DinAmicI
Third Workshop of the
(Young) Italian Dynamicists

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Talks

Alessandra Bianchi (U. di Padova)

Random Walk in a one-dimensional Levy random environment

ABSTRACT: In this talk we introduce a model for a one-dimensional Levy-Lorentz gas corresponding to a random walk in random environment on the line. The environment is provided by a renewal point process with inter-distances having a Levy-type distribution, that can be seen as a set of randomly arranged static scatterers. We investigate the quenched behavior of the walk and provide asymptotic results about its distribution and moments. In particular we show that, contrary to the annealed case, the quenched behavior of the motion is diffusive.
This is joint work with G. Cristadoro, M. Lenci and M. Ligabò.

Claudio Bonanno (U. di Pisa)

On the generalized transfer operators of the Farey map

ABSTRACT: In this talk I will discuss some spectral properties for the generalized transfer operators of the Farey map. In particular I will consider the cases of real temperature and the connections with harmonic analysis on the modular surface.

Oliver Butterley (U. of Vienna)

Area Expanding $C^{1+\alpha}$ Suspension Semiflow

ABSTRACT: I consider suspension semiflows over expanding maps. They are of low regularity in the sense of being merely $C^{1+\alpha}$, discontinuous, and non-Markov. These properties make the flows difficult to study but also make them physically relevant examples. In the aim of determining statistical properties I will describe the functional-analytic framework (twisted transfer operators acting on the Banach space of generalised bounded variation). I will explain what results are now known and what is required to improve on these to obtain a full spectrum of statistical properties.

Gianluigi Del Magno (U. Técnica de Lisboa)

Ergodicity of planar hyperbolic billiards

ABSTRACT: We address the problem of the ergodicity of planar hyperbolic billiards. The first examples of such billiards were the Sinai billiards and

Bunimovich billiards. Their ergodicity, as well as the Bernoulli property, was established a long time ago. In the course of time, new examples of planar hyperbolic billiards have been constructed. Many of these examples belong to a class of billiards introduced by Donnay. We show that Donnay billiards and many others are ergodic. The talk is based on joint work with R. Markarian

Jacopo De Simoi (U. di Roma Tor Vergata)

High energy dynamics of some piecewise smooth Fermi-Ulam models

ABSTRACT: We find a normal form which describes the high energy dynamics of a class of piecewise smooth Fermi-Ulam ping pong models. Depending on the value of a single real parameter, the dynamics can be either hyperbolic or elliptic. In the first case we prove that the set of orbits undergoing Fermi acceleration has zero measure but full Hausdorff dimension. We also show that for almost every orbit, energy eventually falls below a fixed threshold. In the second case we prove that, generically, we have stable periodic orbits for arbitrarily high energies, and that the set of Fermi accelerating orbits may have infinite measure.
This is a joint work with D. Dolgopyat

Davide Ferrario (U. di Milano Bicocca)

Some dynamical and topological properties of symmetric n-body problems.

ABSTRACT: We will study some dynamical and topological properties of n-body problems which are symmetric with respect to the action of suitable extensions of finite rotation groups. The space of symmetric configurations is the complement of an arrangement of linear subspaces in a Euclidean space, and blow-up, McGehee coordinates and variational methods can be in some cases used to understand dynamical and topological properties of trajetories and periodic orbits (around the collision manifold).

Stefano Galatolo (U. di Pisa)

Rigorous computing of invariant measures up to small errors in the Wasserstein distance.

ABSTRACT: We describe an algorithm which is able to approximate invariant measures of dynamical systems up to small errors in the Wasserstein

distance and its practical implementation.
The use of Wasserstein distance, allow to replace some dicult a priori estimations on the regularity of the invariant measure and exploit as much as possible some a posteriori estimation which is made by the computer. The algorithm can hence be applied to systems which are not hyperbolic, as the Manneville map. We compute the invariant measure and the entropy of an example of such kind of maps up to small errors.

Georgie Knight (U. di Bologna)

Follow the fugitive: an application of the method of images to open dynamical systems

ABSTRACT: Borrowing and extending the method of images we introduce a theoretical framework that greatly simplifies analytical and numerical investigations of the escape rate in open dynamical systems. As an example, we explicitly derive the exact size- and position-dependent escape rate in a Markov case for holes of finite size. Moreover, a general relation between the transfer operators of closed and corresponding open systems, together with the generating function of the probability of return to the hole is derived. This relation is then used to compute the small hole asymptotic behavior, in terms of readily calculable quantities. As an example we derive logarithmic corrections in the second order term.
This is joint work with G. Cristadoro and M. Degli Esposti

François Pachet (Sony CSL Paris)

The dynamics of constrained finite-length Markovian sequences

ABSTRACT: In the context of style imitation applications, we need to generate sequences that imitate a style, while satisfying arbitrary constraints, coming from the domain of study such as cardinality, sums or meter. We describe a novel sequence generation technique based on the exploration of the complete set of sequences that a Markov model can generate, using combinatorial optimization techniques. We show that the addition of even simple constraints bias the initial Markov model in interesting ways, which are not fully understood. Interesting structural properties seem to emerge naturally from such combination of Markov models and constraints, and we look for models to study this phenomenon outside the realm of combinatorial optimization. References: `http://www.francoispachet.fr/markovconstraints/markov_ct.html`.

Marcello Seri (U. College London)

Resonances in the two-center Coulomb system

ABSTRACT: We investigate the existence of resonances for two-centers Coulomb systems with arbitrary charges in two and three dimensions, defining them in terms of generalized complex eigenvalues of a non-selfadjoint deformation of the two-center Schrödinger operator. After giving a description of the bifurcation of the classical system for positive energies, we construct the resolvent kernels of the operators and we prove that they can be extended analytically to the second Riemann sheet. The resonances are then defined and studied with perturbation theory and numerical methods.

Alfonso Sorrentino (U. di Roma Tre)

On the existence of invariant Lagrangian graphs

ABSTRACT: In this talk I would like to describe some variational and symplectic approaches to the study of the existence of invariant Lagrangian graphs for Tonelli Hamiltonian systems.

Mikko Stenlund (U. of Helsinki)

Coupling for a random dynamical system

ABSTRACT: We study random transformations on the circle all of which are smooth but collectively possess no uniform bounds on expansion nor distortion. We discuss how to construct a coupling for such a system and prove limit theorems.

Dalia Terhesiu (U. di Roma Tor Vergata)

Mixing for infinite measure preserving semi-flows

ABSTRACT: We recall that the notion of 'mixing' for infinite measure preserving systems is very delicate: given a conservative ergodic infinite measure preserving transformation (X, f, μ) with transfer operator L, we have $\int L^n v d\mu \to 0$, as $n \to \infty$, for all $v \in L^1(\mu)$. Hence, to recover (in some sense) the classical notion of mixing, one needs to find a sequence cn and a reasonably large class of functions v (within L^1) such that $c_n \int L^n v d\mu \to C \int v d\mu$ for some $C > 0$.
In previous joint work with Ian Melbourne [1], we develop a theory that recovers the classical notion of mixing for a very large class of discrete (non-invertible) dynamical systems with infinite measure. In work in progress, also

joint work with Ian Melbourne, we obtain results for suspension semi-flows over the class of discrete dynamical systems with infinite measure considered in [1]. In this talk, after a very brief review of some results in [1], I will present the new results on suspension semi-flows and describe the main steps of the construction.
[1] I. Melbourne, D. Terhesiu. Operator renewal theory and mixing rates for dynam- ical systems with infinite measure, Invent. Math. 1 (2012) 61–110.

Damien Thomine (U. de Rennes 1)

A central limit theorem for observables of the geodesic flow on periodic hyperbolic surfaces

ABSTRACT: In ergodic theory with infinite measure, the behavior of the birkhoff sums of integrable observables is closely related to the behavior of the local time in some subset of finite measure. If an observable has non-zero integral, then the study of the birkhoff sums and the study of the local time are asymptotically equivalent. However, if an observable has zero integral, the asymptotic behavior becomes more subtle. For systems with a probability measure, for observables with zero average, a central limit theorem will be more accurate than Birkhoff's theorem. We will present the main ideas to get some kind of central limit theorem for nice systems with infinite measures; they are borrowed from earlier works by E. Csáki and A. Földes on (true) random walks.
We shall give a special emphasis to a class of dynamical systems which behave like random walks, namely, Z^d extensions of Gibbs-Markov maps. Depending on the examples, the problem of finding an equivalent of the central limit theorem has been solved as soon as 1955 (for the simple random walk on Z), or is still open. We may discuss the variations between those examples, and how it affects our method.

Special Sessions

Eduardo Altmann (Max-Planck-Institut Dresden)

Leaking dynamical systems

Peter Grassberger (Forschungszentrum Jülich)

Applications of mutual information in biology

Thomas Gilbert (U. Libre Bruxelles)

David Sanders (U. Nacional Autónoma de México)

From chaos to transport

Public Lecture (in italian)

François Pachet (Sony CSL Paris)

Creatività e manipolazione dello stile in musica e in letteratura