Abstracts

Plenary Talks

Ricci Flow, Diffeomorphism Groups, and Contractibility of Spaces of Metrics*[1]

Bruce Kleiner (Courant Institute of Mathematical Sciences)

In the lecture I will discuss recent joint work with Richard Bamler, which uses Ricci flow through singularities to construct deformations of spaces of metrics on 3-manifolds. As applications we settle longstanding conjectures about diffeomorphism groups of 3-manifolds, and metrics with positive scalar curvature.

Some Gromov-Witten Invariants over $\mathbb{F}_p$

Kirsten Wickelgren (Duke University)

Gromov-Witten invariants count curves in a given homology class through an appropriate number of marked points. For example, the number of complex degree d rational plane curves passing through $3d-1$ points is such an invariant. It is independent of the generically chosen points over the complex numbers. (There is 1 line through 2 points, 1 conic through 5, 12 rational degree 3 curves through 8...) Over the real numbers, there are invariants due to Jean-Yves Welschinger, Cheol-Hyun Cho and Jake Solomon giving an open Gromov-Witten invariant equal to a signed count of real curves. It is a feature of $\mathbb{A}^1$-homotopy theory that analogous real and complex results can indicate the presence of a common generalization, valid over a general field. We develop and compute an $\mathbb{A}^1$-degree, following Morel, of the evaluation map on Kontsevich moduli space to obtain a count of genus 0 curves on certain del Pezzo surfaces through the appropriate number of marked points. This count is valid for any field k of characteristic not 2 or 3. In particular, we define and compute some Gromov–Witten invariants over a finite field. This is joint work with Jesse Kass, Marc Levine, and Jake Solomon.

Involutive Heegaard Floer Homology and the Homology Cobordism Group

Ian Zemke (Princeton University)

In this talk, we will talk about the homology cobordism group. We will talk about the important questions in the study of the group, and also historical results concerning this group using gauge theory. We will pay particular attention to Hendricks and Manolescu's involutive Heegaard Floer homology as a tool to study this group. We will survey the work of Dai-Hom-Stoffregen-Troung, as well as the surgery formula of Hendricks-Hom-Stoffregen-Zemke. We will only assume minimal background.

[1]An * next to a title indicates that the speaker / presenter will be participating remotely.

An Invitation to Legendrian Submanifolds*

Roger Casals (UC Davis)

In this talk we will discussion Legendrian submanifolds of contact manifolds. To start, motivation and definitions will be provided, with a healthy dose of example. Then we will discuss our current understanding of the classification of Legendrian submanifolds, including the main results concerning Legendrian knots. Finally, we will delve into the study of Lagrangian fillings and, from there, the recently explored connections between contact topology and cluster algebras.

Subsurfaces and Covers in the Wild World of Infinite-Type Surfaces

Tyrone Ghaswala (Université du Québec à Montréal)

Imagine the plane $\mathbb{R}^2$ where every point with integer coordinates has been removed. Call this surface X. Does X have a proper subsurface homeomorphic to X? Which surfaces arise as finite-sheeted covers of X? Which surfaces can X cover by finitely-many sheets?

This talk will be a tour through the intriguing landscape of infinite-type surfaces, with a particular focus on homeomorphic subsurfaces and finite-sheeted covers. We will answer the three particular questions above, as well as many others like them, and see that they are not as innocent as they may first appear! Parts of the talk are taken from joint work with Federica Fanoni and Alan McLeay.

The Equivariant Bredon Cohomology of C_2-Surfaces

Christy Hazel (UCLA)

Let C_2 denote the cyclic group of order 2. In this talk, we'll discuss a bigraded cohomology theory used to study spaces with a C_2 action. This theory can be thought of as an equivariant analog to singular cohomology with integral coefficients. We'll then explore some recent computations done for C_2-surfaces. Time permitting, we'll also explore some interesting patterns in these computations, and discuss how these might generalize to C_2-manifolds of higher dimension.

Towards Knot Homology for 3-Manifolds

Aaron Mazel-Gee (Caltech)

The Jones polynomial is an invariant of knots in $\mathbb{R}^3$. Following a proposal of Witten, it was extended to knots in 3-manifolds by Reshetikhin–Turaev using quantum groups.

Khovanov homology is a categorification of the Jones polynomial of a knot in $\mathbb{R}^3$, analogously to how ordinary homology is a categorification of the Euler characteristic of a space. It is a major open problem to extend Khovanov homology to knots in 3-manifolds.

In this talk, I will explain forthcoming work towards solving this problem, joint with Leon Liu, David Reutter, Catharina Stroppel, and Paul Wedrich. Roughly speaking, our contribution amounts to the first instance of a braiding on 2-representations of a categorified quantum group. More precisely, we construct a braided $(\infty, 2)$-category that simultaneously incorporates all of

Rouquier's braid group actions on Hecke categories in type A, articulating a novel compatibility among them.

Knotted Handlebodies*

Maggie Miller (Stanford University)

Often, interesting knotting vanishes when allowed one extra dimension, e.g. knotted circles in 3-space all become isotopic when included into 4-space. Hughes, Kim and I recently found a new counterexample to this principle: for $g > 1$, there exists a pair of 3-dimensional genus-g solids in the 4-sphere with the same boundary, and that are homeomorphic relative to their boundary, but do not become isotopic rel boundary even when their interiors are pushed into the 5-dimensional ball. This proves a conjecture of Budney and Gabai for $g > 1$ in a very strong sense. I'll talk about this phenomenon and related open questions in 3- and 4-dimensional topology. This is joint with Mark Hughes (BYU) and Seungwon Kim (IBS-CGP).

The Escape Phenomenon in Open Manifolds with Nonnegative Ricci Curvature*

Jiayin Pan (Fields Institute)

We start with a simple phenomenon in an open manifold M with nonnegative Ricci curvature: the set of all minimal representing geodesic loops of $\pi_1(M, p)$ may not be contained in any bounded sets of M. We will talk about how this escape phenomenon is related to the algebraic structure of fundamental groups and the metric structure of asymptotic cones. Part of this talk is joint work with Guofang Wei.

Student Talks

Sutured Decompositions and Detection Results for Knot Floer Homology

Fraser Binns (Boston College)

Knot Floer homology is a powerful invariant of links. I will discuss how knot Floer homology detection results for certain $(2, 2n)$-cables links can be obtained with the help of sutured manifold theory. This is based on joint work in progress with Subhankar Dey.

[*Type: Research; Difficulty: 2/4*]

Triple Knot Grid Diagrams

Sarah Blackwell (University of Georgia)

In this talk I will introduce a project I have been working on which uses trisections of 4-manfiolds to represent "Lagrangian-like" surfaces in $\mathbb{CP}^2$ by "triple knot grid diagrams." Gay and Kirby defined a decomposition of (smooth, closed, connected, oriented) 4-manifolds called a trisection, and proved that every such 4-manifold admits this decomposition. Meier and Zupan showed that surfaces embedded in 4-manifolds inherit a trisection from the trisection of the 4-manifold. Their work includes a description of how to represent these surfaces with "shadow diagrams." In this project I consider specific shadow diagrams of surfaces in $\mathbb{CP}^2$ that naturally arise as grid diagrams on the central surface of the standard (genus one) trisection of $\mathbb{CP}^2$. The result is a process for encoding Lagrangian-like surfaces which appear to be combinatorial representations of Lagrangian surfaces in $\mathbb{CP}^2$. Surprisingly, triple knot grid diagrams representing Lagrangian-like surfaces are sparse; adding the extra necessary condition makes such diagrams hard to find.

[*Type: Research; Difficulty: 2/4*]

Quandle Coloring and the Triple Point Number*

Nicholas Cazet (UC Davis)

Analogous to a classical knot diagram, a surface-knot can be generically projected to 3-space and given crossing information to create a broken surface diagram. A generic compact surface in 3-space has finitely many triple points. The triple point number of a surface knot is the minimal number of triple points among all broken surface diagrams representing that surface-knot. I will talk about the symmetric quandle cocycle invariant to show that there are surface-links of arbitrarily many trivial orientable and non-orientable components, each of arbitrary genus, whose triple point number is determined by the genera of its non-orientable components.

[*Type: Research; Difficulty: 2/4*]

Bi-Incomplete Tambara Functors via Transfer Systems

David Chan (Vanderbilt University)

In equivariant algebra and topology, there is more than one thing someone might mean by a ring; there is an entire poset of equivariant ring structures collectively called the incomplete Tambara functors. In recent work, Blumberg and Hill have defined the notion of incomplete Mackey functors, which analogously encode the various possible additive equivariant structures. In this talk we will explain the ways in which the incomplete multiplicative and additive structures interact and discuss a characterization, via transfer systems, of when these two structures are suitably compatible.

[*Type: Research; Difficulty: 2/4*]

The Geometry of Big Mapping Classes

Yassin Chandran (CUNY Graduate Center)

For a finite type Riemann surface, every mapping class has a representative that distorts the angle measure by a bounded amount. These maps are called "quasiconformal" maps. For infinite type surfaces this is not the case. In fact, there are three possibilities for a mapping class:

(1) Always quasiconformal - There always exists a quasiconformal representative. This case mirrors the finite type setting.
(2) Sometimes quasiconformal - For some complex structures there exists a quasiconformal representative.
(3) Never quasiconformal - For any complex structure there does not exist a quasiconformal representative.

We will discuss these classes with a few examples of each.

[*Type: Research; Difficulty: 2/4*]

Hyperbolic 3-Manifold Groups and Finite Quotients

Tam Cheetham-West (Rice University)

A question of Reid is whether the collection of finite quotients of the (residually finite) fundamental group of a (finite volume) hyperbolic 3-manifold completely determines the 3-manifold. A new full-sized example providing more evidence for a positive answer to the question will be demonstrated.

[*Type: Research; Difficulty: 2/4*]

Khovanov-Type Homology of Null Homologous Links in $\mathbb{RP}^3$

Daren Chen (Stanford University)

Khovanov homology is an invariant for links in S^3, with a relatively easy definition and lots of applications. The definition was extended for links in I-bundles over surface by Asaeda, Przytycki and Sikora. In this talk, we will exhibit some generalization of their construction for null homologous links in $\mathbb{RP}^3$. On the other side of the story, Ozsváth and Szabó defined a spectral sequence relating the Heegaard Floer homology of the branched double cover of S^3 over L to the Khovanov homology of L. We will extend this construction for null homologous links in $\mathbb{RP}^3$, relating the Heegaard Floer homology of the branched double cover of $\mathbb{RP}^3$ over L to our Khovanov-type homology of L.

[*Type: Research; Difficulty: 2/4*]

A Farey Tree Structure on a Family of Pseudo-Anosov Braids*

Ethan Farber (Boston College)

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). By assigning the fractional part of the FDTC to the corresponding braid, we obtain a parameterization of this family by the rationals in the open unit interval. This parameterization respects the combinatorial structure of the Farey tree, and allows us to extract dynamical and geometric information about the braids.

[*Type: Research; Difficulty: 3/4*]

Legendrian Weaves and D-type Lagrangian Fillings

James Hughes (UC Davis)

Given a Legendrian link L in the contact 3-sphere, one can hope to classify the set of Lagrangian fillings of L, i.e. exact Lagrangian surfaces in the symplectic 4-ball with boundary equal to L. Recent developments have led to a conjectural ADE classification of Lagrangian fillings of Legendrian links appearing as closures of positive braids. In this talk, I will present the method of Legendrian weaves, a diagrammatic calculus developed by Casals and Zaslow to construct Lagrangian fillings and compute certain sheaf-theoretic invariants. I will then describe how to use this tool to construct the conjectured number of fillings for D-type Legendrian links.

[*Type: Research; Difficulty: 2/4*]

Foam Evaluation and Legendrian Surfaces

Amit Kumar (Louisiana State University)

Foam has been discovered by several people in various contexts. A foam is a stratified subset of D^3 (the 3-ball) which definition is the topological analogue of the Pleatau's condition for soap films. Generically speaking, A foam is a three dimensional analogue for the trivalent planar graph. I will begin introducing the more general concept of Pre-Foam (Khovanov - Robert), and it's connection to Tait colorings. The main feature of this talk will be the use of foams to construct Lagrangian fillings of Legendrian surfaces in the co-sphere bundle of $\mathbb{R}^3$ as discussed by Zaslow-Treumann in their paper "Cubic Planar graphs and Legendrian surface theory". I will end with possible generalizations of this by bringing up relevant connections of the ideas discussed by Khovanov-Robert to the concept of Legendrian Weaves as discussed by Roger Casals and Eric Zaslow.

[*Type: Expository; Difficulty: 2/4*]

Computational Tools for Real Topological Hochschild Homology

Chloe Lewis (Michigan State University)

Algebraic K-theory is an invariant of rings that touches interesting questions in many branches of mathematics. Hesselholt and Madsen developed an analogue for rings with anti-involution called Real algebraic K-theory (KR). Given its computational difficulty, an active area of research in algebraic topology explores an approximation of KR called Real topological Hochschild homology (THR). In this talk, we'll construct a tool called the Real Bökstedt spectral sequence which uses the algebraic theory of Real Hochschild homology as an input to assist in THR computations. We'll apply this tool to the real bordism spectrum $MU_{\mathbb{R}}$.

[*Type: Research; Difficulty: 3/4*]

Differential Cohomology and Virasoro Central Extensions*

Leon Liu (Harvard University)

The Virasoro groups are a family of central extensions of $\mathrm{Diff}+(S^1)$, the group of orientation preserving diffeomorphisms of S^1, by the circle group $\mathbb{T}$. We give a novel, geometric construction of these central extensions using "off-diagonal" differential lifts of the first Pontryagin class, thus affirmatively answering a question of Freed-Hopkins.

[*Type: Research; Difficulty: 3/4*]

Satellite Operators and Concordance

Alex Manchester (Rice University)

In 2007, Cochran-Friedl-Teichner gave conditions under which a satellite operator sends every knot to a topologically slice knot. I will give the main ideas of their proof, and talk about ways to generalize their result. In particular, one might wonder under what conditions two satellite operators have the same action on the topological concordance group. While this problem remains open, I will give some plausible conditions and some evidence that satellite operators satisfying them act in the same way on the topological concordance group.

[*Type: Research; Difficulty: 3/4*]

Almost Complex Manifolds and Homotopy Complex Projective Spaces

Keith Mills (University of Maryland, College Park)

A smooth manifold is called "almost complex" if its tangent bundle is the underlying real vector bundle of a complex vector bundle. We will examine various interpretations and techniques used to study the question of when a manifold admits an almost complex structure, with a focus on the application of these techniques to manifolds with the oriented homotopy type of complex projective spaces. We will discuss results stating that for $3 \leq n \leq 5$, smooth manifolds with the oriented homotopy type of $\mathbb{CP}^n$ always admit almost complex structures, while for $n = 6$ this is no longer true.

[*Type: Research; Difficulty: 2/4*]

Seiberg-Witten Floer K-Theory and Cyclic Group Actions on Spin 4-Manifolds with Boundary

Ian Montague (Brandeis University)

Given a $\mathbb{Z}/m$-action on a spin rational homology sphere Y, we construct a metric independent G_m- equivariant stable homotopy type associated to Y, where G_m is a certain $\mathbb{Z}/m$-extension of Pin(2). We also construct equivariant analogues of the K-theoretic Froyshov invariant κ defined by Manolescu, and use these to give bounds on the intersection forms of equivariant spin fillings of Y. We provide applications to homology concordance and H-sliceness of knots in spin 4-manifolds.

[*Type: Research; Difficulty: 4/4*]

Blowing Up and Down with Knot Traces

Kai Nakamura (University of Texas at Austin)

At last year's GSTGC, Piccirillo presented joint work with Manolescu on potential constructions of an exotic 4-sphere. These came in the form of five knots K with a zero surgery homeomorphism to another knot K' that has negative s-invariant and therefore is not slice. Soon after I ruled out this possibility and showed that these knots are not slice. To do this, we show that the knot traces of K and K' become stably diffeomorphic after blowing up. This allows us to stably relate their slice properties and use the s-invariant of K' to show K is not slice. Despite the success of our proof, a closer examination reveals a strange coincidence among the Manolescu-Piccirillo knots that allow our proof to work. It would be unsatisfactory if a key hypothesis in our proof is left unexplained and time permitting, we will explain why this key hypothesis arises. This allows us to strongly generalize our proof from the original five knots to the infinite family of zero surgery homeomorphisms that Manolescu and Piccirillo considered.

Difficult 2/4: We will use some basic Kirby Calculus in this talk that we will try to explain along the way. However, a little knowledge of Kirby Calculus will go a long way in making this talk easier to follow.

[*Type: Research; Difficulty: 2/4*]

The Hurewicz Model Structure for Non-Negatively Graded Chain Complexes*

Arnaud Ngopnang Ngompe (University of Regina)

By a theorem of Christensen and Hovey, the category of non-negatively graded chain complexes has a model structure, called the Hurewicz or h-model structure, where the weak equivalences are the chain homotopy equivalences. In this talk, we describe the properties of that model structure, adapting the work of May and Ponto on the h-model structure for unbounded chain complexes.

[*Type: Research; Difficulty: 2/4*]

Totally Geodesic Surfaces in Knot Complements with Small Crossing Number*

Rebekah Palmer (Temple University)

Studying totally geodesic surfaces has been essential in understanding the geometry and topology of hyperbolic 3-manifolds. Recently, Bader-Fisher-Miller-Stover showed that containing infinitely many such surfaces compels a manifold to be arithmetic. We are hence interested in counting totally geodesic surfaces in hyperbolic 3-manifolds in the finite (possibly zero) cases. We expand an obstruction, due to Calegari, to the existence of these surfaces in fibered knot complements using Euler class and Thurston's norm. On the flipside, we prove the uniqueness of known totally geodesic surfaces by considering their behavior in the universal cover. This talk will explore this progress for both the uniqueness and the absence of totally geodesic surfaces in knot complements with small crossing number. Joint work with Khánh Lê.

[*Type: Research; Difficulty: 3/4*]

Branch Groups

Brian Pinsky (Rutgers University)

Like many areas of group theory, the study of branch groups began with Burnside's problem: whether every finitely generated torsion group is finite. One of the first counterexamples was Grigorchuck's group, a group of self-similar automorphisms of cantor space. Self similarity is a powerful tool for working with these groups, and they are among the most useful examples in geometric group theory. I will illustrate this technique by proving Grigorchuck's group is torsion, this is very elegant and requires no group theory background.

Afterwards, I'd like to go over a generalization of Grigorchuck's construction using coding theory; one I thought I'd invented, but Zoron Sunic actually beat me by 15 years. I'd also like to talk about generalizations acting on infinite type surfaces, rather than cantor space, as according to my enthusiastic office-neighbor and some papers I still need to read, this is fruitful.

[*Type: Expository; Difficulty: 1/4*]

An Alexander Method for Infinite-Type Surfaces

Roberta Shapiro (Georgia Tech)

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.

[*Type: Research; Difficulty: 1/4*]

Milnor's Invariants for Knots in Spherical 3-Manifolds

Ryan Stees (Indiana University Bloomington)

In his 1957 paper, John Milnor introduced a collection of invariants for links in the 3-sphere detecting higher-order linking phenomena by studying quotients of the link group by its lower central series. These invariants were later shown to be link concordance invariants, and have since inspired decades of consequential research. In particular, several efforts have been made to extend these invariants to knots in other 3-manifolds. We will describe new constructions of such invariants for knots in spherical 3-manifolds, give some concrete examples, and relate our work to previous efforts. Time permitting, we will fit our work into the larger context of Poincaré embedding type, a universal homotopy invariant of knot concordance.

[*Type: Research; Difficulty: 2/4*]

The Complexity of Shake Slice Knots

Charles Stine (Brandeis University)

We define a notion of complexity for shake-slice knots which is analogous to the definition of complexity for h-cobordisms studied by Morgan-Szabó. We prove that for each framing $n \neq 0$ and complexity $c \geq 1$, there is an n-shake-slice knot with complexity at least c. Our construction makes use of dualizable patterns, and we include a crash course in their constructions and properties. We bound complexity by studing the behavior of the classical knot signature and the Levine-Tristram signature of a knot under the operation of twisting algebraically-one strands.

[*Type: Research; Difficulty: 2/4*]

Rolling Balls on Hills - A Nice Reduction of the Yang-Mills Equation under Symmetry

Keshav Sutrave (Michigan State University)

The Yang-Mills equation is a partial differential equation in gauge theory (a field in differential geometry), which originally comes from physics, but has found a place in pure math, e.g. providing invariants for 4-manifolds, and giving the setup for (Instanton) Floer homology.

...but I won't talk about any of that fancy stuff. Instead I want to give a feel for what it's like to work with these gauge theory objects. In particular I will describe a case where we can actually solve the equation, by looking for symmetric solutions which reduce the PDE into an ODE. This turns the whole thing into a (dynamics) picture about some balls rolling in some hills. Fun!

[*Type: Expository; Difficulty: 2/4*]

Twisted Topological Hochschild Homology and Mackey Functor Fields

Danika Van Niel (Michigan State University)

Topological Hochschild homology (THH) is an invariant of ring spectra and is a key component of the trace method approach to algebraic K-theory. One of the main computational tools for THH is the Bökstedt spectral sequence. In recent years, a generalization of THH for equivariant ring spectra called twisted THH has been developed along with an equivariant version of the Bökstedt spectral sequence. In this talk we discuss Mackey functor fields, which are an equivariant analog of classical fields, and use them in computations of twisted THH. In this talk I'll introduce Mackey functor fields, twisted THH, and discuss work in progress on computations of twisted THH using the equivariant Bökstedt spectral sequence.

[*Type: Research; Difficulty: 3/4*]

Recorded Talks

Algebraic Quantum Field Theory in the Operad Picture*

Matthew Alexander (University of Regina)

Quantum field theory is the field of physics which studies particles and their interactions. Despite its immense success at describing the natural world, at present there is no single unified notion of quantum field theory. Instead, we have distinct quantum field theories, which each can be applied within their own regime, but are difficult to relate to one another. In recent decades, mathematical structures known as operads have been discovered underlying many quantum field theories, lending hope that the operadic picture may provide a pathway to unifying these theories.

In this presentation we will provide an introduction to algebraic quantum field theory and the operad which underlies it.

[*Type: Expository; Difficulty: 2/4*]

Categorification of Jones Polynomial

Nilangshu Bhattacharyya (Louisiana State University)

In this talk, I would discuss the construction of the Khovanov (co) chain complex and show that the graded Euler characteristic of this (co) chain complex is Jones Polynomial (not normalized).

[*Type: Expository; Difficulty: 2/4*]

Series Invariants for 3-Manifolds and Categorification*

Yoon Seok (John) Chae (UC Davis)

Inspired by a prediction for a categorification of a certain numerical invariant of 3-manifolds, series invariants for closed oriented 3-manifolds and knot complements were introduced. In this talk, I'll introduce these invariants, explore their properties and connections to other 3-manifolds and knot invariants.

[*Type: Research; Difficulty: 1/4*]

Right-Angled Links in Thickened Surfaces

Rose Kaplan-Kelly (Temple University)

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 containing 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 according to the polygons in their checkerboard surfaces and provide a bound on the number of RGCR links for a given surface of genus g.

[*Type: Research; Difficulty: 2/4*]

Equivariant Cohomology in Algebraic Geometry and Steiner's Problem

Dohoon Kim (University of Maryland)

In this talk, we introduce equivariant cohomology, which is a cohomology theory that applies to spaces with a group action. One of the most powerful results in equivariant cohomology is the Atiyah-Bott localization formula. In particular, when we have a torus acting on a smooth variety, the localization formula allows us to calculate the integral of an equivariant class (or geometrically, a closed equivariant form) as a sum over the fixed points. We then use the localization formula to solve Steiner's problem of calculating the number of conics tangent to five fixed conics.

[*Type: Expository; Difficulty: 2/4*]

Asymptotics of the Turaev-Viro Invariants for Some Families of 3-Manifolds*

Joseph Melby (Michigan State University)

The Turaev-Viro invariant Volume Conjecture demonstrates deep connections between quantum invariants of 3-dimensional manifolds and hyperbolic geometry. We will discuss methods for constructing infinite families of manifolds that satisfy this conjecture, as well as the stability of the asymptotic behavior of these invariants under gluing operations on certain 3-manifolds.

[*Type: Research; Difficulty: 3/4*]

Fixed Point-Free Pseudo-Anosovs and the Cinquefoil*

Braeden Reinoso (Boston College)

From a genus-two, hyperbolic, fibered knot K in S^3, one may obtain a pseudo-Anosov map $F : S \to S$ on a genus-two surface S with one boundary component. The fixed points of F give a rank bound on the knot Floer homology of K, and it has long been suspected that one could leverage this rank bound to prove that knot Floer homology detects the torus knot $T(2, 5)$. In joint work with Ethan Farber and Luya Wang, we prove this detection result by showing that any such map F has a fixed point (provided K satisfies one mild property). I will discuss the constructions involved in our result, and sketch the main idea for the proof. Our arguments are geometric in nature, and no prior knowledge of Floer homology is needed to understand our fixed point counting result.

[*Type: Research; Difficulty: 3/4*]

Pillowcase Homology and Character Varieties of Tangles

Kai Smith (Indiana University)

Pillowcase homology is a proposed knot homology theory by Hedden, Herald, and Kirk constructed by decomposing a knot into two tangles and counting the intersections of their traceless $SU(2)$ character varieties inside a space called the pillowcase. The motivation behind pillowcase homology is its conjectured relationship with Kronheimer and Mrowka's singular instanton homology. In this talk I will give an overview of pillowcase homology and state some results which aid in its computation. Finally, I will present an example which shows the dependence of pillowcase homology on the choice of tangle decomposition, meaning that its relationship, as currently defined, with singular instanton homology is not as strong as one would hope.

[*Type: Research; Difficulty: 3/4*]

Convergence of the Weighted Yamabe Flow

Zetian Yan (Penn State University)

We introduce the weighted Yamabe flow on smooth metric measure spaces, and prove the long-time existence and convergence.

[*Type: Research; Difficulty: 2/4*]

Posters

SU(2)-Simple Knots

Giacomo Bascape (UC Irvine)

$SU(2)$-simple knots, the definition is due by Raphael Zentner are the one that have the simplest instanton knot Floer homology. It is known that 2-bridges knots are $SU(2)$-simple and not that much is proven for hyperbolic ones. I will show that 8_{18} is $SU(2)$-simple proving that its double branched cover admits only $SO(3)$-abelian representations.

Tropicalization of Spherical Varieties and the Connections with Berkovich Geometry

Desmond Coles (The University of Texas at Austin)

Tropicalization is a way of associating combinatorial data to a variety over a valued field. Oftentimes this is done by constructing a retraction from the Berkovich analytification of the variety onto a subspace admitting a combinatorial description. Given an arbitrary variety there is not necessarily a canonical way to tropicalize it, however one well understood situation is that of toric varieties and their subvarieties. Recently Tevelev and Vogiannou introduced a method for tropicalizing spherical varieties. In this presentation we will review this construction and related work, and introduce original results about the relationship between a spherical variety's tropical geometry and its Berkovich Geometry.

Understanding Weight Filtrations via Derived Motivic Measures

Anubhav Nanavaty (UC Irvine)

Motivic measures appear in many contexts in algebraic geometry, such as the compactly supported Euler characteristic of complex varieties, or the point counting measure of $\mathbb{F}_p$ varieties. After the work of Zakharevich, who constructed a K theory spectrum of the category of varieties, work as been done to lift these motivic measures to maps of K theory spectra (i.e. making them "derived" measures). This presentation will outline results in this direction (including those of the presenter) and discuss open questions. In doing so, we will review methods of cohomological descent used in the construction of the compactly supported Voevodsky Motive and Gillet-Soulé weight filtration, and show that these methods allow us to lift measures to K theory spectra, showcasing the conceptual strength of these approaches.

Prequantum Bundle on the Traceless Character Variety of a Surface with Boundary

Mark Ronnenberg (Indiana University)

Traceless character varieties of 2 and 3-manifolds arise in the construction of Kronheimer-Mrowka's singular instanton homology. The traceless character variety of a (punctured) surface is a stratified space, whose top stratum is a smooth symplectic manifold. Several authors, for example Hedden-Herald-Kirk, have begun to work out a Lagrangian Floer homology theory for traceless character varieties, with the aim of proving that such a homology is isomorphic to singular instanton homology (a version of the Atiyah-Floer conjecture). Their construction involves decomposing a link in a 3-manifold into two tangles. A prequantum bundle is a principal $U(1)$-bundle over a symplectic manifold, equipped with a connection whose curvature induces the symplectic form on the base space. In this poster session, I will describe how to construct a prequantum bundle over the traceless character variety of a surface with boundary, albeit with a slightly different symplectic form, in a way that is tailored to 3-manifolds containing a tangle.

Solving Polynomials, Resolvent Degree, and Geometry*

Alexander Sutherland (UC Irvine)

A classical question in mathematics is to describe the roots of a general polynomial in terms of its coefficients and, ideally, to do so in the simplest manner possible. Resolvent degree is a notion of complexity which which provides a natural framework for investigating this question, but also makes sense more broadly in algebra, geometry, and representation theory. In this poster session, we will introduce resolvent degree, explain how the classical question above connects to finding linear subvarieties on projective complex varieties, and review how new geometric insights have led to new upper bounds on resolvent degree.

Constructing Proper Affine Actions

Neza Zager Korenjak (UT Austin)

We generalize a construction by Danciger-Guéritaud-Kassel, where they describe proper actions of free groups on three-dimensional affine space, to construct proper actions of free groups on $(4n+3)$-dimensional affine space. To do this, we introduce higher strip deformations and analyze them with the Margulis invariant.