PANEM Short Talks Title and Abstracts

Speaker: Josué Vázquez-Becerra

Title: BMT independence: a framework for arbitrary mixtures of boolean, monotone, and tensor independence.

Abstract: In this talk, we will introduce the notion of BMT independence as a rule determined by a given directed graph to compute mixed moments. Arbitrary mixtures of boolean, monotone, and tensor independence can be represented through directed graphs. For any two vertices, no edge between them renders boolean independence, a single directed edge depicts monotone independence, and two edges with opposite directions portray tensor independence. This framework gives a generalization of the mixtures of boolean and monotone independence studied by Wysoczanski and known as BM independence. Moreover, it depicts monotone independence as an interpolation point between boolean and tensor independence, allows algebraic and operator constructions of BMT variables, and recovers Poisson-type and central limit theorems for boolean, monotone, and tensor independence.

This talk is based on ongoing joint work with Octavio Arizmendi and Saul Mendoza.

Speaker: Jacob Campbell

Title: Weingarten calculus and finite free probability

Abstract: In 2015, Marcus, Spielman, and Srivastava realized that the expected characteristic polynomials of sums and products of randomly rotated matrices, like $A+UBU^*$ and $AUBU^*$ where U is a random unitary matrix, behave in some ways like "finite" versions of the additive and multiplicative convolution operations in free probability. In this talk, I will show how techniques from combinatorial representation theory can help to understand these so-called finite free convolutions, focusing on the problem (which I solved in arXiv:2209.00523) of describing the commutator of randomly rotated matrices in this context.

Speaker: Dongwei Chen

Title: A remark on the C-monotonicity of optimal transport with capacity constraints.

Abstract: I will talk about the c-monotone principle of optimal transport with capacity constraints (capacity OT). We introduce the c-capacity monotonicity for capacity OT, which is a generalization of c-cyclical monotonicity in optimal transport. We show that the optimizer of capacity OT is c-capacity monotone.

Speaker: Mikhail Tikhonov

Title: Asymptotics of noncolliding q-exchangeable random walks

Abstract: We consider a process of noncolliding q-exchangeable random walks on $\mathbb{Z}$ making steps 0 (straight) and −1 (down). A single random walk is called q-exchangeable if under an elementary transposition of the neighboring steps (down, straight) $\to$ (straight, down) the probability of the trajectory is multiplied by a parameter q between 0 and 1. Our process of m noncolliding q-exchangeable random walks is obtained from the independent q-exchangeable walks via the Doob's h-transform for a certain nonnegative eigenfunction h with the eigenvalue less than 1. The system of m walks evolves in the presence of an absorbing wall at 0. We show that the trajectory of the noncolliding q-exchangeable walks started from an arbitrary initial configuration forms a determinantal point process, and express its kernel in a double contour integral form. We obtain a limit shape of our noncolliding walks and also show that their local statistics are governed by the incomplete beta kernel. Based on joint work with L. Petrov, arXiv:2303.02380.

Speaker: Fei Cao

Title: Derivation of wealth distributions from biased exchange of money.

Abstract: We are interested in using kinetic theory to better understand the time evolution of wealth distribution and their large scale behavior such as the evolution of inequality (e.g. Gini index). We investigate three types of dynamics denoted unbiased, poor-biased and rich-biased exchange models. At the individual level, one agent is picked randomly based on its wealth and one of its dollars is redistributed among the population. Proving the so-called propagation of chaos, we identify the limit of each dynamics as the number of individual approaches infinity using both coupling techniques and martingale-based approaches. Equipped with the limit equation, we identify and prove the convergence to specific equilibrium for both the unbiased and poor-biased dynamics. In the rich-biased dynamics however, we observe a more complex behavior where a dispersive wave emerges. Although the dispersive wave is vanishing in time, it also accumulates all the wealth leading to a Gini approaching 1 (its maximum value). We characterize numerically the behavior of dispersive waves but further analytic investigation is needed to derive such dispersive waves directly from the dynamics. If

time allows, we will also present results related to an extension of the unbiased dollar exchange model which includes a bank (and allows agents to go into debt).

Speaker: Pei-Lun Tseng

Title: Infinitesimal operators and the Infinitesimal distributions of anticommutators and commutators

Abstract: The idea of free independence (or freeness) was introduced by Voiculescu in 1985. It is very useful in the study of the asymptotic behavior of random matrices. Over time, numerous extensions and generalizations of free probability have emerged. One such generalization is infinitesimal freeness. In this presentation, we will begin by providing an overview of infinitesimal free probability theory and its connection to random matrix theory. Subsequently, we will delve into the topic of infinitesimal operators and explore their properties. Additionally, we will demonstrate techniques for computing infinitesimal distributions of anticommutators and commutators. Lastly, we will examine the concept of infinitesimal R-diagonal operators. This is joint work with J. Mingo.

Speaker: Daniel Muñoz George

Title: Higher order moments and free cumulants of Complex Wigner Matrices.

Abstract: The higher order free cumulants, introduced by Collins, Mingo, Śniady and Speicher in 2006, is a concept that generalizes the free cumulants and permits to define the notion of higher order freeness. In this talk we will talk about the higher order free cumulants (and their corresponding higher order moments) of a complex Wigner matrix. We will talk about previous results around the first and second order case, the first one is part of the work done by Wigner while the second one was answered by Male, Mingo, Péché and Speicher in 2020. We will also talk about the third order case which we solved in co-authorship with James Mingo. If time permits, we will talk about higher order cases and ongoing work.

Speaker: Zhengye Zhou

Title: Dualities of Dynamic Stochastic Higher Spin Vertex Models through Drinfeld Twister.

Abstract: We present a novel algebraic approach for constructing Markov duality functions applicable to integrable dynamic models derived from solutions of the Yang-Baxter Equation. Our method utilizes the universal twister of $\mathcal{U}_q(\mathfrak{sl}_2)$, regarded as a quasi-triangular and quasi-*-Hopf algebra. We study the dynamic stochastic higher spin vertex models by employing this technique. As a result, we obtain a family of duality functions given by ${}_3\varphi_2$ functions, which can further be reduced to dual q-Krawtchouk polynomials.

Speaker: Ting Lu

Title and Abstract: TBD