# Six Vertex model dimers, shapes, and all that workshop Talk Schedule

# Events for: Monday, March 14th - Friday, March 18th

# Monday, March 14th

9:00am Pavel Bleher: Welcome Address - SCGP 102

#### 9:10am Pierre Van Moerbeke - SCGP 102

Title: Edge-tacnode phenomena in random tilings

**Abstract:** Lozenge tilings of non-convex polygons will be discussed in this talk. Letting the polygons grow to infinity in an appropriate way yields new statistical fluctuations in regions of non-convexity. These fluctuations will be governed by a determinantal process given by the so-called edge-tacnode kernel.

#### 10:00am Coffee Break - SCGP Lobby

#### 10:30am Omar Foda - SCGP 102

Title: A one-point function in 4D N=4 supersymmetric Yang-Mills using six-vertex model methods

**Abstract:** Based on work with K Zarembo, I wish to compute the one-point function of a class of composite operators in 4D N=4 supersymmetric Yang-Mills theory, in the presence of a wall. The basic idea is to map this one-point function to a partition function of six-vertex model configurations on a finite lattice with domain-wall boundary conditions in the presence of a partially-reflecting boundary. The result is a modified version of Tsuchiya's determinant. If time allows, I wish to show that this determinant is a tau function of a reduction of KP.

#### 11:20am Luigi Cantini - SCGP 102

Title: Asymmetric simple exclusion process with open boundaries and Koornwinder polynomials

**Abstract:** In this talk I shall present a new approach to the study of the steady state of the Asymmetric Simple Exclusion Process (ASEP) on a finite strip with two particle reservoirs at the two ends. Our approach consists in exploiting the integrability of the model in order to introduce a set of "extra" parameters, usually called spectral parameters. The (unnormalized) probabilities of the particle configurations get promoted to Laurent polynomials in the spectral parameters and are constructed in terms of non-symmetric Koornwinder polynomials. In particular we show that the normalization coincides with a symmetric Macdonald-Koornwinder polynomial. As an outcome we compute the steady current and the average density of first particles.

# 12:10pm Lunch - SCGP Café

## 2:00pm Alexander Stolin - SCGP 102

Title: Classification of quantum groups of Kulish-Reshetikhin type

## 2:50pm Giuliano Ribeiro - SCGP 102

Title: Influence of boundary conditions on bulk properties of six-vertex model

# 3:40pm Coffee Break - SCGP Lobby

#### 4:10pm Carlo Meneghelli - SCGP 102

Title: Prefundamental representations and Q-operators

# **Tuesday, March 15th**

# 9:00am Ivan Corwin - SCGP 102

Title: Stochastic higher-spin vertex models and their self-duality.

**Abstract:** We introduce the higher-spin vertex models (which will be discussed in talks of Borodin and Petrov as well) and show how they can be studied using Markov dualities along with there Bethe ansatz diagonalization. This class of models covers essentially all known integrable KPZ class models and unifies the duality approach to their study. This is based on a cycle of joint works with Borodin, Petrov and Sasamoto.

#### 10:20am Hjalmar Rosengren - SCGP 102

Title: Elliptic pfaffians and solvable lattice models

**Abstract:** The Izergin-Korepin formula expresses the partition function of the domain wall sixvertex model as a simple determinant. It has proved very useful for investigating relation to combinatorics as well as thermodynamic properties of various physical quantities. In spite of recent progress, there is no very pleasing extension of the Izergin-Korepin formula to elliptic lattice models. In our talk, we will discuss expressions involving pfaffians rather than determinants. We introduce twelve pfaffians with elliptic function entries, which are all related by modular transformations. The domain wall partition function for the 8VSOS model (at the combinatorial line) is expressed as a linear combination of two such pfaffians. Similar expressions can be given for certain eigenvalues of Q-operators on inhomogeneous XYZ spin chains. In the homogeneous limit, we obtain new Hankel determinant formulas for the corresponding quantities.

#### 11:10am Jonathan Novak - SCGP 102

Title: Equilibrium measures and limit shapes revisited.

#### 12:00pm Lunch - SCGP Café

#### 1:00pm SCGP Weekly Talk - SCGP 102

Speaker: Alexei Borodin, MIT

Title: The six vertex model and randomly growing interfaces in (1+1)dimensions

**Abstract:** The goal of the talk is to explain how the six vertex model gives rise to models of (1+1)d random growth in the KPZ universality class, and how the Yang-Baxter integrability of the former leads to solvability of the latter.

#### 2:10pm Filippo Colomo - SCGP 102

Title: Arctic curve of the six-vertex model in an L-shaped domain

#### 3:00pm Guilherme Silva - SCGP 102

Title: The mother body phase transition in the normal matrix model

#### 3:40pm Coffee Break - SCGP Lobby

#### 4:10pm Robert Buckingham - SCGP 102

Title: Large-degree asymptotics of rational Painleve functions

# Wednesday, March 16th

#### 9:00am Robert Weston - SCGP 102

Title: Conserved currents and discrete holomorphicity in vertex and face models

#### 9:50am Coffee Break - SCGP Lobby

#### 10:20am Paul Zinn-Justin - SCGP 102

Title: TBA

#### 11:10am Tony Dorlas - SCGP 1202

Title: Rigorous analysis of the 6-vertex model

**Abstract:** I shall examine the Bethe Ansatz equations for the six-vertex model rigorously and establish in certain regions that in the thermodynamic limit the solution is given by the known formulas. In particular this involves establishing the uniqueness of solutions.

#### 12:00pm Lunch - SCGP Café

#### 2:00pm Benjamin Young - SCGP 102

Title: How to invert the Kasteleyn matrix of the 2-periodic Aztec diamond

#### 2:50pm Sunil Chhita - SCGP 102

Title: At the `liquid-gas' boundary of the two-periodic Aztec diamond

**Abstract:** The two-periodic Aztec diamond is a random domino tiling model whose limit shape contains three macroscopic regions called `solid', `liquid' and `gas'. These regions are determined by the correlations between dominoes and are not related to physical states of matter. Continuing from Benjamin Young's talk, we present some asymptotic results for the two-periodic Aztec diamond, including a partial understanding of the behavior at the so-called `liquid-gas' boundary. The talk is based on projects with Vincent Beffara, Kurt Johansson and Benjamin Young.

#### 3:40pm Coffee Break - SCGP Lobby

#### 4:10pm Manuela Girotti - SCGP 102

**Title:** Smallest singular value distribution and large gap asymptotics for products of random matrices

**Abstract:** "We study the distribution of the smallest singular eigenvalues for the finite product of certain random matrix ensemble, in the limit where the size of the matrices becomes large. The limiting distributions that we will study can be expressed as Fredholm determinants of certain integral operators, and generalize in a natural way the extensively studied hard edge Bessel kernel determinant. We will express such quantities in terms of a 2x2 Riemann-Hilbert problem, and use this representation to obtain so-called large gap asymptotics."

# Thursday, March 17th

#### 9:00am Richard Kenyon - SCGP 102

Title: Dimers and Geometry

**Abstract:** We discuss the geometric meaning of the Kasteleyn matrix, and use it to prove several results about spaces of embeddings of planar graphs. For example the space of embeddings of a 3-connected planar graph, with convex faces and pinned boundary is a topological ball. We give global coordinates on this space as well as natural probability measures.

#### 9:50am Coffee Break - SCGP Lobby

#### 10:20am Ivan Kostov - SCGP 102

Title: The six-vertex model on a hexagon

#### 11:10am Greta Panova - SCGP 102

Title: Lozenge tilings with symmetries

12:00pm Lunch - SCGP Café

#### 2:00pm Leonid Petrov - SCGP 102

Title: Exponential jump model in continuous inhomogeneous medium

**Abstract:** I will talk about a stochastic interacting particle system on the continuous real line equipped with a function  $\langle xi(x) \rangle$  determining the speed of jumping particles at each location x. The waiting times and jump lengths of particles are exponentially distributed, and the behavior of the system is somewhat similar to a queuing model. By relating this system to the inhomogeneous stochastic higher spin six vertex model, it can be shown that the exponential jump model is exactly solvable for an arbitrary speed function  $\langle xi(x) \rangle$ . In particular, q-moments of the height function admit explicit multiple contour integral expressions. I will discuss the asymptotic behavior of the system (as time and the number of particles grows), which leads to limit shapes with new unusual phase transitions. The fluctuations of the random height function around the limit shape are governed by the GUE Tracy--Widom distribution.

# 2:50pm Vadim Gorin - SCGP 102

Title: Lozenge tilings: universal bulk limits, global fluctuations and all that

# 3:40pm Coffee Break - SCGP Lobby

# 4:10pm Christian Hagendorf - SCGP 102

Title: The spin-one XXZ chain and symmetry classes of alternating sign matrices

**Abstract:** In this talk, I discuss some recent progress on the ground states of the integrable spin-one XXZ chain with diagonal and anti-diagonal twists. Several components and scalar products of the ground state vectors are related to polynomials which appear in problems of enumeration of alternating sign matrices with symmetries. I show how these relations can be proved by means of the algebraic Bethe ansatz and the quantum separation of variables method. Furthermore, I present a generalisation to models with arbitrary (integer) spin. This talk is based on joint work with Alexi Morin-Duchesne.

# Friday, March 18th

#### 9:00am Jasper Stokman - SCGP 102

Title: Loop models and skein theory

# 9:50am Coffee Break - SCGP Lobby

10:20am Michael Wheeler - SCGP 102

**Title:** Higher rank generalisations of the six vertex model and Macdonald-Koornwinder polynomials

#### 11:10am Karl Liechty - SCGP 102

Title: TBA

#### 12:00pm Lunch - SCGP Café

#### 2:00pm Thomas Bothner - SCGP 102

Title: Deformations of the Tracy-Widom distribution and transition asymptotics for Painleve II

**Abstract:** The distribution functions of the largest eigenvalue of random matrices drawn from the three classical Gaussian ensembles were derived in the early 1990s by Tracy and Widom. For the famous GUE ensemble this result first expresses the distribution function as Fredholm determinant of the Airy integral operator and secondly identifies the underlying integrable system as a distinguished solution of the second Painlev ?e equation. During the following 25 years many links of Tracy-Widom distribution functions to other probabilistic models were discovered, here we will discuss a thinning model in which the Tracy-Widom distribution undergoes a deformation: drop a certain fraction of edge scaled eigenvalues in the GUE. As shown by Bohigas, Carvalho and Pato the Fredholm determinant formalism naturally extends to such incomplete spectra and we have now a one parametric family of Fredholm determinants for the distribution function of the largest eigenvalue in the new particle system. The underlying integrable system in this new system is different from the standard one, still the model offers the possibility to interpolate between random matrix theory statistics and classical Weilbull statistics. We will discuss this interpolation process on the level of the large negative transition asymptotics of the Painlev ?e II

#### 2:50pm Estelle Basor - SCGP 102

Title: Dimer Models and Block Toeplitz Determinants

3:40pm Coffee Break - SCGP Lobby