Cornell Probability Summer School: Schedule of Short Talks

Wednesday, June 12th

3:10 – 3:30 PM: Ahmed Bou-Rabee, University of Chicago

Title: Scaling limit of the random Abelian sandpile

Abstract: The Abelian sandpile is a simple combinatorial model from statistical physics which produces striking fractal-like patterns. What aspects of the patterns persist under the introduction of randomness? I will hint at how tools from stochastic homogenization can be used to answer this question.

3:30–3:50 PM: John Rahmani, University of Southern California

Title: Convergence Rates for the Commuting Chain on the Heisenberg Group

Abstract: Suppose G is a finite group. The *commuting chain* on G is a Markov chain which moves from $x \in G$ to y by selecting y uniformly at random from the elements which commute with x. This is a reversible ergodic Markov chain with a stationary distribution that is uniform on the conjugacy classes of G. We bound the mixing time of this chain for the discrete Heisenberg group. We will also discuss connections the commuting chain has to other Markov chains.

3:50 – 4:10 PM: Yan Dai, University of Arizona

Title: Mirror Model and Critical Percolation

Abstract: We consider a random walk model on the two-dimensional square lattice, starts at the origin and only turns left and right at each step with equal probability. Going straight and revisiting a bound that has been visited before are not allowed. In this model, turning left or right at each step can be viewed as a walk deflecting by a left or right mirror on each vertex. Therefore, we refer this random walk model as a mirror model. Here, we study the nature of mirror model process on the square lattice and its scaling limit.

4:10–4:30 PM: Benjamin McKenna, New York University

Title: Large deviations for the largest eigenvalue of some deformed Wigner random matrices

Abstract: Noisy data is frequently modeled using the random matrix A + B, where A is a deterministic "signal" and B is a Wigner matrix, for example drawn from the Gaussian orthogonal ensemble. We will give a large deviation principle for the largest eigenvalue of this model. This generalizes and builds on the seminal result of Ben Arous-Dembo-Guionnet and a more recent advance by Guionnet-Husson.

1 Monday, June 17th

2:30–2:50 PM: Hengrui Luo, Ohio State University

Title: Asymptotic Detection of Strictly Lower Dimensional Topological Features

Abstract: We investigate the asymptotic behavior of the covering balls that can be used to construct Čech and other nerve complexes in topological data analysis (TDA). Our main result shows that, with an appropriate rate of shrinkage for these covering balls with respect to the sample size and a well-designed collection of covering families, we can detect lower dimensional zero density regions while guarding against false detection. This is closely related to the Minkowski dimension of the zero density regions. The main contribution is to provide a way to detect these lower dimensional zero density regions and to connect the result to the fields of high density regression and manifold learning. This opens a new way of looking at these lower dimensional features from statistical perspectives.

2:50–3:10 PM: Serrai Hernandez Torres, University of British Columbia

Title: Scaling limits of uniform spanning trees in three dimensions

Abstract: Wilson's algorithm allows efficient sampling of the uniform spanning tree (UST) by using loop-erased random walks. This connection gives a tractable method to study the UST. The strategy has been fruitful for scaling limits of the UST in the planar case and in high dimensions. However, three-dimensional scaling limits are far from understood. In this talk, I will discuss recent advances on this problem. I will show that rescaled subtrees of the UST in three dimensions converge to a limiting object.

This work is part of ongoing joint work with Omer Angel, David Croydon, and Daisuke Shiraishi.

3:10–3:30 PM: Mark Rychnovsky, Columbia University

Title: Large Deviations for sticky Brownian motion

Abstract: We consider n-point sticky Brownian motion: a family of n diffusions that evolve as independent Brownian motions when they do not intersect, and interact locally so that their coincidence times have positive Lebesgue measure with positive probability. We produce a large deviation principle with Tracy-Widom corrections, by viewing this well-studied model as the limit of an exactly solvable model in the KPZ universality class: the Beta random walk in random environment.

3:30–3:50 PM: Piet Lammers, University of Cambridge

Title: A generalisation of the honeycomb dimer model to higher dimensions

Abstract: The dimer model on the hexagonal lattice is a well-known integrable model due to the Kasteleyn theory. Each sample is simultaneously a perfect matching of a graph, a tiling with lozenges, and a height function. There is a natural generalisation of the dimer model on the hexagonal lattice to higher dimensions. In this talk I present this generalisation with its several bijections, and I deduce an interesting independence that is present in the "double" model: this is reminiscent of the double dimer model. The independence leads to a surprising identity for the covariance structure.