estimators of some causal effect of interest or falsify the certificates (i.e. the mathematical conditions) that, if otherwise to be true, could ensure valid inference. This work shows how higher-order influence functions can be used in modern causal data analysis. This talk is based on joint works with Rajarshi Mukherjee, James Robins, Whitney Newey and Eric Tchetgen.

Yulan Qin

Title: Boundaries of non-positively curved groups and spaces

Abstract: To every Gromov hyperbolic space X one can associate a space at infinity called the Gromov boundary of X. This boundary is a fundamental tool for studying hyperbolic groups and hyperbolic 3-manifolds. As shown by Gromov, quasi-isometries of hyperbolic metric spaces induce homeomorphisms on their boundaries, thus giving rise to a well-defined notion of the boundary of a hyperbolic group. Croke and Kleiner showed that visual boundary of non-positively curved (CAT(0)) groups is not well-defined, since quasi-isometric CAT(0) spaces can have non-homeomorphic boundaries. For any sublinear function, we consider a subset of the visual boundary called sublinear boundary and show that it is a QI-invariant. This is to say, the sublinear-boundary of a CAT(0) group is well-defined. In the case of Right-angled Artin group, we show that the Poisson boundary of random walks on groups is naturally identified with the (log t)-boundary.

Weiyan Chen

Title: Topology and Arithmetic Statistics

Abstract: Topology studies the shape of spaces. Arithmetic statistics studies the behavior of random algebraic objects such as integers and polynomials. I will talk about a circle of ideas connecting these two seemingly unrelated areas. To illuminate the connection, I will focus on three concrete examples: (1) the Burau representation of the braid groups; (2) analytic number theory for effective 0-cycles on a variety; (3) cohomology of the space of multivariate irreducible polynomials. These projects are parts of a broader research program, with contributions by topologists, algebraic geometers, and number theorists in the past decade, and lead to many future directions yet to be explored.

Changliang Wang

Title: The linear instability of some families of Einstein metrics

Abstract: I will talk about the linear stability question of Einstein metrics. We proved the linear instability of some Einstein metrics with positive scalar curvature, in particular, including some families of Riemannian manifolds with real Killing spinors, and low dimensional homogeneous non-symmetric Einstein manifolds. This is based on joint works with Uwe Semmelmann and McKenzie Wang.

Si'an Nie

Title: Geometric properties of affine Deligne-Lusztig varieties

Abstract: Affine Deligne-Lusztig varieties, first introduced by Rapoport, were the affine analogues of classical Deligne-Luszig varieties. They play an important role in the study of Shimura varieties. I will talk about their geometric properties and applications.

Zaoli Chen

Title: Extremes of Long-Range Dependent Subexponential Sequences.

Abstract: Extreme value theory describe the limiting behavior of the largest value in increasing collections of random variables. Particularly, we can investigate extremes arising from stochastic processes. For a stationary sequence, both the marginal tail and the memory matter in the extremal limit theorem. We will focus on a particular type of dependent structures and subexponential marginal tails. We will start from power-law tails and extend to lighter tails. We will discuss some proved results, and see certain interesting interplay between memories and tails.

Shuxing Li

Title: Formal Duality in Finite Abelian Groups

Abstract: In Euclidean space, a periodic configuration is a union of finitely many translations of a lattice. In particular, energy-minimizing periodic configurations are those which possess minimum energy. Finding energy-minimizing periodic configurations is an interesting problem, not only because of its theoretical significance in physics, but also its connection with the famous sphere packing problem. On the other hand, the search of energy-minimizing periodic configurations is notoriously difficult and very few theoretical results are known. Nevertheless, an insightful idea due to Cohn, Kumar, Reiher and Schurmann, enables us to study the energy-minimizing periodic configurations from a combinatorial viewpoint. Roughly speaking, among pairs of energy-minimizing periodic configurations, they revealed a remarkable symmetry named formal duality. Furthermore, they translated the formal duality into a purely combinatorial context, where the corresponding configuration was called a formally dual pair, which is a pair of subsets in a finite abelian group satisfying a subtle difference-set-like property. In this talk, we will give an overview and present some recent results of formally dual pairs, which involve constructions, nonexistence results and characterizations of formally dual paris.

Meng Wu

Title: Dimension of self-similar measure varies continuously with respect to the defining probability vector

Abstract: Given a homogeneous self-similar IFS and a probability vector p, there is a unique associated self-similar measure \mu_p. We study the regularity of the dependence of dimension of \mu_p on p. In particular, we show that the dimension of \mu_p is continuous as a function of p. We will also present some applications of this result