BUGCAT Conference

Binghamton University Graduate Combinatorics, Algebra, and Topology

November 5 - 6, 2022

Acknowledgments

There are a lot of people we would like to thank that made BUGCAT Conference possible this year!

We will start by thanking Dr. Alexander Borisov, the faculty coordinator of BUGCAT Conference, for always being there to guide us through difficult decisions.

We thank Dr. Kappe and the Kappe family for their generous financial support of our conference in memory of Wolfgang Kappe.

We thank the Binghamton University Department of Mathematics and Statistics and our chair Dr. Marcin Mazur.

Special thanks go to our wonderful secretaries Dianne Anderson and Diana Heggelke, and our truly awesome financial coordinator Grace Holton. They have been a huge assistance in organizing this conference, ranging from handling travel reimbursements to booking hotel rooms to reserving lecture halls.

Many graduate students participated in organizing this conference. The Organizing Committee consists of Hari Asokan, Christopher Chia, Meenakshy Jyothis, Tara Koskulitz, Ezekiel M Lemann, Shuchen Mu, Chris Schroeder, and Lucas Williams. The Advisory Board consists of Ulysses Alvarez, Chris Eppolito, and Sarah Lamoureux. In addition, we would like to thank Mithun Padinhare Veettil, Shiyi Ma, Samruddhi Thakar, and Thu Quan.

Finally, a huge thanks to all our participants, speakers, and moderators! We thank you for making this conference a success.

Signed,
The BUGCAT Conference Organizing Committee

Saturday

Time	Event	Location
8:00	Breakfast and Registration	LH 14 Hallway
8:45	Introduction	LH 14
9:00	Parallel Talks	LH 10, 11, 12, 13
11:30	Break	
11:45	Keynote Talk: Yair Minsky	LH 14
1:00	Lunch	Chenango Room
2:15	Keynote Talk: Kirsten Wickelgren	LH 14
3:15	Break	
3:25	Parallel Talks	LH 10, 11, 13
4:00	Keynote Talk: Rigoberto Flórez	LH 14
6:00	BUGCAT 2022 Banquet	Quality Inn

Sunday
(Daylight Savings!)

Time	Event	Location
8:00	Breakfast and Refreshments	CW 330
9:00	Parallel Talks	CW 305, 307, 329, 331
9:55	Break	
10:10	Parallel Talks	CW 305, 307, 329, 331
11:05	Break	
11:20	Parallel Talks	CW 305, 307, 329, 331
12:15	Conference Ends	

List of Talks

This list of talks is organized by speaker last name (with page references for abstracts, room number, and time).

List of Talks

List of Talks

List of Talks

Exceptional Collections in type $\tilde{A}_n$ LH 10

Ray Maresca Brandeis University

For Q a quiver of type $\tilde{A}$, we will associate to each exceptional collection of kQ modules a unique combinatorial object which is a collection of arcs on an annulus. We will see that these diagrams can be placed into parametrized families and in the case when all arrows of Q but one point in the same direction, the number of families is counted by a generalization of the Catalan numbers. We will finish by providing a bijection between the exceptional collections in this case and certain lattice paths in $\mathbb{R}^2$.

The Semiring Geometry of Routing Problems LH 11

William Bernardoni Case Western Reserve University

Idempotent Semirings naturally generalize the shortest path problem, allowing Floyd's algorithm to be applied to problems such as maximum reliability routing, or k-shortest path routing, or many other similar problems. The shortest path problem has the benefit of working over the tropical semiring, and the tools of tropical geometry have given many powerful extensions within the problem - such as Michael Joswig and Benjamin Schröter's use of tropical hypersurfaces to solve the parameterized all paths shortest path problem. We will introduce two key items, the first is a generalization of the tropical hypersurface over any idempotent semiring, allowing for Joswig's algorithm, or any other tropical geometric algorithm, to be applied over any parameterized algebraic path problem, and the second is a necessary and sufficient condition for the existence of finite length shortest paths in general settings by analyzing the existence of a certain semiring ideal in semirings associated to a given graph.

Idempotents, Free products and quandle coverings LH 12

Dipali Swain University of South Florida

In this paper, we investigate idempotents in quandle rings and relate them with quandle coverings. We prove that integral quandle rings of quandles of finite type that are non-trivial coverings over nice base quandles admit infinitely many non-trivial idempotents, and give their complete description. We show that the set of all these idempotents forms a quandle in itself. As an application, we deduce that the quandle ring of the knot quandle of a non-trivial long knot admit non-trivial idempotents. We consider free products of quandles and prove that integral quandle rings of free quandles have only trivial idempotents, giving an infinite family of quandles with this property. We also give a description of idempotents in quandle rings of unions and certain twisted unions of quandles.

Projective resolutions and the Comparison Theorem LH 13

Eleftherios Chatzitheodoridis University of Virginia

In this talk, we discuss two of the most ubiquitous notions that Homological Algebra has to offer all of Mathematics: that of chain homotopy, which is a central ingredient in establishing the Homotopy Theorem on the homotopy invariance of singular homology (with coefficients) in Algebraic Topology, and that of projective resolutions, which provide a systematic way of studying arbitrary - and possibly quite mysterious - modules through projective modules, whose well-behaved properties are fairly well-studied. Our talk culminates with a discussion of the celebrated Comparison Theorem, followed by the proof of a life-saving result which combines both aforementioned notions and endows their study with purpose: every module admits a projective resolution, which is unique up to chain homotopy equivalence.

Grand-Schnyder woods and applications to drawing LH 10

Shizhe Liang Brandeis University

In 1990, Schnyder showed that every plane triangulation admits a special partition of its inner edges into 3 trees, which is now known as the Schnyder wood. Using this structure, Schnyder designed a straight-line grid drawing algorithm for plane graphs. Since then, other structures and algorithms sharing the same flavor were found by various authors. In this talk I will be presenting a new general construction, named grand-Schnyder wood, that simultaneously generalizes several of these structures (notably the original Schnyder woods, the regular edge labelings of Kant and He, and the d-Schnyder decompositions of Bernardi and Fusy). Precisely, a grand-Schnyder wood of parameter d is defined on a plane graph with an outer face of degree d and inner faces of degree at most d. It is a set of d spanning trees crossing each other in a regular pattern. Using grand-Schnyder woods of parameter $d = 4$ we provide a pair of algorithms, which extend several existing algorithms due to Kant and He, Fusy, Barriere Huemer, and Bernardi Fusy. This is a joint work with Olivier Bernardi and Eric Fusy.

Automorphisms of del Pezzo Surfaces LH 11

Jonathan Smith University of South Carolina

The plane Cremona group over a field k, denoted $Cr_2(k)$, is the group of birational automorphisms of $\mathbb{P}^2_k$. This group has garnered interest among algebraic geometers for well over a century. The finite subgroups of $Cr_2(k)$ are of particular interest, and in 2009, I. Dolgachev and V. Iskovskikh provided an essentially complete classification of the finite subgroups of $Cr_2(\mathbb{C})$ up to conjugacy. The classification uses the fact that every finite subgroup of $Cr_2(k)$ is realized as a group of regular automorphisms of a del Pezzo surface or a conic bundle. For an arbitrary field k of characteristic zero, to classify the finite subgroups of $Cr_2(k)$, one would like to determine which groups act on some del Pezzo surface over k. In this talk, we examine the structure of the plane Cremona group and del Pezzo surfaces and offer some results that generalize the classification of automorphisms of del Pezzo surfaces to arbitrary fields of characteristic zero.

A new way to build a knot: the Thompson group, representation theory, and polynomial invariants LH 12

Louisa Liles University of Virginia

Alexander's theorem states that every knot or link can be realized as the closure of a braid. This expository talk explores an analogous result of Jones that every knot or link can be built from some element of a group of piecewise linear orientation-preserving homeomorphisms of the unit interval, called the Thompson group. I will give examples of Jones' construction and describe its representation-theoretic origins. I will also discuss some extensions of Jones' result by Aiello and Baader and end with connections made by Aiello, Conti and Jones to familiar polynomial knot invariants.

Computing π_1 of the free grouplike E_2-algebra on a point LH 13

Kimball Strong Cornell University

The Hopf fibration provides a beautiful way to compute $\pi_3(S^2)$, but is more geometric then should be necessary to compute an object that can be define purely homotopy-theoretically. In this talk I will sketch an alternate way to compute this group based on the philosophy that homotopy groups of spheres represent coherence laws in higher categories.

Graph Theory and a Generalization of the Exterior Algebra LH 10

Steven Lippold Bowling Green State University

In this talk, we recall $\Lambda_{V_d}^{S^2}$, a graded vector space which generalizes the exterior algebra. Then, we give some connections between $\Lambda_{V_d}^{S^2}$ and edge partitions of the complete graph K_n. Moreover, we define some symmetric group actions and natural involutions of the set of edge partitions of K_n, which allows us to give a generalization of the determinant map. The work presented results from joint work with Staic and Stancu published in Monatshefte für Mathematik (2022).

The cohomology of spherical vector bundles on K3 surfaces LH 11

Yeqin Liu University of Illinois at Chicago

Computing the cohomology of vector bundles on K3 surfaces has been a challenging problem. In this talk we consider this question for spherical vector bundles, which are those stable vector bundles that do not admit any deformations. I will answer this question completely by showing an algorithm to compute the cohomology of every spherical vector bundle on any K3 surface, in terms of its Chern classes. The method heavily involves algebra and quiver representations, and it is very likely to generalize to other cohomology computation problems.

Generalizations of Orthogonal Calculus LH 13

Matt Carr Ohio State University

The orthogonal calculus and its variants comprise one of the three existing branches of functor calculi. In this talk, we will introduce the orthogonal calculus, discuss its similarities to Goodwillie calculus, existing generalizations, and indicate hints which suggest that even more ambitious generalizations exist and what these might look like. This is the subject of ongoing work joint with Niall Taggart.

Shellability of Partial Partitions Ordered by Inclusion LH 10

Michael Gottstein Binghamton

The set of partial partitions of a finite set, ordered by inclusion, can be studied as an abstract simplical complex. We use the theory of shellable nonpure complexes to prove that a set of representatives for a basis of its homology is combinatorially equivalent to a set of cross-polytopes of various dimensions.

Representation Dimensions of Algebraic Tori LH 11

Bailey Heath University of South Carolina

Algebraic tori over a field k are special examples of affine group schemes over k, such as the multiplicative group of the field or the unit circle. Any algebraic torus can be embedded into the group of $n \times n$ invertible matrices with entries in k for some n, and the smallest such n is called the representation dimension of that torus. In this work, I am interested in finding the smallest possible upper bound on the dimension of all algebraic tori of a given dimension d. After providing some background, I will discuss how we can rephrase this question in terms of finite groups of invertible integral matrices. Then, I will share some progress that I have made on this question, including exact answers for certain values of d.

If a closed orientable surface wore pants... LH 12

Megha Bhat CUNY Graduate Center

This talk will discuss a way to obtain a finite presentation for the mapping class group of a closed orientable surface of genus g. We will start with cut systems, which are isotopy classes of the surfaces obtained by removing a set of circles from the surface M. We will see some properties of cut systems, and moves to go between them. A maximal cut system is called a pants decomposition of the surface. Using subsurfaces given by these cuts we will obtain relations for a presentation of the mapping class group of the surface.

Giant red dog algebras and hairy balls LH 13

Benjamin Thompson Cornell

Every mathematician knows that real numbers are generalized by complex numbers, which are in turn generalized by quaternions. These are all associative composition algebras, but generalizing further comes at a cost. The octonions are composition algebras but are not associative. Clifford algebras, on the other hand, are associative but are not necessarily composition algebras. In this talk we provide a friendly introduction to this lesser-known family of associative algebras. By examining an extension of the hairy ball theorem, we aim to show they do more than just share a name with an iconic canine.

The forests filtration of a graph LH 10

Andrés Carnero Bravo Universidad Nacional Autónoma de México

Given a graph G I'll define a filtration of simplicial complexes associated to G,

$$\mathcal{F}_0(G) \subseteq \mathcal{F}_1(G) \subseteq \mathcal{F}_2(G) \subseteq \cdots \subseteq \mathcal{F}_\infty(G)$$

where the first complex is the independence complex and the last the complex is formed by the acyclic sets of vertices. I'll talk about some properties of this filtration as well as the calculation of the homotopy type for various families of graphs.

Locally nilpotent polynomials LH 11

Sayak Sengupta Binghamton University

In this talk we will define and study a class of polynomials, named weakly locally nilpotent polynomials, with iterations modulo all prime ideals in a ring of integers O_K.

Diagrams of Fibered Positive Links, and their consequences LH 12

Lizzie Buchanan Dartmouth College

The maximum degree of the Jones polynomial of a fibered positive knot is at most four times the minimum degree, and we have a similar result for links. This theorem allows us to complete the positivity classification of knots up to 12 crossings. We will talk about the motivation and story behind this result, see some examples and pictures, and get acquainted with Balanced and Burdened link diagrams, new kinds of diagrams we constructed in order to bound the degree of the Jones polynomial.

Higher scissors congruence LH 13

Cary Malkiewich Binghamton University

Hilbert's Third Problem asks for sufficient conditions that determine when two polyhedra in three-dimensional Euclidean space are scissors congruent. Classically, the attempts to solve this problem (in this and other geometries) lead into group homology and algebraic K-theory, in a somewhat ad-hoc way. In the last decade, Zakharevich has shown that the presence of K-theory here is not ad-hoc, but is integral to the definition of scissors congruence itself. This leads to a natural notion of "higher" scissors congruence groups, or higher algebraic K-theory of scissors congruence.

In this short talk I'll advertise an exciting, ongoing program to better understand these higher groups, and to compute them in new cases. The main results so far are a trace map to group homology, a Farrell-Jones isomorphism, a Solomon-Tits theorem, and a new description of scissors congruence K-theory as a Thom spectrum. Much of this is joint work with Anna-Marie Bohmann, Teena Gerhardt, Mona Merling, and Inna Zakharevich.

Fibered 3-manifolds, spun foliations, and end-periodic maps

Yair Minsky (Yale University)

Abstract

An end-periodic map of an infinite-genus surface is a homeomorphism that, "near infinity", looks like a translation. These naturally arise in the theory of foliations of 3-manifolds, as the first-return maps to certain leaves along a transverse flow. In particular Thurston pointed out how they arise in a fibred 3-manifold when the suspension flow of the fibration is transverse to a non-fibre surface. End-periodic maps have been studied deeply by several authors, including Handel-Miller and Cantwell-Conlon-Fenley. We give a somewhat new point of view on this theory by showing that they can always be obtained from the kind of fibered situation that Thurston considered. I will try to describe the background of this story and explain what comes out of the new construction. This is joint work with Michael Landry and Sam Taylor.

The Weil Conjectures and A1-homotopy theory

Kirsten Wickelgren (Duke University)

Abstract

In a celebrated paper from 1948, André Weil proposed a beautiful connection between algebraic topology and the number of solutions to equations over finite fields: the zeta function of a variety over a finite field is simultaneously a generating function for the number of solutions to its defining equations and a product of characteristic polynomials of endomorphisms of cohomology groups. The ranks of these cohomology groups are the number of holes of each dimension of the associated complex manifold.

This talk will describe the Weil conjectures and then enrich the zeta function to have coefficients in a group of bilinear forms. The enrichment provides a connection between the solutions over finite fields and the associated real and complex manifolds. It is formed using A1-homotopy theory. No knowledge of A1-homotopy theory is necessary. The new work in this talk is joint with Margaret Bilu, Wei Ho, Padma Srinivasan, and Isabel Vogt and is available https://arxiv.org/abs/2210.03035

Large Scale Homology LH 10

Zihao Liu Rice University

Generally, large scale geometry considers properties of metric spaces that are visible to an observer at a vantage point preceding to infinity. Specifically, with large scale structures, all bounded metric spaces are equivalent to a point, and thus, the focus will be on unbounded spaces, such as the Cayley graph of a finitely generated infinite group. In this talk, I will introduce my recent work about the large scale homology theory by using the affine n-simplex to characterize topology of the boundary (points at infinity) of an unbounded metric space.

Tales from a translation LH 11

Chris Schroeder Binghamton University

While embedded in a graduate program, it is natural to wonder about careers outside academia, although this information can be hard to come by. In this talk, I will tell the beginning of a story about my experience in academic publishing working with Springer to publish an English translation of Bertram Huppert's 1967 group theory text *Finite Groups I*.

An Invitation to Equivariant Algebra LH 13

Ben Spitz UCLA

Group cohomology for a finite group G famously features "restriction" and "transfer" maps satisfying interesting relations coming from the structure of the (conjugacy classes of) subgroups of G. In the 1970s, Green and Dress found a nice package for all of this data, coining the term "Mackey Functor" and initiating the study of equivariant algebra.

Mackey functors and related equivariant algebraic objects play a central role in (stable) motivic and equivariant homotopy theory, so they are relevant to many mathematicians today. Yet despite the growing importance of equivariant algebra, the field remains under-studied and under-documented.

In this talk, I will introduce the basic ideas and objects of equivariant algebra, with the simple perspective that it is a fun and interesting branch of algebra to study.

Wolfgang and Luise Kappe Alumni Lecture

The strong divisibility property and the irreducibility of generalized Fibonacci polynomials

Rigoberto Flórez (The Citadel)

Abstract

A second order polynomial sequence is of Fibonacci-type (Lucas-type) if its Binet formula has a structure similar to that for Fibonacci (Lucas) numbers. The Fibonacci-type polynomials and Lucas-type polynomials are known as generalized Fibonacci polynomials GFP. Some known examples: Fibonacci polynomials, Pell polynomials, Fermat polynomials, Chebyshev polynomials of second kind, Morgan-Voyce polynomials, Lucas polynomials, Pell-Lucas polynomials, Fermat-Lucas polynomials, Chebyshev polynomials of first kind, Vieta and Vieta-Lucas polynomials.

It is known that the greatest common divisor of two Fibonacci numbers is again a Fibonacci number. It is called the strong divisibility property. However, this property does not hold for every second order recursive sequence. We give a characterization of GFPs that satisfy the strong divisibility property. We also give formulas to evaluate the gcd of GFPs that do not satisfy the strong divisibility property.

It is known that a Fibonacci polynomial $F_p(x)$ is irreducible if and only if p is prime. However, this property does not hold for every GFP. In this talk we also discuss the irreducibility of generalized Fibonacci polynomials. Joint work with R. Higuita, N. McAnally, A. Mukherjee and R. Ramirez.

The conference banquet will take place at 6:00 at the Quality Inn, 4105 Vestal Pkwy E.

A Diagram-Like Basis for the Multiset Partition Algebra CW 305

Alexander Wilson Dartmouth College

There's a classical connection between the representation theory of the symmetric group and the general linear group called Schur-Weyl Duality. Variations on this principle yield analogous connections between the symmetric group and other objects such as the partition algebra and the multiset partition algebra. The partition algebra has a well-known basis indexed by graph-theoretic diagrams which allows the multiplication in the algebra to be understood visually as combinations of these diagrams. I will present an analogous basis for the multiset partition algebra and show how this basis can be used to describe generators and construct representations for the algebra.

Gauss composition and Higher Composition Laws CW 307

Ajith Nair Graduate Center, City University of New York

In this talk, I will describe Bhargava's remarkable generalization of Gauss composition of binary quadratic forms to higher degree forms such as binary cubic forms, senary alternating 3-forms, pairs of binary quadratic forms and pairs of quaternary alternating 2-forms. I will explain Bhargava's methodology and how these spaces of forms parametrize arithmetic objects associated to quadratic number fields. Lastly, I will give an outline of an ongoing work (as part of my PhD) with my advisor Gautam Chinta on formulating the higher composition laws in a manner similar to Gauss's formulation in the binary quadratic forms case.

Finiteness Properties of Generalized Lodha-Moore Groups CW 329

Andy Moawad Miami University

A group has type F_n if it is the fundamental group of a cell complex X with finitely many cells of dimension no more than n, such that X has a contractible universal cover. We say that a group has type F_∞ if it is of type F_n for all n. The property F_1 is equivalent to finite generation; F_2 is equivalent to finite presentability. The higher finiteness properties may therefore be considered generalizations of these basic properties.

Lodha and Moore introduced a group of piecewise projective homeomorphisms of the line. They showed that the Lodha-Moore group is a nonamenable finitely presented group with no free subgroups. Lodha proved that the Lodha-Moore group has type F_∞, thus making it the first F_∞ counterexample to von Neumann's conjecture.

Kodama introduced a class of generalized Lodha-Moore groups and proved that the groups in question are non-amenable finitely presented groups with no free subgroups, thus producing new finitely presented counterexamples to von Neumann's conjecture. We will prove that the groups introduced by Kodama have type F_∞. Our strategy follows recent work by Farley, in which it is shown that certain groups of piecewise projective homeomorphisms of the interval (among them the Lodha-Moore group) have type F_∞. This is a preliminary report.

The $RO(C_3)$-graded Bredon cohomology of C_3-surfaces CW 331

Kelly Pohland Vanderbilt University

For spaces with an action of a group G, there is a cohomology theory graded on the Grothendieck group of real, finite-dimensional, orthogonal G-representations called Bredon cohomology. This theory serves as an equivariant analogue of singular cohomology. We explore a recent family of computations in $RO(C_3)$-graded cohomology where C_3 is the cyclic group of order 3. We first use a method called equivariant surgery to classify all closed, connected surfaces with an action of C_3. Then we use this classification to compute the cohomology of all such surfaces in this $RO(C_3)$-graded Bredon theory. In this talk, we give an overview of the main result as well as demonstrate some of the techniques used through small examples.

A Survey of Symmetries in some Statistics on Words and Catalan Objects CW 305

Aditya Khanna Virginia Tech

(This is an expository talk. There are no prerequisites and all necessary information will be presented during the talk.) On permutations of n distinct letters, one can define two statistics called `inv` and `maj` . It is well known that they are not only equidistributed but also that their bivariate joint distribution is a symmetric function in two variables. The work of Foata and Schutzenberger provides a bijective proof of this claim. There's a natural extension of these statistics from permutations to the set of rearrangements of repeated letters where we see that the equidistribution continues to hold but the symmetry of joint distribution breaks down. One may study similarly defined statistics on the set of Catalan objects such as Dyck paths and Dyck vectors. Although the symmetry of joint distribution is known in these cases, bijective proofs of these claims remain elusive. In this talk, we will go over the history, the elegant results and the brutal unsolved problems that appear while studying symmetries in distributions of statistics.

Enumerating Iterated Tilted Algebras of Type $\mathbb{A}_n$ CW 307

Ryan Schroeder University of Connecticut

Let A be a finite dimensional hereditary algebra, and T be an A-module such that $\operatorname{pd} T \leq 1$, $\operatorname{Ext}^1(T,T) = 0$, and there exists a short exact sequence $0 \to A \to T' \to T'' \to 0$ where T' and T'' are direct sums of summands of T. In this case, T is called a tilting module and $\operatorname{End} T$ is called a tilted algebra. An iterated (or generalized) tilted algebra is constructed by iterating this process. In this expository talk, we give an approachable introduction to the use of quivers in the representation theory of algebras as well a discussion of gentle algebras and their association to ribbon graphs and ribbon surfaces due to Opper, Plamondon, and Schroll. Since Assem and Happel proved that iterated tilted algebras of type $\mathbb{A}_n$ correspond to a subclass of gentle algebras, we can use this association to count them.

Fast multiplication algorithm on 1-punctured torus CW 329

Siki Wang Caltech / Claremont McKenna College

This talk will be an introduction to the Kauffman bracket skein algebra of a surface, which is a generalization of the Jones polynomial for knots and links in S^3. Frohman and Gelca captured the multiplicative structure of the skein algebra on a torus using an elegant product-to-sum formula involving Chebyshev polynomials, but a description for the once-punctured torus is not known. In this talk, I will outline a general algorithm that multiplies torus knots on the once-punctured torus in quadratic time. This sheds light on obtaining a general recursive formula for the algebra.

The Equivariant Framed Pontryagin-Thom Theorem CW 331

Lucas Williams Binghamton University

The classical Pontryagin-Thom Theorem for framed manifolds says that the group of stably framed manifolds considered up to cobordism is isomorphic to the stable homotopy groups of spheres. In this talk, we will discuss an equivariant generalization of this theorem and work through several examples.

Explaining the Math of Queer Relationship Dynamics CW 305

Edison Hauptman University of Pittsburgh

The Stable Marriage Problem is often introduced by considering one group of men and one group of women, and then asking if there is a way to marry the men and women such that no two people prefer one another to their current partners. In this talk, I will introduce the problem from a new angle, then explain how it changes when we include the experiences of queer people. This talk is designed to be accessible to everyone regardless of math background, but anyone interested in combinatorics is especially encouraged to attend.

Characters and polynomial invariants on Hopf monoid species CW 307

Yichen Ma Cornell University

We study characters on Hopf monoids vector species and their associated polynomial invariants. In certain cases, we obtain combinatorial descriptions of these polynomials and see that they recover well-known constructions such as those of Stanley and Stembridge. Hopf monoids provide a natural framework in which these constructions can be unified.

Pants CW 329

Arya Vadnere University at Buffalo

A pair of pants decomposition of a surface is a maximal collection of (isotopy classes of) disjoint simple closed curves on the surface (named as such, since the complementary regions are spheres with three boundaries, aka "pants"). These objects show up in several places when studying the curve complex, mapping class groups, geometric structures on the surface etc. In this talk, we shall explore the geometry of the pants complex - a graph whose vertices are different pants decompositions for a surface, and edges corresponding to elementary moves. In particular, we shall ponder about different candidates for geodesics in the pants graph.

On the homology of equivariant configuration spaces CW 331

Chase Vogeli Cornell University

In an open manifold, an unordered configuration of n points can be extended to a configuration of $n+1$ points by "adding a point near infinity." In the 1970's, McDuff and Segal proved this induces a phenomenon known as *homological stability*: after adding sufficiently many points, the low-dimensional homology groups of the unordered configuration spaces stabilize. In this talk, I'll discuss an equivariant analogue of this phenomenon for manifolds equipped with an action by a finite group. In an appropriate sense, the resulting equivariant configuration spaces exhibit stability with respect to an equivariant homology theory. This is joint work with Eva Belmont and J.D. Quigley.

Matroids Representable by Nonabelian Groups CW 305

Prairie Wentworth-Nice Cornell University

First proposed by Whitney in 1935, matroids are combinatorial objects which generalize the notion of linear independence. They have become useful tools in the study of optimization, coding theory, algebraic geometry, and more. One class of matroids that is particularly well studied is the class of representable matroids - those matroids which can be represented by elements from a vector space. Recently, Swartz has generalized matroid representability to describe representations of polymatroids over finite groups. We will discuss this notion of representability and then prove that a matroid is representable over a nonabelian group if and only if it has no minor isomorphic to the uniform matroid $U_{2,3}$

Plat representations of the unknot CW 329

Deepisha Solanki University at Buffalo

The main result is a version of Birman's theorem about equivalence of plats, which does not involve stabilisation, for the unknot. We introduce the 'pocket move' and the 'flip move' which modify a plat without changing its link type or bridge index. Theorem 1 shows that the pocket and the flip moves are the only obstructions to reducing a closed n-plat representative of the unknot to the standard 0-crossing unknot, through a sequence of plats of nonincreasing bridge index.

Pullbacks and the Slice Filtration CW 331

Carissa Slone University of Rochester

The slice filtration focuses on producing certain spectra, called slices, from a genuine G-spectrum X over a finite group G. There are several constructions which inflate a G/N -spectrum X to a G-spectrum, which generally do not coincide. We will examine three such constructions, when they coincide, and how this relates to slices of Eilenberg-Mac Lane spectra over C_4 and Q_8.

Detection of Small Cycles in Data by the Scale-Invariant Robust Density-Aware Distance (RDAD) Filtration CW 305

Chunyin Siu Cornell University

Topological data analysis refers to the analysis of the study the homology of a family of simplicial complexes constructed from a dataset. Traditional wisdom suggests homology classes with big cycles are more important, but in practice, small cycles could be statistically important too. A novel method, namely the use of the Robust Density-Aware Distance (RDAD) filtration, is proposed to distinguish, from noise, small cycles formed by high-density points. The proposed method is robust against additive noise and outliers. In particular, sample points are allowed to be perturbed away from the manifold. Significance of homology classes may be estimated by bootstrapping. Small cycles are promoted by weighting the distance function by the density in the sense of Bell et al. Distance-to-measure is incorporated to enhance stability and miti- gate noise due to the density estimation. In the talk, I will discuss different properties of the proposed method with synthetic and real-world examples. The talk is based on the work De- tection of Small Holes by the Scale-Invariant Robust Density-Aware Distance (RDAD) Filtration https://export.arxiv.org/abs/2204.07821.

On Graph Cutwidth 2 & 3 CW 307

Evangelos Nastas SUNY

In graph theory, the concept of cutwidth is newer than other graph statistics, and yet it has already found wide use in mathematics, computer science, engineering, and beyond. The cutwidth of a graph G is roughly the lowest number of overlapping edges, provided that the vertices are placed in a line. More precisely, a graph has cutwidth at most k if its vertices are enumerated via $1, \dots n$ s.t. $\forall \quad i = 1, \dots, n-1, \quad \exists$ at most k edges (u, v) s.t. $u \leq i < v$. In this talk, graphs of cutwidth 2 and 3 are considered and results are proved, concerning non-critical graphs, cycles and θ graphs respectively, and some conjectures are presented.

Fixed point theorems for contractive mappings in extended metric spaces with applications CW 329

Afrah Ahmad Abdou University of Jeddah

In this paper, we introduce a new concept of locally contractive mapping, generalized rational contraction and establish fixed point theorems for such mappings in the setting of extended b-metric space. Our main results extend and improve some results given by some authors. We also provide a non trivial example to show the validity of our main results. As an application, we derive some new fixed point result for graphic contraction defined on an extended b-metric space endowed with a graph.

Equivariant Partition Complexes and Trees CW 331

Maxine Calle The University of Pennsylvania

Given a finite set, the collection of partitions of this set forms a poset category under the coarsening relation. This category is directly related to a space of trees, which in turn has interesting connections to operads. But what if your finite set comes equipped with a group action? What is an "equivariant partition"? And what connection is there — if any — to equivariant trees? We will explore possible answers to these questions in this talk. This is joint work with J. Bergner, P. Bonventre, D. Chan, and M. Sarazola.

Disk Configuration Spaces and Representation Stability CW 305

Nicholas Wawrykow University of Michigan

Disk configuration spaces are the set of ways to place open unit diameter disks in a metric space, and their topology is the subspace topology. One of the simplest family of such spaces is the configuration space of open unit diameter disks in the infinite strip of width w. We discuss generators for the homology of these spaces, and show that there is a way to add new disks to these homology classes such that the homology "stabilizes" is a representation theoretic way.

Fixed point results on a topological space CW 329

Buthinah Bin Dehaish University of Jeddah

In this talk we will present some fixed point results on some topological spaces for Lipschitz mappings defined on them.

Equivariant enumerative geometry CW 331

Thomas Brazelton University of Pennsylvania

Classical enumerative geometry asks geometric questions of the form "how many?" and expects an integral answer. For example, how many circles can we draw tangent to a given three? How many lines lie on a cubic surface? The fact that these answers are well-defined integers, independent upon the initial parameters of the problem, is Schubert's principle of conservation of number. In this talk we will outline a program of "equivariant enumerative geometry", which wields equivariant homotopy theory to explore enumerative questions in the presence of symmetry. Our main result is equivariant conservation of number, which states roughly that the sum of regular representations of the orbits of solutions to an equivariant enumerative problem are conserved.

This concludes the conference. Thank you for attending!

Participants List

Tatiana Abdelnaim	University of Oklahoma
Bassam Albalawi	University of Texas at Arlington
Abid Ali	Rutgers University
Beck Almawaldi	Binghamton University
Anna Antal	Yale University
Juliet Aygun	Cornell University
Haley Bahn	University of Oklahoma
Billy Bernardoni	Case Western Reserve University
Megha Bhat	CUNY Graduate Center
Tanishq Bhatia	Northeastern University
Fraser Binns	Boston College
Lizzie Buchanan	Dartmouth College
John Byrne	University of Delaware
Ka Yue (Tom) CHEUK	University at Buffalo
Maxine Calle	The University of Pennsylvania
Andrés Carnero	Universidad Nacional Autónoma de México
Matt Carr	Ohio State University
Sean Carroll	Northeastern University
Yu-Chan Chang	Wesleyan University
Eleftherios Chatzitheodoridis	University of Virginia
Hao Chen	Clemson University
Christopher Chia	Binghamton University
Souvik Dey	University of Kansas
Aritram Dhar	University of Florida
Monalisa Dutta	University of Kansas
Chang Feng	Cornell University
Lilli Frey	Binghamton University
Ryan Gelnett	SUNY Albany
Siddharth Gurumurthy	University of Rochester
Asimina Hamakiotes	University of Connecticut
Bailey Heath	University of South Carolina
Yuqiao Huang	University of Rochester
Elana Israel	Syracuse University

Participants List

Hanlim Jang	Binghamton University
Yushan Jiang	The Graduate Center, CUNY
Meenakshy Jyothis	Binghamton University
Luise-Charlotte Kappe	Binghamton University
Aditya Khanna	Virginia Tech
Tara Koskulitz	Binghamton University
Marie Kramer	Syracuse University
Sarah Lamoureux	Binghamton University
Ezekiel Lemann	Binghamton University
Dezhou Li	Northeastern University
Shizhe Liang	Brandeis University
Louisa Liles	University of Virginia
Weiyan Lin	The Graduate Center, CUNY
Steven Lippold	Bowling Green State University
Zihao Liu	Rice University
Yeqin Liu	University of Illinois at Chicago
Yichen Ma	Cornell University
Cary Malkiewich	Binghamton University
Varinderjit Mann	Cornell University
Ray Maresca	Brandeis University
Micah McClatchey	SUNY Brockport
Jacob Migdail-Smith	Syracuse University
Andy Moawad	Miami University
Seyyed Ali Mohammadiyeh	University of Kashan
Youssef Mousaaid	Perimeter Institute for Theoretical Physics
Zhihao Mu	CUNY Graduate Center
Avi Mukhopadhyay	University of Florida
Ajith Nair	Graduate Center, City University of New York
Evangelos Nastas	SUNY
Wayne Ng Kwing King	University of Kansas
Jared Parks	SUNY Brockport
Alonso Perez-Lona	Virginia Tech
Henry Potts-Rubin	Syracuse University

Participants List

Haochen Qiu	Brandeis University
Robert Rust	The College of New Jersey
Rishabh Sarma	University of Florida
Chris Schroeder	Binghamton University
Ryan Schroeder	University of Connecticut
Sayak Sengupta	Binghamton University
Brad Shearer	Bowling Green State University
Jagdeep Singh	Binghamton University
Chunyin Siu	Cornell University
Carissa Slone	University of Rochester
Jonathan Smith	University of South Carolina
Deepisha Solanki	University at Buffalo
Ben Spitz	UCLA
Kimball Strong	Cornell University
Benjamin Thompson	Cornell
Arya Vadnere	University at Buffalo
Geetika Verma	RMIT University Melbourne
Chase Vogeli	Cornell University
Nicholas Wawrykow	University of Michigan
Prairie Wentworth-Nice	Cornell University
James White	University of Oklahoma
Lucas Williams	Binghamton Unviersity
Alex Wilson	Dartmouth College
Himanshu Yadav	University of Florida
Songyu Ye	Cornell University
Lucas Yong	University of Oklahoma
Eda Yıldız	Yildiz Technical University
Kristoffe Zehr	University at Albany - SUNY
Jake Zukaitis	Binghamton University