Universality classes in non-convex dimer Models (Mark Adler)

Abstract: We discuss, how using large size size limits in various non-convex dimer models, one arrives at new universality classes where interfaces meet.

Geodesics toward corners in first passage percolation (Kenneth Alexander)

Abstract: For stationary first passage percolation in two dimensions, we give an overview of what is known about the structure of semi-infinite geodesics, including their existence and uniqueness in specific directions, and how it relates to the geometry of the limit shape. Geodesics toward corners of the limit shape present particular difficulties and are not covered by most existing results. We construct an example that may be illuminating for the corner case in general, having the following properties: (i) the limiting shape is an octagon, (ii) semi-infinite geodesics exist only in the four axis directions, and (iii) in each axis direction there are multiple such geodesics. By contrast, the generic behavior (known or expected) for a non-corner direction in most more-typical examples is a unique semi-infinite geodesic from each point in each direction. This is joint work with Quentin Berger.

Elliptic bipartite dimers on isoradial graphs (Cedric Boutillier)

Isoradial graphs are infinite planar graphs embedded in the plane in such a way that all faces are inscribed in a circle of radius 1. We define a weight function on edges of any bipartite isoradial graph from the geometry of the embedding through theta functions. Without any assumption on periodicity, we obtain a family of Gibbs measures with a single gaseous measure, parameterized by a two-dimensional magnetic field. These measures are determinantal processes with a kernel whose entries for any two vertices are local, i.e. depend only on the geometry of the graph along a path between these vertices.

When the graph and the weight function is periodic, the spectral curve is a Harnack curve of genus 1, and any Harnack curve of genus 1 can be realized this way.

This construction degenerates to Kenyon's critical dimer weights when the elliptic parameter tends to 0, and generalizes constructions of inverse Kasteleyn operators in connection with the Z-invariant elliptic Ising model or massive Laplacian.

Telegraph equation from the six-vertex model (Vadim Gorin)

Abstract: I will explain how a second order hyperbolic PDE, known as the telegraph equation, arises in the asymptotic of the height function of the six-vertex model. Homogeneous equation describes the limit shape in the system, and its stochastic inhomogeneous version governs the fluctuations.

The 5-vertex model (Richard Kenyon)

Abstract: The 5-vertex model generalizes the lozenge tiling model and is a special case of the 6-vertex model. We compute the free energy, surface tension and solve the limit shape equation, providing explicit analytic parameterizations of limit shapes.

The double random current nesting field (Marcin Lis)

Abstract: A configuration of the planar random current model can be viewed as a collection of dual Ising contours together with an independent Bernoulli bond percolation with prescribed success probabilities. The double random current model is simply a superimposition of two iid random current configurations. Its clusters are composed of XOR-Ising contours and of additional components arising from the percolation process or two overlapping single Ising contours. For each such cluster C we toss an independent +-1 symmetric coin X_C. A cluster C is called odd around a face u if the contours contained in

C assign spin -1 to u under +1 boundary conditions. The double random current nesting field at u is defined to be the sum of X_C over clusters C odd around u.

I will provide a measure-preserving map between double currents and dimers on a particular bipartite graph. Under this map the nesting field becomes the height function of the dimer model. Using this connection together with the results of Kenyon, Okounkov and Sheffield on the dimer model, I will prove that the magnetization of the critical Ising model on any biperiodic graph vanishes.

This is joint work with Hugo Duminil-Copin.

Statistical mechanics and the isometric embedding problem (Govind Menon)

Abstract: This is a somewhat speculative talk on an approach to the isometric embedding problem that I have been developing in the past year. My purpose is to a describe a new approach to the problem that is rooted in statistical mechanics. I will present my motivation for this problem as well as a new model.

Scaling limits of the HCIZ integral (Jonathan Novak)

Abstract: The Harish-Chandra/Itzykson-Zuber integral is a ubiquitous special function which plays a key role in various subjects, ranging from representation theory, to random matrix theory, to dimers. In this talk, I will give a sketch of the theory surrounding the HCIZ integral, and make the case that the "right" way to view this object is as a generating function for Hurwitz numbers.

Perspectives on exponential random graphs (Mei Yin)

Abstract: Exponential random graphs are powerful in the study of modern networks. By representing a complex global configuration through a set of tractable local features, these models seek to capture a wide variety of common network tendencies. This talk will look into the asymptotic structure and dynamics of weighted exponential random graphs and formulate a quantitative theory of phase transitions. The main techniques that we use are variants of statistical physics (both equilibrium and non-equilibrium). Based on joint work with multiple collaborators.