Schedule

Week 1 (June 5- June 8) All talks (including mini-courses and some of the contributed talks by graduate students) from June 5th to June 7th will take place at room **A-211** of the College of Natural Sciences at the University of Puerto Rico - Rio Piedras. Below you may find the schedule for the mini-course lectures (in red) as well as for some contributed talks (in blue).

The general public event on June 8th will take place at Amphitheater **CN-142** at the College of Natural Sciences at the University of Puerto Rico - Rio Piedras.

We will provide transportation on June 5,6 and 7 from the AC Hotel to the University of Puerto Rico (UPR) and back. The buses will leave the AC Hotel at 8:30 am the UPR at 5:30 pm.

On June 8th , for the general public event, we will also provide transportation from the AC Hotel to the University of Puerto Rico (UPR) and back. The buses will leave the AC Hotel at 1:00 pm and the UPR at 5:30 pm.

	Wednesday 6/5	Thursday 6/6	Friday 6/7	Saturday 6/8	Sunday 6/9
9:30-10:30	Naef 1	Naef 2	Naef 3	Free	Free day
11:00-12:00	Knudsen 1	Knudsen 2	Knudsen 3		
12:15-2:15	Lunch	Lunch	Lunch		
2:15-3:15	Gerhardt 1	Gerhardt 2	Gerhardt 3	General Public event (Auditorium CN-142) 2:00pm A. Adem 3:30pm R. Ghrist	
3:30-5:00	L. Liu J. Moreno	D. Manco M. Monaco	S. Martínez K. Strong D. Van Niel		

Week 2 (June 10-June 14) Each invited talk (in red below) will be 50 minutes long. Each contributed talk (in blue below) will be 20 minutes long. All talks will take place at the conference room in the AC Hotel Condado.

	Monday 6/10	Tuesday 6/11	Wednesday 6/12	Thursday 6/13	Friday 6/14
9:30-10:30	Sarazola	Nariman	Knudsen	Patzt	Beaudry
10:45-11:45	Gerhardt	Naef	Perea	Galatius	Behrens
12:00-12:30	M. Peroux	S. Saneblidze	T. Brazelton	Z. Himes	P. Bhattacharya
12:30-2:30	Lunch	Lunch	Free	Lunch	Lunch
2:30-3:30	Osorno	B. Walter, A. Milivojevic		R. Jiménez-Rolland, D. Chan	Malkiewich
3:45-4:15	Break	Break		Break	Break
4:15-5:15	Ellis	Basualdo Bonatto		Antolín-Camarena	Quigley

Abstracts

Mini courses

1. Teena Gerhardt (Michigan State University): Algebraic K-theory

Abstract: Algebraic K-theory is an invariant of rings and ring spectra which illustrates a fascinating interplay between algebra and topology. Defined using topological tools, this invariant has important applications to algebraic geometry, number theory, and geometric topology. One fruitful approach to studying algebraic K-theory is via trace maps, relating algebraic K-theory to (topological) Hochschild homology, and (topological) cyclic homology. In this mini-course I will introduce algebraic K-theory and trace methods, and discuss important recent advances in this area.

Talk 1: In this talk I'll answer the question: What is algebraic K-theory, and why are people interested in it? I'll define algebraic K-theory, and discuss applications of algebraic K-theory to several areas of mathematics.

Talk 2: In this talk I will introduce the trace method approach to studying algebraic K-theory. We will discuss (topological) Hochschild homology and (topological) cyclic homology, and how they can help us understand algebraic K-theory.

Talk 3: This talk will be a further exploration of trace methods, discussing how this approach can facilitate computations of algebraic K-theory groups. We will discuss cyclotomic structures, topological cyclic homology, and computational approaches for K-theory.

2. Florian Naef (Trinity College Dublin): String topology

Abstract: String topology can be thought of as the study of operations on the free loop space of a manifold. The operations are of the type of cutting loops at intersections and regluing them in a different pattern. Since these operations are expected to be defined using transverse intersection, a question that arises is concerning their invariance. That is, what type of maps between manifolds (ranging from homotopy equivalences to diffeomorphisms) intertwine these operations. One approach to study this question, is to try and define the string topology operations more algebraically and identify what the precise input into the algebraic machinery is. In this mini-course we will see a glimpse that this question is related to configuration spaces of points and to algebraic K-theory of spaces.

Talk 1: We will roughly follow the historical discovery of string topology by studying loops on surfaces. Namely, from the Atiyah-Bott symplectic structure on the moduli of flat connections we discover the Goldman bracket and its close relative the Turaev cobracket. We will then try and generalize these formulas to manifolds of arbitrary dimension.

Talk 2: There are (at least) two algebraic models for the homology (or cohomology) of the free loop space, either as Hochschild homology of chains on the based loop space or as Hochschild homology of the cochain algebra. In the latter case (restricted to simply connected spaces), thanks to a strictification result of Lambrechts-Stanley, it is much easier to write down algebraic operations which should correspond to string topology.
When trying to define the loop coproduct Hochschild homology of chains on the based loop space we will discover that additional data is needed.

Talk 3: We will discuss how the loop coproduct is not a homotopy invariant, but sees the trace of the underlying simple homotopy type.

3. **Ben Knudsen (Northeastern University): Configuration spaces**

Abstract: Configuration spaces have been a central concern in topology and many other areas for 60 years and counting. The aim of these lectures is to provide a user's guide to these spaces, detailing five basic answers to the following pragmatic question: given that configuration spaces are interesting, how do we go about studying them? After focusing initially on the manifold setting, and given time, we will describe in the third lecture how these answers do and do not apply to configuration spaces of graphs.

General public event

Alejandro Adem (President of Natural Sciences and Engineering Research Council of Canada, University of British Columbia)

Title: Topology, Groups, and Representations

Abstract: In this lecture we will discuss how methods from algebraic topology can be successfully applied to shed light on fundamental questions related to symmetries and representation theory. We will start with basic invariants such as the Euler characteristic and explore applications to topological space forms, spaces of representations and connections to mathematical physics. This will be illustrated with a variety of examples, ending with some open problems.

Robert Ghrist (University of Pennsylvania)

Title: Harmonic Balance: Using Geometry & Topology to Agree

Abstract: What does it mean to "agree to disagree"? Is that possible? What happens when people communicate over social media and have different viewpoints? This talk will approach issues of balancing forces in tension using the beauty of topology and geometry. There is harmonic convergence in all types of information systems, whether physical, economic, or even social. This talk will converge to some deep mathematical ideas, but in a fun and gentle manner that requires very little background in math besides an active imagination and a bit of matrix algebra.

Invited talks

Omar Antolín-Camarena (UNAM)

Title: Classifying spaces for commutativity in groups

Abstract: Given a topological group G, we can think of the space of homomorphisms Hom(Z^n, G) as the space of n-tuples of elements of G that commute pairwise. These spaces are more subtle than one might think, and even basic invariants such as the number of connected components can lead to surprising results. Fixing G and varying n we get a simplicial space, whose geometric realization is known as the classifying space for commutativity in G. I will survey what is known about these classifying spaces, whose study is still fairly young.

Agnès Beaudry (University of Colorado Boulder)

Title: Parametrized cohomology of the classifying space for C_2-line bundles

Abstract: Classically, as long as one takes coefficients modulo 2, any vector bundle admits a Thom isomorphism. This is because obstructions to orientability are governed by the monodromy of the bundle, which vanishes in characteristic 2. Unfortunately, if one works equivariantly, there are obstructions to orientability beyond monodromy and the Thom isomorphism can fail even with coefficients in the constant Z/2 Mackey functor. The remedy, like in the integral case, is to consider local coefficient systems. In the 90s, Costenoble-Waner developed an extended cohomology theory that encodes local coefficients in the cohomological grading. However, there have been few computations of this theory, even for C_2-spaces. In this talk, I will present the computation of Costenoble-Waner's extended cohomology theory for the classifying space for C_2-line bundles.

This is joint work with Chloe Lewis, Clover May, Sabrina Pauli and Elizabeth Tatum

Mark Behrens (University of Notre Dame)

Title: Equivariant chromatic homotopy theory

Abstract: I will survey some recent advances in equivariant chromatic homotopy theory due to many people in the language of equivariant formal group laws, and discuss computationally how this plays out explicitly, in terms of the equivariant theory of v_n-self-maps introduced by Bhattacharya, Guillou, and Li. This is joint work with Jack Carlisle.

Luciana Basualdo Bonatto (MPI Bonn)

Title: Link Concordance Invariants via Manifold Calculus Techniques

Abstract: Many knot and link invariants were originally defined in a combinatorial manner, and subsequently demonstrated to be preserved via Reidemeister relations. However, in the past decades, there has been a shift towards the use of more categorical techniques, such as Manifold Calculus, to derive descriptions of invariants via universal properties. For instance, the knot embedding tower was shown to detect finite-type knot invariants. In particular, this categorical approach can be beneficial in demonstrating the existence of conjectured invariants. Motivated by the conjectured existence of higher-order Arf invariants, we will discuss a new tower which can be used to detect concordance invariants for links and will explore some of its properties. This is work in progress in collaboration with Hyeonhee Jin and Peter Teichner.

Eugenia Ellis (Universidad de la República, Montevideo, Uruguay)

Title: Homotopy structures realizing algebraic kk-theory

Abstract: Algebraic kk-theory, introduced by Cortiñas-Thom, is a bivariant K-theory defined on the category of algebras over a commutative unital ring ℓ. It consists of a triangulated category kk endowed with a functor $j: \mathrm{Alg}\to kk$ that is the universal excisive, homotopy invariant, and matrix-stable homology theory. Moreover, we can recover Weibel's homotopy K-theory from kk since we have $kk(\ell,A) = KH(A)$ for any algebra A. In this talk, we will see that the category of algebras with fibrations the split surjections and weak equivalences the kk-equivalences is a category of fibrant objects, whose homotopy category is kk. Using this, we are able to construct a stable infinity category whose homotopy category is kk. This is a work in progress, joint with Emanuel Rodríguez Cirone.

Søren Galatius (University of Copenhagen / Columbia University)

Title: Hopf algebra structures in the cohomology of moduli spaces

Abstract: In joint work with Brown, Chan, and Payne, we describe a bigraded cocommutative Hopf algebra structure on the weight zero compactly supported rational cohomology of the moduli space of principally polarized abelian varieties, and use it to give lower bounds on the dimensions of these cohomology groups. One step is to construct a coproduct on Quillen's spectral sequence, abutting to the rational homology of the one-fold delooping of the algebraic K-theory space of the integers, making it a spectral sequence of Hopf algebras. We also relate this spectral sequence to one involving Kontsevich's graph complexes.

Teena Gerhardt (Michigan State University)

Title: Topological Hochschild homology, Witt vectors, and equivariance

Abstract: Hochschild homology of a ring has a topological analogue for ring spectra, topological Hochschild homology (THH), which plays an essential role in the trace method approach to algebraic K-theory. Topological Hochschild homology is closely related to Witt vectors, and this relationship has facilitated algebraic K-theory calculations. For equivariant rings (or ring spectra) there is a theory of twisted topological Hochschild homology that builds upon Hill, Hopkins, and Ravenel's work on equivariant norms. This twisted THH is closely related to an equivariant version of Witt vectors. Indeed, in this talk I will discuss recent work showing that the equivariant homotopy of twisted THH forms an equivariant Witt complex. This is joint work with Bohmann, Krulewski, Petersen, and Yang.

Ben Knudsen (Northeastern University)

Title: Analog category and complexity

Abstract: We study probabilistic versions of the Lusternik–Schnirelmann category and topological complexity. These "analog" homotopy invariants bound their classical "digital" counterparts from below, and we give examples illustrating both wide agreement and wide disagreement between them. Of particular interest is the aspherical context, where these invariants are group invariants. Here we establish an analog version of the Eilenberg–Ganea theorem for torsion-free groups, as well as a contrasting (finite!) upper bound for finite groups. We discuss ongoing work aimed at exact calculations for cyclic groups, leading to interesting problems in equivariant homotopy theory. This talk is based on joint work with Shmuel Weinberger.

Cary Malkiewich (Binghamton University)

Title: Scissors congruence, K-theory, Thom spectra, and homological stability

Abstract: I'll describe a series of recent results about polytopes in Euclidean geometry (and other geometries) up to the relation of "scissors congruence." Classically, scissors congruence is about how to distinguish polytopes up to cut-and-paste operations. This newer work bears more on the cut-and-paste operations themselves -- in other words the group Aut(P) of "scissors automorphisms" of a polytope P.

We show that Aut(P) has a strong form of homological stability, and that the stable homology is the infinite loop space homology of scissors congruence K-theory, previously defined by Zakharevich. This is completely parallel to the relationship between GL_n(R) and K(R) when R is a ring. (Except in this setting all the groups GL_n(R) have the same homology!)

We also show that scissors congruence K-theory is a Thom spectrum (!), leading to new computations of the K-groups of polytopes, and therefore of the homology of Aut(P). In particular, we recover and extend recent results by group theorists and dynamicists on the homology of interval exchange transformations and related groups.

Most of this is based on joint work with Anna-Marie Bohmann, Teena Gerhardt, Mona Merling, and Inna Zakharevich, and with Alexander Kupers, Ezekiel Lemann, Jeremy Miller, and Robin Sroka.

Angélica Osorno (Reed College)

Title: Equivariant operads and transfer systems

Abstract: Transfer systems are combinatorial objects that encode information about equivariant operations. More precisely, a transfer system encodes the transfers (or wrong-way maps) carried by algebras over certain equivariant operads. Thus, transfer systems allow us to use combinatorial tools to study equivariant homotopy theory. This talk will be an overview of various properties, including some structural and combinatorial results. These are part of various collaborations, including Scott Balchin, Evan Franchere, Usman Hafeez, Peter Marcus, Kristen Mazur, Kyle Ormbsy, Weihang Qin, Constanze Roitzheim, Rekha Santhanam, Danika Van Niel, Riley Waugh, and Valentina Zapata Castro.

J.D. Quigley (University of Virginia)

Title: Bredon homological stability

Abstract: The homology of various sequences of topological spaces often stabilizes. For instance, McDuff and Segal showed that the homology groups of unordered configuration spaces of open manifolds stabilize as the number of points in the configuration increases. In this talk, I will discuss an equivariant analogue of this phenomenon, Bredon homological stability, where homology is replaced by Bredon homology and spaces are replaced by G-spaces for some finite group G. I will describe a general strategy for passing between Bredon stability and nonequivariant stability, with configuration spaces of G-manifolds as a guiding example. This is joint work with Eva Belmont and Chase Vogeli.

Florian Naef (Trinity College Dublin)

Title: Dennis trace of Whitehead-torsion and its relationship to configuration spaces

Abstract: I will explain partial results on the slogan: "Manifolds are to K-theory, what manifold calculus is to Hochschild homology". A compact manifold M can be forgotten to a simple homotopy type, where the latter notion can be expressed algebraically in terms of Waldhausen A-theory. Replacing A-theory by topological Hochschild homology, we can "invent" the weaker notion of a THH-simple homotopy type. I will explain joint work with Pavel Safronov on how this weaker structure is related to intersection theory on M and how it can be extracted from the (2-truncated) Disk-presheaf of M. As an application we obtain that string topology, namely the loop coproduct, is not homotopy invariant in general. I will also explain partial results, joint with John Klein and Pavel Safronov, in the case where M is closed (and THH is replaced by THR).

Sam Nariman (Purdue University)

Title: Bounded cohomology of Homeo(R^n) and the failure of Milnor-Wood inequality in higher dimensions.

Abstract: Milnor in 1958 proved that an orientable plane bundle E over a surface of genus g admits a flat connection if and only if the absolute value of the Euler number of E is bounded by g-1. Later Wood in 1971 generalized this result to flat circle bundles over surfaces. Ghys, in the 80s, asked if Wood's inequality can be generalized to flat oriented S^3-bundles. In a joint work with Monod, we showed that the first Pontryagin class and the Euler class are in fact unbounded for flat oriented S^3-bundles. In this talk, I will report on a joint work with Fournier-Facio and Monod in which we prove that topological Pontryagin classes for flat Euclidean bundles are all unbounded.

Peter Patzt (University of Oklahoma)

Title: Unstable cohomology of SL_n Z and Hopf algebras

Abstract: The cohomology of SL_n Z is largely unknown, especially in dimensions outside the stable range and well below the virtual cohomological dimension. We prove that the cohomology of SL_n Z is the direct sum of two commutative Hopf algebras. We also find two infinite families of primitives that allow us to construct new cohomology classes in degrees outside the stable range and well below the virtual cohomological dimension. This talk is on joint work with Avner Ash and Jeremy Miller.

José Perea (Northeastern University)

Title: DREiMac: Dimensionality Reduction with Eilenberg-Maclane Coordinates

Abstract: Dimensionality reduction is the machine learning problem of taking a data set whose elements are described with potentially many features (e.g., the pixels in an image), and computing representations which are as economical as possible (i.e., with few coordinates). In this talk, I will present a framework to leverage the topological structure of data -- as measured by persistent cohomology -- and construct low dimensional coordinates in classifying spaces consistent with the underlying data topology.

Perea et al., (2023). DREiMac: Dimensionality Reduction with Eilenberg-MacLane Coordinates. Journal of Open Source Software, 8(91), 5791, https://doi.org/10.21105/joss.05791

Maru Sarazola (University of Minnesota)

Title: Fibrant transfer for model structures

Abstract: Model structures are robust categorical structures that provide an abstract framework to do homotopy theory. Unfortunately, in practice it is often very hard to prove that something satisfies the requirements of a model structure. To this end, there are several results in the literature that explore techniques for constructing model structures on a given category. Of particular note is the transfer theorem, allowing the user to transfer a model structure along an adjunction.

After a review of model structures, this talk will present a generalization of the transfer theorem where the relevant homotopical structure is only transferred between fibrant objects. Time permitting, we will explore some applications. Based on work with Leonard Guetta, Lyne Moser and Paula Verdugo.

Contributed talks

Week 1:

Sofía Martínez (Purdue University)

Title: Coalgebraic Models for G-spaces

Abstract: Given a commutative ring R, a π_1-R-equivalence is defined to be a continuous map of spaces inducing an isomorphism on fundamental groups and an R-homology equivalence between universal covers. If R is the ring of integers then this notion coincides with that of a weak homotopy equivalence. When R is an algebraically closed field, Rivera and Raptis described a full and faithful (co)algebraic model for the homotopy theory of spaces up to π_1-R-equivalence by means of simplicial coalgebras considered up to a notion of weak equivalence created by the cobar functor. Their work extends previous algebraic models for spaces considered up to R-homology (Kriz, Goerss, Mandell) by including the information of the fundamental group in complete generality. In this talk, I will describe G-equivariant analogs of this statement obtained through generalizations of a celebrated theorem of Elmendorf.

Leon Liu (Harvard University)

Title: A braided monoidal $(\infty,2)$-category of Soergel bimodules

Abstract: The Hecke algebras for all symmetric groups taken together form a braided monoidal category that controls all quantum link invariants of type A and, by extension, the standard canon of topological quantum field theories in dimension 3 and 4. Here we provide the first categorification of this Hecke braided monoidal category, which takes the form of an $\mathbb{E}2$-monoidal $(\infty,2)$-category whose hom-$(\infty,1)$-categories are k-linear, stable, idempotent-complete, and equipped with $\mathbb{Z}$-actions. This categorification is designed to control homotopy-coherent link homology theories and to-be-constructed topological quantum field theories in dimension 4 and 5. This is joint work with Aaron Mazel-Gee, David Reutter, Catharina Stroppel, and Paul Wedrich.

Juan Moreno (UC Boulder)

Title: The Spanier-Whitehead duals of some higher real K-theory spectra

Abstract: Higher real K-theories are central objects in chromatic homotopy theory. Their homotopy groups approximate the K(n)-local part of the stable homotopy groups of spheres, moreover the theory of finite resolutions suggests that these spectra and their Spanier-Whitehead duals form building blocks for the K(n)-local sphere. Work of Beaudry-Goerss-Hopkins-Stojanoska shows that taking the dual of one of these theories amounts to a twist by a certain representation sphere. We identify the dualizing representation in some cases, then focus on some examples in which the result can be simplified further to an integer shift.

Diego Manco (University of Oregon)

Title: Pseudo symmetric multifunctors: coherence, examples, and applications to K-theory.

Abstract: Multicategories and multifunctors between them were introduced in homotopy theory by Elmendorf and Mandell and have since been used as a foundation for multiplicative K-theory. They provide a way of talking about multiinput or multilinear maps even in the absence of tensor products. For some applications to K-theory we need to consider pseudo symmetric multifunctors, that is, multifunctors that preserve the action of the symmetric group by swapping inputs only up to coherent isomorphisms. We introduce these objects, and present some related coherence results, as well as new examples and applications to K -theory.

Kimball Strong (Cornell University)

Title: Strictification of Infinity Groupoids

Abstract: Grothendieck's "Homotopy Hypothesis" states that the homotopy theory of topological spaces is equivalent to the homotopy theory of weak infinity groupoids. Strict infinity groupoids are a simpler object that capture less information than weak infinity groupoids, but more than chain complexes. We define a functor from simplicial sets to simplicial T-complexes, a simplicial model for strict infinity groupoids, and prove it is left quillen. We further prove that the induced functor on quasicategories is comonadic; that is, induces an equivalence of homotopy theories between spaces and coalgebras in strict infinity groupoids. In particular, two simplicial sets are weak homotopy equivalent if and only if the associated coalgebras of strict infinity groupoids are weak homotopy equivalent.

Michael Monaco (Purdue University)

Title: Generalized plethysms and homological applications

Abstract: In recent work with Ralph Kaufmann, we describe a categorical plus construction (in the sense of Baez-Dolan) and use it to give a general plethysm formulation for operadic structures based on the notion of a categorical bimodule (functors of the form G^{op} x G -> C). This generalizes the classical formulation of an operad as a plethysm monoid of symmetric sequences due to Kelly. Kelly's formulation and the properadic variant used by Vallette in his thesis have proven to be particularly amenable to homological questions and methods. In this contributed talk, we discuss some motivation for our result in this direction and describe some further steps. If time allows, we will show how a coalgebraic variant of bimodule Hochschild cohomology gives a generalization of B_+ operators in the sense of Connes and Kreimer as a particular application.

Danika Van Niel (Michigan State University)

Title: Algebraic structures of twisted topological Hochschild homology

Abstract: 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. The study of the algebraic structure of THH and the Bökstedt spectral sequence have advanced our computational ability. 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 introduce THH, twisted THH, and discuss work in progress on the algebraic structure of twisted THH and the equivariant Bökstedt spectral sequence.

Week 2:

Rita Jiménez Rolland (UNAM Oaxaca)

Title: On classifying spaces of mapping class groups

Abstract: Given a discrete group G and a family $\mathcal{F}$ of subgroups of G there is a G-CW complex that classifies G-CW complexes with isotropy contained in the family $\mathcal{F}$. Such space is unique up to G-equivariant homotopy and it is called the *classifying space of* G *for the family* $\mathcal{F}$. In this talk, we will survey what is known about classifying spaces for some families of subgroups of the mapping class group of an orientable surface of finite type. Time permitting, we will present recent joint work with Porfirio León Álvarez and Luis Jorge Sánchez Saldaña in this topic.

Zach Himes (University of Michigan)

Title: A lower bound on the top degree rational cohomology of the symplectic group of a number ring

Abstract: Let R be a number ring. If one fixes i and lets n go to infinity, then the rational cohomology H^{i}(SL_n(R); Q)$ stabilizes in a range.
Outside this range, little is known about the rational cohomology in general except that it vanishes for all i> v_n, where v_n is an explicit constant described by Borel--Serre. For i=v_{n}, Church--Farb--Putman recently showed that the dimension of H^{v_n}(SL_n(R); Q)$ is at least (|Cl(R)| -1)^{n-1}, where Cl(R) denotes the class group of R. For the rational cohomology of the symplectic group Sp_{2n}(R), similar stability and vanishing patterns occur. In joint work with Benjamin Br\"uck, we obtain a similar lower bound for the the top degree rational cohomology of Sp_{2n}(R) and show it has dimension at least (|Cl(R)| -1)^n.

Prasit Bhattacharya (New Mexico State University)

Title: Equivariant Weiss Tower

Abstract: In the nineties, Michael Wiess introduced a Taylor tower corresponding to any functor E from J, the category of finite dimensional inner product spaces, to the category of pointed topological spaces. The Weiss tower restricted to V in J, approximates E(V) as an inverse limit. A fundamental feature of Weiss calculus is that the homogeneous layers are determined using cohomology theories. Thus, using this theory one can study ‘unstable problems’ using techniques from stable homotopy theory.

In a joint work with Yang Hu, we introduce an equivariant analog of Weiss calculus (for a finite group G) in which J is the functor from the orbit category that sends G/H to the category of finite H-representations, for any subgroup H of G. Consequently, we get a Taylor tower indexed by orthogonal G-representations in which the homogeneous layers are understood using genuine equivariant cohomology theories. Time permitting, we will discuss potential applications.

Samson Saneblidze (Razmadze Mathematical Institute, Tbilisi, Georgia)

Title: On the string topology product

Abstract: We introduce a commutative product of degree $-n$ on the homology $H_\ast(X)$ of an n-dimensional special cubical set X and lift it on the free loop homology $H_\ast(\Lambda M)$ for $M=|X|$ to be the geometric realization.These products agree with the intersection and string topology products respectively when M is an oriented closed manifold. We define a cellular product on ΛM that extends the Pontryagin product on the based loops ΩM and induces a degree preserving commutative product on $H_\ast(\Lambda M).$ Then we establish the compatibility relation between the string topology product and the standard coproduct on $H_\ast(\Lambda M).$ This is a joint work with Manuel Rivera.

Benjamin Walter (University of the Virgin Islands)

Title: Infinitesimal Calculations in Fundamental Groups

Abstract: In recent joint work of N.Gadish, A.Ozbek, D.Sinha, and myself, we define and investigate an explicit, computational operation evaluating elements of the Harrison complex of commutative cochains on the fundamental group of a space. The operation descends to the Malcev Lie algebra of the fundamental group, satisfying the properties of a “universal Lie-dual”. On the level of algebraically presented groups and classifying spaces, this leads to combinatorial “letter-braiding” and “letter-linking” invariants; generalizing Magnus expansion and Fox calculus; and yielding a simple computational algorithm for identifying when a power of an element is a k-fold commutator in a group

Thomas Brazelton (Harvard University)

Title: Curious combinatorics of real curves

Abstract: One of the earliest objects we may encounter, in algebra, geometry, or topology, is the vanishing locus of a polynomial in two variables, graphed on the real plane. Asking what these graphs can look like was a well-studied topic in antiquity, and the central focus of Hilbert's 16th problem, and yet remains an open problem. Work of Kharlamov and Sottile exhibits that so-called "maximally inflected curves" of low degrees have an interesting and well-behaved topology that can be investigated. In this talk we will present some conjectures and computational evidence, joint with Frank Sottile, towards a connection between local Brouwer degrees, real Gromov-Witten invariants of planar curves, and purely combinatorial invariants involving Young tableaux. Audience attention span pending, we may discuss how these ideas extend naturally to other fields via ideas of motivic homotopy theory.

Maximilien Peroux (Michigan State University)

Title: Topological homology of rings with a twisted G-action

Abstract: Topological Hochschild homology (THH) is a crucial invariant as it approximates the algebraic K-theory via the Dennis trace. One of its major characteristics is its circle action that leads to cyclotomic structures that allow refinements of THH which approximates K theory more accurately.

THH is the topological analogue of Hochschild homology and both are built from Connes' cyclic category that extends the usual simplex category. Fiedorowicz and Loday introduced analogues of these categories called crossed simplicial groups. They defined homologies associated to these categories for rings with group actions that are compatible with the multiplication on the rings, modulo some twisting.

In this talk, I introduce their topological analogues in stable homotopy theory, we recover THH but also real THH that is defined on rings with involution which is a form of twisted actions. I introduce new invariants such as hyperreal THH (which has a Pin(2)-action instead of a circle action), topological symmetric homology and topological hyperoctohedral homology which are new invariants for rings. I will present some computations of these invariants on monoid rings. This is joint work with Gabriel Angelini-Knoll and Mona Merling.

David Chan (Michigan State University)

Title: The RO(G)-graded K-groups of finite fields

Abstract: The first complete computation of higher algebraic K-groups was done by Quillen, who computed all the K-groups of finite fields. In these cases, the finite fields all come equipped with an action by a cyclic Galois group G, and one can consider the equivariant algebraic K theory, a refinement of algebraic K-theory to a genuine G-spectrum. In this talk I will discuss some recent work on computing the equivariant algebraic K-groups of finite fields. We are able to reduce the computation to the RO(G)-graded coefficient groups of certain equivariant Eilenberg MacLane spectra, giving a complete answer in all cases. This talk is based on joint work with Chase Vogeli.

Aleksandar Milivojevic (University of Waterloo)

Title: Formality and dominant maps

Abstract: In the mid 70's, Deligne-Griffiths-Morgan-Sullivan demonstrated a strong topological condition a closed manifold would have to satisfy if it were to carry a Kähler complex structure. Namely, the manifold would have to be formal, in the sense of its de Rham algebra of forms being weakly equivalent to its cohomology. The salient underlying property of compact Kähler manifolds which implies formality is preserved under surjective holomorphic maps (non-zero degree maps in the holomorphic setting). It turns out, formality itself is preserved under non-zero degree continuous maps of spaces satisfying Poincaré duality on their rational cohomology. Using this result we can recover and extend several seemingly disparate results in this area: the formality of singular complex projective varieties satisfying rational Poincaré duality, the formality of closed manifolds with sufficiently large first Betti number and a non-negative Ricci curvature metric, descent of formality from field extensions, and some more. This is joint work with Jonas Stelzig and Leopold Zoller.