Tuesday May 31

10-10:45 Erik Bates (Wisconsin)

Title: Replica symmetry breaking in multi-species spin glasses

Abstract: There is a rich history of expressing the limiting free energy of mean-field spin glasses as a variational formula over probability measures on [0,1], where the measure represents the similarity (or "overlap") of two independently sampled spin configurations. At high temperatures, the formula's minimum is achieved at a measure which is a point mass, meaning sample configurations are asymptotically orthogonal up to a magnetic field correction. At low temperatures, though, a very different behavior emerges known as replica symmetry breaking (RSB). The deep wells in the energy landscape create more rigid structure, and the optimal overlap measure is no longer a point mass. The exact size of its support remains in many cases an open problem. Here we consider these themes when mean-field models are relaxed to so-called multi-species spin glasses. I will share some results from joint works with Leila Sloman and Youngtak Sohn.

11:15 – 12 Mariana Olvera-Cravioto (UNC)

Title: PageRank on directed preferential attachment graphs

Abstract: We study a family of evolving directed random graphs that includes as special cases the directed preferential model and the directed uniform attachment model. The directed preferential model is of particular interest since it is known to produce scale-free graphs with regularly varying in-degree distribution. We start by describing the local weak limits for our family of random graphs in terms of randomly stopped continuous-time branching processes, and then use these limits to establish the asymptotic behavior of the corresponding PageRank distribution. We show that the limiting PageRank distribution decays as a power-law in both the preferential and uniform attachment models, which is surprising for the uniform attachment model where the in-degree distribution has exponential tails. And even for the preferential attachment model, where the power-law hypothesis suggests that PageRank should follow a power-law, our result shows that the two tail indexes are different, with the PageRank distribution having a heavier tail than the in-degree distribution. This is joint work with Sayan Banerjee and Prabhanka Deka.

2-2:45 Konstantin Matetski (Columbia)

Polynuclear growth and the Toda lattice

Polynuclear growth (PNG) is one of the basic models in the KPZ universality class, which describes a one-dimensional crystal growth. For a special initial state, it can be recast in terms of a Poissonized version of the longest increasing subsequence problem for a uniformly random permutation. In the talk, we present a new formula for the multipoint distribution function of PNG with general initial states, which is given by a Freedom determinant of a kernel written in terms of hitting probabilities of a continuous-time simple random walk. In the appropriate

scaling, this formula converges to the one of the KPZ fixed point. We show how the distributions of the model can be expressed through solutions of a classical integrable system, the Toda lattice. This is a joint work with J. Quastel and D. Remenik.

3-3:45 Nick Cook (Duke)

Title: Structure and stability for sparse exponential random graphs

Abstract:
Exponential random graph models (ERGMs) are widely applied in the social sciences literature. They can be viewed as tilts of the Erdős–Rényi distribution by a Gibbs weight depending on counts of small subgraphs such as triangles. While they have some appealing features for doing statistics, sampling from them is challenging in many parameter regimes; in some other regimes, typical samples are indistinguishable from the Erdős–Rényi model, or may even "degenerate" to an almost-empty or almost-full graph. Following an idea of Lubetzky and Zhao for the dense case, we show how this degeneracy phenomenon is eliminated for sparse ERGMs by imposing growth conditions on the Hamiltonian. We further establish the typical macroscopic structure of sparse ERGMs in the “ferromagnetic” parameter regime, using recent advances on nonlinear large deviations theory for random hypergraphs (developed with Huy Tuan Pham). Based on joint work with Amir Dembo.

4:15-5 Juraj Foldes (Virginia) Law of iterated logarithm for stochastic differential equations and applications to hypoelliptic PDEs

Abstract:
We will discuss the almost sure behavior of solutions of stochastic differential equations (SDEs) as time goes to zero. Our main general result establishes a functional law of the iterated logarithm (LIL) that applies in the setting of SDEs with degenerate noise satisfying the weak Hõrmander condition. We will introduce large deviations to provide some details of proofs. Furthermore, we apply the stochastic results to the problem of identifying regular points for hypoelliptic diffusions and obtain criteria for well posedness of degenerate equations.

This is a joint work with David Herzog (Iowa State University) and Marco Carfagnini (University of Connecticut)

Wednesday June 1

10-10:45 Shankar Bhamidi (UNC)

Title: Weak and strong disorder models for random graphs: FPP, MST, OMG

Abstract: We will survey known results, proof techniques and conjectures for understanding various models of diffusion on random graph models, describing motivations and conjectures since the early 2000s and progress on these conjectures through their connections to continuous time branching processes and critical random graphs.

11:15-12 Evita Nestoridi (Princeton)

Title: Limit Profiles of Reversible Markov chains

Abstract: It all began with card shuffling. Diaconis and Shahshahani studied the random transpositions shuffle; pick two cards uniformly at random and swap them. They introduced a Fourier analysis technique to prove that it takes $1/2 n \log n$ steps to shuffle a deck of n cards this way. Recently, Teyssier extended this technique to study the exact shape of the total variation distance of the transition matrix at the cutoff time from the stationary measure, giving rise to the notion of a limit profile. In this talk, I am planning to discuss a joint work with Olesker-Taylor, which extends the above technique from conjugacy invariant random walks to general, reversible Markov chains. I will also present a new technique that allows to study the limit profile of star transpositions, which turns out to have the same limit profile as random transpositions.