ABSTRACTS (LIST WILL BE COMPLETED SOON)

MICHAEL AIZENMAN (Princeton)

Title: Planar graph zeta functions and symmetry breaking in classical and quantum spin systems

(joint work with Simone Warzel)

ROLAND BAUERSCHMIDT (Cambridge)

Title: Fluctuations of the two-dimensional one-component Coulomb plasma

The two-dimensional one-component Coulomb plasma is a system of identical negative charges in the plane repelling each other via the logarithmic Coulomb potential and confined by an external potential. I will discuss results that show that the fluctuations of linear statistics of many particles are of order 1 and given by a Gaussian free field, at any temperature. This is joint work with P. Bourgade, M. Nikula, and H.-T. Yau.

PIETRO CAPUTO (Roma Tre)

Title: Cutoff at the "entropic time" for sparse Markov chains

Abstract: We discuss convergence to equilibrium for a large class of Markov chains in random environment. The chains are sparse in the sense that in every row of the transition matrix P the mass is essentially concentrated on few entries. Moreover, within each row the entries of P are exchangeable random variables. The models are generally non reversible and the equilibrium distribution is itself unknown. We establish that the mixing time is given by the entropy of the equilibrium distribution divided by the average row entropy of P, and that the chains exhibit the so-called cutoff phenomenon at this "entropic time". Proofs are based on a detailed analysis of the weight of the trajectory followed by the particle. Special cases include various models of random walks on sparse random directed graphs. In certain cases we also obtain detailed information on the cutoff window and shape. Another application concerns the case where the rows of P are i.i.d. random vectors in the domain of attraction of a Poisson-Dirichlet law. This is joint work with Charles Bordenave and Justin Salez.

FRANCESCO CARAVENNA (Milan Bicocca)

Title: Marginally relevant polymer models in the critical window

Abstract: We consider disordered systems which are so-called marginally relevant, focusing on the model of directed polymer in random environment in dimension $(2 + 1)$. As we established in previous work, the partition functions of this model undergo a phase transition, in a suitable weak disorder and continuum limit. In a critical window around the transition point, these partition functions are expected to converge to a generalized random field on R^2 with logarithmically diverging covariances.

We present sharp moment bounds which provide a quantitative step toward proving this convergence. In particular, we show that any subsequential limit is non-trivial and has a unique explicit covariance kernel. Close connections with stochastic PDEs, namely with the two-dimensional Stochastic Heat Equation, will be described.

(Joint work with R. Sun and N. Zygouras)

ALESSANDRO GIULIANI (Roma Tre)

Title: Haldane relation for interacting dimers

Abstract: In this talk I will review some recent results on the existence and nature of the scaling limit of interacting, close-packed, dimers on the two-dimensional square lattice. By constructive Renormalization Group techniques, we compute: the multipoint dimer correlations, which display non-trivial critical exponents, continuously varying with the interaction strength; and the height fluctuations, which, after proper coarse graining and rescaling, converge to the massless Gaussian field with a suitable interaction-dependent pre-factor ('amplitude'). We also prove the identity between the critical exponent of the two-point dimer correlation and the amplitude of this massless Gaussian field. This identity is the restatement, in the context of interacting dimers, of one of the Haldane universality relations, part of his Luttinger liquid conjecture, originally formulated in the context of one-dimensional interacting Fermi systems. Its proof requires the combined use of an exact lattice Ward Identity for the lattice theory, with the chiral Ward Identites of a continuum reference model, which describes the infrared fixed point of the interacting theory. Joint work with V. Mastropietro and F. Toninelli.

CLEMENT HONGLER (Lausanne)

Title: Conformal Field Theory at the Lattice Level

Abstract: Conformal Field Theory conjecturally describes the scaling limit of critical statistical mechanics models. I'll discuss, mostly from the Ising model perspective, how a number of Conformal Field Theory objects and ideas can be given a concrete meaning at the lattice level, and thus understood probabilistically.

GADY KOZMA (Weizmann)

Title: Irreducibility of random polynomials

Abstract: A famous open problem is to determine the probability that a high-degree polynomial with random, independent coefficients taking values 1 and -1 is irreducible over the rationals, i.e. cannot be written as a non-trivial product of two polynomials with rational coefficients. We survey recent progress on this problem, including connections to the cycle structure of random permutations. Joint work with Lior Bary-Soroker.

HUBERT LACOIN (IMPA, Rio de Janeiro)

Title: Wetting and layering for Solid-on-Solid

Abstract: Solid-on-Solid (SOS) is a simplified surface model which has been introduced to understand the behavior of Ising interfaces in $\mathbb{Z}^d$ at low temperature. The simplification is obtained by considering that the interface is a graph of a function ϕ, $\mathbb{Z}^{d-1} \to \mathbb{Z}$. In the present talk, we study the behavior of SOS surfaces in $\mathbb{Z}^2$ constrained to remain positive, and interacting with a potential when touching zero, corresponding to the energy functional:

$$V(\phi) = \beta \sum_{x \sim y} |\phi(x) - \phi(y)| - \sum_{x} \left(h \mathbf{1}_{\{\phi(x)=0\}} - \infty \mathbf{1}_{\{\phi(x)<0\}} \right).$$

We show that if β is sufficiently large, the value of h at which the system undergoes a transition from a localized phase where there is a positive fraction of contact with the wall to a delicalized one is given by

$$h_w(\beta) = \log \left(\frac{e^{4\beta}}{e^{4\beta} - 1} \right).$$

In addition we obtain additional results on the free-energy which give evidence for the occurence an infinite sequence of layering transitions accumulating on the right of $h_w(\beta)$.

BENOIT LASLIER (Paris 7)

Title: Hydrodynamic limit for a lozenge tiling reversible dynamics

Abstract: Lozenge tilings are a natural model of 2+1 dimensional interface that arises for example as the 0 temperature limit of interfaces in 3D Ising model. It is generally expected that microscopic dynamics on these types of models should exhibit a deterministic behaviour at large scale. For reversible dynamics, one expect more precisely to see a kind of mean curvature motion at a diffusive space-time scaling, with two sources of non-linearity: one related to a choice of the appropriate notion of curvature depending only on the equilibrium measure and a kind of diffusion coefficient depending on the choice of dynamics (called the mobility). We prove that this picture indeed holds for a well chosen dynamics on lozenge tilings. The discrete dynamics is chosen in such a way that it displays some form of gradient condition but the mobility is non-trivial.

TITUS LUPU (Zurich)

Title: Improved isomorphism theorems for the continuum Gaussian free field in dimension 2

Abstract: The isomorphism theorems (Dynkin, generalized Ray-Knight) relate the square of a discrete Gaussian free field and the occupation time of Markov path. In dimension 2 this still holds for a continuous domain, where one uses a

renormalized version square of GFF and Brownian trajectories. However in this continuum setting one has more. The level lines of the GFF can be obtained as envelopes of clusters of Brownian paths. One can also define first passage sets for the continuum GFF, which can be represented as clusters of Brownian paths. Such results are obtained by approximating a continuous domain by a metric graph, on which one can get isomorphisms also involving the sign of the GFF.

IOAN MANOLESCU (Friburg)

Title: First order phase transition for the Random Cluster model with $q > 4$

Abstract: This talk aims to prove that the phrase transition of the planar random cluster model (and that of the associated Potts model) is discontinuous when $q > 4$. The result is obtained by computing rigorously the correlation length of the critical RCM using a correspondence with the six vertex model. The latter may be expressed using the transfer matrix formalism; the Perron-Frobenius eigenvalues of the diagonal blocks of the transfer matrix may then be computed using the Bethe ansatz.

ORI GUREL-GUREVICH (Hebrew University)

Title: The power of two choices in point allocation

YUVAL PERES (Microsoft Research)

Title: Gravitational allocation to uniform points on the Sphere

Abstract: Given n uniform points on the surface of a sphere, how can we partition the sphere fairly among them in an equivariant way? "Fairly" means that each region has the same area. "Equivariant" means that if we rotate the sphere, the solution rotates along with the points. It turns out that if the given points apply a two-dimensional gravity force to the rest of the sphere, then the basins of attraction for the resulting gradient flow yield such a partitionwith exactly equal areas, no matter how the points are distributed. Moreover, this partition minimizes, up to a bounded factor, the average distance between points in the same cell. I will also present an application to almost optimal matching of n blue uniform points to n red uniform points on the sphere. This is joint work with Nina Holden and Alex Zhai.

GABOR PETE (Budapest)

Title: Generalized Fourier spectrum and sparse reconstruction in spin systems

Abstract: Consider an invariant function f of plus/minus spins that are given by some invariant measure on some transitive graph, such as Bernoulli percolation or the Ising model on the d-dimensional torus. By learning a small proportion of the spins, can one guess the value of f? In joint work with PhD student Pl Galicza at CEU, we give some partial answers, using the Fourier spectral sample and some generalizations of it.

ALEJANDRO RAMIREZ (Santiago)

Title: Velocity estimates for ballistic random walks in random environment at low disorder

Abstract: We discuss methods to obtain asymptotic expansions and bounds for the velocity of a ballistic random walk at low disorder. This talk is based on a joint work with C. Laurent, C. Sabot and S. Saglietti.

REMI RHODES (Marne-la-Vallée)

Title: Convergence 2d bosonic string theory

Abstract: In physics, string theories describes a one-dimensional object (string) evolving along time. We focus here on the simplest models, bosonic strings, and more specifically on noncritical bosonic string theory (or 2d bosonic strings). Mathematically speaking, this is a Feynman path integral over surfaces, say with fixed genus, the partition of which has been studied by Polyakov in the eighties. The partition function reduces to an integral over the moduli space of the coupling of Liouville quantum field theory with another Gaussian Free Field theory and the Ghost system. We show the convergence of this partition function. This is done by performing a careful analysis of the behaviour of the integrand at the boundary of the moduli space. An essential feature of our approach is that it is probabilistic and non perturbative. The interest of our result is twofold. First, to the best of our knowledge, this is the first mathematical result about convergence of string theories (recall that Wolpert showed divergence of the critical bosonic string in the eighties). Second, our construction describes the conjectural scaling limit of higher genus random planar maps weighted by the discrete Gaussian Free Field. Joint wok with C. Guillarmou and Vincent Vargas

YINON SPINKA (Tel Aviv)

Title: Long-range order in discrete spin systems in high dimensions

Abstract: Consider a uniformly chosen proper coloring with q colors of a domain in Z^d (i.e., the zero-temperature anti-ferromagnetic q-state Potts model). It has been known since the work of Dobrushin that if the number of colors is sufficiently large compared with the dimension then the coloring is disordered, having a unique Gibbs state in the thermodynamic limit. We consider an opposite regime, in which the dimension is much higher than the number of colors, and prove that the system admits a staggered (chessboard-like pattern) long-range order, and hence has several translation-invariant Gibbs states. The result extends to the positive-temperature anti-ferromagnetic Potts model as long as the dimension is taken sufficiently high as a function of the temperature. The $q = 3$ case was previously known. The result further extends to discrete spin systems in which the probability of a configuration is proportional to the product of single-site and nearest-neighbor interactions. The results apply also in low dimensions $d \geq 2$ if

one works with a sufficiently 'thickened' version of Z^d. Joint work with Ron Peled.

PIERRE TARRES (Dauphine & NYU Shangai)

Title: Local time techniques and self-interacting random walks

Abstract: Local time techniques are inherently related to self-interacting random walks, although those were initially devised by Ray-Knight for the study of Markov chains. They were first used in that context by Tóth in the 90s in a series of papers analysing a large class of self-interacting walks on the integer graph. Conversely, Sabot and Tarrès (2016) showed in a link between a reversed version of the so-called Vertex-Reinforced Jump Process and Ray-Knight local time theorem for Markov chains (see also Lupu, Sabot Tarrès, 2017).

On graphs with cycles, the techniques used by Tóth generally do not carry on. In the non-exchangeable but self-repelling case, Tarrès, Tóth and Valkó (resp. Horváth, Tóth and Vetö) were able to describe in 2012 that dynamics of local time from the point of view of the particle for Brownian polymers (resp. self-avoiding walks), at the cost of losing information on the current position of the walk; see also Benaim, Ciotir and Gauthier (2015) in the compact case.

In recent work with Merkl and Rolles (2016), we analyse, at fixed time horizon, the distribution of local time of the Vertex-Reinforced Jump Process on general graphs, using exchangeability properties. This enables us to interpret, through asymptotic analysis, variables which appear in an extension of the SuSy hyperbolic H2—2 model associated to that VRJP (Sabot and Tarrès 2016). Our analysis is linked to the one developed by Keane and Rolles (2000) for the study of the Edge-Reinforced Random Walk.

CRISTINA TONINELLI (Paris 7)

Title: Bootstrap percolation and kinetically constrained spin models: critical time and length scales

Abstract: Recent years have seen a great deal of progress in understanding the behavior of bootstrap percolation models, a particular class of monotone cellular automata. In the two dimensional lattice there is now a quite complete understanding of their evolution starting from a random initial condition, with a universality picture for their critical behavior. Much less is known for their non-monotone stochastic counterpart, namely kinetically constrained models (KCM). In KCM each vertex is resampled (independently) at rate one by tossing a p-coin iff it can be infected in the next step by the bootstrap model. In particular infection can also heal, hence the non-monotonicity. Besides the connection with bootstrap percolation, KCM have an interest in their own : when $p \to 0$ they display some of the most striking features of the liquid/glass transition, a major and still largely open problem in condensed matter physics. I will discuss some recent results on the characteristic time scales of KCM as $p \to 0$ and the connection with the critical

behavior of the corresponding bootstrap models.

BALINT TOTH (Bristol and Budapest)

Title: Quenched CLT for random walk in doubly stochastic random environment

Abstract: The step forward is getting from CLT in probability with respect to the environment to the quenched one (that is: a.s. with respect to the environment).

YVAN VELENIK (Geneva)

Title: Potts model with a defect line

Abstract: We analyze in detail the effect of a line of modified coupling constants on the correlation length of the Potts model on Z^d ($d > 1$) above the critical temperature. By duality, this also provides an analysis of interface pinning in the two-dimensional Potts model below the critical temperature. This is joint work with Sebastien Ott.

WENDELIN WERNER (ETH Zurich)

Title: On the relation between the values of κ for SLE(κ) and the value of q for the Potts(q) models.

Abstract: We will explain/survey how new work on Conformal Loop Ensembles (CLEs) provide ways to identify, working with these continuous structures only, which SLE(κ) should correspond to the conjectural scaling limit of which discrete O(N) or FK(q) percolation model.

One approach (j.w. with Jason Miller) is based on the determination of crossing probabilities of conformal rectangles for CLEs with appropriate boundary conditions. The other one (j.w. with Jason Miller and Scott Sheffield) is based on our CLE version of the Edwards-Sokal coupling and on consequences of its relation to Liouville Quantum Gravity.