

“Statistical Mechanics, Integrability and Combinatorics”

Schedule for Week 1, May 11-15

Monday May 11, Room B, 14.30

Weighted Hurwitz numbers and hypergeometric \mathcal{T} -functions

John Harnad (*CRM and Concordia University, Montreal*)

Parametric families in the center $Z(\mathbb{C}[S_n])$ of the group algebra of the symmetric group S_n are constructed by identifying one set of indeterminates in the Cauchy-Littlewood formula as commuting Jucys-Murphy elements, and the other as weighting parameter values. Their eigenvalues provide coefficients in the double Schur function expansion of 2D Toda \mathcal{T} -functions of hypergeometric type. Expressing these in the basis of products of power sum symmetric functions, the coefficients are interpreted geometrically as parametric families of weighted Hurwitz numbers, enumerating weighted branched coverings of the Riemann sphere. Combinatorially, they may be interpreted as weighted sums over paths in the Cayley graph of S_n generated by transpositions. Dual pairs of bases for the algebra of symmetric functions provide both the geometrical and combinatorial significance of these weighted enumerative invariants. If time permits, a quantum deformation of these results, based on the generating function for Macdonald polynomials, will be presented.

Monday May 11, Cloister, 17.30

Welcome drink

Wednesday May 13, Room B, 11.30

Discrete parafermions and quantum-group symmetries

Yacine Ikhlef (*CNRS-UPMC Jussieu, Paris*)

In this talk, I will give an overview of discrete parafermions in integrable lattice models, based on the Bernard-Felder construction of non-local quantum group currents, and focusing on the example of the six-vertex model and the related loop model on the square lattice.

Thursday May 14, Room B,
Mini-workshop on “Integrability and Combinatorics”

10.00-10.45

Limit shapes in the Schur process

Dan Betea (*CNRS-UPMC-Jussieu, Paris*)

We will talk about the asymptotics of large pyramid partitions, q^{Volume} weighted, and non-uniformly weighted Aztec diamonds from the perspective of Schur processes. Joint work with Cedric Boutillier and Mirjana Vuletić.

11.00-11.45

Computing the inverse Kasteleyn matrix for domino tilings of Aztec diamonds

Sunil Chhita (*Bonn University*)

Simulations of domino tilings of large Aztec diamonds give striking pictures due to the emergence of macroscopic regions. These regions are often referred to as solid, liquid and gas. Limiting curves separate these regions and interesting probabilistic behaviors occur around these curves, which are related to random matrix theory. One approach to analyze these behaviors is through entries of the inverse Kasteleyn matrix which give joint probabilities of dominoes occurring in a random tiling. In this talk, we present an elementary combinatorial method, via certain recurrence relations, which computes the generating function of the inverse Kasteleyn matrix for uniform domino tilings of the Aztec diamond, which contains two macroscopic regions. This method also extends to give a derivation of the generating function of the two-periodic Aztec diamond, which contains all three macroscopic phases. The talk is based on joint work with Benjamin Young (Oregon).

11.45-12.30

Macdonald superpolynomials and the Ruijsenaars-Schneider model

Olivier Blondeau-Fournier (*King's College, London*)

Macdonald polynomials were discovered around 1988 and provide a remarkable (and rich) generalization of many other symmetric polynomials, such as the Jack, Hall-Littlewood, Schur, zonal, etc. Macdonald polynomials are also related to the solutions of a certain quantum (mechanic) integrable model, the so called Ruijsenaars-Schneider (RS) model. Recently, supersymmetric extension of integrable models lead to the discovery of a new family of polynomials, called superpolynomials, that now depend on anti-commuting variables (in addition to the usual commuting variables). Quite surprising, the subset of symmetric superpolynomials, which are invariant under a diagonal action of the symmetric group, can be defined combinatorially provided one is ready to introduce new objects that generalize standard partitions: the superpartitions. In this talk I will give an introduction to superpolynomials and present a generalization of Macdonald polynomials. Depending of the time, here is an outline: 1) Classical basis. 2) Duality and orthogonality. 3) Macdonald superpolynomials. 4) Properties and conjectures. 5) Cherednik operators. 6) Supersymmetric version of the RS model.

14.30-15.15

Thermodynamic limit of the six-vertex model with reflecting boundary

Giuliano Pavan Ribeiro (*Universidade Federal de São Carlos, São Paulo*)

We study the thermodynamic limit of the six-vertex model with domain wall boundary and reflecting end. We evaluated the partition function explicitly in special cases. We calculated the homogeneous limit of the Tsuchiya determinant formula for the partition function. We evaluated the thermodynamic limit and obtain the free energy of the six-vertex model with reflecting end. We determined the free energy in the disordered regime.

15.30-16.15

On Random matrices and spin chains

Miguel Tierz (*Universidad Complutense de Madrid*)

We will introduce a one-dimensional spin chain model and review how its associated thermal correlation functions admit a random matrix description. We will show how to generalize the construction to the case of interactions beyond the nearest neighbour setting and discuss physical implications of the random matrix formulation.

Friday May 15, Room B, 11.30

A special case of the XYZ model with boundaries

Vladimir Mangazeev (*Australian National University, Canberra*)

It is known that on the combinatorial line $\eta = \pi/3$ the ground state energy of the XYZ periodic spin chain is proportional to the size of the system for even sizes only. In this paper we generalize this result to open boundaries. We consider the XYZ model at $\eta = \pi/3$ with non-diagonal boundary terms. Then we find a one-parametric family of boundary parameters when the ground state energy is proportional to the size of the system for both even and odd system sizes. In the trigonometric limit it reproduces the $U_q(\mathfrak{sl}(2))$ -invariant XXZ spin Hamiltonian.