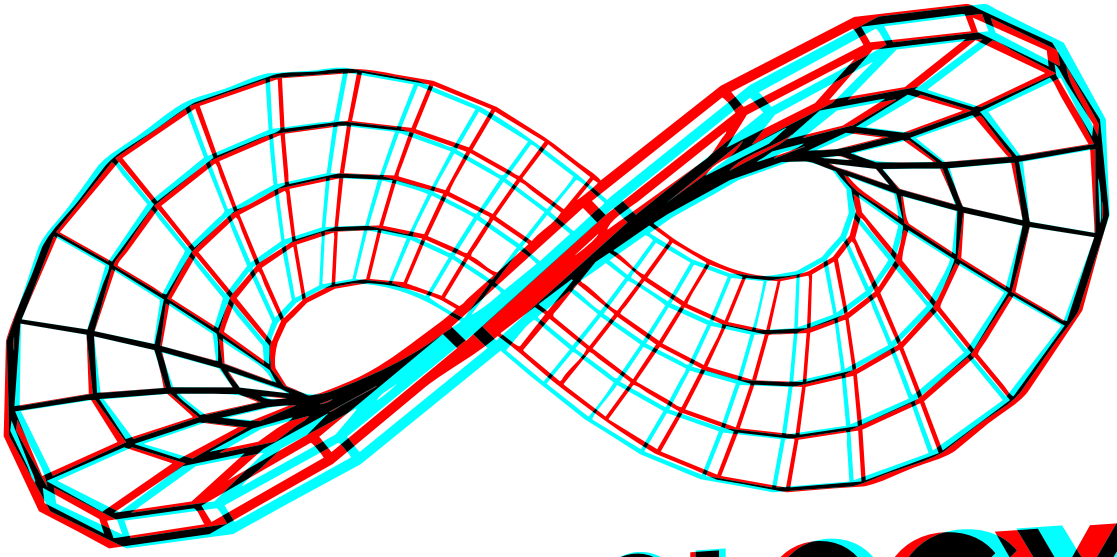

55TH SPRING TOPOLOGY AND DYNAMICAL SYSTEMS CONFERENCE

March 9TH-12TH, 2022

Program

With Support From:
The National Science Foundation
Baylor Department of Mathematics
Baylor College of Arts & Sciences

Contents

Plenary and Semiplenary

Cars, Interchanges, Traffic Counters, and a Pretty Darned Good Knot Invariant [In Person]
Dror Bar-Natan, University of Toronto, drorbn@math.toronto.edu

Reporting on joint work with Roland van der Veen, I'll tell you some stories about ρ_1, an easy to define, strong, fast to compute, homomorphic, and well-connected knot invariant. ρ_1 was first studied by Rozansky and Overbay, it has far-reaching generalizations, and I wish I understood it. URL: http://drorbn.net/waco22.

Convergent sequences, elementary submodels, forcing extensions [In Person]
Hector Barriga-Acosta, University of North Carolina at Charlotte, hbarriga@uncc.edu

Sequentially compact spaces are topological spaces in which the closure of any subset is generated by the limit points of convergent (countable) sequences within the subset. If we extend this notion (that is, by letting the sequences have any length) among the class of compact spaces, we call the spaces pseudoradial. Join this talk to see how elementary submodels and convergent sequences interact, and how this interaction behaves in some forcing extension. In this direction, we explore when compact sequentially compact spaces are pseudoradial.
Co-authors: Dr. Alan Dow

Ramsey properties in ultraproducts of finite structures [In Person]
Dana Bartošová, University of Florida, dbartosova@ufl.edu

Ultraproducts of sequences of finite structures model sentences satisfied by the finite structures in the sequence and they are therefore a suitable model to study properties of the sequence. We will explore the Ramsey theoretic properties of such ultraproducts, in particular, versions of big Ramsey degrees.
Co-authors: Mirna Džamonja, Rehana Patel, Lynn Scow

Cross-pollinations of set theory and algebraic topology [Remote]
Jeffrey Bergfalk, University of Vienna, jeffrey.bergfalk@univie.ac.at

One of the more interesting recent developments within set theory, at least to the speaker, has been its cross-pollination with the fields of algebraic topology and homological algebra. A main conduit for this cross-fertilization have been the *higher derived limits* of the inverse limit functor. After briefly reviewing these functors, we will survey their appearance in a number of seemingly disparate research lines, including:

- the study of homology theories on classes of spaces properly extending that of polyhedra,
- the study of the combinatorics of the cardinals $\aleph_n$,
- the development of stronger invariants for the study of limit objects within topology, such as solenoids or mapping telescopes.

We will close with a list of questions shaping work for the near future.

Filling functions of groups [Remote]
Noel Brady, University of Oklahoma, nbrady@ou.edu

Two important filling functions of finitely presented groups are the divergence function and the Dehn function. We give a survey of these functions and discuss examples of groups exhibiting new divergence and Dehn function behavior.
Co-authors: Hung Cong Tran

From one dimensional Lebesgue measure-preserving maps to the pseudo-arc [In Person]

Jernej Činč, AGH University of Science and Technology Krakow and University of Ostrava, jernej.cinc@osu.cz

In this talk I will review recent progress in the study of topological and measure-theoretic properties of generic one-dimensional Lebesgue measure-preserving maps and discuss some implications of the results in higher dimensions. Namely, I will address several natural properties of generic continuous maps of the interval and circle which preserve the Lebesgue measure such as the structure of periodic points, mixing properties, shadowing properties, as well as crookedness. I will also show how to obtain analogous topological properties for generic maps from the closure of the set of interval maps with dense sets of periodic points. In the second part of the talk I will discuss how a parametrized family of these generic interval maps induces a family of pseudo-arc attractors in the plane varying continuously with the parameter and mention some surprising implications of this result. If time permits I will also mention our current work in progress and pose some open questions related to this line of research.

Co-authors: Piotr Oprocha (AGH Kraków), Jozef Bobok (Czech Technical University in Prague) and Serge Troubetzkoy (Aix-Marseille University)

The Kervaire conjecture and the minimal complexity of surfaces [In Person]

Lvzhou Chen, University of Texas at Austin, lvzhou.chen@math.utexas.edu

We use topological methods to solve special cases of a fundamental problem in group theory, the Kervaire conjecture, which has connection to various problems in topology. The conjecture asserts that, for any nontrivial group G and any element w in the free product $G * Z$, the quotient $(G * Z)/\langle w \rangle$ is still nontrivial. We interpret this as a problem of estimating the minimal complexity (in terms of Euler characteristic) of surface maps to certain spaces. This gives a conceptually simple proof of Klyachko's theorem that confirms the Kervaire conjecture for any G torsion-free. We also obtain new results concerning injectivity of the map $G \to (G * Z)/\langle w \rangle$ when w is a proper power.

Long curves and random hyperbolic surfaces [In Person]

James Farre, Yale University, james.farre@yale.edu

We will fix some topological data, a pants decomposition, of a closed surface of genus g and build hyperbolic structures by gluing hyperbolic pairs of pants along their boundary. The set of all hyperbolic metrics with a pants decomposition having a given set of lengths defines a (3g-3)-dimensional immersed torus in the (6g-6)-dimensional moduli space of hyperbolic metrics, a twist torus. Mirzakhani conjectured that as the lengths of the pants curves tend to infinity, that the corresponding twist torus equidistributes in the moduli space. In joint work-in-progress with Aaron Calderon, we confirm Mirzakhani's conjecture. In the talk, we explain how to import tools in Teichmüller dynamics on the moduli space of flat surfaces with cone points to dynamics on the moduli space of hyperbolic surfaces with geodesic laminations.

Co-authors: Aaron Calderon

Convergence in topological groups [Remote]

Michael Hrusak, Universidad Nacional Autonoma de Mexico, michael@matmor.unam.mx

We shall present recent results concerning convergent sequences in topological groups, including a new set theoretic axiom coined the Invariant Ideal Axiom and its consequences.

Co-authors: Alexander Shibakov

Problems on continua and hyperspaces, solutions and more questions [In Person]
Alejandro Illanes, Universidad Nacional Autónoma de México, illanes@matem.unam.mx

Let X be a continuum (compact connected metric space). In this talk we will discuss some problems on continua and some of its hyperspaces. We will present solutions to some problems and some open questions. Specifically, we will talk about the following topics. -Arc connectedness of the hyperspace of totally disconnected closed subsets of X, -Induced mappings on hyperspaces, -Shore sets of dendroids, -Irreducible hereditarily decomposable continua, -Strong size mappings for the hyperspace Cn(X), -Colocal connectedness of the hyperspace of singletons in symmetric products, -Models for the hyperspaces of a simple closed curve. Of course we will present the definitions, examples and motivations for the problems.
Co-authors: Verónica Martínez-de-la-Vega

Boundary rigidity of lattices in product of trees [In Person]
Kasia Jankiewicz, University of California Santa Cruz, kasia@ucsc.edu

The visual boundary is a well-defined compactification of a hyperbolic or CAT(0) space. For hyperbolic groups the boundary is unique up to homeomorphism. However, Croke-Kleiner constructed examples of CAT(0) groups acting geometrically on CAT(0) spaces with non-homeomorphic boundaries. I will discuss the uniqueness of the boundary for lattices in product of trees, i.e. groups acting geometrically on a product of two trees. This is a wide family of groups including products of free groups, as well as some simple groups. This is joint work with Annette Karrer, Kim Ruane and Bakul Sathaye.
Co-authors: Annette Karrer, Kim Ruane and Bakul Sathaye

Katok's flexibility paradigm and its realization in symbolic dynamics [In Person]
Tamara Kucherenko, City University New York, tkucherenko@ccny.cuny.edu

Katok launched the flexibility program which he described as follows:"under properly understood general restrictions, within a fixed class of dynamical systems dynamical invariants take arbitrary values" This is a novel direction in dynamics, yet the core problems are clear and accessible to a rather broad community of mathematicians and this has made the program develop at a rapid pace. I will outline the flexibility program and showcase related results obtained within the last few years. Then I will present a striking application of the flexibility paradigm to the pressure function on compact symbolic systems. This is based on joint work with Anthony Quas.
Co-authors: Anthony Quas

On the problem of uniqueness for some topological structures [In Person]
Daria Michalik, Jan Kochanowski University, daria.michalik@ujk.edu.pl

For a given topological space X we can construct several structures $K(X)$ associated to X like: Cartesian product, cone, suspension, space of mappings to the real line, hyperspaces, etc. A natural question is whether we can recover the space X from the space $K(X)$. In other words, the question is if the operator K is injective. This problem, often referred to in the literature as the problem of uniqueness, is very natural. In this talk we present some classic and recent results concerning this topic.

Graphically discrete groups and rigidity [In Person]

Emily Stark, Wesleyan University, estark@wesleyan.edu

Viewing finitely generated groups as geometric objects offers a powerful perspective because groups that have a similar large-scale geometry often share common algebraic structure. Rigidity theorems prove that a group's geometry determines its algebra, typically up to virtual isomorphism. We study graphically discrete groups, which impose a discreteness criterion on the automorphism group of any graph the group acts on geometrically. Classic examples of graphically discrete groups include virtually nilpotent groups and fundamental groups of closed hyperbolic manifolds. We will present new examples and discuss rigidity phenomena for free products of graphically discrete groups. This is joint work with Alex Margolis, Sam Shepherd, and Daniel Woodhouse.

Co-authors: Alex Margolis, Sam Shepherd, Daniel Woodhouse

Simplicity of some natural equivalence relations on compact metric spaces [In Person]

Benjamin Vejnar, Charles university, benvej@gmail.com

The aim of this talk is to briefly describe a natural way of measuring simplicity/complexity (covered by Invariant Descriptive Set Theory) and to discuss recent applications in the context of (mainly) topological relations such as isometry, homeomorphism, conjugacy or homotopy.

The high-degree rational cohomology of the special linear group [In Person]

Jennifer Wilson, University of Michigan, jchw@umich.edu

In this talk I will describe some current efforts to understand the high-degree rational cohomology of $SL_n(Z)$, or more generally the cohomology of $SL_n(R)$ when R is a number ring. Although the groups $SL_n(R)$ do not satisfy Poincare duality, they do satisfy a twisted form of duality, called Bieri–Eckmann duality. Consequently, their high-degree rational cohomology groups are governed by an $SL_n(R)$-representation called the Steinberg module. The key to understanding these representations is through studying the topology of certain associated simplicial complexes. I will survey some results, conjectures, and ongoing work on the Steinberg modules, and the implications for the cohomology of the special linear groups. This talk includes work joint with Brück, Kupers, Miller, Patzt, Sroka, and Yasaki. The talk is geared for topologists and will not assume prior expertise on the cohomology of arithmetic groups!

Co-authors: Benjamin Brück, Sander Kupers, Jeremy Miller, Peter Patzt, Robin Sroka, and Dan Yasaki

Continuum Theory

Open diameter maps on suspensions [In Person]

Hussam Abobaker, Virginia Tech University, ahussam@vt.edu

It is shown that if X is a metric continuum which admits an open diameter map then the suspension of X admits an open diameter map. As a corollary we have that all spheres admit open diameter maps.
Co-authors: Wlodzimierz J. Charatonik and Robert P. Roe

Mappings of inverse limits revisited revisited [In Person]

Iztok Banic, University of Maribor, iztok.banic@um.si

We revisit the results from two papers, Mioduszewski's "Mappings of inverse limits" and Feuerbacher's "Mappings of inverse limits revisited" to obtain new mapping theorems for inverse limits of inverse sequences of compact metric spaces with continuous single-valued bonding functions. Then, we apply the results to the theory of inverse limits of inverse sequences of compact metric spaces with upper semi-continuous set-valued bonding functions to obtain new mapping theorems for such inverse limits.
Co-authors: Judy Kennedy and Goran Erceg

On the hyperspace of nonblockers of $F_1(X)$ [Remote]

Javier Camargo, Universidad Industrial de Santander, jcamargo@saber.uis.edu.co

A nonempty closed subset B of a continuum X does not block $F_1(X)$ provided that for each $x \in X \setminus B$, the union of all subcontinua of X containing x and contained in $X setminus B$ is a dense subset of X. We say that $B \in NB(F_1(X))$ if B does not block $F_1(X)$. We present geometric models for $NB(F_1(X))$. Particularly, we see continua X such that its hyperspace $NB(F_1(X))$ is a continuum.
Co-authors: Félix Capulín, Enrique Castañeda-Alvarado, David Maya.

Closed sets with non-zero entropy that generate no periodic points II [In Person]

Goran Erceg, University of Split, Croatia, goran.erceg@pmfst.hr

We use previous results of the autors to analyze properties of various examples of closed subsets G of [0,1]x[0,1] such that (1) the entropy of G is non-zero, (2) no periodic point or exactly one periodic point is generated by G, and (3) no Cantor set is finitely generated by G.
Co-authors: Iztok Banič and Judy Kennedy

Dendrites and measures with discrete spectrum [Remote]

Magdalena Foryś-Krawiec, AGH University of Science and Technology, maforys@agh.edu.pl

n the talk we answer the following question arising from the M"obius disjointness conjecture: *Which one-dimensional continua X have the property that every invariant measure of (X, f) has discrete spectrum, assuming f is a zero-entropy map?* In particular we present the properties of dendrites for which the set of endpoints has a countable closure and we show that all invariant measures of zero-entropy maps of such dendrites have discrete spectrum. All results presented during the talk are obtained as a joint work with J. Hantáková, J. Kupka, P. Oprocha and S. Roth.
Co-authors: Jana Hantáková, Jiri Kupka, Piotr Oprocha, Samuel Roth

Complexity of η-od-like continua. [Remote]
Hugo Adrian Maldonado Garcia, UNAM, hugo_gcn@hotmail.com

Abstract. W. Lewis asked in it Indecomposable Continua. Open problems in topology II, whether there exists, for every $\eta \geq 2$, an atriodic simple $(\eta+1)$-od-like continuum which is not simple η-od-like and, if such continuum exists, whether it has a variety of properties such as being planar or being an arc-continuum, among others. Some partial results have been obtained by W.T. Ingram, P. Minc, C.T. Kennaugh and L. Hoehn. In each case, the most substantial challenge is in proving that a continuum is not T-like, for a given tree T. We develop the notion of a combinatorial η-od cover of a graph, a tool which may enable one to prove that certain examples of continua are not η-od-like.
Co-authors: Logan Hoehn

A characterization of a map whose inverse limit is an arc [Remote]
Sina Greenwood, University of Auckland, s.greenwood@auckland.ac.nz

In 1968 Rogers asked: what kind of maps will yield an inverse limit that is an arc, or more specifically, what kind of single bonding map will yield an arc? For a continuous function $f : [0, 1] \to [0, 1]$ we define a splitting sequence admitted by f and outline the proof that the inverse limit of f is an arc if and only if f does not admit a splitting sequence, thereby answering Rogers' question.
Co-authors: Sonja Štimac

Combinatorial folding maps [Remote]
Logan Hoehn, Nipissing University, loganh@nipissingu.ca

We introduce the notion of a combinatorial folding map, which is a discrete analog of the topological concept which was instrumental in the 2016 characterization of the pseudo-arc as the only hereditarily indecomposable continuum with span zero. I will formulate a characterization of hereditary indecomposability in terms of existence of certain refinements of covers using combinatorial folding maps. I will also discuss potential applications to the study of hereditarily indecomposable weakly chainable continua.
Co-authors: Jernej Cinc

Taming closed subsets of the Cantor Fence [In Person]
Carlos Islas, Universidad Autónoma de la Ciudad de México, carlos.islas@uacm.edu.mx

Tymchatyn and Walter proved that every embedding h of the Cantor fence $(C \times [0, 1])$ into the plane is tame, i.e., there is a homeomorphism $H : \mathbb{R}^2 \to \mathbb{R}^2$ such that $H(h(C \times [0, 1])) \subset C \times [0, 1]$. In this talk we answer a question of L. Oversteegen by proving that every embedding of a closed subset of the Cantor fence into the plane is tame.
Co-authors: E. D. Tymchatyn and R. Leonel

The inverse limit property for subcontinua of inverse limits of set-valued functions [In Person]
James Kelly, Christopher Newport University, james.kelly@cnu.edu

We examine when a subcontinuum of an inverse limit with set-valued functions is equal to the inverse limit of its projections. There are multiple ways to interpret this problem. We focus on one particular interpretation due to Banič et al (2017). When this does hold, we say that the inverse sequence has ILP$(C(\varprojlim f_i))$. We identify properties of the bonding functions which imply that the system has ILP$(C(\varprojlim f_i))$. We also show a relationship between this property and connectedness im kleinen and use this to identify inverse sequences that do not have ILP$(C(\varprojlim f_i))$.

Closed sets with non-zero entropy that generate no periodic points I [In Person]
Judy Kennedy, Lamar University, kennedy9905@gmail.com

Building on previous work, we define entropy for closed subsets of X x X, where X is a compact metric space. We prove that our definition has the properties desired. We also give a theorem that gives sufficient conditions for a closed subset of [0,1] x [0,1] to have non-zero entropy.
Co-authors: Iztok Banic and Goran Erceg

Splittings of the homology of Peano continua [In Person]
Curtis Kent, Brigham Young University, curtkent@matheamtics.byu.edu

We will discuss several characterizations of the shape topology on the fundamental group of a Peano continuum, which we will use to construct large cotorsion subgroups of the first homology. In particular, we will show that the first homology of every Peano continuum that embeds into $\mathbb{R}^3$ is either free abelian or splits as the direct sum of $\mathbb{Z}^{\mathbb{N}}$ with an uncountable cotorsion group.
Co-authors: Gregory Conner, Petar Pavesic, Wolfgang Herfort

Complexity of homogeneous continua [Remote]
Pawel Krupski, Wroclaw University of Science and Technology, pawel.krupski@pwr.edu.pl

The family of all homogeneous continua in the hyperspace of all subcontinua of the cube $[0,1]^n$, $2 \leq n \leq \omega$, is an analytic subspace of the hyperspace which is not $G_{\delta\sigma}$. It is Borel for $n = 2$. The result and related problems will be discussed.

Line-free subgroups of ℓ^2 in complex dynamics [Remote]
David Lipham, Auburn University at Montgomery, dlipham@aum.edu

I will present several new results concerning line-free subgroups of the Hilbert space and subsets of the complex plane that are generated by the exponential function. These spaces embed into the Lelek fan. They also surface in homeomorphism groups of many one-dimensional fractal continua.

On Bellamy's Set Function Gamma [Remote]
Sergio Macias, Universidad Nacional Autonoma de Mexico, sergiom@matem.unam.mx

David P. Bellamy defined the set function Γ in his paper *Some Topics in Modern Continua Theory*, We present properties of this set function.

Some answers to problems on Hyperspaces of Sub continua [Remote]
Verónica Martínez de la Vega, UNAM, vmvm@im.unam.mx

The continuum X is k-mutually aposyndetic provided that given k distinct points of X, there are k mutually disjoint subcontinua of X, each containing one of the points in its interior. Given $n, k \geq 2$, we show that for each continuum X, the hyperspace $C_n(X)$ is k-mutually aposyndetic
Co-authors: Alejandro Illanes, Jorge M Martínez Montejano

Making holes in the hyperspace of subcontinua of a continuum having property (b) [Remote]
David Maya, Universidad Autónoma del Estado de México, dmayae@uaemex.mx

Let $C(X)$ be the hyperspace of all subcontinua of a continuum X. An element $AinC(X)$ textslmakes a hole in $C(X)$ provided that $C(X) - A$ is non-unicoherent. In this talk, we present a characterization of the elements $AinC(X)$ satisfying A makes a hole in $C(X)$ when X is a continuum having property (b).
Co-authors: Rosa I. Carranza, José G. Anaya and Fernando Orozco-Zitli

Graphs Have Unique Quotient Hyperspace $\mathcal{C}_1^n(X)$ [Remote]
Ulises Morales-Fuentes, State University of Morelos, ulises.morales@ciencias.unam.mx

Let X be a metric continuum. Let n be a positive integer, and let $\mathcal{C}_n(X)$ be the space of all nonempty closed subsets of X with at most n components topologized with the Hausdorff metric. We consider the quotient space $\mathcal{C}_1^n(X) = \mathcal{C}_n(X)/\mathcal{C}_1(X)$, with the quotient topology. We prove that given a graph X and a continuum Y , we have that $\mathcal{C}_1^n(X)$ is homeomorphic to $\mathcal{C}_1^n(Y)$ if and only if X is homeomorphic to Y.
Co-authors: Sergio Macias

The hyperspace of totally disconnected sets [Remote]
Patricia Pellicer-Covarrubias, UNAM, paty@ciencias.unam.mx

In this talk we will discuss the hyperspace of nonempty, closed, totally disconnected subsets of a topological space. We will present several properties of such hyperspace and we will focus particularly on its behavior concerning path connectedness.
Co-authors: R. Escobedo and V. Sanchez-Gutierrez

Generalized inverse limits and the Cantor set [Remote]
Felix Capulin Perez, Universidad Autónoma del Estado de México, fcapulin@gmail.com

In this talk we show some inverse limits with a single upper semicontinuous function F such that it is union of mappings from a compact metric space X into itself. To this, we are going to show some result concerning the concept $Dom(F)$. Mainly, we will prove that if $Dom(F)$ is a totally disconnected space, then $\varprojlim F$ is homeomorphic to the Cantor set .
Co-authors: Monica Sanchez Garrido, Fransisco R. Ruiz del Portal

On break points in Continuum theory [Remote]
Pavel Pyrih, Charles University, pavel.pyrih@mff.cuni.cz

Presenting a definition of a break point some selected classical results concerning break points will be discussed with respect to new ones. Announcement of Continuum Theory Gem Award winners.

Projective Fraïssé limits of trees [Remote]
Robert Roe, Missouri University of Science & Technology, rroe@mst.edu

A projective Fraïssé limit is a dualization of the injective Fraïssé limit from model theory. Consider a family $\mathcal{F}$ of finite graphs, i.e., finite discrete spaces each with a reflexive and symmetric relation which is called an edge, together with mappings between the spaces which preserve this edge relation. If the family $\mathcal{F}$ satisfies certain conditions then there exists a unique topological graph $\mathbb{F}$, a 0-dimensional, compact, second-countable space with a closed, reflexive and symmetric relation, which is known as a projective Fra"iss'e limit. If the edge relation on $\mathbb{F}$ is also transitive then it is an equivalince relation and the associated quotient space $|\mathbb{F}|$ is called the topological realization of $\mathbb{F}$. We modify the ideas of monotone, confluent, retraction, and light mappings as well as several properties of continua so as to apply to topological graphs. As the topological realizations of the Fra"iss'e limits we obtain either some known continua, for example the dendrite D_3 or the Cantor fan, or quite new, interesting ones for which we do not yet have topological characterizations.

Generalizations of the inscribed square problem [Remote]

Cristina Villanueva Segovia, Faculty of Sciences, National Autonomous University of Mexico, cristina.vs@ciencias.unam.mx

In this talk we present some generalizations of the itinscribed square problem —given a Jordan curve γ, can we always find four points in γ that are the vertices of an Euclidean square?— in particular we address the problem of inscribing rectangles in subsets of the plane. We present a characterization of locally connected plane continua that inscribe rectangles and we examine some open questions.
Co-authors: Ulises Morales Fuentes

Projective Fraïssé Classes to Approximate Knaster Continua and Solenoids [In Person]

Lauren Wickman, University of Florida, wickmanlauren@ufl.edu

In this talk we will give projective Fraïssé classes that approximate the universal Knaster continuum and the universal solenoid (respectively). We will discuss the automorphism groups of quotients of the limit spaces by their relations, and densely embedding those automorphism groups into subgroups of the homeomorphism groups of their respective continua.

Dynamical Systems

Characterizing Endpoints in Set-Valued Inverse Limits [In Person]
Lori Alvin, Furman University, lori.alvin@furman.edu

We investigate the endpoints of inverse limits for a family of set-valued functions using Lelek's definition of an endpoint. We provide a characterization for a point to be an endpoint of the inverse limit by utilizing structures that arise within the finite approximations of the inverse limit.
Co-authors: Katherine Betts, James Kelly

Some reversing orbits for a rattleback model [In Person]
Gianni Arioli, Politecnico di Milano - Italy, gianni.arioli@polimi.it

A physical rattleback is a toy that can exhibit counter-intuitive behavior when spun on a horizontal plate. Most notably, it can spontaneously reverse its direction of rotation. Using a standard mathematical model of the rattleback, we prove the existence of reversing motion, reversing motion combined with rolling, and orbits that exhibit such behavior repeatedly.
Co-authors: Hans Koch

Geometric Ideas on Injectivity applied to Discrete Dynamics. [Remote]
E. Cabral Balreira, Trinity University, ebalreir@trinity.edu

A central question in discrete dynamics is to establish when a map has a globally asymptotically stable fixed point. This can be naturally framed as a question of injectivity. We will discuss how geometric methods to detect injectivity can be applied to detect global stability. We will illustrate our results by providing applications to monotone maps and periodic maps.

Equilibrium states and overlined-continuity beyond subshifts of finite type [In Person]
Jasmine Bhullar, University of Houston, jbhullar@cougarnet.uh.edu

The concept of $\overline{d}$-distance on the space of measures on a shift space was introduced by Ornstein to study the isomorphism problem for Bernoulli shifts. For mixing subshifts of finite type, Coelho and Quas showed that the map that sends a Hölder continuous potential ϕ to its equilibrium state μ_ϕ is $\overline{d}$-continuous. In this talk, we will discuss an extension of this result for countable-state Markov shifts.

Some dynamical properties of linear operators [Remote]
Emma D'Aniello, Universitá degli Studi della Campania "Luigi Vanvitelli", emma.daniello@unicampania.it

We investigate some notions from topological dynamics in the linear setting of bounded operators on Banach spaces. We focus, in particular, on composition operators on arbitrary spaces, which include the weighted shifts as a special case.

An adelic version of the three gap theorem [In Person]

Akshat Das, University of Houston, atdas@cougarnet.uh.edu

In order to understand problems in dynamics which are sensitive to arithmetic properties of return times to regions, it is desirable to generalize classical results about rotations on $\mathbb{R}/\mathbb{Z}$ to the setting of rotations on adelic tori. One such result is the classical three gap theorem, which is also referred to as the three distance theorem and as the Steinhaus problem. It states that, for any $\alpha \in \mathbb{R}$ and $N \in \mathbb{N}$, the collection of points $n\alpha \bmod 1$, $1 \leq n \leq N$, partitions $\mathbb{R}/\mathbb{Z}$ into component arcs having one of at most three distinct lengths. Since the 1950s, when this theorem was first proved independently by multiple authors, it has been reproved numerous times and generalized in many ways. One of the more recent proofs has been given by Marklof and Strömbergsson using a lattice based approach to gaps problems in Diophantine approximation. In this talk, we use an adaptation of this approach to the adeles to prove a natural generalization of the classical three gap theorem for rotations on adelic tori. This is joint work with Alan Haynes.

Co-authors: Alan Haynes

The graph of the logistic map is a tower [Remote]

Roberto De Leo, Howard University, roberto.deleo@howard.edu

The qualitative behavior of a dynamical system can be encoded in a graph. Each node of the graph is an equivalence class of chain-recurrent points and there is an edge from node A to node B if, using arbitrary small perturbations, a trajectory starting from any point of A can be steered to any point of B. In this talk we describe the graph of the logistic map. Our main result is that the graph is always a tower, namely there is an edge connecting each pair of distinct nodes. For special parameter values, this tower has infinitely many nodes.

Co-authors: James A. Yorke

The topological and dynamical structure of the omega-limit set of a non-automous dynamical system [In Person]

Saber Elaydi, Trinity University, selaydi@trinity.edu

We consider a discrete non-autonomous semi-dynamical system generated by a family of continuous maps defined on a locally compact metric space. It is assumed that this family of maps uniformly converges to a continuous map. Such a non-autonomous system is called an asymptotically autonomous system. We extend the dynamical system to the metric one-point compactification of the phase space. This is done via the construction of an associated skew-product dynamical system. We prove, among other things, that the omega limit sets are invariant and invariantly connected. We apply our results to two populations models, the Ricker model with no Allee effect and Elaydi-Sacker model with the Allee effect, where it is assumed that the reproduction rate changes with time due to habitat fluctuation

Co-authors: Emma D'Aniello

Dendrites and measures with discrete spectrum [Remote]

Magdalena Foryś-Krawiec, AGH University of Science and Technology, maforys@agh.edu.pl

In the talk we answer the following question arising from the Möbius disjointness conjecture: *Which one-dimensional continua X have the property that every invariant measure of (X, f) has discrete spectrum, assuming f is a zero-entropy map?* In particular we present the properties of dendrites for which the set of endpoints has a countable closure and we show that all invariant measures of zero-entropy maps of such dendrites have discrete spectrum. All results presented during the talk are obtained as a joint work with J. Hantáková, J. Kupka, P. Oprocha and S. Roth.

Co-authors: Jana Hantáková, Jiri Kupka, Piotr Oprocha, Samuel Roth

Periodicity of automorphisms on one dimensional solenoids [Remote]
Faiz Imam, BITS-Pilani, Hyderabad Campus, India., mefaizy@gmail.com

Solenoids are compact connected finite dimensional commutative groups. Alternatively, a one dimensional solenoid is a topological group Σ, such that its Pontryagin dual $\widehat{\Sigma}$ is a subgroup of $\mathbb{Q}$ containing $\mathbb{Z}$. An additional description for a one-dimensional solenoid Σ whose dual is non-cyclic subgroup of $\mathbb{Q}$ is obtained using the inverse limit of a sequence of circle maps. The classification of the sets of periodic points of a family of topological dynamical systems has been extensively studied. The study of periodicity helps us in understanding the other dynamical aspects in many cases. This talk is based on the work done by authors for the family of automorphisms on a one dimensional solenoid. In this talk, we start with dyadic solenoids, which is obtained as the intersection of the members of a nested system of embedded solid tori in $\mathbb{R}^3$ (a solid torus wrapped twice around inside another solid torus). We describe this solenoid in terms of inverse limits and Pontryagin duality, followed by the description of the periodic points of automorphism of this solenoid. Although it is a very specific case, this gives a very good geometric insight and dynamical aspect of what happens in general. The latter part of the talk considers the problem of similar characterization for general one dimensional solenoids using Pontryagin duality as done in [Gopal; Raja, Periodic Points of Solenoidal Automorphisms, Topology Proc., 50 (2017), 49-57] and using inverse limits as in [Gopal; Imam, Periodic points of solenoidal automorphisms in terms of inverse limits, Appl. Gen. Topology, Vol. 22 (2021), 321-330]. The last part of the talk will further continue this characterization for some higher dimensional solenoids in terms of inverse limits.
Co-authors: Sharan Gopal

Bratteli diagrams and their generalizations [Remote]
Olena Karpel, AGH University of Science and Technology, okarpel@agh.edu.pl

Bratteli diagrams turned out to be a very powerful tool for the study of dynamical systems not only on a measure space but also on Cantor and Borel spaces. This is due to the fact that homeomorphisms of a Cantor space and Borel automorphisms of a standard Borel space can be represented as Vershik maps acting on the path spaces of corresponding Bratteli diagrams. Various properties of the transformations become more transparent when one deals with corresponding Bratteli-Vershik dynamical systems. We will discuss some natural methods for the study of the set of invariant measures in Cantor and Borel dynamics based on the structure of the underlying diagram. We consider different classes of the so-called generalized Bratteli diagrams, study the properties of the tail equivalence relation and give conditions for the existence of a finite ergodic invariant measure on a diagram. The talk is based on a joint work in progress with Sergey Bezuglyi, Palle E.T. Jorgensen and Shrey Sanadhya.
Co-authors: Sergey Bezuglyi, Palle E.T. Jorgensen, Shrey Sanadhya

Orientation preserving Lozi mappings [Remote]
Przemysław Kucharski, AGH University of Science and Technology, pkuchars@agh.edu.pl

The family of Lozi mappings is a parametrized family of piecewise linear planar homeomorphisms given by $f_{(a,b)}(x, y) = (1 + y - a|x|, bx)$ for $a, b \in \mathbb{R}$. It has been introduced in 1978 by R. Lozi as a simplification of H'enon family, potentially sharing some of its properties and being more approachable. In 1980 Michał Misiurewicz proved that for a certain subset of parameter space for which $f_{(a,b)}$ is orientation reversing, that is for $b > 0$, there exists an attractor for $f_{(a,b)}$ on which $f_{(a,b)}$ is mixing. Since then Lozi family has been studied in terms of its entropy, possible coding, characterisation as inverse limits of certain spaces, either as an example of existing phenomena, or as a stepping stone towards more general families. Yet it has not been rigorously verified that attractors of Lozi family exist for $b > 0$, that is in the orientation preserving case. We will talk about this result and its consequences.

The Zero Entropy Locus for the Lozi Maps [In Person]

Kristijan Kilassa Kvaternik, University of Zagreb, Kristijan.KilassaKvaternik@fer.hr

We will present a solution to the zero entropy locus problem for the Lozi map family in a specific region in the parameter space by proving that the topological entropy of the Lozi map is zero if the period-two orbit is attracting and there are no homoclinic points for the fixed point X in the first quadrant. This is a joint work with Michał Misiurewicz and Sonja Štimac.

Co-authors: Michał Misiurewicz, Sonja Štimac

Movability of one-dimensional invariant continua in flows [Remote]

Krystyna Kuperberg, Auburn University, kuperkm@auburn.edu

One of the most important notions in shape theory, introduced by Karol Borsuk, is that of movability. Let X be a compact set embedded in the Hilbert Q. X is movable if for every neighborhood U of X there is a neighborhood V of X such that for any neighborhood W of X there is a homotopy moving V into W within U. The Hilbert cube can be replaced by any metric ANR; the property does not depend on the embedding. In dynamics, movability is closely related to the notion of stability. Other so called UV-properties can be considered for invariant sets in dynamics as well. This talk concentrates on movability of one-dimensional invariant continua in continuous flows.

Exploring Dynamics in Thermoacoustic Coupled Resonators [In Person]

Scott Lewis, Utah Valley University, lewissc@uvu.edu

Thermoacoustic engines continue to be an important area of research with wide ranging applications from clarinets to nuclear reactors. While each application is different many have common behaviors as seen in basic coupled resonators (such as Rijke tubes). Empirical data shows behavior rich in variety. We explore and refine a model that may be used to describe behavior seen in bottle type resonators. We begin with linearized dimensionless momentum and energy equations for acoustics (see Balasubramanian and Sujith 2008)

Co-authors: Bonnie Anderson

The real teapot [In Person]

Michal Misiurewicz, IUPUI, mmisiure@math.iupui.edu

William Thurston in his last paper defined a Master Teapot as the closure of the set of pairs (s, z), where $s \in (1, 2]$ is the slope of a tent map T_s with the turning point periodic, and a complex number z is a Galois conjugate of s. Then $1/s$ and $1/z$ are zeros of the kneading determinant of T_s. We study the zeros of the kneading determinants of the maps T_s that belong to the real interval $(0, 1)$, for all $s \in (1, 2]$. This is work in progress.

Co-authors: Lluis Alseda, Jozef Bobok, and Lubomir Snoha

On conjugacy between natural extensions of 1-dimensional maps [Remote]

Piotr Minc, Auburn University, mincpio@auburn.edu

We show that there exists a topologically mixing map $f : [0, 1] \to [0, 1]$ such that $\varprojlim([0, 1], f)$ is homeomorphic to the pseudo-arc, and f can be factored by a surjection onto any nondegenerate dendrite. It follows that for any nondegenerate dendrite D there is a topologically mixing map $F : D \to D$ such that the shift homeomorphisms on $\varprojlim(D, F)$ and $\varprojlim([0, 1], f)$ are conjugate. Consequently, $\varprojlim(D, F)$ is homeomorphic to the pseudo-arc. https://arxiv.org/pdf/2110.11440.pdf

Co-authors: Jan Boroński, Sonja Štimac

Obtaining asymptotic formula for orbit counting in conformal dynamical systems [In Person]
Hamid Naderiyan, University of North Texas, HamidNaderiyan@my.unt.edu

The orbit counting problem has been studied in various contexts, from the circle problem studied by Gauss to lattice point counting in hyperbolic spaces in the 20th century. In this talk we try to see the applications of some Tauberian theorems in dynamics for obtaining an asymptotic formula of number of words of finite length of specific property in symbolic space. The transfer operator and especially the spectral theory of the transfer operator establishes the bridge from themodynamics formalism to the Tauberian theorems for this purpose.

On entropies in quasi-metric spaces [In Person]
Olivier Olela Otafudu, School of Mathematical and Statistical Sciences North-West University, Potchefstroom Campus, Potchefstroom 2520, South Africa, olivier.olelaotafudu@nwu.ac.za

In this talk, we present quasi-uniform entropy $h_{QU}(\psi)$ defined for a uniformly continuous self-map ψ on a quasi-metric space (X, q). General statements are proved about this entropy, and we proved that the completion theorem for quasi-uniform entropy holds in the class of all join-compact quasi-metric spaces. It is shown that the uniform entropy $h_U(\psi, q^s)$ is less or equals to $h_{QU}(\psi, q)$ for a uniformly continuous self-map ψ on a quasi-metric space (X, q).
Co-authors: Paulus Haihambo

Dynamical classification of the Lozi maps [In Person]
Sonja Stimac, University of Zagreb, sonja@math.hr

In this talk, I will show how we classified the Lozi maps (up to conjugacy, for Misiurewicz's set of parameters) by using two powerful tools, the symbolic dynamics, and the inverse limit spaces. This is joint work with Jan Boronski.
Co-authors: Jan Boronski

Stable laws for random dynamical systems [In Person]
Andrew Torok, University of Houston, torok@math.uh.edu

For a random system consisting of beta-transformations, or more general uniformly expanding maps, we consider the convergence to a stable law (the analogue of the Central Limit Theorem for certain observations that have infinite second moments). We obtain quenched convergence (that is, for almost each choice of the sequence of maps) in the Skorokhod J_1 topology, by extending results of Marta Tyran-Kaminska. We obtain some of these results also for random systems of intermittent maps. This is joint work with Matthew Nicol and Romain Aimino
Co-authors: Matthew Nicol and Romain Aimino

Geometric Group Theory

Bestvina–Brady Groups that are not right-angled Artin groups. [Remote]
Yu-Chan Chang, Oxford College of Emory University, yuchanchang74321@gmail.com

In joint work with Lorenzo Ruffoni, we give a family of graphs whose associated Bestvina–Brady groups are not isomorphic to right-angled Artin groups. Our examples generalize the construction given by Papadima–Suciu.
Co-authors: Lorenzo Ruffoni

A closed, fibered hyperbolic 3-manifold determined by its finite quotients [In Person]
Tamunonye Cheetham-West, Rice University, tac7@rice.edu

By comparing small order finite quotients we can attempt to distinguish finitely generated, residually finite groups. One can then ask whether the collection of finite quotients of a finitely generated, residually finite group distinguishes that group up to isomorphism. For finite covolume arithmetic lattices in PSL(2,C), the work of Bridson, McReynolds, Reid, and Spitler provides a roadmap for giving a positive answer in some cases. We give a new example of an arithmetic lattice corresponding to a closed hyperbolic 3-manifold with positive b1 that is determined completely by its collection of finite quotients.

Some computability properties of left-orderable groups and their subgroups [Remote]
Arman Darbinyan, Texas A&M, adarbina@math.tamu.edu

In my talk I will discuss some recent advances related to the computability properties of finitely generated left-orderable groups. Special attention will be on the subclass of finitely generated left-orderable groups that are simple, and on the subgroups of such groups.

Graph Analogues of Big Mapping Class Groups: Coarse Geometry [In Person]
George Domat, University of Utah, domat@math.utah.edu

We will introduce an analogue of big mapping class groups as defined by Algom-Kfir and Bestvina which hopes to answer the question: What is "Big Out(F_n)"? This group will consist of proper homotopy classes of proper homotopy equivalences of locally finite, infinite graphs. We will then discuss work with Hannah Hoganson and Sanghoon Kwak on the coarse geometry of these groups.
Co-authors: Hannah Hoganson, Sanghoon Kwak

The Geometry of Subgroup Embeddings and Asymptotic Cones [In Person]
Andy Jarnevic, Vanderbilt, andrew.n.jarnevic@vanderbilt.edu

Given a finitely generated subgroup H of a finitely generated group G and a non-principal ultrafilter *omega*, we consider a natural subspace, $Cone^{\omega}_{G}(H)$, of the asymptotic cone of G corresponding to H. We discuss how the connectedness and convexity of $Cone^{\omega}_{G}(H)$ are related to natural properties of the embedding of H in G. We begin by defining a generalization of the distortion function which determines whether $Cone^{\omega}_{G}(H)$ is connected. We then describe a natural convexity property of $Cone^{\omega}_{G}(H)$ in the asymptotic cone of G that detects whether H is strongly quasi-convex in G.

Right-angled links in thickened surfaces [Remote]
Rose Kaplan-Kelly, Temple University, rose.kaplan-kelly@temple.edu

Traditionally, alternating links are studied with alternating diagrams on S^2 in S^3. In this talk, we will consider links which are alternating on higher genus surfaces S_g in $S_g \times I$. We will define what it means for such a link to be right-angled generalized completely realizable (RGCR) and show that this property is equivalent to the link having two totally geodesic checkerboard surfaces, equivalent to each checkerboard surface consisting of one type of polygon, and equivalent to a set of restrictions on the link's alternating projection diagram. We will then use these diagram restrictions to classify RGCR links and the commensurability of their complements.

Totally geodesic surfaces in hyperbolic knot complements [Remote]
Khanh Le, Temple University, khanh.q.le@temple.edu

The study of surfaces has been essential in studying the geometry and topology of the 3-manifolds that contain them. There has been considerable work in understanding the existence of totally geodesic surfaces in hyperbolic 3-manifolds. Most recently, Bader, Fisher, Miller, and Stover showed that having infinitely many maximal totally geodesic surfaces implies that the 3-manifold is arithmetic. In this talk, we will discuss various new techniques to count totally geodesic surfaces in hyperbolic knot complements. As an application, we will also present examples of infinitely many non-commensurable (non-arithmetic) hyperbolic 3-manifolds that contain exactly k totally geodesic surfaces for every positive integer k. If time permits, we will also report on ongoing project on counting totally geodesic surfaces in the complement of knot with small crossing number. This is joint work with Rebekah Palmer.
Co-authors: Rebekah Palmer

Counting lattices in products of trees [Remote]
Ivan Levcovitz, Tufts University, ivan.levcovitz@tufts.edu

BMW (Burger-Mozes-Wise) groups are a class of groups that act geometrically on the product of two infinite, regular trees. For large enough trees, these groups admit the same coarse geometry (they are all pairwise quasi-isometric), yet they can be algebraically quite different. In fact, by a celebrated result of Burger-Mozes, such groups can even be virtually simple. In this talk, I will discuss a random model for generating BMW groups and how we use ideas from this model to solve counting problems related to these groups. This is joint work with Nir Lazarovich and Alex Margolis.
Co-authors: Nir Lazarovich and Alex Margolis

Metric Spaces of Arbitrary Finitely-Generated Scaling Group [In Person]
Daniel Levitin, University of Wisconsin, Madison, dlevitin@wisc.edu

A quasi-isometry between uniformly discrete spaces metric spaces of bounded geometry is textitscaling if it is k-to-1 on finite subsets up to an error term that takes into account the geometry of the set. The collection of k for which scaling self-maps exist is a multiplicative group by composing maps. Scaling maps and the scaling group have been used to prove a variety of quasi-isometric rigidity theorems for groups and spaces. In this talk, I will trace the development of this theory from Whyte's early results on BiLipschitz maps of non-amenable spaces to Genevois and Tessera's rigidity theorem on certain wreath products. I will then sketch my construction of a space with any finitely-generated scaling group.

CTs for Free Products [Remote]

Rylee Alanza Lyman, Rutgers Universityâ€"Newark, rylee.lyman@rutgers.edu

A homotopy equivalence of a graph is called a train track map when it sends vertices to vertices, and the restriction of any iterate of the map to an edge of the graph yields an immersion. (Relative) train track maps are one of the main tools for studying outer automorphisms of free groups; they were introduced in 1992 by Bestvina and Handel. There are by now many proofs of the existence of relative train track maps for free products, with the first by Collins and Turner in 1994. In the intervening time, the theory of relative train track maps for Out(Fn) has progressed, first with improved relative train track maps, and more recently with Feighn and Handel's construction of CTs. Free products have lagged behind. The purpose of this paper is to rectify this situation: we construct CTs for rotationless outer automorphisms of free products.

Pleated surfaces for SO(2,n)-maximal representations [Remote]

Filippo Mazzoli, University of Virginia, ecu4xw@virginia.edu

Since their introduction by Thurston, pleated surfaces have been extensively employed in the study of the structure of hyperbolic 3-manifolds. In this talk we will describe a natural adaptation of this notion for the study of maximal surface group representations inside SO(2,n). Applications of our techniques include: a shear-bend parametrization of the space of quasi-Fuchsian anti-de Sitter manifolds, and a new proof of the convexity of length functions on Teichmüller space along shear paths (see works of Kerckhoff, Bestvina-Bromberg-Fujiwara-Suoto, Théret). This is a joint project with Gabriele Viaggi (Heidelberg University).

Co-authors: Gabriele Viaggi

QI rigidity of lattice products [Remote]

Josiah Oh, The Ohio State University, oh.480@osu.edu

Schwartz proved quasi-isometric rigidity for non-uniform lattices in rank one Lie groups. Frigerio-Lafontâ-Sisto later proved QI rigidity for products $\pi_1(M) \times \mathbb{Z}^d$ where M is a complete, non-compact, finite-volume real hyperbolic manifold of dimension at least 3. This talk will cover QI rigidity for products $\Lambda \times L$, where Λ is a non-uniform lattice in a rank one Lie group and L is a lattice in a simply connected nilpotent Lie group. Specifically, any finitely generated group quasi-isometric to such a product is, up to some finite noise, an extension of a non-uniform rank one lattice by a nilpotent lattice. Under some extra hypotheses, this extension is (virtually) nilcentral, a notion we introduce as a generalization of central extensions.

Hyperbolic actions of metabelian groups [In Person]

Alexander J. Rasmussen, University of Utah, rasmussen@math.utah.edu

Classifying the actions of a given group on different hyperbolic metric spaces is a natural but typically very difficult problem. Recently, several authors have classified the hyperbolic actions of several families of classically-studied metabelian groups. In this talk we will describe how commutative algebra may be used as a tool to approach these classification problems in a uniform way, and extend the classifications to larger families of metabelian groups.

Co-authors: Carolyn R. Abbott, Sahana Balasubramanya

Regular languages and growth in Morse local-to-global groups [In Person]
Jacob Russell, Rice University, jacob.russell@rice.edu

We construct regular languages for the Morse geodesics of the mapping class group, CAT(0) groups, 3-manifold groups, and any other group satisfying a local-to-global condition for their Morse geodesics. These regular languages allow us to study the growth of stable subgroups of these groups. We prove that these stable subgroups have rational growth and grow exponentially slower than the ambient group in all known examples. In the case of the mapping class group, this produces new results on the growth of the convex cocompact subgroups.
Co-authors: Matthew Cordes, Davide Spriano, Abdul Zalloum

Graphs of curves and arcs quasi-isometric to big mapping class groups [Remote]
Anschel Schaffer-Cohen, University of Pennsylvania and Temple University, anschelsc@gmail.com

When is a big mapping class group quasi-isometric to a graph whose vertices are curves or arcs on the underlying surface? Also, what on earth do I mean by "quasi-isometric" when these groups aren't even countable? I will attempt to explain these things.

Rational stable translation lengths of right-angled Artin groups []
Donggyun Seo, Seoul National University, seodonggyun@snu.ac.kr

It is not obvious that every element of a group acting on a graph has rational stable translation length even if the given graph is the Cayley graph. For example, some polycyclic group acting on its Cayley graph contains an irrational stable translation length element [Conner 97, Corollary 3.2]. But Gromov [Gromov 87, Section 8.5.S] proved every hyperbolic group with the action on the Cayley graph has a rational length with the common denominator. Delzant [Delzant 96, Proposition 3.1(iii)] presented another simple proof for the rationality of hyperbolic groups. Bowditch improved Delzant's way to prove the rationality of the curve graph action of a mapping class group. One of the characteristic of our paper is the improvement of Delzant's method and application to right-angled Artin groups acting on their induced hyperbolic graph called extension graphs. This is joint work with Hyungryul Baik and Hyunshik Shin.
Co-authors: Hyungryul Baik, Hyunshik Shin

Divergence in Coxeter groups [In Person]
Ignat Soroko, Florida State University, ignat.soroko@gmail.com

Divergence of a metric space is an interesting quasi-isometry invariant of the space which measures how geodesic rays diverge outside of a ball of radius r, as a function of r. Divergence of a finitely generated group is defined as the divergence of its Cayley graph. For symmetric spaces of non-compact type the divergence is either linear or exponential, and Gromov suggested that the same dichotomy should hold in a much larger class of non-positively curved CAT(0) spaces. However this turned out not to be the case and we now know that the spectrum of possible divergence functions on groups is very rich. In a joint project with Pallavi Dani, Yusra Naqvi, and Anne Thomas, we initiate the study of the divergence in the general Coxeter groups. We introduce a combinatorial invariant called the 'hypergraph index', which is computable from the Coxeter graph of the group, and use it to characterize when a Coxeter group has linear, quadratic or exponential divergence, and also when its divergence is bounded by a polynomial.
Co-authors: Pallavi Dani, Yusra Naqvi, Anne Thomas

Profinitely Rigid Seifert Fibered Spaces and Grothendieck's Problem [In Person]
Ryan Spitler, Rice University, rfs8@rice.edu

One natural starting point when studying a group is to investigate its finite quotients, and one might wonder how much these finite quotients can detect about the group in question. In particular, many have recently been interested in distinguishing fundamental groups of 3-manifolds using just their finite quotients. I will discuss a few infinite families of Seifert fibered spaces whose fundamental groups can be shown to be profinitely rigid; each of these groups can be distinguished from all other finitely generated, residually finite groups by their finite quotients. I will also discuss how these 3-manifold groups can be used to create interesting examples related to Grothendieck's problem on profinite completions. This is joint work with Martin Bridson and Alan Reid.

Geometry of the Deligne–Mostow lattices in $\mathrm{SU}(3,1)$ [In Person]
Joseph Wells, Virginia Tech, joseph.wells@vt.edu

The construction of non-arithmetic lattices in $\mathrm{SU(n,1)}$ is a major open problem. By studying monodromy groups of hypergeometric functions, Deligne and Mostow were able to produce a large family of lattices in $\mathrm{SU(n,1)}$ for $n = 2, \ldots, 9$, with several non-arithmetic examples in $\mathrm{SU}(2,1)$ and a single non-arithmetic example in $\mathrm{SU}(3,1)$. In her thesis, Pasquinelli found explicit fundamental domains for all of Deligne–Mostow lattices in $\mathrm{SU}(2,1)$, providing a more concrete geometric understanding of them. In this talk I'll present some joint work-in-progress with Irene Pasquinelli in extending these ideas to find fundamental domains for the Deligne–Mostow lattices in $\mathrm{SU}(3,1)$ (and notably, the non-arithmetic example).

Homology directions and translation length on sphere complex [Remote]
Chenxi Wu, UW Madison, wuchenxi2013@gmail.com

McMullen's "Teichmuller polynomial" provides a characterization of the stretch factors of pseudo-Anosov maps corresponding to primitive integer points on a fibered cone. We investigated analogous results for sphere complex translation length and on more general setting. I will also discuss some applications on handlebody groups.
Co-authors: Harry Baik, Dongryul Kim

A 3-manifold invariant for collections of closed curves on surfaces [In Person]
Andrew Yarmola, Princeton University, yarmola@math.princeton.edu

Let S be a surface of negative Euler characteristic and consider a finite filling collection C of closed curves on S in minimal position. An observation of Foulon and Hasselblatt shows that $M_C = PT(S) \setminus \hat{C}$ is a finite-volume hyperbolic 3-manifold, where $PT(S)$ is the projectivized tangent bundle and $hatC$ is the set of tangent lines to C. In particular, any invariant of M_C is a mapping class group invariant of the collection C. Further, M_C uniquely determines the mapping class group orbit of C. In this talk, we will go over results that explain the behavior and provide coarse bounds on the volume of M_C in terms of topological and geometric properties of the family C. For example, when C is a filling pair of simple closed curves, we show that the volume is coarsely comparable to Weil-Petersson distance between strata in Teichm"uller space. Further, we will explain algorithmic methods and tools for building such links and computing invariants.
Co-authors: Tommaso Cremaschi, Jacob Intrater, Jose Andres Rodriguez-Migueles

Geometric Topology

Group Trisections and Smoothly Knotted Surfaces [In Person]
Sarah Blackwell, University of Georgia, seblackwell@uga.edu

A trisection of a (smooth, connected, closed, oriented) 4-manifold induces a Van Kampen cube of fundamental groups coming from the pieces of the trisection, and more surprisingly, vice versa. That is, a cube of groups satisfying a few simple requirements produces a trisection of a 4-manifold [Abrams-Gay-Kirby]. One natural question to ask is whether the same holds for bridge trisections of smoothly knotted surfaces in 4-manifolds. In this talk I will show how algorithmically producing a trivial tangle from a surjection between free groups allows us to answer this question in the affirmative. Consequently, although smoothly knotted surfaces in the 4-sphere cannot be distinguished by fundamental groups, they can be distinguished by group trisections. Stallings folding, a technique that translates between surjections between free groups and directed graphs, guides the proof. This is joint work with Robion Kirby, Michael Klug, Vincent Longo, and Benjamin Ruppik.
Co-authors: Robion Kirby, Michael Klug, Vincent Longo, Benjamin Ruppik

The normal growth exponent of a codimension-1 hypersurface of a negatively curved manifold [In Person]
Corey Bregman, University of Southern Maine, corey.bregman@maine.edu

Let M be a closed, negatively curved $(n+1)$-manifold and $N \subset M$ a totally geodesic, codimension-1 submanifold. We define the normal growth exponent of N, which measures the divergence of geodesics orthogonal to the universal cover of N in the universal cover of M. We prove that if N is bi-Lipschitz to a real hyperbolic n-manifold and has normal growth exponent is at most 1, then $\pi_1(M)$ is isomorphic to a lattice in $\mathrm{Isom}(\mathbb{H}^{n+1})$. We also exhibit a family of examples that demonstrate the assumption on the normal growth exponent is necessary in dimensions at least 4.
Co-authors: Merlin Incerti-Medici

Volume of a random geodesic lift [In Person]
Tommaso Cremaschi, University of Southern California, cremasch@usc.edu

Given a filling closed geodesic on a hyperbolic surface, one can consider its canonical lift in the projective tangent bundle. Drilling this knot, one obtains a hyperbolic 3-manifold. In this talk we are interested in volume bounds for these manifolds in terms of geometric quantities of the geodesic, such as the hyperbolic length. In particular, we give a volume lower bound in terms of length when the filling geodesic is a closed geodesic approximating the Liouville geodesic current. The bound is given in terms of a counting problem in the unit tangent bundle that we solve by applying an exponential multiple mixing result for the geodesic flow. This is joint work with Didac Martinez Granado, Yannick Krifka and Franco Vargas Pallete.

Big Pure Mapping Class Groups are Never Perfect [In Person]
George Domat, University of Utah, domat@math.utah.edu

Pure mapping class groups of finite type surfaces are known to have trivial abelianizations (perfect) once the surface has genus at least 3 due to a classic result of Powell. Aramayona-Patel-Vlamis showed that this is not always true for pure mapping class groups of infinite-type surfaces. We show that this is in fact never the case for any infinite-type surface. Furthermore, we show that the abelianization of the closure of the compactly supported mapping classes contains a direct summand isomorphic to an uncountable direct sum of Qs. To find nontrivial elements in the abelianization we use the projection complex machinery of Bestvina-Bromberg-Fujiwara to build quasimorphisms that "see" certain infinite products of Dehn Twists.

A Farey tree structure on a family of pseudo-Anosov braids [Remote]
Ethan Farber, Boston College, farbere@bc.edu

Braids are ubiquitous in low-dimensional topology. In this talk we think of braids as transformations on a punctured disc. We describe a family of braids possessing many intriguing properties: they are (1) positive, (2) pseudo-Anosov, and (3) represent every positive non-integral fractional Dehn twist coefficient (FDTC). The fractional part of the FDTC provides a parameterization of our braids by the Farey tree, and by leveraging this structure we extract dynamical data. For example, we find that the dilatation of the braids grows monotonically with the FDTC, and the Galois conjugates display an intricate limiting behavior on the unit circle in C.

Tropical moduli spaces and configurations on graphs [In Person]
Nir Gadish, University of Michigan, gadish@umich.edu

The moduli spaces of algebraic curves have hugely complicated and interesting cohomology. While in low dimensions the cohomology exhibits various forms of stability, near the top dimension very little is known. Tropical geometry gives access to some of this high dimensional cohomology, namely its top weight. In this talk I will briefly describe the moduli spaces of tropical curves with marked points, and how they relate to the top weight cohomology of the algebraic moduli spaces. Then we will discuss joint work with Bibby, Chan and Yun that reduces the calculation in genus 2 to configurations on a graph, as well as some new computations made possible by this reduction.
Co-authors: Christin Bibby, Melody Chan, Claudia Yun

Generalized group boundaries with applications [Remote]
Craig Guilbault, University of Wisconsin-Milwaukee, craigg@uwm.edu

begindocument Gromov boundaries of hyperbolic groups and visual boundaries of CAT(0) groups are useful tools in geometric group theory. They also play important roles in geometric and algebraic topology—in particular, in attacks on the Borel, Novikov, Farrell-Jones, and Baum-Connes Conjectures. Bestvina axiomatized the notion of group boundary by defining a $\mathcal{Z}$*-boundary* for a group G. In addition to CAT(0) and hyperbolic groups, there are groups that satisfy no curvature conditions but which admit a $\mathcal{Z}$-boundary. Farrell and Lafont added an equivariance condition and called the result an $E\mathcal{Z}$*-boundary*. They showed that the Novikov Conjecture holds for any torsion-free group that admits an $E\mathcal{Z}$-boundary. The crucial open question becomes: Which groups admit a $\mathcal{Z}$- or an $E\mathcal{Z}$-boundary? It is possible that every Type F group admits an $E\mathcal{Z}$-boundary, but a proof seems out of reach In this talk, I will give an introduction to this topic and discuss recent progress on the above open question. One focus will be recent work with Burns Healy and Brian Pietsch involving semidirect products of the form $Gr \times \mathbb{Z}$; another will be work with Molly Moran and Kevin Schreve on higher-dimensional generalizations of Baumslag-Solitar groups. enddocument
Co-authors: Burns Healy, Molly Moran, Brian Pietsch, Kevin Schreve

Geography of spanning surfaces [In Person]
Joshua Howie, University of California, Davis, jahowie@ucdavis.edu

The geography problem for spanning surfaces asks for a classification of all pairs of slope and euler characteristic which can be realised by a spanning surface for a given knot in the 3-sphere. It is enough to understand the meridionally essential one-sided spanning surfaces, a somewhat larger class of surfaces than the geometrically essential spanning surfaces. I will discuss the existence of such one-sided surfaces, and give an algorithmic solution to the geography problem.

Slope detection and toroidal 3-manifolds [In Person]

Ying Hu, University of Nebraska Omaha, yinghu@unomaha.edu

The L-space Conjecture says that for a prime 3-manifold, properties NLS (not being an L-space), LO (having left-orderable fundamental group), and CTF (admitting a co-orientable taut foliation), are equivalent. We investigate these properties for toroidal 3-manifolds through the notion of slope detection. We show that all toroidal integer homology spheres are LO, and that the n-fold cyclic branched covers of a prime satellite knot are NLS and LO, and are CTF if its companion is fibered. We also prove a partial extension of the latter result to links and confirm a folklore conjecture that prime satellite links are never quasi-alternating.
Co-authors: Steve Boyer, Cameron Gordon

Subspace stabilisers in hyperbolic lattices [Remote]

Alexander Kolpakov, University of Neuchâtel, kolpakov.alexander@gmail.com

This paper shows that immersed totally geodesic m–dimensional suborbifolds of n–dimensional arithmetic hyperbolic orbifolds correspond to finite subgroups of the commensurator whenever $m \geq \lfloor \frac{n}{2} \rfloor$. We call such totally geodesic suborbifolds finite centraliser subspaces (or fc–subspaces) and use them to formulate an arithmeticity criterion for hyperbolic lattices. We show that a hyperbolic orbifold M is arithmetic if and only if it has infinitely many fc–subspaces, and provide examples of non–arithmetic orbifolds that contain non–fc subspaces of codimension one. We analyse the relation between Vinberg's commensurability invariants of an arithmetic hyperbolic orbifold and those of its totally geodesic suborbifolds, provide an algebraic characterisation of totally geodesic immersions of hyperbolic orbifolds, and use it to construct examples of totally geodesic immersions of arithmetic hyperbolic orbifolds with different adjoint trace fields and ambient groups of different types. Finally, we study arithmetic properties of orbifolds that descend to their totally geodesic suborbifolds, proving that all suborbifolds in a (quasi)–arithmetic orbifold are (quasi)–arithmetic.
Co-authors: Mikhail Belolipetsky, Nikolay Bogachev, Leone Slavich

Finite-order mapping classes of del Pezzo surfaces [In Person]

Seraphina Eun Bi Lee, University of Chicago, seraphinalee@uchicago.edu

Let M be the underlying smooth 4-manifold of a degree d del Pezzo surface. The Nielsen realization problem for M asks: which finite subgroups G of $\mathrm{Mod}(M) := \pi_0(\mathrm{Homeo}^+(M))$ have lifts to $\mathrm{Diff}^+(M) \leq \mathrm{Homeo}^+(M)$ under the quotient map $\pi : \mathrm{Homeo}^+(M) \to \mathrm{Mod}(M)$? In this talk, I will give a complete classification of such finite subgroups of $\mathrm{Mod}(M)$ for degrees $d \geq 7$. If time permits, I will also discuss the case of subgroups $G \cong \mathbb{Z}/2\mathbb{Z}$ of $\mathrm{Mod}(M)$ for all del Pezzo manifolds M.

Purely pseudo-Anosov subgroups of fibered 3-manifold groups [In Person]

Christopher J Leininger, Rice University, cjl12@rice.edu

Farb and Mosher, together with work of Hamenstädt, proved that Gromov hyperbolicity for surface group extensions is entirely encoded by algebraic and geometry properties of the monodromy into the mapping class group. They were thus able to give a purely geometric formulation for Gromov's Coarse Hyperbolization Question for the class of surface group extensions: Given a finitely generated, purely pseudo-Anosov (free) subgroup of the mapping class group, is it convex cocompact? In this talk, I will explain joint work with Jacob Russell in which we answer the question affirmatively for a new class of subgroups, namely, subgroups of fibered 3-manifold groups, completing a program for such groups started over a decade ago.
Co-authors: Jacob Russell

Cheeger-Gromov rho-invariant and Cha inequality [Remote]
Geunho Lim, University of California, Santa Barbara, limg@ucsb.edu

Due to Thom's classical work, one has an algebraic topological condition for a closed manifold to bounds a null-cobordism. In 1999, Gromov gave a conjecture that the geometric complexity of a null-cobodism is linearly bounded by that of its boundary, raising quantitative topology. We introduce a topological analog of Gromov's conjecture which supports Gromov's original conjecture. The topological analog not only is interesting in itself but also gives applications on the quantitative bounds for Cheeger-Gromov rho-invariants. By Cha, explicit linear bounds for 3-manifolds are known but it is open for high dimensional (4k-1)-manifolds. We give a new result of linear bounds for high dimensional manifolds endowed with a faithful representation. A key ingredient is to construct (4k)-cobordisms π_1-injectively bounded by (4k-1)-manifolds, using relative hyperbolization. This talk is based on a recent joint work with Shmuel Weinberger.
Co-authors: Shmuel Weinberger

Counting for cusped Hitchin representations [In Person]
Giuseppe Martone, University of Michigan, martone@umich.edu

The Hitchin component is a subset of the character variety of a surface group into the Lie group SL(d,R). This component, which coincides with the Teichmuller space of marked hyperbolic structures on the surface when d=2, is an important example of a higher Teichmuller space. We use the thermodynamic formalism for countable Markov shifts to study the dynamics of Hitchin representations for surfaces with cusps. We associate (well-behaved) potentials to cusped Hitchin representations and use Kessebohmer and Kombrink extension of Lalley's renewal theorem to prove a counting result for this class of potentials and countable Markov shifts. This talk is based on joint work with Harry Bray, Dick Canary, and Nyima Kao.
Co-authors: Harrison Bray, Richard Canary, Lien-Yung Kao

The homotopy type of the complex of separating curves [In Person]
Daniel Minahan, Georgia Tech, dsminahan@gmail.com

The curve complex is an important object in the theory of mapping class groups. It is a result of Harer that the curve complex is homotopy equivalent to a wedge of spheres. We show that the analogous object for the Torelli group, the complex of separating curves, is also homotopy equivalent to a wedge of spheres. This generalizes a result of Looijenga. The proof proceeds by applying certain discretized versions of Morse theory. We will also discuss a few other related connectivity results for other subcomplexes of the curve complex.

Topology and geometry of random 2-dimensional hypertrees [In Person]
Andrew Newman, Carnegie Mellon University, anewman@andrew.cmu.edu

A hypertree is one of several high-dimensional generalizations of a tree; in this case it means a rationally acyclic complex. We'll discuss the asymptotic topological and geometric structure of these spaces when sampled according to the determinantal measure, especially the asymptotic properties of the fundamental group.
Co-authors: Matthew Kahle

Morita Conditions, Direct Systems, and Extension Theory [In Person]
Leonard R. Rubin, University of Oklahoma, lrubin@ou.edu

In 1953, K. Morita introduced certain conditions on a collection $\mathcal{F}$ of closed subsets of a space X. We refer to them as the it Morita Conditions: For each $\mathcal{G} \subset \mathcal{F}$,

1. $\bigcup \mathcal{G}$ is closed in X, and
2. as a subspace of X, $\bigcup \mathcal{G}$ has the weak topology with respect to $\mathcal{G}$.

He related them to the detection of normality and dimension of X in case $\mathcal{F}$ is a cover of X. In 2009, S. Mardevsić and I extended Morita's result in two ways. One of these shows that the theorem applies to all of extension theory, and the other involves a lessening of the assumptions involving cardinality. Moreover, we framed our proposition in terms of direct systems and their limits. We will state and discuss this result and will reflect on some of the difficulties involved in employing direct systems. Finally we will state a theorem about the preservation of extension-theoretic properties in the limit of a direct system. This result has applications in the theory of cohomological dimension.

Totally symmetric sets and the representation theory of mapping class groups [In Person]
Nick Salter, Notre Dame, nsalter@nd.edu

A "totally symmetric set" is a special finite subset of a group G which exerts a great deal of control on the homomorphisms in and out of G. I will discuss recent work with Caplinger which lays the groundwork for using this technology as an approach to the representation theory of braid and mapping class groups.
Co-authors: Noah Caplinger

An Alexander method for infinite-type surfaces [In Person]
Roberta Shapiro, Georgia Tech, rshapiro32@gatech.edu

The Alexander method is a combinatorial tool used to determine whether two self-homeomorphisms of a surface are isotopic. This statement was formalized in the case of finite-type surfaces by Farb-Margalit, although the main ideas date back 100 years to the work of Dehn. A version of the Alexander method was proven for infinite-type surfaces by Hernández-Morales-Valdez and Hernández-Hidber. We prove the entire statement of the Alexander method, with a special focus on all infinite-type surfaces. In this talk, we will also discuss several applications of the Alexander method, including verifying relations in the mapping class group, showing that the centralizers of certain twist subgroups of the mapping class group are trivial, and providing a simple basis for the topology of the mapping class group.

Intersection points on Hyperbolic surfaces [In Person]
Tina Torkaman, Harvard University, torkaman@math.harvard.edu

In this talk, First I discuss the intersection number of closed geodesics on finite volume hyperbolic surfaces and then I explain the equidistribution of the intersection points of the closed geodesics.

The topology of the moduli spaces of dilation surfaces [In Person]
Jane Wang, Indiana University Bloomington, wangjan@iu.edu

Translation surfaces are geometric objects that can be defined as a collection of polygons with sides identified in parallel opposite pairs by translation. If we generalize slightly and allow for polygons with sides identified by both translation and dilation, we get a new family of objects called dilation surfaces. While translation surfaces are well-studied, much less is known about dilation surfaces and their moduli spaces. Surprisingly though, the topology of the moduli spaces of dilation surfaces is much easier to understand than the moduli spaces of translation surfaces. In this talk, we will survey recent progress in understanding the homotopy groups of moduli spaces of dilation surfaces.
Co-authors: Paul Apisa and Matt Bainbridge

Extended geometrically finite representations [In Person]

Theodore Weisman, University of Texas at Austin, weisman@math.utexas.edu

We introduce a new notion of geometrically finite subgroups of higher-rank Lie groups. Our definition generalizes previous definitions of relatively Anosov subgroups due to Kapovich-Leeb and Zhu, but has fewer restrictions on cuspidal behavior. This means that the definition interacts well with the theory of convex projective structures, and is stable under a wider family of relative deformations.

Adjoint twisted Reidemeister torsion of fundamental shadow link complements and its application [In Person]

Ka Ho Wong, Texas A&M University, daydreamkaho@tamu.edu

The adjoint twisted Reidemeister torsion of a 3-manifold M is a non-zero complex-valued invariant associated with the representation of $\pi_1(M)$ into $\mathrm{SL}(2;\mathbb{C})$. There is a well-known formula relating the torsion of a link complement and that of the manifold obtained by doing hyperbolic Dehn-filling on the boundary components. Moreover, every closed oriented 3-manifolds can be obtained by doing a Dehn surgery on the boundaries of a suitable fundamental shadow link complements, which have truncated tetrahedra as their building blocks. In this talk, we will discuss how the adjoint twisted Reidemeister torsion of fundamental shadow link complements is related to the Gram matrix function associated with the building blocks of the link complements. As an application, we find new explicit formulas for the adjoint twisted Reidemeister torsion for most hyperbolic 3-manifolds. This is a joint work with Tian Yang.

Co-authors: Tian Yang

Set-Theoretic Topology

Semi-proximal Spaces and Normality [In Person]

Khulod Almontashery, York University, khulod@yorku.ca

We consider the relationship between normality and semi-proximality with respect to subspaces of products of ordinals. We prove that every normal subspace of the product of finitely many ω_1 is semi-proximal, and we have a conjecture for building a consistent counter example to the converse. This is joint work with Paul Szeptycki.

Co-authors: Paul Szeptycki

Partitions of the real line [In Person]

Will Brian, University of North Carolina at Charlotte, wbrian.math@gmail.com

By a theorem of Hausdorff, the real line can be partitioned into $\aleph_1$ Borel sets. It can also be partitioned into any countable number of Borel sets, or into $\mathfrak{c}$ Borel sets (e.g., by partitioning it into singletons). But other than this, the spectrum of possible sizes of partitions of $\mathbb{R}$ into Borel sets can be fairly arbitrary. For example, for any $A \subseteq \omega$ with $0, 1 \in A$, there is a forcing extension in which $A = \{n :$ there is a partition of $\mathbb{R}$ into $\aleph_n$ Borel sets$\}$. In this talk, I will discuss some of the more topological aspects of the proof of this fact, and will present some related unsolved problems.

Analytic order-isomorphisms of countable dense subsets of the unit circle [Remote]

Maxim R. Burke, University of Prince Edward Island, burke@upei.ca

The countable dense homogeneity of the real line R (i.e., the existence for any two countable dense sets A and B of a homeomorphism h such that h(A)=B) is witnessed by homeomorphisms of the real line which are the restriction to R of entire functions, by a theorem of Barth and Schneider. The same is not true for unit circle T, but we show in answer to a question of P. M. Gauthier that the homeomorphisms in this case can be taken to be analytic in C-0 with a nonzero derivative on the circle.

Counting the Uncountable, or, How I Learned to Stop Worrying and Love Elementary Submodels [In Person]

Steven Clontz, University of South Alabama, steven.clontz@gmail.com

Consider the following game. Let W be some subset of the reals. During the initial round, Alice chooses $-\infty$ and Bob chooses $+\infty$. Then each subsequent move of either player is a real number strictly between the two most recently chosen numbers. After ω-many rounds, Alice wins this game provided that some number in W is both greater than all her choices and less than all Bob's choices. Bob has a winning strategy in this game if and only if W is countable. To see this, we will demonstrate two proofs accessible to a general mathematical audience, one utilizing countable elementary submodels, and the other involving limited information strategies.

Co-authors: Will Brian

Selection Games with Continuous Functions [Remote]

Christopher Caruvana, Indiana University Kokomo, chcaru@iu.edu

We will summarize some equivalences between covering properties for a space and clustering properties for the space of continuous real-valued functions with a corresponding topology. We will also discuss the obstacles in generalizing these results to continuous group-valued functions.

Co-authors: Jared Holshouser

A class of homogeneous structures for which all Borel sets are Ramsey [Remote]
Natasha Dobrinen, University of Denver, natasha.dobrinen@du.edu

We extend the Galvin-Prikry theorem, which shows that all Borel subsets of the Baire space are Ramsey, to a class of homogeneous structures satisfying a certain amalgamation property. As a corollary, we recover exact big Ramsey degrees, answering a question of Todorcevic.

Remote Points [Remote]
Alan Dow, UNC Charlotte (Mathematics), adow@uncc.edu

A remote point of a space X is a point in the Cech-Stone remainder that is not in the closure of any nowhere dense subset of X. These were introduced by Fine and Gilman and studied assuming CH. Famously, van Douwen established that remote points exist in ZFC for the reals. For pseudocompact spaces their existence involves measurable cardinals and so the most interesting results are for non-pseudocompact (in fact locally compact and sigma-compact spaces). This talk may be a survey or an update.

Partition forcing and independent families [Remote]
Vera Fischer, University of Vienna, vera.fischer@univie.ac.at

Revisiting Miller partition forcing, we show that consistently the minimal cardinality of a maximal independent family is strictly smaller than the minimal cardinality of a partition of the Baire space into compact sets.
Co-authors: J. A. Cruz-Chapital, O. Guzman, J. Šupina

Discrete Generators [Remote]
Paul Gartside, University of Pittsburgh, gartside@math.pitt.edu

A subset G of $C(X)$, the set of all continuous real-valued functions on a space X is a generator provided: whenever a point x is not in a closed set C then for some g in G we have $g(x)$ not in the closure of $g(C)$. Equivalently G is a generator if $\{g^{(-1)}U : U \text{ open in } R \text{ and } g \text{ in } G\}$ is a base for X. With the topology of pointwise convergence $C(X)$ becomes a space, $Cp(X)$, and every generator picks up the subspace topology. In this talk we investigate which spaces have a discrete generator.
Co-authors: Ziqin Feng and Alex Yuschik

One more improvement of the cardinal inequality of Hajnal and Juhász [Remote]
Ivan S. Gotchev, Central Connecticut State University, gotchevi@ccsu.edu

Hajnal and Juhász, in 1967, proved that if X is a Hausdorff space, then $|X| \leq 2^{c(X)\chi(X)}$. In 1974, Šapirovskiĭ improved this inequality for the class of regular, T_1-spaces by showing that if X is a regular, T_1-space, then $|X| \leq \pi\chi(X)^{c(X)\psi(X)}$. Sun, in 1988, improved further these two inequalities by proving that if X is a Hausdorff space, then $|X| \leq \pi\chi(X)^{c(X)\psi_c(X)}$. In 2016, together with Tkachenko and Tkachuk we improved significantly all these three inequalities by showing that if X is a Hausdorff space, then $|X| \leq \pi w(X)^{\mathrm{ot}(X)\psi_c(X)}$, where $\mathrm{ot}(X)$ is the o-tightness of X defined by Tkachenko in 1983. In the same paper we introduced the notion of it dense o-tightness as follows: the dense o-tightness of a space X does not exceed κ, or $\mathrm{dot}(X) \leq \kappa$, if for every family $\mathcal{U}$ of open subsets of X whose union is dense in X and for every point $x \in X$ there exists a subfamily $\mathcal{V} \subset \mathcal{U}$ such that $|\mathcal{V}| \leq \kappa$ and $x \in \overline{\bigcup \mathcal{V}}$. We note that $\mathrm{dot}(X) \leq \mathrm{ot}(X)$, $\mathrm{dot}(X) \leq \pi\chi(X)$ and $\mathrm{dot}(X) \leq c(X)$ are valid for every space X. In this talk we will show that if X is a Hausdorff space, then $|X| \leq \pi w(X)^{\mathrm{dot}(X)\psi_c(X)}$, which improves even further all four inequalities mentioned above.

Applications of C_p-theory to the definability of pathological Banach spaces in Model Theory [Remote]

Clovis Hamel, University of Toronto, chamel@math.toronto.edu

We explore applications of C_p-theory in Model Theory and Analysis. In particular, we will discuss Gowers' problem, which asks if the Tsirelson space or more generally, if Banach spaces not including isomorphic copies of l^p or c_0 are definable. This problem is model-theoretic in nature and its answer depends on the logic one is working with. Casazza, Dueñez and Iovino's work negatively answers Gowers' problem in first-order (in fact, continuous) logic. However, one could argue that those logics are not the most appropriate ones to deal with these Banach spaces as they lack enough expressive power for analysts. Whereas first-order logic involves compact spaces, we use techniques from C_p-theory in order to generalize the aforementioned undefinability results far beyond first-order logic, for example to infinitary logics such as countable fragments of continuous $\mathcal{L}_{\omega_1,\omega}$, which have non-compact spaces associated to them. We had previously reported results for logics with associated countably tight Lindelof Sigma spaces; now all we require is countable tightness.
Co-authors: Franklin D. Tall

A zero-dimensional F-space that is not strongly zero-dimensional [Remote]

K. P. Hart, TU Delft, k.p.hart@tudelft.nl

We describe various examples of F-spaces that are zero-dimensional but not strongly so
Co-authors: Alan Dow

Translation for a Star Selection Game on the Pixley-Roy Hyperspace [Remote]

Jared Holshouser, Norwich University, JHolshou@Norwich.edu

In this talk we will show how to fit star selection principles into our game translation framework. We will then use that to construct show how a star selection game on the Pixley-Roy hyperspace connects to a more basic selection game on the ground space. From this process, the topological and combinatorial aspects of the connection will be made clear and distinct.
Co-authors: Chris Caruvana

Connectedness and forcing [Remote]

Akira Iwasa, Howard College, aiwasa@howardcollege.edu

We discuss how forcing destroys connectedness of a topological space. A topological space is said to be strongly connected if every continuous real-valued function defined on the space is constant. We give an example where forcing destroys strong connectedness.

Suslin tree preservation and club isomorphisms [Remote]

John Krueger, University of North Texas, jkrueger@unt.edu

In this talk I will discuss my recent result of the construction of a model of set theory in which there exists a Suslin tree and satisfies that any two normal Aronszajn trees, neither of which contains a Suslin subtree, are club isomorphic.

Results about P-normality [Remote]

Mansouri, Mai, King Abdulaziz University, mfmansouri1@kau.edu.sa

A topological space X is called P-normal if there exist a normal space Y and a bijective function $f : X \longrightarrow Y$ such that the restriction $f_{|_A} : A \longrightarrow f(A)$ is a homeomorphism for each paracompact subspace $A \subseteq X$. P-normality is an additive topological property which is not, in general, multiplicative nor hereditary. In this paper we present some new results about P-normality. We study the invariance and inverse invariance of P-normality. We also investigate the Alexandroff Duplicate of a P-normal space, the closed extension of a P-normal space, the discrete extension of a P-normal space. We give some Dowker spaces which are not P-normal. Furthermore, we introduce a new property related to P-normality which we call strong P-normality.
Co-authors: Kalantan, Lutfi

Sub-Ostaszewski spaces, normal and otherwise [Remote]

Peter Nyikos, University of South Carolina, nyikos@math.sc.edu

A *sub-Ostaszewski space* is a locally compact Hausdorff space of cardinality $\aleph_1$ in which every closed subset is either countable or co-countable. An it Ostaszewski space is a countably compact sub-Ostaszewski space. All Ostaszewski spaces are perfectly normal, but the question of when a sub-Ostaszewski space is normal is still little understood. **Problem 1.** Does the existence of Ostaszewski spaces imply CH? **Problem 2.** Is $\clubsuit$ alone enough to imply the existence of a normal sub-Ostaszewski space? These problems are discussed along with a theorem that $\mathfrak{b} > \aleph_1$ implies all sub-Ostaszewski spaces are normal, and an example, assuming $\clubsuit + \mathfrak{b} = \aleph_1$, of a non-normal sub-Ostaszewski space.

On the complement of diagonal, its functional countability and Corson compact spaces [Remote]

Vladimir Tkachuk, Universidad Autonoma Metropolitana de Mexico, vova@xanum.uam.mx

A space X is called it functionally countable if $f(X)$ is countable for any continuous function $f : X \to \mathbb{R}$. Given an infinite cardinal κ, we prove that a compact scattered space K with $d(K) > \kappa$ must have a convergent κ^+-sequence. This result implies that a Corson compact space K is countable provided that the space $(K \times K) \setminus \Delta_K$ is functionally countable; here $\Delta_K = \{(x, x) : x \in K\}$ is the diagonal of K. We also establish that, under Jensen's Axiom $\diamondsuit$, there exists a compact hereditarily separable non-metrizable compact space X such that $(X \times X) \setminus \Delta_X$ is functionally countable and show in ZFC that there exists a non-separable σ-compact space X such that $(X \times X) \setminus \Delta_X$ is functionally countable.

Workshop on Topological Methods in Linear Dynamics

Presented by:

Udayan Darji, University of Louisville, udayan.darji@louisville.edu

Juan Bés, Bowling Green State University, jbes@bgsu.edu

Linear dynamics is a relatively recent area of mathematics which lies at the intersection of operator theory and dynamical systems. It studies operators on separable Banach spaces from the viewpoints of topological dynamics, ergodic theory and recently hyberbolic dynamics. Many important, interesting and deep results have been obtained concerning topological dynamics notions such as transitivity, mixing, chaos and frequent hypercyclicity. At the same time many interesting and novel problems remain open. Research in the field concerning ergodicity and invariant measure is relatively new and there is much to be uncovered. Research concerning hyperbolicity, shadowing and expansivity is yet newer. In this workshop we will introduce the basics of the material introducing fundamental results, current research trends and open problems. The workshop is intended for and will be accessible to graduate students and novices to the area.