UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Analysis/Probability

01-01-2013 to 06-30-2013

Wednesday, January 16, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Horng-Tzer Yau (Harvard University) *Dyson's Brownian and De Georgi-Nash-Moser theory of parabolic regularity. (Ziwet Lecture II)* -- 1360 East Hall

Wednesday, February 06, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Alexander Powell (Vanderbilt University) *Consistent reconstruction and some geometry of random polytopes* -- 4096 East Hall

Wednesday, February 27, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Artem Zvavitch (Kent State University) *Some remarks on Mahler's conjecture for convex bodies* -- 4096 East Hall

Wednesday, March 27, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Mykhaylo Shkolnikov (Berkeley) *Large deviations for diffusions interacting through their ranks* -- 4096 East Hall

Wednesday, April 03, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Tamara Grava (SISSA (Italy)) *Hamiltonian perturbation of elliptic and hyperbolic systems: universality of critical behaviour* -- 4096 East Hall

Monday, April 08, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Antti Knowles (Courant Institute) *Quantum diffusion and delocalization for random band matrices [Combined with Differential Equations Seminar]* -- 1360 East Hall

Wednesday, April 10, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Yuliy Baryshnikov (University of Illinois, Urbana-Champaign) *Hadwiger's theorem for functions* -- 4096 East Hall

Wednesday, April 17, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Pavel Bleher (IUPUI) *Normal matrix model with a cubic potential. The Riemann-Hilbert approach* -- 4096 East Hall

Monday, April 22, 2013	
4:00pm-5:00pm	**Analysis/Probability** -- Dong Wang (National University of Singapore) *Non-intersecting Brownian motions on the circle and discrete Gaussian orthogonal polynomials* -- 3866 EH (Special date!)

Wednesday, April 24, 2013	
4:10pm-5:00pm	**Analysis/Probability** -- Hoi Nguyen (Yale University) *Random matrix: Law of the determinant* -- 4096 East Hall

Abstracts

Analysis/Probability
Wednesday, January 16, 2013, 4:10pm-5:00pm
1360 East Hall
Horng-Tzer Yau (Harvard University)
Dyson's Brownian and De Georgi-Nash-Moser theory of parabolic regularity. (Ziwet Lecture II)

Eugene Wigner's revolutionary vision predicted that the energy levels of large complex quantum systems exhibit a universal behavior: the statistics of energy gaps depend only on the basic symmetry type of the model. These universal statistics show strong correlations in the form of level repulsion and they represent a new paradigm of point processes that are characteristically different from the Poisson statistics of independent points.

Simplified models of Wigner's thesis have recently become mathematically accessible. For mean field models represented by large random matrices with independent entries, the celebrated Wigner-Dyson-Gaudin-Mehta (WDGM) conjecture asserts that the local eigenvalue statistics are universal. For invariant matrix models, the eigenvalue distributions are given by a log-gas with potential V and inverse temperature $\beta = 1, 2, 4$. For $\beta \not\in \{1, 2, 4\}$, there is no natural random matrix ensemble behind this model, but the analogue of the WDGM conjecture asserts that the local statistics are independent of V.

In these lectures, we review the recent solution to these conjectures for both invariant and non-invariant ensembles. We will discuss two different notions of universality in the sense of (i) local correlation functions and (ii) gap distributions.

We will demonstrate that the local ergodicity of the Dyson Brownian motion is the intrinsic mechanism behind the universality. Furthermore, we will show that the universality of gap distribution requires to prove a Holder regularity of a discrete parabolic equation with random coefficients. For this purpose, we incorporate the ideas of parabolic regularity via a De Giorgi-Nash-Moser approach.

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Analysis/Probability
Wednesday, February 06, 2013, 4:10pm-5:00pm
4096 East Hall
Alexander Powell (Vanderbilt University)
Consistent reconstruction and some geometry of random polytopes

Consistent reconstruction is a linear programming approach for estimation problems involving bounded noise (for example, the problem of reconstructing a signal from a set of quantized linear measurements). We prove new mean squared error bounds for consistent reconstruction in the setting of random frames and under the uniform quantization noise model. In particular, we prove that the mean squared error for consistent reconstruction is of the optimal order C/N^2 where N is the number of measurements, and we prove bounds on the associated dimension dependent constant C. For comparison, in the case of unit-norm tight frames with linear reconstruction (instead of consistent reconstruction) the mean squared error only satisfies a weaker bound of order 1/N. Our main results involve an analysis of random polytopes and of associated coverage processes on the sphere. This is joint work with Tyler Whitehouse.

Analysis/Probability
Wednesday, February 27, 2013, 4:10pm-5:00pm
4096 East Hall
Artem Zvavitch (Kent State University)
Some remarks on Mahler's conjecture for convex bodies

The volume product (Mahler volume) of origin symmetric convex body K is just a product of volume of K and its its dual/polar body. It turned out to be quite a useful object in Functional Analysis and Convex Geometry. Santalo inequality tell us that the volume product takes its maximal value at the Euclidean Ball. Mahler conjectured that the volume product is minimized by a cube. Despite many important partial results, the conjecture is still open in dimensions 3 and higher. In this talk we will discuss some recent progress and ideas concerning this conjecture.

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Analysis/Probability
Wednesday, March 27, 2013, 4:10pm-5:00pm
4096 East Hall
Mykhaylo Shkolnikov (Berkeley)
Large deviations for diffusions interacting through their ranks

Systems of diffusion processes (particles) with rank-based interactions have been studied heavily due to their importance in stochastic portfolio theory and the intriguing relations with particle systems appearing in statistical physics. We will study the behavior of this particle system as the number of particles gets large. By obtaining a large deviations principle, we will show that the limiting dynamics can be described by a porous medium equation with convection, whereas paths of finite rate are given by solutions of appropriately tilted versions of this equation. This is the first instance of a large deviations principle for diffusions interacting both through the drift and the diffusion coefficients with the diffusion coefficients not being globally Lipschitz (and not even continuous). Based on joint work with A. Dembo, S.R.S. Varadhan and O. Zeitouni.

Analysis/Probability
Wednesday, April 03, 2013, 4:10pm-5:00pm
4096 East Hall
Tamara Grava (SISSA (Italy))
Hamiltonian perturbation of elliptic and hyperbolic systems: universality of critical behaviour

We consider the solution of Hamiltonian perturbations of elliptic and hyperbolic systems. We study the behaviour of solutions of the perturbed system in the neighbourhood of critical points for the solution of the elliptic or hyperbolic systems. We show that such behaviour does not depend either on the equation or on the initial data and it is described by solutions of ODEs of the Painleve' family.

Analysis/Probability
Monday, April 08, 2013, 4:10pm-5:00pm
1360 East Hall
Antti Knowles (Courant Institute)
Quantum diffusion and delocalization for random band matrices [Combined with Differential Equations Seminar]

I give a summary of recent progress in establishing the diffusion approximation for random band matrices. We obtain a rigorous derivation of the diffusion profile in the regime W > N^{4/5}, where W is the band width and N the dimension of the matrix. As a corollary, we prove complete delocalization of the eigenvectors. Our proof is based on a new self-consistent equation for the Green function. Joint work with L. Erdos, H.T. Yau, and J. Yin.

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Analysis/Probability
Wednesday, April 10, 2013, 4:10pm-5:00pm
4096 East Hall
Yuliy Baryshnikov (University of Illinois, Urbana-Champaign)
Hadwiger's theorem for functions

Hadwiger's theorem states that continuous valuations on convex sets in Euclidean
space that are invariant with respect to Euclidean motions are spanned by Minkowski functionals.

Valuations on functions - functionals satisfying v(f)+v(g)=v(max(f,g))+v(min(f,g)) - are natural generalizations of valuations on sets.

I will explain what are the reasonable classes of functions to serve as the domain of a valuation, and what notions of continuity to deploy to obtain a generalization of Hadwiger's theorem to functions.

Analysis/Probability
Wednesday, April 17, 2013, 4:10pm-5:00pm
4096 East Hall
Pavel Bleher (IUPUI)
Normal matrix model with a cubic potential. The Riemann-Hilbert approach

We consider the normal matrix model with a cubic potential. We develop the Riemann-Hilbert approach to orthogonal polynomials associated with this model, and we obtain their asymptotic behavior on the complex plane as the degree n of the polynomial goes to infinity.

Analysis/Probability
Monday, April 22, 2013, 4:00pm-5:00pm
3866 EH (Special date!)
Dong Wang (National University of Singapore)
Non-intersecting Brownian motions on the circle and discrete Gaussian orthogonal polynomials

I will discuss the relation between the non-intersecting Brownian motions on a circle, where n particles start from a common point and end at a common point after a time, and the discrete Gaussian orthogonal polynomials, i.e., discrete orthogonal polynomials with respect to the weight exp(-x^2). I will show that as the number of particles goes to infinity, the asymptotics of the discrete Gaussian orthogonal polynomials give rise to the asymptotic behaviours of the non-intersecting Brownian motions, such as the limiting Sine process, Airy process etc. This is joint work with Karl Liechty.

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Analysis/Probability
Wednesday, April 24, 2013, 4:10pm-5:00pm
4096 East Hall
Hoi Nguyen (Yale University)
Random matrix: Law of the determinant

Let M_n be a random matrix with iid entries with mean zero and variance one.
The determinant det M_n is an important parameter and has been studied for a long time.
In this talk, we focus on the limiting distribution and prove that the logarithm of |det M_n| satisfies a central limit theorem. For simplicity, we will mainly consider the case when the entries are Bernoulli random variables; the proof extends easily to the general case.