

Titles and Abstracts

Geometry of rotation sets for kicked Denjoy diffeomorphisms

Jan Boroński

Jagiellonian University

In the first part of my talk I shall discuss a joint work with T. Kucherenko (CUNY), in which motivated by a construction of Beguin, Crovisier and Le Roux, we study the geometry of rotation sets for a family of kicked Denjoy toral diffeomorphisms. We show that this single family exhibits an entire spectrum of rotation set types. Not only is this the first such family, but also it is the first time that some of these rotation set types are found in the category C^1 . In the second part, time permitting, I shall discuss a roundness of non-polygonal rotation sets of Kwapisz toral diffeomorphisms, as a function of the irrational rotation number of the Denjoy circle diffeomorphisms. We obtain lower and upper bounds for the roundness and show that it is neither continuous nor monotone. This part is a joint work with A. Clark (QMUL) and B. Perrot (Paris-Saclay).

Surface mapping class group actions on 3-manifolds

Lei Chen

Academy of Mathematics and Systems Science, Chinese Academy of Science

For each circle bundle $S^1 \rightarrow X \rightarrow \Sigma_g$ over a surface with genus $g \geq 2$, there is a natural surjection $\pi : \text{Homeo}^+(X) \rightarrow \text{Mod}(\Sigma_g)$. When X is the unit tangent bundle $U\Sigma_g$, it is well-known that π splits. In this talk, I will discuss the condition for π split. We conjectured that it only splits when the Euler number is exactly $2 - 2g$ or $2g - 2$. We will discuss many cases for this conjecture. This is joint work with B. Tshishiku and A. Beaini.

Dynamics of surface diffeomorphisms with positive entropy

Sylvain Crovisier

Laboratoire de Mathématiques, Université Paris-Saclay

The dynamics of surface diffeomorphisms whose topological entropy vanishes is highly restricted: this is reflected for instance through works by Franks-Handel, Le Calvez-Tal, Crovisier-Pujals-Tresser, ... For surface diffeomorphisms whose entropy is positive, the dynamics seems much more flexible, but satisfies also some constraints: for instance it always contains a horseshoe (Katok's theorem).

In this talk I will discuss techniques which have been developed in the recent years for smooth systems and which allow to propose a global framework for describing the dynamics of general systems, focusing on their decomposition and on their ergodic theory. This is mainly based on results obtained with J. Buzzi, O. Sarig, and E. Pujals.

Classification of Stable Surfaces with respect to Automatic Continuity

George Domat

University of Michigan

Topological groups often exhibit lots of interplay between their algebraic and topological structures. A stark example of this is the automatic continuity property: A topological group has the automatic continuity property if every (algebraic) homomorphism to any other separable group is continuous. We provide a complete classification of when the homeomorphism group of a stable surface has the automatic continuity property. Towards this classification, we provide a general framework for proving automatic continuity for groups of homeomorphisms. This is joint work with Mladen Bestvina and Kasra Rafi.

Multiple closed geodesics on positively curved Finsler spheres

Huagui Duan

Nankai University

In this talk, we will introduce the closed geodesic problem and some index theories. In particular, we will explain some ideas to prove our recent result as follows: for every Finsler metric on a sphere S^n of dimension $n \geq 4$ with its flag curvature satisfying certain pinching condition, there exist at least n prime closed geodesics on S^n , which solved a conjecture of Katok and Anosov for such spheres when n is even. This is a joint work with Dr. Dong Xie.

Legendrian knots and Lagrangian fillings

Honghao Gao

Tsinghua University

Legendrian knots and their exact Lagrangian fillings are central objects to study in low dimensional contact and symplectic topology. Therefore, it is an important question to classify exact Lagrangian fillings up to Hamiltonian isotopy. It is conjectured that this classification is controlled by a quiver and some derived algebraic structures. In this talk, I will review the historical developments, and explain the algebraic machinery to distinguish fillings. Then, I will discuss the ideas to obtain a subjectivity result, which

involving new ideas such as understanding polygons on surfaces, quiver with potentials, etc. This is based on a joint work with Roger Casals.

Degenerate symplectic fixed points and Gromov-Witten invariants

Wenmin Gong

Beijing Normal University

The degenerate Arnold conjecture posits that every Hamiltonian diffeomorphism of a closed symplectic manifold M must have at least as many fixed points as the cuplength of M . Although this conjecture has been known for a long time, it remains largely unresolved. In this talk, I will explore its connections to Gromov–Witten invariants through the theory of spectral invariants with bulk, as developed by K. Fukaya, Y.-G. Oh, H. Ohta, K. Ono, and M. Usher.

Rotational Axiom A homeomorphisms for higher genus surfaces

Pierre-Antoine Guihéneuf

Sorbonne Université

Consider a homeomorphism of closed surface of genus ≥ 2 . I will explain that in the case its homological rotation set is big enough, the whole rotational behaviour is contained in a compact set that resembles a finite union of homoclinic classes with some heteroclinic connections. This is related to C^0 rotational versions of properties like Markov partitions, rotational density of periodic orbits, stability under perturbations... as well as purely rotational features such as the description of the rotation set's shape or some bounded deviations properties. The whole thing is based on Le Calvez-Tal forcing theory but I will mainly focus on some examples.

On the growth of the number of periodic points of C^1 maps

Luis Hernández-Corbato

Facultad de Matemáticas, Universidad Complutense de Madrid

A conjecture by Shub states that the asymptotic exponential growth rate of the number of periodic points of a C^1 map $f : M \rightarrow M$ is bounded from below by an algebraic topological quantity: the exponential growth rate of Lefschetz numbers $L(f^n)$. In particular, if M is a sphere the conjecture states that

$$\limsup_{n \rightarrow +\infty} \frac{1}{n} \log \left(\# \text{Fix}(f^n) \right) \geq \log \left(\deg(f) \right)$$

where $\deg(f)$ denotes the degree of f . The conjecture is wide open in general, even in S^2 . In the talk, we will review some results in very particular cases: maps on S^3 leaving

invariant a circle and maps preserving a singular foliation on a closed surface. This is joint work with H. Barge, A. Moreno, J. Sanchez–Gabites (Madrid).

Two or infinity

Umberto Hryniewicz

RWTH-Aachen University

In this talk I would like to describe a result, recently obtained in collaboration with Cristofaro-Gardiner, Hutchings and Liu, that confirms, as a special case, a conjecture made by Hofer, Wysocki and Zehnder in the year 2000 asserting that every Reeb flow on the standard contact 3-sphere has either exactly two or infinitely many periodic orbits. This confirms an old conjecture in differential geometry asserting that Finsler metrics on the two-sphere have either exactly two or infinitely many closed geodesics. We also discuss the validity of several other structural conjectures in low dimensional symplectic dynamics. For instance, in joint work with Colin and Rechtman we establish a rigidity result about 3d Reeb flows admitting Legendrian knots with finitely many geometrically distinct Reeb chords: these can only exist in lens spaces where the Reeb flow has exactly two periodic orbits. I would also like to discuss several refinements of the “two or infinity” dichotomy for 3d Reeb flows, including a conjecture about the growth rate of periodic orbits (with respect to the period) being at least quadratic, unless the number of periodic orbits is finite. In particular, I will discuss a result of Bernhard Albach drastically improving on the known growth rates (due to Nancy Hingston) of the number of closed geodesics on a Riemannian two-sphere.

Action of fixed points and spectral invariants of Hamiltonian homeomorphisms of surfaces

Vincent Humilière

Sorbonne Université

I will report on some joint work in progress with Lev Buhovsky and Sobhan Seyfaddini, where we study whether the spectral invariants of Hamiltonian homeomorphisms of surfaces are "spectral", i.e. correspond to the action of fixed points, as defined by Jian Wang. This property, when it holds, is crucial for applications. I will present a partial result and some application.

Minimal periodic orbits and global surfaces of section in convex contact spheres

Jungsoo Kang

Seoul National University

Minimal periodic orbits play a central role in various results and conjectures concerning the rigidity properties of convex contact forms on odd-dimensional spheres (i.e. contact forms arise from convex embeddings of spheres into Euclidean spaces). Hofer, Wysocki, and Zehnder conjectured that minimal periodic orbits bound global surfaces of section of disk type for 3-dimensional convex contact spheres. In this talk, I will present an affirmative answer to this conjecture. This is based on joint work with Alberto Abbondandolo and Oliver Edtmair.

Rotation theory on Dehn twist isotopy classes

Alejandro Kocsard

IMPA

The vertical rotation set is the most important dynamical invariant for homeomorphisms of the 2-torus that are homotopic to a Dehn twist, i.e. a linear torus automorphism induced by the linear map

$$I_k := \begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix} \in \mathrm{SL}_2(\mathbb{Z}), \quad \text{with } k \neq 0.$$

In this talk, we will review some classical results on the topological dynamics of these homeomorphisms and discuss some new ones motivated by a fixed point theorem due to Hillel Furstenberg. This is a joint work with Heric Corrêa (IMPA).

Birkhoff sections for integrable flows on 3-manifolds

Wentian Kuang

Great Bay University

In this talk, we introduce a method for directly constructing Birkhoff sections for integrable flows on 3-manifolds. We establish the necessary and sufficient conditions for various types of periodic orbits to serve as boundary orbits of a Birkhoff section. The construction can be applied to boundaries of toric domains and energy surfaces of separable Hamiltonian systems, providing criteria for the existence or non-existence of certain types of Birkhoff sections.

Rotation sets and algebra via the fine curve graph

Frédéric Le Roux

Sorbonne Université

We study the group of homeomorphisms of the 2-torus which are isotopic to the identity. We show that the rotation set of a torus homeomorphism, in the case when it

has interior, is essentially determined by its axis in the fine curve graph. This is used to prove several results: we get a "Tits alternative" for our group, we show that two elements having non-homothetic rotation sets generate a free group, and that an element with a non-symmetric rotation set have positive stable commutator length. Work in collaboration with Sebastian Hensel.

Two irrationally elliptic closed Reeb orbits on the boundary of star-shaped domain

Xiaorui Li

Shandong University

There are two long-standing conjectures in Hamiltonian dynamics concerning Reeb flows on the boundaries of star-shaped domains in $\mathbb{R}^{2n}$ ($n \geq 2$). One conjecture states that such a Reeb flow possesses either n or infinitely many prime closed orbits; the other states that all the closed Reeb orbits are irrationally elliptic when the domain is convex and the flow possesses finitely many prime closed orbits. In this talk, we show that for dynamically convex Reeb flow on the boundary of a star-shaped domain in $\mathbb{R}^{2n}$ ($n \geq 2$) with exactly n prime closed orbits, at least two of them must be irrationally elliptic. The main ingredients include iteration theory of Maslov-type indices and descriptions of local Floer-theoretic invariants for certain closed Reeb orbits. This is a joint work with Profs. Hui Liu and Wei Wang.

Closed geodesics and the first Betti number

Marco Mazzucchelli

Sorbonne Université

In this talk, based on joint work with Gonzalo Contreras, I will sketch a proof of the following theorem: on any closed manifold of dimension at least two with non-zero first Betti number, a C^∞ generic Riemannian metric has infinitely many closed geodesics, and indeed closed geodesics of arbitrarily large length. I will derive this result as a consequence of the following new theorem of independent interest: the existence of minimal closed geodesics, in the sense of Aubry-Mather theory, implies the existence of a transverse homoclinic, and thus of a horseshoe, for the geodesic flow of a suitable C^∞ -close Riemannian metric.

On BBM technique and planar attractors

Piotr Oprocha

IRAFM, University of Ostrava

A very useful technique called BBM (Brown-Barge-Martin), incorporates inverse

limits and natural extensions of the underlying bonding maps to embed attractors in manifolds. The original idea goes back to the paper of Barge and Martin, where the authors constructed strange attractors from a wide class of inverse limits. One of the crucial steps for this technique to work is the usage of Brown's approximation theorem. Recently, this technique found several interesting applications and extensions. In this talk we will present a few possible applications of BBM technique in a construction of concrete examples of dynamical systems on surfaces. The talk is based on joint works with Jernej Cinc and Michal Kowalewski.

The relative periodic orbits in the spatial isosceles three body problem

Yuwei Ou

Shandong University

In Hamiltonian dynamics and celestial mechanics, finding periodic orbits on a given energy surface is an important topic. In four dimensions, the global surface of section serves as a key structure for finding periodic orbits, an approach that can be traced back to Poincaré's study of periodic orbits in the planar restricted three-body problem. In this talk, we first review some historical results, and then we focus on the spatial isosceles three-body problem—a system with two degrees of freedom after modulo the rotation symmetry. For certain values of energy and angular momentum, the energy surface is a 3-sphere, and we identify an open book structure in which each page is a disk-like global surface of section for the Hamiltonian flow. The Euler orbit forms their common boundary, and a brake orbit passes through them. By analyzing the Poincaré maps of these global surfaces of section, we will discuss the existence of infinitely many periodic orbits on a given energy surface. If time permits, we will discuss further research topics.

Towards an applicable theory of Chaos

Alejandro Passeggi

CMAT, FCien, UdelaR, Montevideo

Despite over a century of progress, determining whether a prescribed system exhibits chaotic behavior remains a major mathematical challenge. Even foundational examples like the Three-Body Problem and the Van der Pol Equation are still not fully understood. Classical concepts from Poincaré and Birkhoff—such as instability regions and homoclinic points—remain difficult to apply without detailed knowledge of the system, limiting their usefulness in practice.

Recent advances in the topological theory of surface dynamics have led to topological criteria for detecting rotational chaos, i.e., the presence of rotational horseshoes, based on simple properties of annular maps. These criteria translate classical notions into conditions that can be verified by finding a finite orbit connecting two open sets, which are easy to compute from basic information of the map.

In this talk, we present these results, beginning with annular dynamics and applications to families of maps, billiards, and Poincaré sections, and extending them to surfaces of higher genus, reaching applications to Reeb flows having Birkhoff sections.

Four-dimensional Hamiltonians

Rohil Prasad

Department of Mathematics, Princeton University

I will discuss some work using holomorphic curve techniques to investigate the dynamics of Hamiltonian flows on $\mathbb{R}^4$, without any convexity or contact-type conditions.

Finite energy foliations in the restricted three-body problem

Pedro Salomon

Southern University of Science and Technology

In this talk I will explain the use of pseudo-holomorphic curves to study the circular planar restricted three-body problem. For mass ratios sufficiently close to $1/2$ and energies slightly above the first Lagrange value, we show the existence of finite energy foliations whose binding orbits are two retrograde orbits around the primaries and the Lyapunov near the first Lagrange point. These foliations explain the existence of homoclinic orbits to the Lyapunov orbits. This is joint work with L. Liu.

On the Topological Invariance of Helicity

Sobhan Seyfaddini

ETH Zürich

Helicity is an invariant of divergence free vector fields on three-manifolds. One of its fundamental properties is invariance under volume preserving diffeomorphisms. Arnold, having derived an ergodic interpretation of helicity as an asymptotic linking number, asked whether helicity remains invariant under volume preserving homeomorphisms, and more generally, whether it admits an extension to topological volume preserving flows.

I will present affirmative answers to both questions in the case of non-singular flows via an approach relying on recent advances in C^0 -symplectic topology, particularly new insights into the algebraic structure of the group of area-preserving homeomorphisms. This is joint work with Oliver Edtmair.

A symplectic Hilbert-Smith conjecture

Egor Shelukhin

University of Montreal

A well-known open question in group actions and topological dynamics is the Hilbert-Smith conjecture. It extends Hilbert's fifth problem and states that a locally compact group acting faithfully on a manifold must be a Lie group. We discuss a recent result regarding p -adic actions by homeomorphisms of symplectic nature, which provides new evidence to support this conjecture.

Classification of Hénon maps with strange attractors via the topology of a stable manifold

Sonja Štimac

University of Zagreb, Faculty of Science, Department of Mathematics

In an earlier work with Boroński, we classified (up to conjugacy) the Hénon maps with strange attractors in terms of three invariants that we introduced for them: (a) kneading sequences, (b) pruned trees, and (c) folding patterns of the unstable manifold of the hyperbolic fixed point X in the attractor. In my talk, I will introduce yet another way to determine conjugacy classes of these maps, this time purely from the topology of the stable manifold W^s of X . We consider a region of dissipation D for the Hénon map and study the connected components of $D \cap W^s$. To each such component, we assign a separation type and prove that two Hénon maps are conjugate if and only if their corresponding components share the same separation type. This is joint work with Jan Boroński.

Area-preserving homeomorphisms of closed surfaces with no topological horseshoes

Fabio Armando Tal

Universidade de São Paulo

Building on the works of Franks, Handel and Le Calvez-Tal on the 2-sphere, we establish a decomposition theorem for area-preserving homeomorphisms of closed surfaces with a fixed point and no topological horseshoes. If the map is homotopic to a Dehn twist, we obtain an invariant maximal annulus where the rotation number is continuous and the dynamics is homotopic to a Dehn twist, reducing to the identity case. In the isotopic-to-identity setting, the surface splits into invariant annuli with continuous rotation number and positive-genus components where the dynamics resembles an irrational flow with singularities, while the remaining points are heteroclinic to $Fix(f)$. This yields a structural description of such systems and highlights the central role of rotation theory in their dynamics.

On the dynamics of invariant graphs for dissipative twist maps

Lin Wang

Beijing Institute of Technology

For two-parameter families of dissipative twist maps, I will talk about the dynamics of invariant graphs as well as the thresholds for their existence and breakdown.

C^0 -closedness of $Symp_0(X)$

Weiwei Wu

Zhejiang University

The C^0 topology of the symplectomorphism groups has lots of mysterious basic questions. The famous symplectic rigidity theorem says that, given any symplectic manifold X , the symplectomorphism group $Symp(X)$ is closed in $Diff(X)$ with respect to the C^0 topology. The question of whether $Ham(X)$ is C^0 -closed in $Symp_0(X)$ is the content of the famous C^0 flux conjecture. However, the relation between $Symp(X)$ and $Symp_0(X)$ is largely unexplored. Using Floer theory, Jannaud proved that iterations of a Dehn twist cannot lie in the closure of $Symp_0(X)$ for some Liouville domains.

In this talk, we will present a proof of the closedness of $Symp_0(X)$ in $Symp(X)$ when X is a log Calabi-Yau surface of type D , in the sense of Li-Li-Wu. For these symplectic manifolds, it was previously known that $Symp_h(X)$ is a subset of $Diff_0(X)$. The key to our approach is to apply the techniques of J -holomorphic foliations and inflations to obtain necessary C^0 -estimates. This is a joint work with Marcelo Atallah and Cheuk-Yu Mak.

Indecomposable continua and branched covering dynamics

Juliana Xavier

IMERL-FING-UdelaR, Montevideo

The goal of this talk is to present new examples of self-coverings and branched covering of indecomposable continua and show how they are relevant to the study of long-standing questions regarding one-dimensional complex dynamics as well as differentiable surface endomorphisms.

Symmetry and Dynamics

Zhihong Xia

Great Bay University

Symmetry plays an important role in Hamiltonian dynamics, from conservation laws to abundance of quasi periodic trajectories. In this talk, we will exploit symmetries, discrete and continuous, to obtain interesting dynamical structures.

Geometry and Dynamics of mean curvature flows

Jinxin Xue

Tsinghua University

Mean curvature flow is to evolve an embedded hypersurface in Euclidean space according to the vector field given by the mean curvature at each point. We show how to extract geometric information from the asymptotic dynamics of a mean curvature flow approaching a singularity. We show that when the flow approaches a cylinder in a nondegenerate manner, i.e. with the slowest asymptotic rate, the flow can be extended through the singularity and the topology change can be described explicitly. When the flow approaches a cylinder in a degenerate manner, i.e. with exponential asymptotic rate, the singularity set can be proved to be at least C^2 modulo a lower dimensional set. This talk is based on a series of works jointly with Ao Sun and Zhihan Wang.

Generalizations of Poincaré–Bendixson theorem and their applications

Tomoo Yokoyama

Saitama University

We generalize the classical Poincaré–Bendixson theorem for flows on surfaces, extending it from the case of finitely many singular points to settings with countably many and even arbitrarily many singular points. In these general contexts, we demonstrate that only two new types of limit sets can occur: quasi-circuits and quasi- Q -sets, which are generalizations of classical limit circuits and Q -sets. As applications, we characterize non-trivial recurrence via generalized Maier-type theorems, describe that α - and ω -limit sets are not independent, even when singular points are finite, and establish finiteness results for quasi- Q -sets depending on the genus of the surface. Moreover, we present an equivalence between the infinitude of α -limit sets and that of ω -limit sets if the singular points are finite.

Dax invariants, light bulbs, and isotopies of symplectic structures

Boyu Zhang

University of Maryland

In this talk, I will present several results about isotopy problems in dimension 4. First, we give a classification of the isotopy classes of embeddings of Σ in $\Sigma \times S^2$ that

are geometrically dual to $\{pt\} \times S^2$, where Σ is a closed oriented surface with a positive genus, and show that there exist infinitely many such embeddings that are homotopic to each other but mutually non-isotopic. This answers a question of Gabai. Second, we show that the space of symplectic forms on an irrational ruled surface homologous to a fixed symplectic form has infinitely many connected components. This gives the first such example among closed 4-manifolds and answers a question of McDuff-Salamon. We also show that symplectic forms on a closed 4-manifold with a fixed cohomology class do not admit the h-principle, which answers a question of Cieliebak-Eliashberg-Mishachev. The proofs are based on a generalization of the Dax invariant to embedded closed surfaces. This is joint work with Jianfeng Lin, Weiwei Wu, and Yi Xie.

Quantitative studies on dynamically convex domains

Jun Zhang

University of Science and Technology of China

Dynamical convexity serves as a symplectic analogue of classical convexity, capturing key Reeb dynamical properties on the contact boundary of a Liouville domain. In this talk, we will explore both the rigidity and flexibility of dynamically convex domains from multiple viewpoints. The rigidity aspect is illustrated by an Arnold-type result (joint work with Jungsoo Kang), which guarantees the existence of a specific number of genuine Reeb chords. On the other hand, flexibility is examined through a metric-geometric notion known as the (symplectic) Banach–Mazur distance. This perspective is supported by a large-scale geometric result (joint with Julien Dardennes, Jean Gutt, and Vinicius G. B. Ramos) that quantitatively distinguishes dynamically convex domains from convex ones. The methods employed encompass symplectic capacities, embedded contact homology, and Hamiltonian shape invariants.

The positive fundamental group of $Sp(2n)$ and closed geodesics of Hofer’s metric

Qinglong Zhou

Zhejiang University

In this talk, we examine the homotopy classes of positive loops in $Sp(2n)$. We demonstrate that two positive loops are homotopic if and only if they are homotopic through positive loops. This provides a positive answer to a conjecture raised by McDuff. As consequences, we can extend several results of McDuff and Chance to higher dimensional symplectic manifolds without dimension restrictions. This is a joint work with Jian Wang.

On uniqueness of Lagrangian fillings

Zhengyi Zhou

Eliashberg and Polterovich showed that the standard Legendrian unknot in standard contact $\mathbb{R}^3$ has exactly one exact Lagrangian filling up to isotopy. I will explain a higher dimensional analogue in the topological category: any exact filling of the standard Lagrangian unknot in standard contact S^{2n-1} is topologically unknotted, i.e., a topological n dimensional disk in a $2n$ dimensional disk. Moreover, this result is local in the sense that it holds for standard unknot in a contact Darboux chart on any contact manifold. This is a joint work in progress with Lite Du.

Young Session

The asymptotic action of irrational pseudo-rotations

David Bechara Senior

RWTH-Aachen University

Given a diffeomorphism of the disk that preserves the standard symplectic form, I will introduce the asymptotic action associated to this map. I will then show a pointwise formula relating the asymptotic action to the asymptotic winding number of pairs of points. I will focus on how this formula can be used to study symplectic dynamical information for irrational pseudo-rotations of the disk. This talk is based in joint work with Patrice Le Calvez and Abror Pirnapasov.

Classification of action of homeomorphisms on the fine curve graph of higher genus surfaces

Nastaran Einabadi

Sorbonne Université

We can associate to a surface its fine curve graph, which is a Gromov hyperbolic space. The homeomorphisms of the surface act as isometries on the fine curve graph, either hyperbolically, parabolically, or elliptically. It turns out that the problem of classifying homeomorphisms based on the type of their action on this graph, is related to the rotational behaviour of homeomorphisms. This connection has been established in the case of the torus leading to a complete classification. In this talk, we will present the progress that has been made towards solving the problem for higher genus surfaces.

Explicit uniform bound for fixed elliptic islands

Alejo Garcia

IMERL-FING-UdelaR, Montevideo

We study isotopic-to-the-identity torus homeomorphisms, whose rotation set has nonempty interior. We find explicit uniform bounds for the diameter of any fixed disk, in terms of the size of the rotation set and the $\mathcal{C}^0$ norm of the homeomorphism. This is a joint work with Alejandro Passeggi and Fábio Armando Tal.

A geometric group theoretic tool to study the group of Hamiltonian diffeomorphisms of the 2-sphere

Yongsheng Jia

The University of Manchester, Faculty of Science and Engineering

The group of Hamiltonian diffeomorphisms of the 2-sphere is a fundamental object in symplectic geometry, but it has not yet been systematically studied with methods from geometric group theory. In this talk, I'll introduce a new hyperbolic graph (in the sense of Gromov) on which this group acts by isometries. This graph can be viewed as an analogue of the curve graphs for mapping class groups, and it allows us to import ideas from that setting to the study of the group of Hamiltonian diffeomorphisms of the 2-sphere. As an application, I will explain how to construct new homogeneous quasimorphisms from this action and how these quasimorphisms reflect the dynamics of different types of elements. This is joint work with Richard Webb.

Rotational Chaos for Non-Wandering Annulus Maps

Favio Martín Piràn Lampariello

IMERL-FING-UdelaR, Montevideo

In various physical systems, it is useful to analyze dynamics via return maps on global surfaces of section. Often, annular sections can be found, as in notable cases like the Restricted Three-Body Problem. Any return map arising from a Hamiltonian system is conservative, meaning it preserves an area form. This motivates the main object of study in this talk: non-wandering maps of the annulus, where “non-wandering” is understood as a topological generalization of area preservation.

This talk focuses on rotational chaos in such maps, meaning the presence of a horseshoe with a non-trivial rotation set. Recent results by Alejandro Passeggi and Fabio Tal provide simple criteria for detecting rotational chaos: it is enough to find two disjoint neighborhoods of fixed points with different rotation numbers, such that some iterate of one neighborhood intersects the other.

I will present the ideas behind this result and ongoing work with Alejandro aimed at removing the fixed-point condition. We will discuss the challenges that arise when this assumption is lifted and, time permitting, explore our ideas on how to locate the resulting horseshoe.

Action and periodic orbits of area-preserving surface diffeomorphisms

Huadi Qu

Sichuan University

Periodic orbits for area-preserving diffeomorphisms on surfaces is a classic subject in dynamical systems. Recently converting area-preserving surface diffeomorphisms to Reeb flow via open book decomposition provided a powerful way for understanding periodic orbits of area preserving diffeomorphisms, and the ECH (Embedded Contact Homology) theory invented by M. Hutchings proves to be powerful. In particular, the dynamical invariant, action, of periodic orbit plays a very important role. The definition of the action function depends on a preferred closed 1-form, and this dependence is related with another important invariant of periodic orbits or more general invariant measure of area-preserving surface diffeomorphisms. In this talk, by analysis this dependence we can extend some previous results by Hutchings and Weiler about the existence of periodic orbits with prescribed action. This is a joint work with Zhihong Jeff Xia.

Poster Session

Barcodes in symplectic geometry

Habib Alizadeh

University of Science and Technology of China

The poster will introduce the theory of persistence barcodes and survey a selection of their applications within symplectic geometry including the following,

1. One can extract numerical symplectic invariants from (“infinite bars of”) Barcodes and a norm, so called the spectral norm, on the group of Hamiltonian diffeomorphisms of a symplectic manifold.
2. We will discuss some interesting questions on the spectral norm some of which we will partially answer: its diameter, relation to other norms, Lagrangian intersections,

behaviour under iterations, closing lemmas, topological entropy, pseudo-rotations and etc.

3. (“Finite bars of”) Barcodes can detect infinitely many periodic points of Hamiltonian diffeomorphisms.

Hyperbolicity in One Dimensional Dynamics

Joyce Kelly Figueiredo

IME-USP

This work is based in part on the article “Hyperbolicity, Sinks and Measure in One Dimensional Dynamics” by Ricardo Mañé, which deals with the dynamics of maps of the class C^2 defined on the circle or on the interval, in limited regions far from the critical points. There are several properties to be analyzed in a dynamical system, among which structural stability and hyperbolicity stand out. Structural stability is the property that allows us to understand a system by studying only other systems close to it. Thus, the interest arises in identifying which maps are structurally stable, which leads us to exploring the property called hyperbolicity. Interested in the one-dimensional case, we prove that the structurally stable diffeomorphisms of the circle are the hyperbolic ones. However, the main focus of this work lies in the case of endomorphisms of class C^2 (defined on the circle or the interval): we define what a hyperbolic set is and present a criterion for hyperbolicity (Mañé’s Theorem). In essence, this criterion shows that, under certain conditions, if the set has no non-hyperbolic periodic points, then we can extend hyperbolicity to the whole set. Hyperbolic sets have many interesting properties and this result reduces the characterization of structurally stable systems to a problem related to links of critical points. In addition, we present and prove some results on adapted intervals and bounded distortion that end up being applied in the proof of Mañé’s Theorem.

Rotation sets for random iterations of torus homeomorphisms

Catalina Freijo

IME-USP

We analyze various concepts of rotation sets for cocycles of torus homeomorphisms that are isotopic to the identity. We investigate their fundamental properties, with a focus on the possible shapes of these rotation sets and the phenomenon of bounded deviations. Furthermore, we examine the continuity properties of these rotation sets with respect to measures invariant under the base dynamics

Topological Horseshoes

Lara Maffei

IME-USP

Verifying whether or not a dynamical system is chaotic can be very complex, even when the system is defined by a simple map. A very useful tool for this type of analysis is the verification of the existence of a semiconjugacy to a shift map, whose dynamics are well known and which are chaotic, that is, they have positive topological entropy. A classic example of this method is Smale's Horseshoe, which has a compact invariant set in which the dynamics are a factor of the shift on two elements. This example assumes hyperbolicity for its analysis, which makes it harder to generalize for computational studies, since it is not always possible to verify hyperbolicity numerically. Thus, the search for sufficient conditions for a map to be considered a topological horseshoe, without the need for hyperbolicity, becomes extremely relevant. We say a map is a topological horseshoe if it has a compact invariant set in which the dynamics are a shift on M elements. In this poster, we will present a theorem by Kennedy and York, which lays out these conditions and provides a few examples.

Teoria de rotação e a difusão no modelo kicked Harper (Rotation theory and diffusion in the kicked Harper model)

Giovanne Oliveira

IME-USP

This particular work is based on the paper “On the onset of diffusion in the kicked Harper model” by Tobias Jäger, Andres Korošček and Fabio Armando Tal which examines a two parameter family of area-preserving torus diffeomorphisms homotopic to the identity, the kicked Harper model, using rotation theory to understand how the transition from regular motion to more complex behaviour (diffusion). The map is obtained by composing two shears, one vertical and one horizontal, in which the length of each shear is determined by a real parameter. We describe average motion using the rotation set of a Hamiltonian lift, as defined by Misiurewicz and Ziemian. If the rotation set has empty interior, orbits stay essentially confined to a region of the torus, if it has non-empty interior, orbits can spread across the torus and diffusion appears. We identify two complementary parameter regions, E , formed by parameters associated to rotation sets with empty interiors, and N , the complement of E . We prove the continuity of the rotation set map $F \rightarrow \rho(F)$ within the class of Hamiltonian lifts. A geometric conclusion is a cusp-shaped region formed by N around the diagonal $\alpha = \beta$, parameters inside this cusp yield rotation sets with non-empty interior. We also obtain explicit asymptotic bounds for the diffusion thresholds $\beta^-(\alpha)$ and $\beta^+(\alpha)$. When α is large, in this case, for $\alpha \geq 1$, they satisfy :

$$\frac{c}{\sqrt{\alpha}} \leq \beta^-(\alpha) \leq \beta^+(\alpha) \leq \frac{C}{\sqrt{\alpha}}, \quad \text{where } 0 < c < C \text{ are constants.}$$

Pseudo-rotações irracionais do anel fechado (Pseudo-rotations of the closed annulus)

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Our goal here is to explore how the concept of rotation number introduced by H. Poincaré can be extended to homeomorphisms of the closed annulus $S^1 \times [0, 1]$ isotopic to the identity. We will see that, in this context, what we obtain is a rotation set, and we will call an irrational pseudo-rotation a map h whose rotation set is reduced to a single irrational number. For this type of map, we will present the result of F Béguin, S Crovisier, F Le Roux and A Patou which guarantees that, for every positive integer n , there exists a simple arc γ_n joining one of the boundary components of the annulus to the other and such that γ_n is disjoint from its first n iterates under h .

The Lagrange problem from the viewpoint of toric geometry

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I mainly prove the following results. For every energy value below the minimum of the first, second and third critical value, each bounded component of the regularized energy hypersurface of the Lagrange problem with $0 < m_2 \leq m_1 \leq 9m_2$, $m_1 \geq 2 > 0$ and $m_2 \geq 3$ arises as the boundary of a strictly monotone toric domain, which is dynamically convex as a corollary. For the Euler problem as a special case of the Lagrange problem, when the energy $c < -m_1 - m_2$, the bounded component around the fixed center e of the regularized energy hypersurface of the Euler problem with two fixed points e and m of masses m_1 and m_2 respectively satisfying $m_1 > 0$, $m_2 \leq 0$ and $m_1 \geq |m_2|$ arises as the boundary of a convex toric domain. Together with Gabriella Pinzari's result, when the energy is less than the critical value, the toric domain $X_{\Omega_{m_2}}$ defined above is concave for $m_2 \geq 0$, convex for $m_2 \leq 0$.