Gaussian Free Field and related topics

Organizer: Santiago Juan Saglietti, NYU - Shanghai, China

Abstract
The d-dimensional Gaussian free field (GFF) is a d-dimensional-time analog of Brownian motion. Just as Brownian motion is the limit of the simple random walk (when time and space are appropriately scaled), the GFF is the limit of many incrementally varying random functions on d-dimensional grids. Like Brownian motion, it is a simple random object of widespread application and that has attracted great attention recently for its connections with other important topics within the probability community. It plays an important role in statistical physics and the theory of random surfaces, particularly in the case d = 2. It is also a starting point for many constructions in quantum field theory. Recently, strong links between Gaussian Free Fields on finite graphs and local time fields of simple random walks on such graphs have been established and exploited in the study of cover times of finite graphs. Furthermore, the GFF has also intimate connections with Schramm-Lowener evolutions (SLE), which appear in the study of the level lines of the GFF. Finally, the GFF has also deep links with the study of the vacant set of random interlacements. The aim of this session is to bring together experts on both discrete and continuum versions of the GFF to communicate on the recent developments made in the area and in connection with the other related topics mentioned above.

Conferences:

Weak convergence for the scaled cover time of the rooted binary tree
Oren Louidor (Technion, IL)

We consider a continuous time random walk on the rooted binary tree of depth n with all transition rates equal to one and study its cover time, namely the time until all vertices of the tree have been visited. We prove that, normalized by 2^{n+1}n and then centered by (log2)n-log n, the cover time admits a weak limit as the depth of the tree tends to infinity. The limiting distribution is identified as that of a randomly shifted Gumbel random variable with rate one, where the shift is given by the sum of the limits of the derivative martingales associated with two negatively correlated discrete Gaussian free fields on the infinite version of the tree. The existence of the limit and its overall form were conjectured in the literature. Our approach is quite different from those taken in earlier works on this subject and relies in great part on a comparison with the extremal landscape of the discrete Gaussian free field. Joint work with Aser Cortines and Santiago Saglietti.

High points of a random model of the Riemann-Zeta function and Gaussian multiplicative chaos
Lisa Hartung (University Mainz, DE)

We study the total mass of high points in a random model for the Riemann-Zeta function. We establish a connection between the total mass of points which are a linear order below the maximum and Gaussian multiplicative chaos. Our results are based on a branching approximation of the model and the second moment method. Joint work with L.-P. Arguin and N. Kistler.

On level sets of the two-dimensional Gaussian free field
Avelio Sepúlveda (Université Lyon 1, FR)

In this talk, we will give an overview of the theory of level sets of the two-dimensional continuum Gaussian free field (GFF). This theory studies points where, in a certain sense, the GFF takes finite values. We will

present the geometric and percolative properties of these sets, as well as their applications to the theory of Liouville quantum gravity and XOR-Ising model. Based on joint work with J. Aru, T. Lupu, E. Powell, L. Schoug, F. Viklund and W. Werner.