Monday May 14

9:30 Leo Petrov (Virginia)
Nonequilibrium particle systems in inhomogeneous space

I will discuss stochastic interacting particle systems in the KPZ universality class evolving in one-dimensional inhomogeneous space. The inhomogeneity means that the speed of a particle depends on its location. I will focus on integrable examples of such systems, i.e., for which certain observables can be written in exact form suitable for asymptotic analysis. Examples include a continuous-space version of TASEP (totally asymmetric simple exclusion process), and the pushTASEP (=long-range TASEP). For integrable systems, density limit shapes can be described in an explicit way. We obtain asymptotics of fluctuations, in particular, around slow bonds and infinite traffic lights.

11:00 Sumit Mukherjee (Columbia)
Monochromatic subgraphs of uniformly randomly colored graphs

We study the number of monochromatic copies $T(H, G_n)$ of a subgraph H in a randomly colored graph G_n, whose vertices are colored by c_n colors uniformly at random, where the number of colors c_n is so chosen that $\mathbb{E}T(H, G_n)$ converges to a constant λ. We will characterize the distribution of $T(H, G_n)$ completely if either H is a star graph, or G_n is a sequence of dense graphs converging in cut metric. For general graphs H we will show the following second moment phenomenon, that if $Var(T(H, G_n))$ converges to λ, then $T(H, G_n)$ converges in distribution to Poisson(λ). We will end with a discussion on the number of monochromatic edges of a particular color, which turns out to be surprisingly more difficult than the number of monochromatic edges of all colors together.
This is based on joint work with B.B. Bhattacharya, P. Diaconis, and S. Mukherjee.

1:30 Wei-Kuo Chen (Minnesota)
Phase transition in spiked random tensors

The problem of detecting a deformation in a symmetric Gaussian random tensor is concerned about whether there exists a statistical hypothesis test that can reliably distinguish a low-rank random spike from the noise. Recently Lesieur et al. (2017) proved that there exists a critical threshold so that when the signal-to-noise ratio exceeds this critical value, one can distinguish the spiked and unspiked tensors and weakly recover the spike via the minimal mean-square-error method. In this talk, we will show that in the case of the rank-one spike with Rademacher prior, this critical value strictly separates the distinguishability and indistinguishability of the two tensors under the total variation distance. Our approach is based on a subtle analysis of the high temperature behavior of the pure p-spin model, arising initially from the field of spin glasses. In particular, the signal-to-noise criticality is identified as the critical temperature, distinguishing the high and low temperature behavior, of the pure p-spin model.

2:30 Megan Bernstein (Georgia Tech)
Cutoff with window for the random to random shuffle

Cutoff is a remarkable property of many Markov chains in which they after number of steps abruptly transition in a smaller order window from an unmixed to a mixed distribution. Most random walks on the symmetric group, also known as card shuffles, are believed to mix with cutoff, but we are far from being able to prove this. Spectral techniques are one of the few known that are strong enough to give cutoff, but diagonalization is difficult for random walks on groups where the generators of the walk are not conjugation invariant. Using a diagonalization by Dieker and Saliola , I will show an upper bound that, together with a lower bound from Subag, gives that cutoff occurs for the random-to-random card shuffle on n cards occurs at $3/4n \log n - 1/4n \log\log n \pm cn$ steps (answering a 2001 conjecture of Diaconis). Includes joint work with Evita Nestoridi.

4:00 Elliot Paquette (Ohio State)
Random matrix point processes via stochastic processes

In 2007, Virág and Válko introduced the Brownian carousel, a dynamical system that describes the eigenvalues of a canonical class of random matrices. This dynamical system can be reduced to a diffusion, the stochastic sine equation, a beautiful probabilistic object requiring no random matrix theory to understand. Many features of the eigenvalues of the random matrix can then be studied via this stochastic process. We will sketch how this stochastic process is connected to eigenvalues of a random matrix and how problems relating to the eigenvalues of this process (such as a functional CLT or deviation estimates for the eigenvalue counting function) can be tackled using this stochastic process.
Based on joint works with Diane Holcomb, Gaultier Lambert, Bálint Vető, and Bálint Virág.

Tuesday, May 15

9:30 Laura Eslava (Georgia Tech)
The giant component in a degree bounded process

Graph processes $(G(i), i \geq 0)$ are usually defined as follows. Starting from the empty graph on n vertices, at each step i a random edge is added from a set of available edges. For the d-process, edges are chosen uniformly at random among all edges joining vertices of current degree at most $d-1$. The fact that, during the process, vertices become 'inactive' when reaching degree d makes the process depend heavily on its history. However, it shares several qualitative properties with the classical Erdos-Renyi graph process. For example, there exists a critical time t_c at which a giant component emerges, whp (that is, the largest component in $G(tn)$ goes from logarithmic to linear order).

In this talk we consider $d \geq 3$ fixed and describe the growth of the size of the giant component. In particular, we show that whp the largest component in $G((t_c + \epsilon)n)$ has asymptotic size cn, where $c \sim c_d\epsilon$ is a function of time ϵ as $\epsilon \to 0+$. The growth, linear in ϵ, is a new common qualitative feature shared with the Erdos-Renyi graph process and can be generalized to hypergraph processes with different max-allowed degree sequences. This is work in progress jointly with Lutz Warnke.

11:00 Hanbaek Lyu (Ohio State)
Double jump phase transition in soliton cellular automata

In 1990, Takahasi and Satsuma obtained a cellular automaton with soliton solutions called the box-ball system from the discrete Korteweg-de Vries equation through a limiting procedure. We consider this model with a random initial configuration. We first give multiple constructions of a Young diagram describing various statistics of the system in terms of familiar objects like birth-and-death chains and Galton-Watson forests. Using these ideas, we establish limit theorems showing that if the first n boxes are occupied independently with probability $p \in (0,1)$, then the number of solitons is of order n for all p, and the length of the longest soliton is of order $\log n$ for $p < 1/2$, order $\sqrt{n}$ for $p = 1/2$, and order n for $p > 1/2$. Additionally, we uncover a condensation phenomenon in the supercritical regime: For each fixed $j \geq 1$, the top j soliton lengths have the same order as the longest for $p \leq 1/2$, whereas all but the longest have order at most $\log n$ for $p > 1/2$. As an application, we obtain scaling limits for the lengths of the kth longest increasing and decreasing subsequences in a random stack-sortable permutation of length n in terms of random walks and Brownian excursions. This is a joint work with Lionel Levine and John Pike.