TITLES AND ABSTRACTS

Mini-courses

Speaker: Anne Vaugon and Pierre Dehornoy
Title: Contact flows and Birkhoff sections
Abstract: This course is devoted to the interplay of several topological and dynamical notions, namely contact forms and their Reeb flows, open book decompositions, and Anosov flows. We will spend some time explaining the basic definitions and several important examples. The rough plan is

(1) Contact forms, Reeb flows, and open book decomposition
(2) Birkhoff sections, Anosov flows, and Reeb-Anosov flows
(3) Surgeries

Speaker: Colin Guillarmou
Title: Microlocal methods for Anosov flows
Abstract: We will introduce some tools from analysis (in particular microlocal analysis) in order to understand the Fredholm theory of Anosov flows. We will then explain how these tools can be used to study a rigidity problem consisting in determining a Riemannian metric from the lengths of its marked closed geodesics, and we will describe a variational approach to study this problem locally near a fixed negatively curved Riemannian metric on a closed manifold.

Speaker: Kathryn Mann and Thomas Barthelmé
Title: Anosov flows in 3 dimensions and Anosov-like actions
Abstract: A (pseudo)-Anosov flow on a 3-manifold can be understood through its orbit space, a bifoliated plane with a natural action of the fundamental group of the manifold. In this minicourse, we will describe techniques to study the dynamics of these orbit space actions as a means to understand the topological theory and the classification of (pseudo)-Anosov flows in dimension 3. This leads to a more general theory of "Anosov-like" actions on bifoliated planes, which form a rich class of discrete dynamical systems including but not limited to the orbit space actions from flows.

Long talks

Speaker: Christian Bonatti
Title: Anosov flows on 3-manifolds: bifoliated plane, Markov partitions and classification.
Abstract: keeping in mind a program trying to classify Anosov flow on 3 manifolds through Markov partition, I will present some results by Ioannis Iakovoglou, or both of us.

- If what we know of the Anosov flow is the action on its bifoliated plane, what is a Markov partition? Iaonnis defines precisely this notion and their "geometric type". Then he checks that two Anosov flows admitting Markov partitions with the same "geometric type" are obtained one from the other by Dehn-Goodman-Fried durgeries along the periodic orbits in the boundary of the partitions. One may complete the geometric type by integers associated to every boundary periodic orbit and one gets a complete invariant for the orbital conjugacy.
- As an application, he provides a complete classification of Anosov flows assuming that every "pivot orbit" (notion defined by Fenley) is pivot in every direction. Fenley proved that every non-R-covered Anosov flow admits a finite collection of pivots orbits. For that, Ioannis provides a finite collection of canonical geometric types of Markov partitions for these flows. It happens that the dynamical hypothesis on pivots is equivalent to a family described by T. Barbot, of flows on graph manifolds with periodic orbits parallel to the fibers in the Seifert pieces.
- Going further we very recently got a canonical geometric type for the obtained from the "fake horseshoe" by gluing the entrance/exit boundary tori. Our construction seems to be generalizable to flows obtained by gluing hyperbolic plugs for which that maximal invariant in each either consist in finitely many orbits or admits a Markov partition with 1 rectangle.
- This approach uses (and abuses) a family of periodic orbits canonically associated to the flow: that is the case of every non-R-covered flow. For R covered flows, I suggest trying to classify in a first time the pairs of a flow endowed with a periodic orbit.

Speaker: Jonathan Bowden
Title: TBA
Abstract:

Speaker: Vincent Colin
Title: Birkhoff sections for Reeb flows in dimension 3
Abstract: We will explain that, in dimension 3, a generic Reeb vector field admits a Birkhoff section. An intermediate step is to prove that a nondegenerate Reeb vector field is carried by a so called "broken book decomposition". Along the way we will discuss other dynamical properties of Reeb flows: count of periodic orbits and topological entropy. This is a joint work with Pierre Dehornoy, Umberto Hryniewicz and Ana Rechtman.

Speaker: Rhiannon Dougall
Title: Comparison of entropy for infinite covering manifolds

Abstract: A classical example of an Anosov flow is the geodesic flow associated to a compact hyperbolic manifold M. The periodic orbits are the closed geodesics in M, and relate to the fundamental group of M. In general Anosov flows are not so well behaved, there may be infinitely many periodic orbits in a free homotopy class, in contrast to geodesic flows. Nevertheless one has results on the asymptotic number of periodic orbits up to period T. In this talk we will discuss the problem of counting periodic orbits in infinite covering manifolds. Unlike in the geodesic flow case, a lack of symmetry can already force a drop in entropy in an abelian cover. Nevertheless, we still manage to characterize a drop in terms of properties of the covering group. I will motivate this as a dynamically-rich problem. Joint work with Richard Sharp.

Speaker: Anna Florio
Title: Universal dynamics in 3D stationary Euler flows
Abstract: Understanding the dynamical complexity of an ideal fluid has motivated many research works. According to Arnold's vision, the dynamics of stationary Euler flows should be as complicated as those in celestial mechanics. In a joint work with Pierre Berger and Daniel Peralta-Salas, we recover Arnold's vision by showing the existence of a locally dense set of stationary solutions of the Euler equations in $\mathbb{R}^3$ made up of universal vector fields. For the proof we introduce new perturbative methods in the context of Beltrami fields in order to import tools from bifurcation theory.

Speaker: Danijela Damjanovic
Title: On global rigidity of Anosov actions of large groups
Abstract: We consider an Anosov action of a simple Lie group of rank greater than 2 and prove that if the centralizer of the Anosov element contains enough Anosov elements, then the manifold of the action is homogeneous and the whole action is essentially algebraic. This result relies on building homogeneous structure on the manifold given an abelian Anosov action. This is joint work with R. Spatzier, K. Vinhage and D. Xu.

Speaker: Matilde Martinez
Title: Foliated horocycle flow
Abstract: The geodesic flow on hyperbolic surfaces is a classical object in dynamics, and it is one of the prime examples of Anosov flows. Its study is inseparable of that of the horocycle flow, which parametrizes its strong stable manifolds. Both these flows, their similarities, their differences, and their interaction, can be understood in the wider setting of flows in homogeneous spaces.

An action of the Lie group $\mathrm{PSL}(2,\mathbb{R})$ on a space which is not necessarily homogeneous gives rise to "foliated" geodesic and horocycle flows on a foliation by hyperbolic surfaces. The dynamics of these flows combines a tangential component (which is the dynamics of the usual flows in noncompact hyperbolic surfaces) with the transverse dynamics of the foliation. While the foliated geodesic flow is not in general hyperbolic, many ideas and techniques from both Anosov and homogeneous dynamics shed light on its behaviour.

I will give an overview of some work I have done over the years on the subject of the topological and ergodic dynamics of these flows, focusing on the foliated horocycle flow. It is

joint work with several collaborators, notably Fernando Alcalde, Françoise Dal'Bo, Shigenori Matsumoto and Alberto Verjovsky.

Speaker: Jana Rodriguez Hertz
Title: A Livsic-type condition for an mme to be an SRB measure in the DA-case
Abstract: How often does it occur that the measure of maximal entropy of a system is an SRB measure?

We study this question for partially hyperbolic diffeomorphisms isotopic to Anosov on $\mathbb{T}^3$, and establish a rigidity result: the measure of maximal entropy μ is an SRB measure for a C^{1+}-DA-diffeomorphism f if and only if $h_{top}(f_*) = \Lambda(p)$ for all periodic points p in the support of μ, where $\Lambda(p) = \lambda^u(p)$ if $\lambda^c(f_*) < 0$, and $\Lambda(p) = \lambda^u(p) + \lambda^c(p)$ if $\lambda^c(f_*) > 0$. (λ^* are the Lyapunov exponents.) In that case, μ is also the unique SRB measure.

We obtain non-Anosov DA-examples, both conservative and non conservative, such that the mme is SRB.

Speaker: Khadim War
Title: TBA
Abstract:

Short talks

Speaker: Alena Erchenko
Title: Flexibility and rigidity for Cantor repellers
Abstract: We will consider dynamical systems that we call Cantor repellers which are expanding maps on invariant Cantor sets coming from iterated function systems. Cantor repellers have two natural invariant measures: the measure of full dimension and the measure of maximal entropy. We show that dimensions and Lyapunov exponents of those measures are flexible up to well understood restrictions. We will also discuss the boundary case for the range of values of the considered dynamical data. This is joint work with Jacob Mazor.

Speaker: Minsung Kim
Title: Deviation spectrum of Birkhoff integrals for locally Hamiltonian flows on compact surfaces
Abstract: The deviation of the Birkhoff integral for area-preserving flow on compact surfaces was studied by Forni. The Lyapunov exponent of the so-called Kontsevitch-Zorich cocycle determined the deviation spectrum. This deviation result was also proved later by Bufetov and Ulcigrai-Fraczek for translation flows and locally Hamiltonian flows for non-degenerate types.

In our work, we study the spectrum for deviations of Birkhoff integrals beyond the case of Forni where the observable vanishes at the singularities. Our new developments include a better understanding of the asymptotics at singularities (degenerate type) and the appearance of a new deviation spectrum. This is joint work with Krzysztof Fraczek.

Speaker: Martin Mion-Mouton
Title: Regularity of invariant distributions and rigidity of partially hyperbolic diffeomorphisms
Abstract: The stable, unstable (and central) distributions of (partially) hyperbolic dynamics are a priori only Hölder continuous, and several works seem to suggest that their lack of regularity is in fact the main obstacle to their rigidity. Concerning contact-Anosov flows, successive works of Ghys (in dimension three) and Benoist-Foulon-Labourie (in higher dimensions) have for instance proved that the smoothness of the stable and unstable distributions forces the system to be algebraic. In this talk, I will present an analog rigidity result for three-dimensional volume-preserving partially hyperbolic diffeomorphisms whose stable, unstable and central distributions are smooth, and whose stable-unstable plane field is a contact distribution. If the time allows, I will present a work in progress with Elisha Falbel concerning higher-dimensional partially hyperbolic diffeomorphisms with smooth invariant distributions that preserve a contact form.

Speaker: Federico Salmoiraghi
Title: Surgery on Anosov flows using bi-contact structures
Abstract: Nearly thirty years ago Mitsumatsu first noticed that the generating vector field of an Anosov flow with orientable weak invariant foliations is defined by the intersection of a pair of transverse contact structures rotating towards each other along the flow. Flows defined

by bi-contact structures are called projectively Anosov. Recent work of Hozoori has further highlighted the role of of pA flows as a link between Anosov dynamics and contact/symplectic geometry yelding recently to the definition of Floer theoretical invariants for Anosov flows. In this talk we introduce two different kind of surgeries on pA flows using a supporting bi-contact structure. The first operation is performed along a transverse annulus and can be interpreted as the natural extension of Goodman surgery to the realm of pA flows. The other one is performed along a tangent annulus and can be used to produce new examples of contact Anosov flows.

Speaker: Chi Cheuk Tsang
Title: Veering triangulations and Birkhoff sections
Abstract: This talk is an advertisement for the correspondence theorem between veering triangulations and pseudo-Anosov flows on 3-manifolds, developed by Agol, Gueritaud, Schleimer, Segerman, and others. We will give a quick introduction to how the correspondence theorem works, then use those ideas to sketch a proof that every transitive pseudo-Anosov flow on a 3-manifold admits a Birkhoff section with two boundary components.
