**Patrik Ferrari**

Anisotropic (2+1)-d growth and Gaussian limits of q-Whittaker processes

We consider a discrete model for anisotropic (2+1)-dimensional growth of an interface height function. Owing to a connection with q-Whittaker functions, this system enjoys many explicit integral formulas. By considering a certain limit, we obtain a Gaussian process and determine its space-time covariance. We see the phenomenon of slow-decorrelation along characteristic directions, but also the convergence in space-time to the (2+1)-dimensional additive stochastic heat equation (or Edwards Wilkinson equation) along characteristic directions. For the analysis of the covariance we employ some random matrix methods.

**Sunil Chhita**

A (2+1)-dimensional Anisotropic KPZ growth model with a rigid phase.

Stochastic growth processes in dimension (2+1) were conjectured by D. Wolf, on the basis of renormalization-group arguments, to fall into two distinct universality classes known as the isotropic KPZ class and the anisotropic KPZ class (AKPZ). The former is characterized by strictly positive growth and roughness exponents, while in the AKPZ class, fluctuations are logarithmic in time and space. These classes are determined by the sign of the determinant of the Hessian of the speed of growth.
It is natural to ask (a) if one can exhibit interesting growth models with "rigid" stationary states, i.e., with O(1) fluctuations (instead of logarithmically or power-like growing, as in Wolf's picture) and (b) what new phenomena arise when the speed of growth is not smooth, so that its Hessian is not defined. These two questions are actually related and in this talk, we provide an answer to both, in a specific framework. This is joint work with Fabio Toninelli (CNRS and Lyon 1).

**Ofer Zeitouni**

The characteristic polynomial of random permutations.

## Gernot Akemann

### From the circular law to Gauss and beyond: high temperature crossover for 2D Coulomb gases

We consider $N$ particles in the plane with a Gaussian or higher order confining potential that are subject to the Coulomb interaction in two dimensions at inverse temperature $\beta$. At large temperature, when $\beta=2c/N$ for some fixed constant $c>0$, we observe in the large-$N$ limit a crossover from the circular law or its generalisation to the density of non-interacting particles at $\beta=0$. Using different methods we derive a partial differential equation of generalised Liouville type for the crossover density. It can be continued to negative values $-2<c<0$, representing a weakly attractive Coulomb gas. This is joint work with Sungsoo Byun and generalises previous findings of Allez et al. in one dimension.

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## Mykhaylo Shkolnikov

### Edge of spiked beta ensembles, stochastic Airy semigroups and reflected Brownian motions

Abstract: We access the edge of Gaussian beta ensembles with one spike by analyzing high powers of the associated tridiagonal matrix models. In the classical cases beta=1, 2, 4, this corresponds to studying the fluctuations of the largest eigenvalues of additive rank one perturbations of the GOE/GUE/GSE random matrices. In the infinite-dimensional limit, we arrive at a one-parameter family of random Feynman-Kac type semigroups, which features the stochastic Airy semigroup of Gorin and Shkolnikov as an extreme case. Our analysis also provides Feynman-Kac formulas for the spiked stochastic Airy operators, introduced by Bloemendal and Virag. The Feynman-Kac formulas involve functionals of a reflected Brownian motion and its local times, thus, allowing to study the limiting operators by tools of stochastic analysis. We derive a first result in this direction by obtaining a new distributional identity for a reflected Brownian bridge conditioned on its local time at zero.

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## Diane Holcomb

### On the centered maximum and linear statistics of the Sine beta process

There has been a great deal or recent work on the asypmtotics of the maximum of characteristic polynomials or random matrices. Other recent work studies the analogous result for log-correlated Gaussian fields. Here we will discuss a maximum result for the centered counting function of the Sine beta process. We will also present a new result on the linear statistics of the Sine beta process which makes use of related techniques. The Sine beta process arises as the local limit in the bulk of a beta-ensemble, and was originally described as the limit of a generalization of the Gaussian Unitary Ensemble by Valko and Virag with an equivalent process identified as a limit of the circular beta ensembles by Killip and Stoiciu. A brief introduction to the Sine process as well as some ideas from the proof of the maximum and linear statistics result will be covered. This talk includes joint work with Elliot Paquette, Gaultier Lambert, Balint Virag, and Balint Veto.

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## Christophe Charlier

### Periodic weights for lozenge tilings of hexagons

The model of lozenge tilings of a hexagon is equivalent to a model of non-intersecting paths on a discrete lattice, i.e. the positions (or heights) of these paths, as well as their domains (times), are discrete. The discrete lattice can be viewed as a graph where we assign a weight on the arrows joining the vertices. In the simplest case, the weight function is periodic of period 1 in both space and time directions. We review some known results in this case. Then, we introduce some larger periodicities in the weight. We will focus on the case when the weight is periodic of period 2 in both space and time directions. In the second part of the talk, based on a recent preprint by M. Duits and A.B.J. Kuijlaars, we introduce matrix valued orthogonal polynomials of size 2x2 related to a 4x4 Riemann-Hilbert problem (RHP), and we show how the correlation kernel can be expressed in terms of this RHP. Some steps in the Deift/Zhou steepest descent does not appear in usual steepest descent for 2x2 RHPs. We will finish by showing some pictures when we allow higher periodicities in the weight. This talk is based on a work in progress with M. Duits, A.B.J. Kuijlaars and J. Lenells.

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## Yiting Li

### On random Schnyder Wood

In this talk I will introduce the model of random Schnyder wood and its scaling limit. A Schnyder wood is a plannar map and it determines a triple of lattice walks. For a uniformly distributed Schnyder wood of size N, we prove that the triple of lattice walks will converge to a triple of Brownian excursions as N goes to infinity. The limiting triple of Brownian excursions corresponds to a Liouville quantum gravity with parameter 1 decorated by a triple of SLE_{16} curves. If time permits I will also talk about some applications of Schnyder wood in computational geometry and physics. This is a joint work with Xin Sun and Samuel Watson.

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**Arno Kuijlaars**

The two-periodic Aztec diamond and matrix valued orthogonal polynomials

Uniform domino tilings of the Aztec diamond have the arctic circle phenomenon: near the corners the pattern is fixed and only one type of domino appears, while in the middle there is disorder and all types appear. The transition is sharp with fluctuations described by the Tracy-Widom distributions.

In the two-periodic Aztec diamond the dominos have a two-periodic weighting and this creates a new phase in the large size limit, where correlations decay at an exponential rate. In recent work with Maurice Duits (KTH Stockholm) we analyze this model with the help of matrix valued orthogonal polynomials. We obtain a remarkably simple double contour integral formula for the correlation kernel that we can analyze in the limit to recover the three phases of the model and the fluctuations near the transition curves.

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**Tom Claeys**

Critical behavior for Gaussian perturbations of Hermitian matrices

It is well known that eigenvalues of Gaussian perturbations of large deterministic Hermitian matrices typically exhibit universal sine kernel behavior, even if the size of the perturbations is small. However, for specific choices of Hermitian matrices, the situation can be quite different. The sensitivity to Gaussian perturbations on microscopic scales depends on the limit distribution and on the rigidity of the eigenvalues of the deterministic matrix. We investigate the case of Hermitian matrices whose limiting eigenvalue density vanishes at interior points of their support. Depending on the order of vanishing of the eigenvalue distribution, different types of behavior can occur. We focus on critical sizes of perturbations, and remarkably observe that the Airy ensemble appears near certain special interior points of the spectrum. The talk will be based on ongoing work with Thorsten Neuschel and Martin Venker.

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**Rostyslav Kozhan**

Relative strong Szego Theorem and a CLT for unitary RMT ensembles

We prove a relative analogue of the strong Szego Theorem on asymptotics of Toeplitz determinants. This can also viewed as a central limit theorem for the linear statistics of point charges on the unit circle whose joint distribution is given by $$ \prod_{j<k} |z_j - z_k|^2 \prod_{j=1}^n d\mu(z_j). $$ We focus on the case when the essential support of $\mu$ is a single arc of the unit circle and we handle cases when $\mu$ is allowed to have a singular component within or outside of the arc. This is a joint work with M. Duits.

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## Elliot Paquette

### Distributional approximation of the characteristic polynomial of a Gaussian beta-ensemble

The characteristic polynomial of the Gaussian beta--ensemble can be represented, via its tridiagonal model, as an entry in a product of independent random two--by--two matrices. For a point z in the complex plane, at which the transfer matrix is to be evaluated, this product of transfer matrices splits into three independent factors, each of which can be understood as a different dynamical system in the complex plane. Using this, we show that the characteristic polynomial is always represented as product of at most three terms, two of which are exponentials of Gaussian fields and one of which is the stochastic Airy function, up to vanishing multiplicative errors. Sufficiently far into the complex plane, it can be represented using only one. At a point z at the spectral edge, there are two. At a point z in the bulk of the spectrum, all three are necessary to describe the characteristic polynomial. Joint work with Diane Holcomb and Gaultier Lambert.

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## Christian Webb

### Title: Multiplicative chaos in random matrix theory and related fields

I will give an overview talk about how so-called multiplicative chaos arises and can be used in various models of random matrix theory. I will also discuss connections to related models in number theory and statistical mechanics.

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## Alexey Bufetov

### Fluctuations of random tilings of domains with holes.

A Kenyon-Okounkov conjecture states that the fluctuations of the height function in random tiling models should converge to a Gaussian Free Field in suitable coordinates. We will discuss some particular cases where this convergence was proven, including uniformly random tilings of a class of domains with holes.

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## Yan Fyodorov

### Freezing Transition in Decaying Burgers Turbulence and Random Matrix Dualities

We study one-dimensional decaying Burgers turbulence with the covariance of initial profile of Gaussian-distributed velocities decaying as inverse square of the distance. Combining the heuristic replica trick of statistical mechanics with insights from the random matrix theory we reveal a freezing phase transition with decreasing viscosity. In the low-viscosity phase the one-point probability density of velocities becomes non-Gaussian reflecting a spontaneous one step replica symmetry breaking in the associated statistical mechanics problem. We obtain the low orders velocity cumulants analytically which favourably agree with numerical simulation. The presentation will be based on a joint work with P. Le Doussal and A. Rosso.

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## Nick Simm

### Moments of random matrices and Wilson polynomials

I will discuss a new perspective on moments of n x n random matrices $X_{n}$. Specifically, we consider moments $E\,Tr(X_{n}^{-s})$ for a complex variable s and completely describe the analytic structure. For $\beta=2$, several new features are revealed, including a functional equation, zeros on a vertical line ("Riemann hypothesis") and orthogonality relations. These are a consequence of a remarkable polynomial property of the moments, related to orthogonal polynomials of Askey-Wilson type (e.g. Meixner, Hahn or Wilson). I will discuss some of the implications of these results, including the partial proof of an integrality conjecture for negative moments of Wishart matrices. When $\beta=1$ or 4, we obtain a duality relation implying that these properties persist for suitable combinations of orthogonal and symplectic moments. This is joint work with Fabio Deelan Cunden (UCD), Francesco Mezzadri (Bristol) and Neil O'Connell (UCD).

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## Joseph Najnudel

### On the maximum of the CBE field

We investigate the extremal values of the characteristic polynomial of a random unitary matrix whose spectrum is distributed according to the Circular Beta Ensemble. With Reda Chhaibi and Thomas Madaule, we show that the maximum on the unit circle of the logarithm of this characteristic polynomial is equal to sqrt(2/beta) (log n - (3/4) log log n) + O(1), where n is the dimension and O(1) denotes a tight family of random variables. Our result partially solves a conjecture by Fyodorov, Hiary and Keating.

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## Benjamin Fahs

### The probability of 2 gaps in the bulk of the spectrum of random matrices

We consider the probability of having no eigenvalues in two disjoint intervals (two gaps) in the bulk scaling limit of eigenvalues of random matrices, and the asymptotics as the size of the gaps grow. We consider several scaling limits, including the double-scaling limit when the gaps come together to form a single interval, and also when the gaps are pulled apart. The talk is based on joint work with I. Krasovsky.

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## Igor Krasovski

### Gap probability problems for the sine process.

We consider the behavior of the particles in the bulk of the spectrum of random matrices. Namely, we discuss the probability of a gap in the spectrum when the particles of the sine process are subject to thinning. It is given by a Fredholm determinant for the sine kernel with a constant prefactor. We discuss the asymptotics for the large gap for the interesting transition as the prefactor tends to 1, which corresponds to the removal of the thinning. We also discuss the probability of 2 large gaps for the sine process and how the transition from one to two large gaps occurs. The talk is based on joint works with T. Bothner, P. Deift, B. Fahs, and A. Its.

## Tatyana Shcherbina

### Local eigenvalue statistics of random band matrices

Random band matrices (RBM) are natural intermediate models to study eigenvalue statistics and quantum propagation in disordered systems, since they interpolate between mean-field type Wigner matrices and random Schrodinger operators. In particular, RBM can be used to model the Anderson metal-insulator phase transition (crossover) even in 1d. In this talk we will discuss some recent progress in application of the supersymmetric method (SUSY) and transfer matrix approach to the analysis of local spectral characteristics of some specific types of RBM.

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## Bufetov Alexander

### Patterson-Sullivan measures for point processes and the reconstruction of harmonic functions(joint work with Yanqi Qiu)

The Patterson-Sullivan construction is proved almost surely to recover every Hardy function from its values on the zero set of a Gaussian analytic function on the disk. The argument relies on the conformal invariance of the point process and the slow growth of variance for linear statistics. Patterson-Sullivan reconstruction of Hardy functions is obtained in real and complex hyperbolic spaces of arbitrary dimension, while reconstruction of continuous functions is established in general CAT(-1) spaces. Based on joint work with Yanqi Qiu, https://arxiv.org/abs/1806.02306

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## Berggren Tomas

### Double integral formulas for non-intersecting paths with periodic transition matrices

Recently, important progress has been made on the asymptotic behavior of ensembles of non-intersecting paths with periodic transition matrices, including the periodic weightings of domino tilings of the Aztec diamond and periodic weightings of lozenge tilings of a hexagon. In a general setting Duits and Kuijlaars recently proved a double integral formula for the kernel of the point process in terms of matrix valued orthogonal polynomials. I will discuss a simplification in the case of certain particle systems with infinite levels. In those cases, the integrand in the double integral formula can be expressed in terms of a matrix Wiener-Hopf factorization for an associated weight function. As illustrating examples I will give a double integral formula for the $ 1 $-periodic, and the $ 2 $-periodic weighting of domino tilings of the Aztec diamond.