# YTM 2024
# UNI-MÜNSTER

## ABSTRACTS

## TALKS

## Valentina Bais: Spin structures on Pseudo-Riemannian Cobordisms

I will talk about a joint work with Victor Gustavo May Custodio and Rafael Torres, in which we study necessary and sufficient conditions for the existence of a Spin $(n+1)$-dimensional cobordism that supports a non-singular and non-degenerate pseudo-Riemannian metric of signature $(2, n-1)$, which restricts to a non-singular time-orientable Lorentzian metric on its boundary.

## Max Blans: On the chain rule in Goodwillie calculus

Goodwillie calculus attaches to a functor $F\colon C \to D$ a tower of functors approximating $F$. The layers in this tower are determined by symmetric multilinear functors $Sp(C)^n \to Sp(D)$, called the derivatives of $F$. The chain rule, as originally proved by Arone and Ching, describes the derivatives of a composite of functors $FG$ in terms of the derivatives of $F$ and $G$. I will describe joint work with Thomas Blom, where we prove that taking Goodwillie derivatives yields a lax functor of $(\infty, 2)$-categories, providing a generalization of the chain rule.

## Emma Brink: Equivariant bordism and Thom spectra

By work of Thom and Pontryagin, geometric bordism theories are represented by a Thom spectrum. For a compact Lie group $G$, we describe equivariant versions of geometric bordism with stable tangential structures. The geometric theories define $\mathbb{Z}$-graded equivariant homology theories which admit a Thom-Pontryagin comparison map to the homology theory represented by associated Thom spectra. We show that if $G$ has non-abelian connected identity component (e.g. $G = SU(2)$), the geometric bordism theory is not represented by a genuine $G$-spectrum as it fails to admit Wirthmüller isomorphisms. In particular, the Thom-Pontryagin map can not be an isomorphism. The geometric reason for this is the failure of the equivariant analogue of Thom transversality. However, the Thom-Pontryagin map is an isomorphism if $G$ has abelian connected identity component (e.g. if $G$ is the semidirect product of a finite group and a torus). This follows from non-equivariant transversality and a comparison of geometric fixed points. For unoriented bordism, this is a result of Wasserman (1970) and our arguments are an adaptation of the proof strategy from Schwede (2018). The equivariant Thom spectra can be organized into global spectra. In future work, we hope to show that the Thom-Pontryagin map becomes an isomorphism of global homology theories after a global localization at certain inverse Thom classes. This has been carried out for unoriented bordism in Schwede (2018).

## Jesse Cohen: Bordered Floer theory, Hochschild homology, and links in $S^1 \times S^2$

We will sketch a construction of a spectral sequence with $E^2$-page given by the Khovanov homology of a link in $S^1 \times S^2$, as defined by Rozansky, which converges to the $A_\infty$-Hochschild homology of an $A_\infty$-bimodule defined using bordered Floer homology.

## Antoine Commaret: Persistent Intrinsic Volumes

Combining tools from persistent homology and geometric measure theory, we address the problem of estimating the area of a compact subset $X$ of $\mathbb{R}^d$ from a set $Y$ that is close in the Hausdorff distance. We introduce an estimator that enjoys a linear rate of convergence as a function of the Hausdorff distance under mild regularity conditions on $X$. This can be seen as a way to extend the noise filtering properties of persistent homology from the realm of topology to geometry.

## Anushree Das: Volume growth on manifolds with multiple ends

For a manifold $M$ and a function $v$ with bounded growth of derivative, there exists a metric of bounded geometry on $M$ such that the volume growth function lies in the same growth class as $v$. This was first proved by R. Grimaldi and P. Pansu with the proof focusing on the case on manifolds with a single end. We prove this explicitly in the case of manifolds with multiple ends, and call the constructed metrics Grimaldi-Pansu metrics. We give exact bounds for the volume growth function of these metrics in the same of certain manifolds which can be written as connected sums of a finite collection of closed and compact manifolds. We study other geometric properties of the Grimaldi-Pansu metrics including the Relatively Connected Annulus (R.C.A.) property introduced by Grigor'yan and Sallof-Coste.

## Jordi Daura Serrano: If it swims like a torus and quacks like a torus, then is it a torus? On rigidity and symmetry

The toral degree of symmetry of a manifold, denoted by $t(M)$, is defined as the maximum dimension of all tori which act effectively on $M$. A classical theorem states that if $M$ is a closed connected $n$-dimensional manifold then $t(M)$ is less or equal than $n$ and the equality holds if and only if $M$ is homeomorphic to a torus. In this talk we will introduce the discrete degree of symmetry, an analogous invariant for abelian finite group actions on manifolds, and obtain similar rigidity-type results on closed aspherical manifolds. We will also show the relationship between the discrete degree of symmetry and other properties of the homeomorphism group of the manifold, like the Jordan property or almost-asymmetry. Time-permitting, we will discuss further generalizations to study the symmetries of nilmanifolds.

## Riya Dogra: Molecular Braids

Topological isomers of molecules can differ a lot in their chemical and physical properties. A common form of topological isomers in co-ordination polymers is characterised by weaving. Their '1-dimensional' interwoven structures can mathematically be described as braids. Our aim is to model molecular braids geometrically and address new mathematical questions that arise from this model. Topological braids have been studied well in geometric topology. However, molecular braids can be described as piece-wise linear rigid objects that are realisations of topological braids with an added notion of symmetry and transitivity. Motivated by these crystalline structures, we focus on a particular class of braids that we call as 'Special Diagonal Braids' on $n$-strands. We characterise them by their Artinian word type and discuss the notions of their 'periodicity'. Moreover, we study their linking behaviour and present some generalisations. We also associate certain 'linking graphs' to such braids and study their properties.

## Arturo Espinosa: Sequential topological complexity of aspherical spaces and sectional categories of subgroup inclusions

The sequential topological complexities (TCs) of a space are homotopy invariants that are motivated by the motion planning problem from robotics. One of the most important open problems on the field is the characterization on purely algebraic terms of the (sequential) topological complexity of aspherical spaces. One of the possible approaches to this problem is through the study of the sectional categories of subgroup inclusions, as natural generalizations of sequential TCs for this algebraic setting. We will discuss how to obtain new lower bounds for sectional categories of subgroup inclusions through homological algebra methods, and discuss their consequences for sequential TCs of aspherical spaces. If time permits, we will also mention how some of our methods allow to obtain results on spaces that are not necessarily aspherical. This is joint work with Michael Farber, Stephan Mescher and John Oprea.

## Helge Frerichs: Scalar curvature deformations with non-compact boundaries

We develop a general deformation principle for families of Riemannian metrics on smooth manifolds with possibly non-compact boundary, preserving lower scalar curvature bounds. The principle is used to strengthen boundary conditions from mean convex to totally geodesic or doubling. It allows for the comparison of the homotopy type of spaces of metrics with these boundary conditions. The deformation principle preserves other geometric properties such as completeness and a given quasi-isometry type. As an application, we prove non-existence results for Riemannian metrics with uniformly positive scalar curvature and mean convex boundary, including some investigation of the Whitehead manifold.

## Zachary Gardner: Moduli of truncated prismatic $(G, \mu)$-displays

Dieudonne theory, which links $p$-divisible groups with semi-linear algebraic objects like displays, has widespread applications within both arithmetic geometry and homotopy theory. Following a suggestion of Drinfeld and building off of much recent work on prismatic Dieudonne theory and "stacky" prismatic cohomology, we introduce (truncated) prismatic $(G, \mu)$-displays as a group-theoretic generalization of (truncated) $p$-divisible groups which crucially allows $G$ to be any smooth group scheme over $Z_p$ and mu any (unramified) 1-bounded cocharacter of $G$. We study the moduli of (truncated) prismatic $(G, \mu)$-displays and resolve several conjectures of Drinfeld on the resulting (derived) formal stacks $BT_n^{G,\mu}$ ($n$ encodes the degree of truncation). In particular, we show that the stacks $BT_n^{G,\mu}$ have good smoothness, finiteness, and representability properties and construct analogues of Dieudonne theory and Grothendieck-Messing theory in this setting. This is joint work with Keerthi Madapusi and Akhil Mathew.

## Ioannis Gkeneralis: Topological rigidity of quoric manifolds

Topological classification of manifolds is considered a classical problem in geometric topology. If the manifolds are "weakly the same" (homotopy equivalent, weakly topologically equivalent) then we would like to show that they are topologically equivalent. There are a lot of conjectures towards this direction, with the strongest being the Isomorphism Conjecture of Farrell-Jones. Furthermore, there are the corresponding conjectures when the manifolds are equipped with a group of symmetries (group actions) or they are stratified. In this case, all the structures (homotopy equivalences, homeomorphisms) should preserve the group action (equivariant) or the stratification. The original idea of the classification problems is Mostow's Rigidity Theorem in which it was proved that two hyperbolic manifolds, of dimension larger than 2, which are homotopy equivalent, are isometric. This result is the basis of most of the conjectures of classification and rigidity. Usually, one of the two manifolds has nice properties (nonpositive curvature, hyperbolic fundamental group) and the other is simply homotopy equivalent to the first. The problem is to equip the second manifold with the properties of the first through the homotopy equivalence. After that, geometric methods, similar to the ones in Mostow's Theorem, will give the result. In the case of interest, we start with Euclidean spaces $\mathbb{R}^n$ on which we can define a multiplication such that, if $x, y \neq 0$, then $xy \neq 0$. If we insist that the multiplication is associative, then $n = 1, 2, 4$ from Frobenious Theorem. In the first case divisible by 4 that appear, then we can show that the action is by quaternionic multiplication. The rest of the process is the same as the torus case.

## Alexey Gorelov: Lifting maps between graphs to embeddings

We study conditions for the existence of an embedding $F\colon P \to Q \times \mathbb{R}$ such that $f = pr_Q \circ F$, where $f\colon P \to Q$ is a piecewise linear map between polyhedra. Our focus is on non-degenerate maps between graphs, where non-degeneracy means that the preimages of points are finite sets. We introduce combinatorial techniques and establish necessary and sufficient conditions for the general case and show that a weaker condition is sufficient for a specific case. Additionally, we demonstrate that the problem of the existence of a lifting reduces to testing the satisfiability of a 3-CNF formula and construct a counterexample to a result by V. Poénaru on lifting of smooth immersions to embeddings.

## Muhammed E. Guelen: Reeb flows on 3-manifolds, the two or infinity conjecture

Reeb dynamics studies the behavior of trajectories under a Reeb vector field on a contact manifold. A fundamental question dating back to Weinstein in 1978 concerns the number of periodic orbits, which are closed loops a trajectory traces. While the existence of a single such orbit is already highly non-trivial, the two or infinity conjecture proposes a striking dichotomy: a Reeb vector field on a closed 3-manifold either possesses only two periodic orbits, or infinitely many. This talk will explore this conjecture, its historical background as well as recent advancements in its understanding and its implications. We'll begin with an introduction to Reeb dynamics and contact manifolds. No prior knowledge on contact or symplectic topology will be assumed.

## Najwa Haddar: Topological localization and applications to K-theory

There is many different localization techniques which have shown their effectiveness in different fields: Algebraic Topology, Algebraic and Orthogonal K-theory... . In this work,we will see how Quillen defines higher K-theory groups, computes the higher K-theory groups, then we will see that those techniques arecrucial to determine the p-torsion of algebraic and orthogonal K-theory groups. Most of this talk will be devoted to study some applications of the localization to algebraic K-theory.

## Bjørnar Gullikstad Hem: An analogue of manifold calculus for multi-persistence modules

Functor calculus is a general framework for studying functors, and comes in many flavors. Common for all of them is that one defines a notion of degree $n$ functors, and then studies a functor by considering its degree $n$ approximations. In Goodwillie's functor calculus, the degree $n$ functors are $n$-excisive functors, i.e., functors that take strongly cocartesian $(n+1)$-cubes to cartesian $(n+1)$-cubes. Inspired by Weiss' manifold calculus, we construct a flavor of functor calculus for studying functors from a distributive lattice to a model category. In this calculus, the degree $n$ functors take strongly bicartesian $(n+1)$-cubes to cocartesian $(n+1)$-cubes. Our motivation is to better understand multi-persistence modules, as these modules can be viewed as functors from $\mathbb{N}^k$ into a category of chain complexes. It is a well-known problem in TDA that multi-persistence modules do not always admit an interval decomposition, and hence data from multi-persistence homology is difficult to analyze. We show that in our calculus, each functor out of $\mathbb{N}^k$ is degree k and has a well-behaved tower of lower degree approximations.

## Kaif Hilman: Parametrised functor calculus and a universal property of Mackey functors

I will introduce the notion of parametrised cubes which underpins a generalisation of functor calculus to the setting of higher categories parametrised over the epiorbital categories of Barwick-Dotto-Glasman-Nardin-Shah, and then explain how one can use this theory to prove a new universal property of Mackey functors over such categories in terms of certain sphere inversions, generalising the classical result in the equivariance context. This talk reports on aspects from joint work with Sil Linskens and with Tobias Barthel and Nikolay Konovalov.

## Milica Jovanović: Steenrod operations on polyhedral products

In this talk we describe the action of the mod 2 Steenrod algebra on the cohomology of various polyhedral products and related spaces. By studying the combinatorics of underlying simplicial complexes, we deduce some consequences for the lowest cohomological dimension in which non-trivial Steenrod operations can appear. Finally, we see how non-trivial Steenrod actions on the building blocks of polyhedral products and joins propagate to these spaces themselves. The talk is based on a paper that came out as a result of a team project in the Women In Topology IV workshop.

## Branko Juran: The algebraic K-theory of algebraic tori via equivariant homotopy theory

There is an equivalence of categories between algebraic tori over a field $F$ and topological tori with an action of the absolute Galois group of $F$. We prove that the algebraic K-theory of an algebraic torus coincides with the equivariant homology of the associated topological torus with respect to the equivariant homology theory represented by the K-theory of the base field $F$ and its field extensions. This is joint work in progress with Shachar Carmeli, Qingyuan Bai and Florian Riedel.

## Tony Mbambu Kakona: On the Evaluation of The Path Integral representation of the Analytic Torsion

There are very few explicit evaluations of path integrals for topological gauge theories in more than 3 dimensions. As a Physicist, for this talk, I will derive such a calculation for the path integral representation of the analytic Ray-Singer Torsion of a flat connection on a vector bundle on base manifolds that are themselves $S^1$ bundles of any dimension. The calculation relies on a suitable algebraic choice of gauge which leads to a convenient factorization of the path integral into horizontal and vertical parts.

## Shai Keidar: Higher Galois theory

In the context of topological quantum field theories (TQFTs), we explore the universal target space for fully extended TQFTs, which Freed and Hopkins suggest [arXiv:1604.06527] should be an n-category whose pi-finite torsion of its Picard spectrum is the shifted Brown-Comenetz dual of the sphere. To achieve this, we develop a Galois theory framework tailored for higher semiadditive categories of height $n$, replacing finite groups with $n$-finite groups, or more generally, $(n+1)$-finite spaces. We demonstrate the existence of a pro $(n+1)$-finite "Galois space" representing Galois extensions, extending previous work by Mathew [arxiv:1404.2156]. Utilizing Galois correspondence, we establish a Galois closure — a universal algebra with a contractible Galois space. Furthermore, we provide a construction of the algebraic closure via a Thom construction. Notably, we find that the algebraic closure of $\mathbb{C}$-vector spaces in $\mathbb{C}$-linear presentable categories is the category of super vector spaces. Additionally, we identify the pi-finite-torsion in the Picard spectrum of any algebraically closed category with the shifted Brown-Comenetz dual of the sphere, aligning with Freed-Hopkins' proposal.

## Tuomas Kelomäki: Discrete Morse theory for additive categories and Khovanov homology

The original Discrete Morse theory (Forman 1998) is a method for simplifying CW-complexes while preserving their homotopy equivalence. The combinatorial nature of this tool has proven its use in both theoretical mathematics and in applications. In this talk, we will take an algebraic view towards discrete Morse theory (Sköldberg 2005) while simultaneously trying to keep the original geometric picture in mind. We will observe that Sköldberg's formalization generalizes from R-modules to additive categories. This allows for effective applications towards Khovanov homology, a homology theory for knots and links which categorifies the Jones polynomial. The results we present in Khovanov homology will be both theoretical and computational in nature. Based on https://arxiv.org/abs/2306.11186 and recent work.

## Priyanka Magar: Concordance structure sets of 8,9 and 10-dimensional manifolds

In this talk, we present the concordance classes of smooth structures on PL-manifolds of dimensions 8, 9, and 10 in terms of cohomology and Steenrod operations. The method involves analyzing the Postnikov decomposition of the space PL/O. As a consequence, we exhibit the classification of diffeomorphism classes of Lens spaces and real projective spaces. If time permits, we discuss the homotopy inertia groups of manifolds of dimensions between 8 and 10.

## Sofía Marlasca Aparicio: Ultrasolid Homotopical Algebra

We present the theory of ultrasolid modules over a field (first proposed by Dustin Clausen), which generalises the solid modules over $\mathbb{Q}$ or $\mathbb{F}_p$ of Clausen and Scholze. Ultrasolid modules are a notion of complete modules over a discrete field. We build some basic results in ultrasolid commutative algebra and study its derived variants. Many results mimic the classical theory and we finally apply this to obtain an extension of the Lurie-Schlessinger criterion, which says that any formal moduli problem with coconnective tangent fibre is representable by a suitable ultrasolid derived algebra.

## Fadi Mezher: Residual finiteness of some automorphism groups of manifolds

We discuss a proof that $\pi_0\mathrm{Homeo}(M)$, for a closed, smoothable 2-connected manifold, is residually finite and in particular an arithmetic group, in contrast to the smooth analogue. We use embedding calculus and profinite homotopy theory to obtain this result.

## Łukasz Michalak: Reeb graph invariants of Morse functions and 3-manifold groups

We will discuss the problem of the existence of Morse functions on a closed manifold which are far from being ordered, i.e. whose Reeb graphs have positive first Betti number, especially the maximal possible, equals the corank of the fundamental group of the manifold. A description of such functions is closely realated to the possible number of degree 2 vertices in the Reeb graph of a Morse function, which has three essentially different lower bounds in terms of the fundamental group, homology groups and Lusternik-Schnirelmann category. In the 3-dimensional case we define an invariant of 3-manifold groups and their presentations, and using Heegaard splittings we show its utility in determining occurrence of disordered Morse functions. In particular, the Freiheitssatz, a result for one-relator groups, allows us to calculate this invariant in the case of orientable circle-bundles over a surface, which provides an interesting example of the behaviour of Morse functions.

## Monika: On a Generalization of the Jones Polynomial and the Khovanov Homology for Legendrian knots

The pair $(\mathbb{R}^3, \xi_{st})$ denotes the contact manifold $\mathbb{R}^3$ with the standard tight contact structure $\xi_{st}$ which is given by the kernel of 1-form $dz - ydx$. A Legendrian knot in the contact manifold $(\mathbb{R}^3, \xi_{st})$ is a smooth knot which is everywhere tangent to the contact structure. In this talk, I will define two invariants of the Legendrian knot type, namely, the Legendrian Jones polynomial and the Legendrian Khovanov homology. We will see that both of these invariants are natural generalizations of the Jones polynomial and the Khovanov homology for topological knots to the setting of Legendrian knots. In other words, for a Legendrian knot $K$, the Legendrian Jones polynomial $P_K(A, r)$ reduces to the Jones polynomial of the underlying topological knot after substituting $r = 1$. We will also see that the Thurston-Bennequin number which is a classical invariant of the Legendrian knot type, occurs as grade shift in the Legendrian Khovanov homology.

## Leor Neuhauser: Categorical Frobenius algebras are right adjoint to cospans

A categorification of Frobenius algebras in monoidal $(\infty, 2)$-categories, termed "Frobenius objects" in the context of $(2, 2)$-categories (Walter & Woods 2007), is recently understood to be a better behaved version of rigid categories with applications in condensed mathematics and continuous K-theory. We will reprove results about categorical Frobenius algebras in the $(\infty, 2)$-categorical setting, showing how they blend the 1-categorical notion of duality with the 2-categorical notion of adjunction. As a consequence, the full $(\infty, 2)$-subcategory of categorical Frobenius algebras inside all algebras is only an $(\infty, 1)$-category. On the other hand, given an $(\infty, 1)$-category with finite colimits, there is a symmetric monoidal $(\infty, 2)$-category of cospans. We will show that under mild restrictions, those two constructions are adjoint, providing a new perspective on certain 6-functor formalisms.

## Kamen Pavlov: On the homotopy classification of 4-manifolds with fundamental group $\mathbb{Z} \times \mathbb{Z}/p$

The quadratic 2-type of a closed, oriented 4-manifold is a collection of invariants, introduced by Hambleton and Kreck in 1988, which has been shown to determine the manifold up to homotopy equivalence for certain classes of fundamental groups, though it fails in general. A counterexample is given by products of 3-dimensional lens spaces with the circle, thus motivating the investigation of general 4-manifolds with fundamental group $\mathbb{Z} \times \mathbb{Z}/p$. In this talk we will introduce the quadratic 2-type, give the counterexample coming from lens spaces, and discuss how much information we can still obtain from the quadratic 2-type when it comes to the homotopy classification of manifolds with fundamental group $\mathbb{Z}\times\mathbb{Z}/p$. Based on joint work with Daniel Kasprowski.

## Alice Rolf: Endomorphisms and Automorphisms of the Framed Little Disk Operad

In a recent paper, Horel–Krannich–Kupers proved that all endomorphisms of the little disk operad are automorphisms. This prompts the question whether this is true for a more general class of operads, that is little disk operad with an action of a group. In this talk we are going to show some conditions of the group acting on the little disk operad in order for every endomorphism to be an automorphism and will apply this to the example of the framed little disk operad.

## Victor Saunier: Trace methods for stable categories

Trace methods is the name usually given to the way compute K-theory from various flavours of topological Hochschild homology, and are one of the most powerful ways to compute K-theory. In this talk, we present a synthetic, categorical approach to the theory, which yields new and generalized results as well as simpler and more conceptual proofs.

## Anna Schenfisch: Verbose Persistence and Caterpillar Metric Spaces

The Vietoris–Rips filtration of a metric space is built by adding an $i$-simplex whenever $i$ points of the space are all within a particular distance threshold of each other. By keeping track of the homology of the complex as the threshold changes, we obtain a "concise" persistence diagram, a standard tool in topological data analysis. If we additionally keep track of the boundary and cycle groups instead of just homology groups, we obtain "verbose" persistence. In this talk, we explore when the verbose persistence diagram from a Vietoris–Rips filtration does or does not uniquely correspond to an underlying metric space. In particular, we investigate a family of metric spaces whose points and distance correspond to the points and distance of caterpillar graphs. By interpreting persistence points as graph invariants, we connect to established results from graph reconstruction.

## Florian Schwarz: Differential bundles in tangent (infinity) categories

Tangent categories generalize differential geometry in a functorial way. Applications of their infinity categorical version, tangent infinity categories include Goodwillie functor calculus. Differential bundles are one of the most important structures appearing in tangent categories. They can be used for connections and dynamical systems. A special case of them, differential objects, provide an adjunction between cartesian differential categories and tangent categories. While differential objects have been generalized to tangent infinity categories, differential bundles have not yet. In this talk I will present the current status of the generalization process. A key step of our construction is a functorial characterization of differential bundles in the classical 1-categorical setting for tangent categories. I will provide such a classification.

## Kurt Stoeckl: Segal Infinity Props

Props, and their traced variants (wheeled props), are special types of symmetric monoidal categories with two types of strictly associative compositions, the first being categorical, and the second monoidal. They are ubiquitous in mathematics, encoding structures in algebraic topology, deformation theory and knot theory such as Hopf algebras and tangles. However, many interesting mathematical objects, such as Segal's cobordism categories, don't admit strictly associative compositions. In this talk, without assuming familiarity with the prior structures, we will introduce a Segal model for homotopy (or infinity) props, which lets us weaken the associativity of the categorical and monoidal compositions up to coherent homotopy. We will then relate this model to other definitions of infinity props, operads, and categories via various nerve theorems. This talk is based on joint work with Philip Hackney and Marcy Robertson.

## Sven van Nigtevecht: A synthetic version of topological modular forms

A lot of our understanding of stable homotopy theory comes from using spectral sequences. The advent of synthetic spectra has revolutionised our way of working with these, as it allows one to use homotopical techniques to modify and construct new spectral sequences. In this talk, I will define a synthetic spectrum called *synthetic modular forms*, which serves as an improvement to the ordinary spectrum of topological modular forms. The properties of Smf better reflect the algebraic geometry underlying Tmf; specifically, it captures the descent spectral sequence of Tmf. This is joint work with Christian Carrick and Jack Davies.

## Marco Volpe: Traces of dualizable categories and functoriality of the Becker-Gottlieb transfers

For any fiber bundle with compact smooth manifold fiber $X \to Y$, Becker and Gottlieb have defined a "wrong way" map $S[Y] \to S[X]$ at the level of homology with coefficients in the sphere spectrum. Later on, these wrong way maps have been defined more generally for continuous functions whose homotopy fibers are finitely dominated, and have been since referred to as the Becker-Gottlieb transfers. It has been a long standing open question whether these transfers behave well under composition, i.e. if they can be used to equip homology with a contravariant functoriality. In this talk, we will approach the transfers from the perspective of sheaf theory. We will recall the notion of a locally contractible geometric morphism, and then define a Becker-Gottlieb transfer associated to any proper, locally contractible map between locally contractible and locally compact Hausdorff spaces. We will then use techniques coming from recent work of Efimov on localizing invariants and dualizable stable infinity-categories to construct fully functorial "categorified transfers". Functoriality of the Becker-Gottlieb transfers is then obtained by applying topological Hochschild homology to the categorified transfers. If time permits, we will also explain how one can use similar methods to extend the Dwyer-Weiss-Williams index theorem for compact topological manifolds fiber bundles to proper locally contractible maps. In particular, this shows that the homotopy fibers of a proper locally contractible map are homotopy equivalent to finite CW-complexes. Therefore, it is still unclear whether functoriality of the transfers associated to maps with finitely dominated homotopy fibers holds. This is a joint work with Maxime Ramzi and Sebastian Wolf.

## Kaelyn Willingham: Spectral Properties of the Algebraic Path Problem

The algebraic path problem unifies a number of optimal routing algorithms on graphs under a single generic, algorithmic umbrella. While these path problems have been well-studied computationally, their relationship to spectral graph theory is still relatively under-explored which, in turn, prompts a number of interesting topological questions. For example, to what extent can the shortest paths in the graph be computed from the spectrum of the graph itself, and which graph topologies interfere in this relationship? Does the algebraic path problem generalize to higher dimensions? If so, can this generalized problem be expressed in the language of cellular (co)sheaves, and what aspects of (co)sheaf (co)homology may be utilized to study these generalized algebraic path problems? How might we apply this relationship between the algebraic path problem and algebraic topology? This is joint work with Russell Funk and Thomas Gebhart.

## Valentina Zapata Castro: Monoidal $(\infty, n)$-categories

A monoid can be interpreted as a category with a single object, where the morphisms correspond to the elements of the monoid. This equivalence allows us to encode the binary operation of the monoid using the properties of composition and associativity inherent in any category. Extending this concept to higher categories, Bergner established a connection between simplicial monoids and Segal categories. In this presentation, I will explore the relationship between complete Segal spaces with a monoidal structure and complete Segal $\Theta_2$ spaces, considering an approach to capturing the idea of having a single object that aligns with the nature of the previously mentioned work.

## Ningchuan Zhang: Equivariant algebraic K-theory and Artin L-functions

The celebrated Quillen-Lichtenbaum Conjecture (QLC), proved by Voevodsky and Rost, connects special values of the Dedekind zeta function of a number field to sizes of its algebraic K-groups. In this talk, I will explain how to generalize the QLC to Artin L-functions of Galois representations of finite, function, and number fields. On the K-theory side, we compute equivariant algebraic K-groups with coefficients in those representations. This is joint work with Elden Elmanto.