ERGODIC GEOMETRY, a conference in honor of François Ledrappier.

Titles and abstracts.

Wednesday, June 1st

10h30 : **Measures maximizing the entropy for surface diffeomorphisms**, by J. Buzzi.

In a joint work with Sylvain Crovisier and Omri Sarig, we extend classical results about the spectral decomposition of uniformly hyperbolic diffeomorphisms and the coding of their basic pieces to arbitrary surface diffeomorphisms with positive entropy. We deduce the finite multiplicity of their measures maximizing the entropy in the C^∞ case. The proof uses Sarig's symbolic extensions, Yomdin's theory, dimensions of dynamical foliations and a version of Sard's lemma.

11h30 : **Spectral zeta functions of graphs**, by A. Karlsson.

This talk will be an introduction to a topic in spectral graph theory under development. Instead of the Ihara zeta function, we study Carleman's spectral zeta function. Interest from the point of view of analytic number theory, combinatorics, and a few topics in physics will be mentioned. In particular, the Riemann hypothesis is equivalent to an asymptotic functional equation of the usual type, s versus 1-s, for certain graph zetas. The same picture holds for Dirichlet L-functions. Work together with G. Chinta, J. Jorgenson, F. Friedli and J. Dubout.

14h30 : **On the foliated horocyclic flow**, by F. Dal'bo.

Let M be a compact manifold admitting a minimal foliation by hyperbolic surfaces. The horocyclic flow on each leaf induces a flow on the "unitary tangent bundle" of the foliation. When M is a single surface it is well known that all horocyclic orbits are dense. What happens in the foliated situation? Joint work with F.Alcalde-Cuesta, M.Martinez, A.Verjovsky.

15h30 : **Lebesgue spectrum for a class of surface flows**, by B Fayad.

How much "chaotic" can area preserving surface flows be? It is widely known (from the works of Kolmogorov, Katok and then Kochergin) that starting from very low regularity these flows, if they do not have singularities, cannot be mixing. Via Poincaré sections, the latter phenomenon is due to a Denjoy type rigidity of discrete time one dimensional dynamics. However, Kochergin and then Khanin and Sinai showed that these flows can be mixing when they have singularities. Nothing more than that was know about their spectral type. We will explain why Kochergin flows with one (sufficiently strong) power like singularity typically have a maximal spectral type equivalent to Lebesgue measure on the circle. So, these quasi-minimal flows on the two torus, that have almost the same phase portrait as that of a minimal translation flow, share the same maximal spectral type as Anosov flows! In fact, the Lebesgue spectrum is rather reminiscent of the parabolic paradigm (of horocyclic flows for example) to which the Kochergin flows are related due to the shear along their orbits. We will discuss this relation and its consequences as well as several questions around mixing voulme preserving surface flows.

17h00 : **Temporal limit theorems for maps with zero entropy**,
by O. Sarig.

The orbits of zero entropy uniquely ergodic map do not always all have the same qualitative behavior, but to expose the richness of the orbit structure one needs to look at second order asymptotic behavior such as the error term in the ergodic theorem. "Temporal distributional limit theorems" are a probabilistic tool for doing this. Joint with D. Dolgopyat.

Thursday, June 2nd

9h00 : **Sturmian colorings on regular trees**,
by S. Lim.

Let f be a vertex coloring on a regular tree. By subball complexity $b_n(f)$ of f, we mean the number of colored balls of radius n up to color-preserving isometries. We call f a Sturmian coloring if it has the minimal unbounded subball complexity, which is $b_n = n+2$.

In this talk, we will explain a key property of Sturmian colorings similar to a property enjoyed by irrational rotations or Sturmian sequences. This is a joint work with Dong Han Kim.

10h30 : **Spectral analysis of Morse-Smale gradient flows**,
by G. Rivière.

On a smooth, compact and oriented manifold without boundary, I will explain how to obtain a complete description for the correlation function of a Morse-Smale gradient flow satisfying a certain nonresonance assumption. In particular, I will prove that the spectrum of the generator is given by linear combination with integer coefficients of the Lyapunov exponents at the critical points of the Morse function. If time permits, I will briefly discuss how one can recover, via this spectral analysis, classical results from differential topology such as the Morse inequalities. This is a joint work with Nguyen Viet Dang (Université Lyon 1).

11h30 : **Poisson boundary : from discrete to continuous groups**, by S. Brofferio.

Let μ be a probability measure on a group G. A classical problem in probability theory is to characterize the harmonic functions on G, that is functions are constant after convolution with μ.

On groups of matrices, the question is fairly well understood if the measure μ is smooth on G, and namely for countable groups. In many cases, it is known how give an integral representation of bounded harmonic functions, that is to describe the Poisson boundary.

However, the question is still wide open when the measure μ is supported on a finite number of group elements. In this case the measure μ and the associated harmonic functions live both on the continuous group G and on Γ, countable sub-group generated by the support of μ.

A natural question is to understand how the s harmonic functions on a discrete group Γ are related to harmonic functions on the continuous group G. In particular: Can we build the Poisson G-boundary when we know (as is often the case) the Poisson Γ-boundary ?

In this presentation I will show that G-boundary coincides with the space of ergodic components for the diagonal action of Γ on the product of G and Γ-boundary. In particular this action is ergodic if and only if there is no bounded harmonic G-functions.

This will permit, in particular, to build the Poisson boundary for Baumslag-Solitar group. seen as a dense sub group of a Lie group.

14h30 : **Speed of hyperbolic Poisson-Delaunay random walks**, by P. Lessa.

We will discuss ongoing joint research with Matías Carrasco and Elliot Paquette on establishing positive speed for the random walk on the Voronoi Tesselation (equivalently the Delaunay graph) associated to a random discrete subset of hyperbolic space. In comparison to uniform tesselations (which would correspond to a random walk on a Fuschian group) Poisson-Voronoi tesselations do not satisfy a strong isoperimetric inequality or any uniform geometric estimate. Also, anchored isoperimetric inequalities strong enough to establish positive speed are known (thanks to the work of Benjamini, Paquette, and Pfeffer) only in dimension 2.

We will discuss how a Furstenberg type formula for speed can be useful for showing positive speed at least in some cases (in a way which doesn't rely on isoperimetric estimates). In comparison to the case of geodesic random walks (where one advances in a uniform random direction a fixed distance r at each step) the random horofunction capturing the speed of a Poisson-Delaunay walk is not independent from the walk itself. From the probabilistic viewpoint this dependence relation is the main technical issue which needs to be addressed to establish positive speed.

15h30 : **Entropy and zeta functions for higher Teichmüller spaces**, by M. Pollicott.

We will consider the generalizations of the topological entropy and the Selberg zeta function from the setting of Fuchsian groups and surfaces of constant curvature to that of representations in $PSL(d, R)$ where $d > 2$. This is joint work with Richard Sharp.

Friday, June 3rd

9h00 : **Stochastic entropies on covers of compact manifolds**,
by L. Shu.

We consider the linear drift and the entropy associated with the Brownian motion on a cover a compact Riemannian manifold. We discuss rigidity results concerning their relation and their individual regularities with respect to metric changes in the case of negative curvature.

10h30 : **SRB measure for partially hyperbolic attractors with singularity**,
by R. Leplaideur.

This is a joint work with D. Yang (Suzhou). We prove that any flow resulting from a partially hyperbolic attractor with singularity (inside the attractor) admits a unique SRB measure. This holds in any dimension. The proof does not need the use of a PoincarŐ section. It only involves "classical" and general results from Thermodynamic formalism and from the Pesin theory.

11h30 : **Unipotent flows on infinte volume hyperbolic manifolds** ,
by B. Schapira.

In work with F. Maucourant, we study the dynamics of unipotent subgroups of $SO(n, 1)$ acting on the frame bundle $\Gamma\backslash SO(n, 1)$ of infinite volume hyperbolic manifolds. We show that they act topologically transitively on their nonwandering set, and that the natural invariant measure, the so-called Burger-Roblin measure, is ergodic and conservative, as soon as the critical exponent of the group Γ is large enough, and the geodesic flow admits a finite measure of maximal entropy.

14h00 : **On some extreme value properties for multivariate affine random walks**,
by Y. Guivarc'h.

We establish Fréchet's law and other extreme value properties for affine random walks, using the asymptotics of products of random matrices.

15h00 : **Conditional limit theorems for products of random matrices**,
by M. Peigné.

Consider the product $G_n = g_n...g_1$ of the random matrices $g_1, ..., g_n$ in $GL(d, \mathbb{R})$ and the random process $G_n v = g_n...g_1 v$ in $\mathbb{R}^d$ starting at point $v \in \mathbb{R}^d \setminus \{0\}$. It is well known that under appropriate assumptions, the sequence $(\log \|G_n v\|)_{n\geq 1}$ behaves like a sum of i.i.d. r.v.'s and satisfies standard classical properties such as the law of large numbers, law of iterated logarithm and the central limit theorem. Denote by $\mathbb{B}$ the closed unit ball in $\mathbb{R}^d$ and by $\mathbb{B}^c$ its complement. For any $v \in \mathbb{B}^c$ define the exit time of the random process $G_n v$ from $\mathbb{B}^c$ by $\tau_v = \min\{n \geq 1 : G_n v \in \mathbb{B}\}$. We establish the asymptotic as $n \to \infty$ of the probability of the event $\{\tau_v > n\}$ and find the limit law for the quantity $\frac{1}{\sqrt{n}} \log \|G_n v\|$ conditioned that $\tau_v > n$. (joint work with I. Grama & E.Le Page)

We will conclude with some application to the estimation of the probability of extinction of a critical multi-type Galton-Watson process in random environment. (work in progress by T.Da Cam Pham)