Tim Austin

Scenery entropy and the asymptotic geometry of marginals

Simple random walks in random sceneries can be turned into examples of dynamical systems with interesting ergodic theoretic properties. In particular, they provide some of the few known 'natural' systems which have the 'K property' but are not measure theoretically isomorphic to Bernoulli shifts.

The construction gives a large family of these examples, and it is natural to ask whether they are all really distinct up to isomorphism. After introducing these examples and their role in ergodic theory, this talk will sketch a new invariant for probability-preserving systems which can be used to recover the entropy rate of the scenery as an isomorphism-invariant of these systems. This implies that they form continuum-many distinct examples. In essence, this new invariant of systems is defined by viewing the sequence of finite-dimensional marginals of a stationary stochastic process as a sequence of probability measures on the appropriate Hamming metric spaces, and then considering asymptotic features of the metric geometry of those spaces.

Fabrice Baudoin

Hypocoercive diffusions

In this talk, we will present a new method to study the convergence to equilibrium of hypocoercive diffusions. The method is based on local computations and parallels the Bakry-Emery approach to hypercontractivity.

Tamara Broderick

Feature allocations, probability functions, and paintboxes

The problem of inferring a clustering of a data set has been the subject of much research in Bayesian analysis, and there currently exists a solid mathematical foundation for Bayesian approaches to clustering. In particular, the class of probability distributions over partitions of a data set has been characterized in a number of ways, including via exchangeable partition probability functions (EPPFs) and the Kingman paintbox. Here, we develop a generalization of the clustering problem, called feature allocation, where we allow each data point to belong to an arbitrary, non-negative integer number of groups, now called features or topics. We define and study an "exchangeable feature probability function" (EFPF)—analogous to the EPPF in the clustering setting—for certain types of feature models. Moreover, we introduce a "feature paintbox" characterization—analogous to the Kingman paintbox for clustering—of the class of exchangeable feature models. We use this feature paintbox construction to provide a further characterization of the subclass of feature allocations that have EFPF representations.

Eyal Lubetsky

Random walks on Erdös-Rényi random graphs

We study random walks on the giant component of the Erdös-Rényi random graph $G(n, p)$ where $p = \lambda/n$ for $\lambda > 1$ fixed. The mixing time from a worst starting point was shown by Fountoulakis and Reed, and independently by Benjamini, Kozma and Wormald, to have order $\log^2 n$. We prove that starting from a uniform vertex (equivalently, from a fixed vertex conditioned to belong to the giant) both accelerates mixing to $O(\log n)$ and concentrates it (the cutoff phenomenon occurs). Joint work with N. Berestycki, Y. Peres and A. Sly.

Elizabeth Meckes

Concentration of spectral measures of some random matrices

I will discuss a circle of ideas leading to rates of convergence of the empirical spectral measures of many random matrix ensembles. In particular, I will focus on results for Wigner matrices, powers of random matrices from the compact classical matrix groups, the complex Ginibre ensemble, and a random matrix model for Hamiltonians of quantum spin chains. The common threads around which approaches to the different ensembles crystallize are some remarkable properties of determinantal point processes, the concentration of measure phenomenon, and some elements of matrix analysis.

Brian Rider

Matrix Dufresne identities

The classical Dufresne identity relates the distribution of the infinite time integral of geometric Brownian motion to an inverse gamma law. This fact, along with various extensions, lurks behind the scenes in the geometric lifting of Pitmans $2M - X$ formula due to Matsumoto-Yor, as well as in OConnells recent work on the quantum Toda lattice. I will describe what can be said thus far in a matrix setting, when the Wishart distribution replaces the gamma, and Brownian motion on the general linear group steps in for the one-dimensional geometric Brownian motion. This is joint work with B. Valkó (University of Wisconsin).

Nike Sun

The exact k-SAT threshold for large k

We establish the random k-SAT threshold conjecture for all k exceeding an absolute constant k_0. That is, there is a single critical value $\alpha_*(k)$ such that a random k-SAT formula at clause-to-variable ratio α is with high probability satisfiable for $\alpha < \alpha_*(k)$, and unsatisfiable for $\alpha > \alpha_*(k)$. The threshold $\alpha_*(k)$ matches the explicit prediction derived by statistical physicists on the basis of the one-step replica symmetry breaking (1RSB) heuristic. In the talk I will describe the main obstacles in computing the threshold, and explain how they are overcome in our proof. Joint work with Jian Ding and Allan Sly.