Midwest Representation Stability Research Meeting 2019
Abstracts

Friday, April 26, 2019: Colloquium at U Chicago (Eckhart 206)

3:30 – 4:30: Jennifer Wilson

Title: Representation Stability
Abstract: This talk will give an overview of the recent field of 'representation stability'. I will discuss how we can use representation theory to illuminate the structure of certain families of groups and topological spaces with actions of the symmetric groups S_n, focusing on configuration spaces as an illustrative example.

Saturday, April 27, 2019 at Cenacle House

8:00 – 8:45: Coffee and donuts

8:45 – 8:55: Welcome and anouncements by Cenacle House

9:00 – 9:30: Jordan Ellenberg

Title: Property T for FI-groups
Abstract: Kaluba, Kielak, and Nowak recently settled a long-standing question by proving that $\mathrm{Aut}(F_n)$ has property T for $n \geq 6$. Their proof has an interesting "FI flavor". I will speculate about the right way to set this up as an argument about FI-groups, and try to describe what input on an FI-group G is needed to ensure that G_n has property T for all sufficiently large n. (Joint work with Eric Ramos.)

9:45 – 10:15: Jeremy Miller

Title: Integral generation of Steinberg modules
Abstract: Assuming the generalized Riemann hypothesis, we show that the Steinberg module of SL_n of a number ring is generated by integral apartments if and only if the ring is Euclidean. Our methods give new examples of rings where the cohomological dimension of SL_n agrees with the virtual cohomological dimension. This is joint with Peter Patzt, Jennifer Wilson, and Dan Yasaki.

10:15 – 10:45: Coffee break

10:45 – 11:15 and 11:30 – 12:00: Nir Gadish and Christin Bibby

Title: The "generating function" of configuration spaces, as a source for explicit formulas and representation stability, Part I and Part II

Abstract: As countless examples show, sequences of complicated objects should be studied all at once via the formalism of generating functions. We apply this point of view to the homology and combinatorics of (orbit-)configuration spaces: using the notion of twisted commutative algebras, which essentially categorify exponential generating functions. With this idea, originating from the work of Petersen, we will describe a factorization of the configuration space "generating function" into an infinite product, whose terms are surprisingly easy to understand. Beyond the intrinsic aesthetic of this decomposition and its quantitative consequences, it encodes all primary, secondary, and higher representation stability phenomena.

In Part I, we will discuss the product decomposition, and in Part II, we will discuss the consequences.

12:00 – 2:00: Lunch break

2:00 – 2:30: Graham White

Title: Random walks on FI-graphs

Abstract: An FI-graph is a functor from FI to the category of graphs. Equivalently, it is a family of graphs G_n, each equipped with an action of the symmetric group S_n, and inclusions from each G_n to G_{n+1} which are compatible with these symmetric group actions. These graphs can be thought of as generalisations of Kneser graphs, where G_n has a vertex for each k-tuple of elements of $[n]$, and two vertices are joined by an edge if their tuples are disjoint. I will describe the classification of finitely-generated FI-graphs, and use this result to investigate some properties of random walks on FI-graphs, with the goal of exploring FI-behaviour in a new setting. I will discuss the moments of hitting times of these random walks (how long it takes to reach a certain vertex or set of vertices), the mixing times (how long it takes for a random walk to be close to its stationary distribution), and the possibility of cutoff (whether or not a random walk transitions from far-from-mixed to close-to-mixed very quickly). It will turn out that each moment of any hitting time is eventually equal to a rational function, and that the mixing times of the random walks are bounded by certain ratios of the sizes of edge orbits.

2:45 – 3:15: Megan Maguire

Title: Cohomology rings of unordered configuration spaces of closed surfaces.

Abstract: The rational cohomology ring of the nth unordered configuration space of the genus 1 closed surface can be generated as a $\mathbb{Q}$-algebra in degree at most 6, independent of the value of n. Likewise, there is a similar finite bound independent of n for the degree of generation (as a $\mathbb{Q}$-algebra) for the nth unordered configuration space of the genus 0 closed surface. However, no such bound exists for closed surfaces of genus at least 2. We explore different possible explanations for this dichotomy and ask what this might suggest about the FI-algebra structure of the rational cohomology rings of ordered

configuration spaces of closed surfaces.

3:15 – 3:45: Coffee break

3:45 – 4:15: Rita Jimenez Rolland

Title: Linear representation stable bounds for pure mapping class groups
Abstract: In this talk, I will explain how results from Church, Miller, Nagpal, and Reinhold can be used to obtain explicit linear bounds for the presentation degree of the cohomology of pure mapping class groups of surfaces. This improves upon previous results by including integral coefficients and pure mapping class groups of non-orientable surfaces.

4:30 – 5:00: Peter Patzt

Title: Polynomial functors and stability
Abstract: In joint work with Jeremy Miller and Dan Petersen, we bound the presentation degree (and degrees of higher syzygies) of polynomial functors. This resolves a question of Galatius–Kupers–Randal-Williams. We apply this to prove representation stability for the homology of pure braid groups with coefficients in the Burau representation, establish secondary stability for the homology of mapping class groups with polynomial coefficients, compute the stable homology of hyperelliptic mapping class groups, and improve the homological stable range for GL_n of the sphere spectrum.

5:00 – 8:00: Dinner break

8:00 – 9:00: Problem session

Sunday, April 28, 2019 at Cenacle House

8:00 – 9:00: Coffee and donuts

9:00 – 9:30: Wee Liang Gan

Title: Inductive machinery for categories with shift functors
Abstract: I will discuss how various properties of FI-modules and its variants such as OI-modules and FI_d-modules can be proved using shift functors. This is joint work with Liping Li.

9:45 – 10:15: John Wiltshire-Gordon

Title: A quiver for linear FI-modules
Abstract: This talk is a research update on joint work with P. Patzt about FI-modules and their tails.

10:15 – 10:45: Coffee break

10:45 – 11:15: Weiyan Chen

Title: Homological stability of the space of complex irreducible polynomials in several variables
Abstract: We will show that the space of complex irreducible polynomials of degree d in n variables satisfies two forms of homological stability: first, its cohomology stabilizes as d increases, and second, its compactly supported cohomology stabilizes as n increases. Our topological results are inspired by counting results over finite fields due to Carlitz and Hyde.

11:30 – 12:00: Trevor Hyde

Title: Factorization statistics, representation stability, and the growing gaps principle
Abstract: Church, Ellenberg, and Farb showed that the representation stability of the cohomology of point configurations in the plane manifests as asymptotic stability of factorization statistics of squarefree polynomials over finite fields. In this talk I will explain how this connection extends in an unexpected way to one between the statistics of polynomials without the squarefree restriction and the cohomology of point configurations in 3-dimensional Euclidean space.

12:00 – 1:30: Lunch break

1:30 – 2:00: Nate Harman

Title: Superrigidity and Representation Stability
Abstract: I will briefly explain what superrigidity is and what it tells us about the representation theory of $\mathrm{SL}_n(\mathbb{Z})$ (for $n > 2$). Then I will describe my recent work using superrigidity to understand the structure of finitely generated, pointwise finite dimensional $\mathsf{VIC}(\mathbb{Z})$-modules.

2:15 – 2:45: Rohit Nagpal

Title: S_∞-equivariant modules over polynomial rings in infinitely many variables
Abstract: Let R be the polynomial ring $k[x_1, x_2, \ldots]$. Cohen proved that S_∞-stable ideals in R satisfy the ascending chain condition. This makes the category of smooth equivariant R-modules a noetherian category. The first step to analyze this category is to understand its spectrum. In this talk, we describe this spectrum. In particular, we show that the S_∞-stable ideal I_n generated by n-variable discriminants is in this spectrum. We show that every nonzero S_∞-stable ideal must contain I_n for some large n, and so these ideals are of primary interest. We also mention some new algebraic properties of discriminants. This is a part of an ongoing project with Andrew Snowden.

3:00 – 3:30: Phil Tosteson

Title: Representation Stability and Milnor Fibers
Abstract: The Type A_n Milnor fiber is the subset of $\mathbb{C}^n$ defined by the equation $\prod_{i<j}(x_i - x_j) = 1$. Surprisingly, the homology of this space is not known for all n. We will talk about how representation stability can be used to study the homology for $n \gg 0$. This is joint work with Jeremy Miller.

3:30 – ??: Coffee for the road