Dubrovnik X - Topology & Dynamical Systems
Book of abstracts

June 24 - 28, 2024,
Inter-University Centre Dubrovnik, Croatia

Plenary talks

Ursula Hamenstädt

University Bonn

Title: $\mathrm{Out}(F_n)$ via sphere system graphs

Abstract: For a closed surface of genus $g > 1$ and $k < g/2+1$, the graph of non-separating sphere systems is hyperbolic. We show a similar statement for a certain $\mathrm{Out}(F_n)$-graph of non-separating spheres in the connected sum of n copies of $\mathbb{S}^1 \times \mathbb{S}^2$. We use this to shed some light on large scale geometric properties of $\mathrm{Out}(F_n)$, in particular in the case $n = 3$. This is partially joint work with Sebastian Hensel.

Chris Leininger

Rice University

Title: Atoroidal surface bundles

Abstract: I will discuss joint work with Autumn Kent in which we construct the first known examples of compact atoroidal surface bundles over surfaces for which the base and fiber genus are both at least 2. This is a consequence of our construction of a type-preserving embedding of the fundamental group of the figure eight knot complement into the mapping class group of a thrice-punctured torus.

Marco Martens

Stony Brook University

Title: Renormalization in Dynamics

Abstract: Renormalization is a technique to study small scale geometrical properties of attractors. If an attractor is topologically not too wild then it often has surprising geometrical properties. In particular, only the topology of the attractor determines the geometry of the attractor.

Kasra Rafi

University of Toronto

Title: Benjamini-Schramm limits of high genus translation surfaces.

Abstract: A sequence of random finite-volume manifolds X_i Benjamini-Schramm converges to a random pointed manifold (X, p) if, when p_i is a random point in X_i chosen uniformly, then the law of (X_i, p_i) converges to the law of (X, p) in the space of Borel probability measures on the space of pointed manifolds. This convergence notion admits natural generalizations to manifolds endowed with extra structures, such as abelian differentials. We will describe the Benjamini-Schramm limit of a random translation surface of genus g as g approaches infinity. This is a joint work in progress with Lewis Bowen and Hunter Vallejos.

Invited Talks

Naomi Andrew

University of Oxford

Title: The Farrell–Jones Conjecture and automorphisms of relatively hyperbolic groups

Abstract: The Farrell–Jones conjecture predicts that the K-theory of a group ring is isomorphic to a certain equivariant homology theory, and there are also versions for L-theory and Waldhausen's A-theory. In principle, a positive answer for a family of groups allows one to calculate these K-groups, as well as classifying the manifolds admitting a given fundamental group and implying a positive answer to the Borel conjecture. I will discuss recent work with Yassine Guerch and Sam Hughes on the conjecture for extensions of relatively hyperbolic groups, as well as an application to automorphism groups in the one-ended case, going via the theory of JSJ decompositions to produce acylindrical actions on trees.

Macarena Arenas

University of Cambridge

Title: Taut smoothings and shortest geodesics

Abstract: In this talk we will discuss the connection between combinatorial properties of minimally self-intersecting curves on a surface S and the geometric behaviour of geodesics on S when S is endowed with a Riemannian metric. In particular, we will explain the interplay between a smoothing, which is a type of surgery on a curve that resolves a self-intersection, and k-systoles, which are shortest geodesics having at least k self-intersections, and we will present some results that partially elucidate this interplay.

André Belotto da Silva

Université Paris Cité

Title: Sard Conjecture in analytic manifolds

Abstract: I will present some recent results concerning the Sard Conjecture in Sub-Riemannian geometry (SR geometry). SR geometry studies the trajectories in a manifold M which satisfies an extra constraint: they must be almost everywhere tangent to a totally non-holonomic distribution D over M. Some of these trajectories, which are called singular, have pathological behaviours which have no analog in Riemannian geometry. The Sard Conjecture states that the set of points one can reach via singular horizontal paths is "small", that is, it has Lesbeague measure zero.

I will explain how this Conjecture can be interpreted as a geometrical problem concerning the behavior of a characteristic singular foliation in the cotangent bundle. Under the hypothesis of analyticity of M and D, we can study this singular foliation via methods of singularity theory, subanalytic geometry and control measure theory. This is the approach used in our recent results in collaboration with Figalli, Parusinki and Rifford.

Luka Boc Thaler

University of Ljubljana

Title: On the geometry of simply connected wandering domains

Abstract: In this talk we will construct an entire function $f : \mathbb{C} \to \mathbb{C}$ for which the unit disk $\mathbb{D}$ is a wandering domain. The construction relies on the approximation techniques and can be generalized so that the unit disk $\mathbb{D}$ may be replaced by any simply connected Jordan domain. We can also use similar approach to show that a unit ball $\mathbb{B} \subset \mathbb{C}^m$ is a wandering domain of some automorphism of $\mathbb{C}^m$.

Jan Boroński

Jagiellonian University

Title: A classification of Hénon maps in the presence of strange attractors

Abstract: In my talk I shall present my work with Sonja Štimac on Hénon maps with strange attractors (Wang-Young parameters). First I shall explain a construction (inspired by a work of Crovisier and Pujals on mildly dissipative diffeomorphisms of the plane) of conjugacy of these maps to the shift homeomorphisms on inverse limits of dendrites with dense set of branch points, and a characterization of orbits of critical points in terms of these inverse limits. Then I will explain how this leads to a classification of conjugacy classes of such maps in terms of a single sequence of 0s and 1s.

References:

Boronski J., Štimac S; Densely branching trees as models for Hénon-like and Lozi-like attractors, Advances in Mathematics 429 (2023) 109191

Boronski J., Štimac S; The pruning front conjecture, folding patterns and classification of Hénon maps in the presence of strange attractors, arXiv: 2302.12568v2

Rachael Boyd

University of Glasgow

Title: Diffeomorphisms of reducible 3-manifolds

Abstract: I will talk about joint work with Corey Bregman and Jan Steinebrunner, in which we study the moduli space $B\,\mathrm{Diff}(M \text{ rel } \partial M)$, for M a compact, connected, reducible 3-manifold. We prove that when M is orientable and has non-empty boundary, $B\,\mathrm{Diff}(M \text{ rel } \partial M)$ has the homotopy type of a finite CW-complex. This was conjectured by Kontsevich and previously proved in the case where M is irreducible by Hatcher and McCullough.

Christopher Cashen

University of Vienna

Title: RAAGedy RACGs

Abstract: Some positive and negative partial results about the question of when a given 2-dimensional right-angled Coxeter group is quasiisometric to some right-angled Artin group. This is work in progress with Dani, Edletzberger, and Karrer.

Jernej Činč

University of Maribor & ICTP Trieste

Title: On homeomorphisms of the Lelek fence

Abstract: Lelek fence is a non-locally connected space whose proper subcontinua are arcs, has a Cantor set base and dense set of endpoints. It appears naturally in complex dynamics under the name hairy Cantor set. In this talk I will discuss how to translate homeomorphisms of the Cantor set base to homeomorphisms of the Lelek fence. Moreover, I will present some applications of our main theorem as well as discuss some interesting examples. This talk is based on a joint work with Udayan Darji and Benjamin Vejnar.

Spencer Dowdall

Vanderbilt

Title: Lattice Veech group extensions of surfaces groups: rigidity and hierarchical hyperbolicity

Abstract: Going beyond the setting of convex cocompactness, there is an effort to develop a theory of geometric finiteness for subgroups of mapping class groups that captures a broader range of behaviors and relates these to the structure of Teichmüller space, the action on the curve complex and the geometry of surface group extensions. Perhaps the most compelling candidates in this direction are the lattice Veech subgroups, which are stabilizers of Teichmüller disks for which the affine action on the underlying flat structure determines a lattice in $SL(2,\mathbb{R})$. I will explain the geometric structure of these groups and explain how it gives rise to hierarchical hyperbolicity and quasi-isometric rigidity for the associated surface group extensions. Time permitting, we will also look at other subgroups, such as combinations of lattice Veech groups. Joint work with Matt Durham, Chris Leininger, and Alex Sisto.

Federica Fanoni

CNRS & University of Paris-Est Créteil

Title: From curve graphs to fine curve graphs, and back

Abstract: Fine curve graphs were introduced by Bowden, Hensel and Webb to study homeomorphism and diffeomorphism groups of closed surfaces. An important observation in their work is the fact that fine curve graphs can be approximated by curve graphs of the punctured surface. In this talk, we will present joint work with Sebastian Hensel in which we investigate to which extent we can use curve graphs of punctured surfaces to study boundary points of fine curve graphs. We will also show how we can use fine curve graph techniques to construct a parabolic isometry of a graph of curves of an infinite-type surface.

Uta Freiberg

TU Chemnitz

Title: (Non)Minkowski-measurability of self similar fractals

Abstract: With the help of renewal theory one can show that self-similar fractals (satisfying the OSC) are Minkowski measurable in the so-called non-lattice case. The converse is still open for fractals embedded into Euclidean spaces with dimension greater than one. We sketch the history of this problem and give a family of examples supporting the conjecture. This is a joint ongoing project with Jonas Lippold (TU Chemnitz) and Steffen Winter (KIT).

Camille Horbez

CNRS and Université Paris-Saclay

Title: Integrable measure equivalence rigidity of right-angled Artin groups

Abstract: The notion of measure equivalence was introduced by Gromov as a measure-theoretic analogue to the notion of quasi-isometry between groups. In this talk, I will present a rigidity theorem for a class of right-angled Artin groups in measure equivalence, under a (necessary) integrability condition on a cocycle naturally associated to the measure equivalence. This will establish a parallel with the behaviour of these groups for quasi-isometry. This is joint work with Jingyin Huang.

Thomas Jordan

University of Bristol

Title: The shrinking target problem for certain self-affine sets

Abstract: For a dynamical system you can consider the starting points of orbits which hit a set of shrinking targets infinitely often. This set is usually known as the shrinking target set. You can study whether the set has zero or full measure for some suitable invariant measure and in appropriate settings you can consider the Hausdorff dimension of the set. For conformal systems in $\mathbb{R}^d$ there problems are fairly well understood but as usual much less is known in the non-conformal setting. We consider a special class of self-affine sets on the plane and make use of both transversality and recent work by Shmerkin on the L^q spectra of self-similar measures to find the dimension of the shrinking target sets. We will also highlight differences with the self-similar and conformal cases. This is joint work with Henna Koivusalo.

Tamara Kucherenko

City University New York

Title: Realization of Anosov Diffeomorphisms on the Torus

Abstract: We study area preserving Anosov maps on the two-dimensional torus within a fixed homotopy class. We show that the set of pressure functions for Anosov diffeomorphisms with respect to the geometric potential is equal to the set of pressure functions for the linear Anosov automorphism with respect to Hölder potentials. We use this result to provide a negative answer to the $C^{1+\alpha}$ version of the question posed by Rodriguez Hertz on whether two homotopic area preserving C^∞ Anosov difeomorphisms whose geometric potentials have identical pressure functions must be C^∞ conjugate. (This is based on joint work with A. Quas)

Monika Kudlinska

University of Oxford/University of Cambridge

Title: Solving equations in free-by-cyclic groups

Abstract: A group is said to be equationally Noetherian if any system of equations over the group which involves a finite number of variables is equivalent to a finite subsystem. In joint work with Motiejus Valiunas, we prove that all free-by-cyclic groups are equationally Noetherian. As an application, we combine this with the work of Sela and Fujiwara to shos that the set of exponential growth rates is well-ordered for many free-by-cyclic groups.

Jean Lafont

Ohio State University

Title: High dimensional hyperbolic Coxeter groups that virtually fiber

Abstract: I'll describe an iterative procedure to produce hyperbolic Coxeter groups that virtually algebraically fiber. The examples we produce have arbitrarily high virtual cohomological dimension. This is joint work with Minemyer, Sorcar, Stover, and Wells.

Alex Margolis

Ohio State University

Title: Quasi-isometric rigidity of commensurated subgroups

Abstract: A finitely generated group can be thought of as a metric space when equipped with the word metric with respect to a finite generating set. This metric space is well-defined up to quasi-isometry. A major program in geometric group theory, initiated by Gromov, is determining to what extent the coarse geometry of a group determines its algebra. In this talk, we investigate when normal and commensurated subgroups, and their associated quotient groups and spaces, are preserved by quasi-isometries.

Dmitry Novikov

Weizmann Institute of Science

Title: Strengthening o-minimality

Abstract: O-minimal structures are classes of functions and objects satisfying global uniform finiteness properties, similar to those of semialgebraic sets. This notion provides a unified point of view on many classical subjects, from dynamical systems to number theory. I will survey a series of recent results sharpening this now classical notion by strengthening the qualitative finiteness requirement with some quantitative analogue (joint with Gal Binyamini).

Piotr Oprocha

AGH University of Krakow

Title: Interval maps with dense periodicity

Abstract: This talk is based on a recent study of the class of interval maps with dense set of periodic points CP and its closure Cl(CP) equipped with the metric of uniform convergence. We will focus on typical properties in the class of these maps, its geometric structure, conjugacy classes and related topics motivated by properties in topological dynamics and ergodic theory (e.g. entropy, mixing, etc.). We will compare our results with naturally related class of interval maps preserving Lebesgue measure.

The talk is based on joint works with J. Bobok, J. Cinc and S. Troubetkoy

Bram Petri

IMJ-PRG, Sorbonne Université, Paris, France

Title: Random surfaces and systoles

Abstract: The systole of a hyperbolic (or more generally Riemannian) surface is the length of its shortest closed geodesic. This invariant plays a role in many places in hyperbolic geometry. How large the systole can be as a function of the topology of the surface - a hyperbolic version of the Euclidean lattice packing density problem - is a notoriously difficult problem. I will speak about joint work with Mingkun Liu on constructions of random hyperbolic surfaces with large systoles.

Goran Radunović

University of Zagreb

Title: Support measures and associated fractal zeta functions

Abstract: We study new geometrical functions for arbitrary compact subsets of the d-dimensional Euclidean space called the basic and support functions which are tightly related to the general Steiner-like formula of Hug, Last and Weil involving the support measures of the given set. By introducing appropriate critical rescaling exponents for the basic functions we connect them to the Minkowski dimension of the given set. On the other hand, a Steiner-like formula for arbitrary compact sets can also be obtained by using the theory of complex fractal dimensions and the associated fractal zeta functions. In order to connect and complement these two theories, we introduce new basic and support zeta functions and provide functional equations connecting them to the classical distance zeta function. This provides a first glimpse on how the complex dimensions are generated by the basic geometrical functions a given set. Furthermore, we also comment on the connection to the theory of fractal curvature measures. We provide interesting examples to support our results. This a joint work in progress with S. Winter.

Jan Rataj

Charles University, Prague

Title: On regularity of the distance function from a compact set

Abstract: The (Euclidean) distance function to a compact subset F of a Euclidean (or Riemannian) space possesses certain regularity properties even for highly irregular sets F as fractals, and the sublevel sets of the distance function (called also parallel sets) are often used as suitable approximations of F. We concentrate here mainly on the planar case and show results on the "smallness" of two sets associated with F: the set of critical values of the distance function, and the set of radii of non-differentiability of the volume function of parallel sets. The results are formulated by using concepts related to the Minkowski dimension.

Maja Resman

University of Zagreb

Title: Analytic invariants of parabolic germs from their orbits

Abstract: The moduli of analytic classification of parabolic germs of diffeomorphisms, germified at a parabolic fixed point, are given by a finite number of diffeomorphisms, called the Horn- maps (Écalle, Voronin). We read the analytic invariants by fractal analysis of one orbit (i.e. one realization) of a diffeomorphism. The object that we study is the so-called theta function of one orbit, which, in the case of real orbits considered as fractal strings (introduced by Lapidus), is closely related to their fractal theta function. The fractal theta function of a fractal string is inspired by and generalizes the geometric zeta function of a fractal string (Lapidus). Standardly, fractal zeta functions talk about the geometry of a fractal string, its first singularity being the box dimension of the string. We show how to read the analytic class analysing the singularities of the theta function of one orbit in the integral plane. This is a joint work with Martin Klimeš, Pavao Mardešić (University of Burgundy, France) and Goran Radunović (University of Zagreb, Croatia).

Chandrika Sadanand

Bowdoin College

Title: Symmetries of flat surfaces of infinite type

Abstract: Flat surfaces have two types of symmetries: isometries and affine symmetries. In this talk we ask "what groups of symmetries are realized by flat structures on a fixed topological surface of infinite type?" Joint with Artigiani, Randecker, Valdez and Weizte-Schmithüsen, we approach these problems.

Emily Stark

Wesleyan University

Title: Conformal dimension of certain Bowditch boundaries

Abstract: A relatively hyperbolic group pair admits a Bowditch boundary whose homeomorphism type carries algebraic information about the group. For certain relatively hyperbolic groups this boundary further admits a canonical quasi-symmetric structure and has a well-defined conformal dimension. We study a family of Coxeter groups that are hyperbolic relative to virtually abelian subgroups and fit in this framework. We give bounds on the conformal dimension for these groups. Our results imply there are infinitely many quasi-isometry classes within the family of Coxeter groups with defining graph a complete graph and edge labels equal to three. This is joint work with Elizabeth Field, Radhika Gupta, and Rylee Lyman.

Sonja Štimac

University of Zagreb

Title: Two properties of the Hénon maps with strange attractors

Abstract: My talk is a sequel to Jan Boroński's talk on the classification of the Hénon maps with strange attractors. Whenever we presented that classification result, we were always asked the following two questions:

How many non-conjugate Hénon maps are there?

Do all branch points of the densely branching tree (related to the Hénon map) 'come from' hetero/homoclinic tangencies?

In this talk I will answer these two questions. This is joint work with Jan Boroński.

Marie Trin

Université de Rennes

Title: (Non-)Recognizing spaces for stable subgroups

Abstract: Quasi-convex subgroups of a hyperbolic group are exactly the finitely generated subgroups that quasi-isometrically embed in the ambient group. There is a notion that extends quasi-convexity to non-hyperbolic groups for which we have similar caracterisations in RAAGs and Mapping class groups for example. This notion is the stability. Based on the examples mentioned previously, we will introduce the notion of recognizing spaces for stable subgroups and give examples and non-example of such spaces. This is based on a joint work with S. Balasubramanya, M. Chesser, A. Kerr and J. Mangahas.

Machiel van Frankenhuijsen

Utah Valley University

Title: Self-Similar Fractal Strings and Quasicrystals

Abstract: Quasicrystals were discovered by Dan Shechtman. Jeffrey Lagarias has introduced ideal crystals, of which the complex dimensions of a lattice self-similar fractal string is an example. In our work with Michel Lapidus and Edward Voskanian, we study such ideal crystals. A guiding question is whether the complex dimensions of a nonlattice string form a quasicrystal as well.

Ric Wade

University of Oxford

Title: Handlebody mapping class groups are virtual duality groups

Abstract: We show that the mapping class group of a handlebody is a virtual duality group, in the sense of Bieri and Eckmann. In positive genus we give a description of the dualising module of any torsion-free, finite-index subgroup of the handlebody mapping class group as the homology of the complex of non-simple disc systems.

The proof constructs a submanifold of Teichmüller space on which the handlebody group acts properly and cocompactly. We use combinatorial methods to identify the boundary of this manifold with the suspension of the complex of non simple disc systems and analyse its topology.

Joint work with Dan Petersen.

Jonguk Yang

University of Zurich

Title: Hénon-like Renormalization

Abstract: A 1D smooth map on an interval is unimodal if it maps the interval into itself by folding it once (at the unique critical point). Analogously, a 2D smooth diffeomorphism on a square is Hénon-like if it maps the square into itself by squeezing it along the vertical direction to a thin strip, then bending it into a "C"-shape.

Joint with S. Crovisier, M. Lyubich and E. Pujals, we extended the celebrated renormalization theory of 1D unimodal maps to the 2D setting, so that it can be applied to the study of Hénon-like maps. In this talk, I will give a summary of our main results. This includes renormalization convergence and the uniqueness of the "2D critical point." If time permits, I will also outline the proof that the required regularity conditions of the return maps is robust, so that they are finite-time checkable.