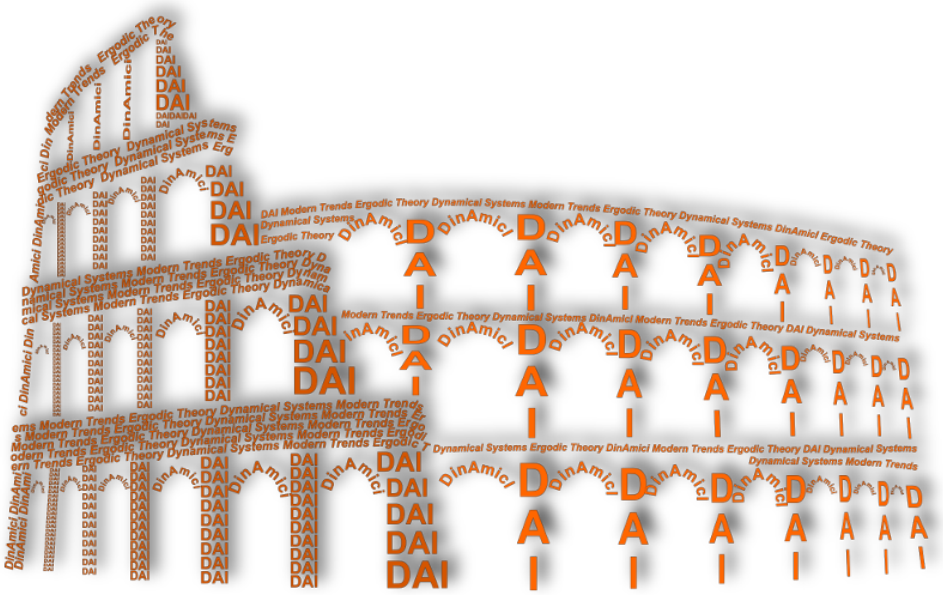
INdAM Workshop

DinAmicI V

Modern Trends in the Ergodic Theory of Dynamical Systems

Rome, Italy
June 5 – 9, 2017

Abstracts of the talks



	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:30 - 10:20	Welcome	ULCIGRAI	ARTUSO	FRANTZIKINAKIS	GIULIETTI
10:30 - 11:20	DOLGOPYAT	RAVOTTI	CRISTADORO	CELLAROSI	SENTI
11:30 - 12:00			Coffee Break		
12:00 - 12:50	BUNIMOVICH	LUZZATTO	NATALINI	GIDEA	PESIN
			Lunch Break		
14:30 - 15:20	CHERUBINI	ZHANG	FREE AFTERNOON	PINZARI	
15:30 - 16:20	MONGE	DE SIMOI		CHAZOTTES	
16:30 - 17:00	Coffee break			Coffee break	
17:00 - 17:50	MARMI	SZASZ			
			Conference Dinner (20:00)		

ROBERTO ARTUSO, Università dell'Insubria
Numerical mixing

Abstract. I will review some theoretical tools which lead to (indirect) numerical schemes to explore rate of mixing for deterministic systems. In particular I will emphasise procedures that involve investigations of Poincaré recurrences and the distribution of finite time Lyapunov exponents.

LEONID BUNIMOVICH, Georgia Tech, Atlanta
When and where orbits of chaotic systems prefer to go

Abstract. We show that for the "extremely" uniformly hyperbolic systems time interval is partitioned into three subintervals. In the finite short time interval there is hierarchy of first hitting probabilities for elements of Markov partition. In the third (infinite) long times interval there is opposite hierarchy. It allows to make finite time prediction of dynamics and to find optimal Young tower for a given Markov partition.

FRANCESCO CELLAROSI, Queen's University, Kingston
Ergodic and statistical properties of B-free numbers

Abstract. I will present some results about the statistical properties of B-free numbers and the dynamical systems naturally associated to them.
These results come from a joint paper with M. Avdeeva and Ya.G. Sinai.

JEAN-RENÉ CHAZOTTES, Ecole Polytechnique, Palaiseau
Concentration inequalities for dynamical systems

Abstract. I will present the state-of-the-art of concentration inequalities for non-uniformly hyperbolic maps. Such inequalities provide (sharp) bounds, for all n, on the fluctuations of functions of the form $F(x, Tx, ...T^n x)$ around their expected value (wrt the SRB measure) where F is only assumed to be separately Lipschitz. In particular, F can be highly nonlinear and implicitly defined. A very particular case is the Birkhoff $\sum f(x) + f(Tx) + ... + f(T^n x)$ of a Lipschitz function f. I will of course present various examples of F's to illustrate the power of these bounds. I will then present some open questions about partially hyperbolic systems and coupled map lattices.

Anna Maria Cherubini, Università del Salento

A study of the stochastic resonance as a periodic random dynamical system

Abstract. We study a standard model for the stochastic resonance from the point of view of dynamical systems.We present a framework for random dynamical systems with nonautonomous deterministic forcing and we prove the existence of an attracting random periodic orbit for a class of one-dimensional systems with a time-periodic component. In the case of the stochastic resonance,we use properties of the attractor to derive an indicator for the resonant regime.
The work is in collaboration with J.S.W. Lamb, M. Rasmussen and Y. Sato.

Giampaolo Cristadoro, Università di Bologna

About the relationship between symmetry and structure in DNA sequences

Abstract. We present a dynamics on symbolic sequences that model the action of some biological processes considered as one of the major mechanisms shaping DNA. We investigate the link between symmetries and structure that emerges through such a dynamics. Numerical results agree with our predictions.

Jacopo De Simoi, University of Toronto

Spectral rigidity and planar convex billiards

Abstract. Convex billiards were introduced by Birkhoff in the 1920's as a natural example of Hamiltonian dynamical system.In this talk we describe a remarkable relation between their dynamics and inverse spectral theory. We prove spectral rigidity among generic (finitely) smooth axially symmetric domains which are sufficiently close to a circle and discuss possible generalizations of our result. This gives a partial answer to a question by P. Sarnak.

Dmitry Dolgopyat, University of Maryland

Error in Central Limit Theorem for i.i.d. random variables with atomic distribution

Abstract. We consider sums of independent identically distributed random variables those distributions have d atoms. Such distributions never admit an Edgeworth expansion of order d-1 but we show that for almost all parameters the Edgeworth expansion of order d-2 is valid and the error of the order d-1 Edgeworth expansion is typically of order $n^{-(d-1)/2}$.
This is a joint work with Kasun Fernando.

Nikos Frantzikinakis, University of Crete

Ergodicity of the Liouville system implies the Chowla conjecture

Abstract. The Liouville function assigns the value one to integers with an even number of prime factors and minus one elsewhere. Its importance stems from the fact that several well known conjectures in number theory can be rephrased as conjectural properties of the Liouville function. A conjecture of Chowla states that the signs of the Liouville function are distributed randomly on the integers,that is, they form a normal sequence of plus and minus ones. Reinterpreted in the language of ergodic theory this conjecture asserts that a system naturally arising from the Liouville function is a Bernoulli system. The main objective of this talk is to prove that ergodicity of this "Liouville system" implies Bernoullicity, and as a consequence the Chowla and the Sarnak conjecture.

Marian Gidea, Yeshiva University, New York

Diffusion along chains of normally hyperbolic cylinders

Abstract. We consider a geometric framework that can be applied to prove the existence of drifting orbits in the Arnold diffusion problem. The main geometric objects that we consider are 3-dimensional normally hyperbolic invariant cylinders with boundary, which admit well-defined stable and unstable manifolds. These enable us to define chains of cylinders i.e., finite, ordered families of cylinders in which each cylinder admits homoclinic connections, and any two consecutive cylinders admit heteroclinic connections. We show the existence of orbits drifting along such chains, under precise conditions on the dynamics on the cylinders, and on their homoclinic and heteroclinic connections.Our framework applies to both the a priori stable setting, once the preliminary geometric reductions are preformed, and to the a priori unstable setting, rather directly.
This is joint work with J.-P. Marco.

Paolo Giulietti, Scuola Normale, Pisa
Infinite mixing for maps with an indifferent fixed point

Abstract. We study certain one-dimensional maps with indifferent fixed point which possess an infinite invariant measure. It is known that extending the definition of mixing of finite ergodic theory is not trivial, and can lead to various definitions of infinite mixing. We show that our maps are mixing, where the relevant mixing behavior is captured by pairing a global observable and a local observable.
Joint work with C. Bonanno and M. Lenci

Stefano Luzzatto, ICTP Trieste
Young Towers and SRB measures for (nonuniformly) hyperbolic surface diffeomorphisms

Abstract. We give some very weak and natural geometric conditions which imply the existence of a first return Young tower, and thus of an SRB measure, for surface diffeomorphisms.
Joint work with V. Climenhaga and Y. Pesin.

Stefano Marmi, Scuola Normale, Pisa
TBA

Maurizio Monge, U.F. Rio de Janeiro
Rigorous computation in random dynamics and computer-aided proof of noise-induced-order

Abstract. We will explain the techniques used to compute rigorouslythe invariant measure and rigorously estimate observables for generaldynamical systems with noise. We will illustrate the interplay ofWasserstein, L^1 and variation norms on the space of signedmeasures, and show how it can be exploited to obtain a surprisinglyeffective estimation of the invariant measure in the L^1 norm. Weconclude showing how this allows to prove rigorously the noise-inducedorder phenomenon for a model of the Belousov-Zhabotinsky reaction,that had been discovered with numerical simulations by Matsumoto-Tsudain 1983.
Joint work with Stefano Galatolo and Isaia Nisoli.

ROBERTO NATALINI, Istituto per le Applicazioni del Calcolo - CNR, Roma
Large time behavior of evolutionary problems in cell biology

Abstract. One of the main problems in mathematical biology is to understand the time asymptotic profile of solutions for models describing the behavior of cell aggregates.In this talk I will present some specific examples ranging from continuous to discrete models, and I will focus on some current open problems.

YAKOV PESIN, PennState University
A geometric approach for constructing equilibrium measures in hyperbolic dynamics

Abstract. In the classical settings of Anosov diffeomorphisms or more general locally maximal hyperbolic sets I describe a new approach for constructing equilibrium measures corresponding to some continuous potentials and for studying some of their ergodic properties. This approach is pure geometrical in its nature and uses no symbolic representations of the system. As a result it can be used to effect thermodynamics formalism for systems for which no symbolic representation is available such as partially hyperbolic systems. This approach applies to a broad class of potentials satisfying Bowen's property, which includes the usual class of Holder continuous potentials. Furthermore, this approach gives a new way for constructing measures of maximal entropy (first constructed in this setting by Margulis). It also reveals a crucial geometric property of equilibrium measures that has not been known before — the conditional measures they generate on (un)stable leaves are measures of full Caratheodory dimension — the fact that lies in the heart of the geometric approach.
The talk is based on a joint work with V. Climenhaga and A. Zelerovich.

GABRIELLA PINZARI, Università di Padova
Recent results on the three–body problem

Abstract. We shall present some recent results concerning the three–body problem, in the the planetary case (two small bodies and a star). We shall talk about the coexistence, in a suitable region of the phase space, of both stable and unstable quasi-periodic motions.

Davide Ravotti, University of Bristol

Quantitative mixing for area-preserving flows on compact surfaces

Abstract. Given a compact surface, we consider the set of area-preserving flows with isolated fixed points. The study of these flows dates back to Novikov in the 80s and since then many properties have been investigated. Starting from an overview of the known results, we show that typical such flows admitting several minimal components are mixing when restricted to each minimal component and we provide an estimate on the decay of correlations for smooth observables.

Samuel Senti, U.F. Rio de Janeiro

Thermodynamical Formalism for multidimensional intermittent maps

Abstract. We will present joint work with Y. Pesin and K. Zhang.
For any arbitrarily small $t < 1$ we prove the existence and uniqueness of equilibrium measures associated to the t-geometric potential for intermittent torus maps known as Katok's examples. These measures exhibit exponential decay of correlations and satisfy the central limit theorem. The maps under consideration constructed by Katok by slowing down the orbits of a linear Anosov in a neighborhood of the fixed point, can be generalized to any surface. Time permitting we will also explain how to show that the (invariant) Lebesgue measure has polynomial decay of correlations.

Domokos Szasz, Budapest U. of Technology

Equidistribution for standard pairs in planar dispersing billiard flows

Abstract. Exponential correlation decay is proved in planar dis- persing billiard flows on the torus assuming finite horizon and lack of corner points. With applications aimed at describing heat conduction, the highly singular initial measures are concentrated on 1-dimensional submanifolds (given by standard pairs) and the observables are supposed to satisfy a generalized Hölder continuity property. The result is based on the recent exponential correlation decay bound of Baladi, Demers, Liverani obtained for Hölder continuous observables in these billiards. As we learnt from Chernov and Dolgopyat, standard pairs are most appropriate for the perturbative analysis of billiard-like systems therefore we pay special attention to the model dependence of the constants in our bounds.
The results are joint with P. Bálint, P. Nándori and IP. Tóth.

Corinna Ulcigrai, University of Bristol
A CLT for cocycles over rotations

Abstract. We will present an instance of the central limit theorem in entropy zero dynamics obtained as a temporal limit theorem. We consider deterministic random walks on the real line R driven by a rotations (or in other words, a skew product over an irrational rotation) and prove a temporal CLT for badly approximable rotation numbers and piecewise cocycle with jumps at certain irrational values. This generalizes previous results by J.Beck and by D. Dolgopyat and O. Sarig. The proof uses continued fraction and Ostrowsky renormalization.
The talk is based on joint work with Michael Bromberg.

Hong-Kun Zhang, U. of Massachusetts, Amherst
Diffusion for Sinai billiards with flat points

Abstract. We investigate the diffusion and statistical properties of several types of Lorentz gas with flat points. This include modifications of billiards with cusps, dispersing billiards on a torus with infinite horizon, etc.The decay rates are proven to depend on the degree of the flat points, which varies from n^{-a}, for $a \in (0, \infty)$.The stochastic processes experience different behaviors varying from normal diffusion, super-diffusion and/or with Levy jumps.