LIMIT THEOREMS FOR SLOWLY MIXING SYSTEMS: TITLES AND ABSTRACTS

Viviane Baladi: Deviation from the average for horocycle flows on surfaces of variable negative curvature

Abstract: We will explain how to use transfer operators on anisotropic spaces and Dolgopyat bounds to show that the deviation from the time-T average of the horocyle flow of any suitably bunched C3 contact 3-d Anosov flow (with orientable strong-stable distribution) is bounded by a negative power of T. This transports the discrete-time model of Giulietti-Liverani to the natural setting of geodesic *flows* in variable negative curvature, where nontrivial resonances exist. (This work is part of the PhD thesis of Alexander Adam.)

Bojan Basrak: Tail process and related limit theorems

Abstract: Stochastic processes with regularly varying distributions are frequently suggested as an appropriate model for applications. In this lecture, we rigorously introduce this class of processes and investigate consequences of such a notion for the long range behaviour of extremes and partial sums of a given sequence. We show how one can rescale all observations in a neighbourhood of an extreme observation to obtain a local limit called the tail process. Furthermore, we show that the partial sums of such data often satisfy a particular kind of functional limit theorems. We also show how some classical probabilistic models fit into this framework.

Ilya Chevyrev: Path functions and homogenisation of superdiffusive fast-slow systems

Abstract: In this talk, I will present a framework for differential equations with jumps based on the notion of path functions. This notion allows one to keep track of movement that happens in infinitesimal time and turns out important in applications where convergence fails in classical Skorokhod spaces due to non-linear oscillations surviving over short time periods. As an application, I will show how homogenisation theorems of superdiffusive fast-slow systems can be stated and proved in this framework. Based on joint works with Peter Friz, Alexey Korepanov, and Ian Melbourne.

Date: June 13, 2022.

Mark Demers: Topological Entropy and Pressure for Sinai Billiards

Abstract: For a class of finite horizon dispersing billiards, we review recent results proving the existence and uniqueness of equilibrium states for a family of geometric potentials, $-t \log J^u T$, $t \geqslant 0$.

The importance of this family stems from the fact that $t = 1$ corresponds to the smooth invariant (SRB) measure, while $t = 0$ corresponds to the measure of maximal entropy. By constructing anisotropic Banach spaces adapted to the potentials, we are able to prove exponential mixing for $t > 0$ by way of

a spectral gap for the associated transfer operator. Yet the spectral gap vanishes as $t \to 0$ and we discuss a possible phase transition for the billiard at $t = 0$.

Ana Cristina Freitas: Extremes and records for dynamically generated stochastic processes

Abstract: We consider stationary stochastic processes arising from dynamical systems by evaluating a given observable along the orbits of the system. We focus on the occurrence of extremal observations corresponding to exceedances of high thresholds, which is related to the entrance in certain neighbourhoods of the set of points where the observable is maximised. We study extreme value laws and record time point processes both in the absence and presence of clustering of exceedances.

Nicholas Fleming-Vázquez: Optimal iterated moment bounds for nonuniformly hyperbolic maps

Abstract: Moment bounds for Birkhoff sums $\sum_{i=0}^{n-1} v \circ T^i$ and iterated sums $\sum_{0 \leqslant i < j < n} v \circ T^i w \circ T^j$ arise when proving deterministic homogenisation (convergence of a fast-slow system to a stochastic differential equation). In this talk we will present a new result which gives optimal iterated moment bounds when T is a slowly mixing nonuniformly hyperbolic map. We will also discuss a generalisation of decay of correlations called the Functional Correlation Bound, which is the key tool in our proofs.

Sébastien Gouëzel: Phase transition for the minimal distance between orbits in random dynamical systems

Abstract: Given two independent starting points x and y in a dynamical system, one can measure how close their orbits get within time n: the decay rate of this quantity is given by a dimension-like quantity that can be expressed geometrically. Consider now a random dynamical systems, and the quenched analogue of the above question where x and y are taken in the same fiber. We compute again the decay rate of typical distance between orbits in this setting, and show that two dimension-like exponents show up, roughly measuring on-diagonal and off-diagonal behavior, one or the other being predominant depending on the system. In particular, along a smooth family of random dynamical systems, we show that the dominating exponent may behave in a non-smooth way.

Joint work with Jérôme Rousseau and Manuel Stadlbauer

Mark Holland: Dichotomy results for eventually always hitting time statistics and almost sure growth of extremes

Abstract: Suppose $(f, \mathcal{X}, \mu)$ is a measure preserving dynamical system and $\phi \colon \mathcal{X} \to \mathbb{R}$ a measurable function. Consider the maximum process $M_n := \max\{X_1, \ldots, X_n\}$, where $X_i = \phi \circ f^{i-1}$ is a time series of observations on the system. Suppose that (u_n) is a non-decreasing sequence of real numbers, such that $\mu(X_1 > u_n) \to 0$. For certain dynamical systems, we obtain a zero–one measure dichotomy for $\mu(M_n \leq u_n \text{ i.o.})$ depending on the sequence u_n. Specific examples are piecewise expanding interval maps including the Gauss map. For the broader class of non-uniformly hyperbolic dynamical systems, we make significant improvements on existing literature for characterising the sequences u_n. Our results on the permitted sequences u_n are commensurate with the optimal sequences (and series criteria) obtained by Klass(1985) for i.i.d. processes. Moreover, we also develop new series criteria on the permitted sequences in the case where the i.i.d. theory breaks down. Our analysis has strong connections to specific problems in eventual always hitting time statistics and extreme value theory. This work is joint with M. Kirsebom, P. Kunde and T. Persson.

Natalia Jurga: Cover times in dynamical systems

Abstract:

Alexey Korepanov: Polynomial mixing for measure of maximal entropy on dispersing billiard maps

Abstract: Usually measures of maximal entropy are exponentially mixing, but maybe they aren't for dispersing billiards, no one knows what is really going on. We prove a polynomial mixing rate and we think that it is either optimal or suboptimal. More taxpayers money is urgently needed to fund travel and coffee. This is a joint work with Mark Demers.

Zemer Kosloff: Sinai factors in nonsingular ergodic theory

Abstract: We will discuss a recent joint work with Terry Soo where we establish factor results for systems which are not measure preserving. We show:

(a) Totally dissipative systems have all nonsingular dynamical systems as factors;

(b) C^2 Anosov systems, even ones which are not measure preserving always have (stationary) Bernoulli shift factors and the bound of the maximal entropy finitary (a.e. continuous) factor is dramatically different.

(c) An extension of the finitary factor results of Keane and Smorodinsky to the broad class of nonsingular Bernoulli shifts.

Yuri Lima: Polynomial decay of correlations of geodesic flows on some nonpositively curved surfaces (Part 1)

Abstract: In a joint work with Carlos Matheus and Ian Melbourne, we consider a class of nonpositively curved surfaces and show that their geodesic flows have polynomial decay of correlations. In this first of two lectures, I will discuss the surfaces considered and how to analyze the hyperbolicity near zero curvature using a suitable Poincaré section and its Poincaré return map.

Carlos Matheus: Polynomial decay of correlations of geodesic flows on some nonpositively curved surfaces (Part 2)

Abstract: In a joint work with Yuri Lima and Ian Melbourne, we consider a class of nonpositively curved surfaces and show that their geodesic flows have polynomial decay of correlations. In this second of two lectures, we will discuss how the features of the Poincare section constructed in the first lecture allow to derive statistical laws for the relevant class of geodesic flows.

Florence Merlevède: Strong approximations and deviation inequalities for non uniformly expanding maps

Abstract:

Matt Nicol: Stable Laws for Random Dynamical Systems. Joint with Romain Aimino and Andrew Torok

Abstract: We consider random dynamical systems formed by concatenating maps acting on the unit interval $[0, 1]$ in an iid fashion. Considered as a stationary Markov process, the random dynamical system possesses a unique stationary measure ν. We consider a class of non square-integrable observables ϕ, mostly of form $\phi(x) = d(x, x_0)^{-\frac{1}{\alpha}}$ where x_0 is non-periodic point satisfying some other genericity conditions, and more generally regularly varying observables with index $\alpha \in (0, 2)$. The two types of maps we concatenate are a class of piecewise C^2 expanding maps, and a class of intermittent maps possessing an indifferent fixed point at the origin. Under conditions on the dynamics and α we establish Poisson limit laws, convergence of scaled Birkhoff sums to a stable limit law and functional stable limit laws, in both the annealed and quenched case.

Maxence Phalempin: Asymptotic behavior of self-intersection of trajectories from the flow of a Z-periodic Lorentz gaz

Abstract: H.A Lorentz introduced in 1905 a model describing the behavior a constant speed moving point particle elastically colliding round obstacles, the Lorentz gas model. In this talk I present the Z-periodic Lorentz gaz (Lorentz gaz on a tube) in finite horizon, on which I study the number of self-intersections of the trajectory generated by a particle. Since such system seen through the Lebesgue measure is recurrent and ergodic, the number of self-intersections increases along with time and evaluating this growth leads us to some limit theorem. Such result is proven through describing the problem within a Z-extension over a Sinai Billard. On such hyperbolic billiard, decorrelation results allows us to approximate the trajectories through the product of two parameters, one in local scale describing their states within some "cells" and a global one seen as a one dimensional random walk on the Z-extension.

Marks Ruziboev: Quenched decay of correlations for nonuniformly hyperbolic random maps with an ergodic driving system

Abstract: In this article we study random tower maps driven by an *ergodic* automorphism. We prove quenched exponential correlations decay for tower maps admitting exponential tails. Our technique is based on constructing suitable cones of functions, defined on the random towers, which contract with respect to the Hilbert metric under the action of appropriate transfer operators. We apply our results to obtain quenched exponential correlations decay for several *non-iid* random dynamical systems including small random perturbations of Lorenz maps and Axiom A attractors.

Joint work with J. F. Alves, W. Bahsoun, P. Varandas.

Fanni Sélley: Differentiability of the diffusion coefficient for a family of intermittent maps

Abstract: It is well known that the Liverani–Saussol–Vaienti map satisfies a central limit theorem for Hölder observables in the parameter regime where the correlations are summable. In this talk we show that for C^2 observables, the variance of the limiting normal distribution is a C^1 function of the parameter.

Dalia Terhesiu: Local large deviation in the absence of the classical central limit theorem and some applications

Abstract: Local large deviations (LLD) for one dimensional i.i.d. random variables that do not satisfy the classical central limit theorem (with the standard normalisation) but are in the domain of a stable law are subject of recent progress (Caravenna & Doney, 2019 and Berger, 2019) In recent work with Melbourne (2021) we provided a new proof of such LLDs for i.i.d. random variables, which allowed us an easy generalization to Gibbs Markov maps. In very recent work with Melbourne and Pène (2021+), we obtained LLD for the periodic infinite horizon Lorentz gas. In work in progress with Melbourne and Pène we aim to use this LLD to obtain a Mixing Local Central Limit Theorem for the periodic infinite horizon Lorentz gas.
