
**Topology
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ALEJANDRO ADEM, University of British Columbia + NSERC

KRISTINE BAUER, University of Calgary
Differentiability in homotopy theory

Homotopy theory is not usually seen as a setting for differentiation: homotopy classes of spaces and maps lack the rigidity needed for classical derivatives. Yet homotopy theory and calculus have been closely linked since Goodwillie's functor calculus of the 1990s, which shows that homotopy-invariant functors admit Taylor-like approximations whose layers behave like derivatives. Recent work with collaborators clarifies the structural basis for this analogy. With Johnson, Osborne, Riehl, and Tebbe, we showed that abelian functor calculus carries the structure of a *cartesian differential category*, providing an intrinsic notion of differentiation. With Burke and Ching, we further demonstrated that this viewpoint extends to the setting of homotopy functor calculus while simultaneously extending these ideas to infinity categories.

These ideas flow both ways: categorical structures illuminate the essential ingredients of functor calculus, while topological phenomena inspire new categorical constructions. Recent works of Schwarz in *tangent* categories, and work of Ching and Arro in *tangent infinity categories*, use these methods to generalize differential bundles, revealing new structures relevant to functor calculus.

This talk will survey these developments and outline emerging directions in differentiability and homotopy theory.

STEVEN BOYER, UQAM
The L-space conjecture

The L-space conjecture contends that the following three conditions are equivalent for closed, orientable 3-manifolds M : (a) M admits a co-oriented taut foliation, (b) the fundamental group of M admits a left-invariant total order (i.e. it is left-orderable), and (c) the reduced Heegaard Floer homology of M is non-trivial (i.e. M is not a Heegaard Floer L-space). In this talk I will survey what is known about the conjecture and discuss some of the most important open challenges.

DANIEL CARRANZA, Johns Hopkins University
Generalizing the Bousfield-Kan formula

In 1972, Bousfield and Kan gave a formula for computing homotopy colimits of (pointed) spaces using an ordinary colimit of a "fattened up" diagram. This formula, which holds in any simplicial model category, is both intuitive and powerful, due to the central role of homotopy colimits in homotopy theory. For instance, they provide a unifying framework for results such as the van-Kampen theorem, the Mayer-Vietoris long exact sequence, and the Blakers-Massey theorem.

In this talk, I will present a generalization of this formula to the setting of monoidal model categories (j/w Kensuke Arakawa and Chris Kapulkin, arXiv:2511.12809). This talk aims to be accessible to mathematicians from across topology, and will introduce homotopy colimits from the ground up using a "topology-first" perspective.

ADAM CLAY, University of Manitoba
Slope detection in knot complements and the L-space conjecture

The L-space conjecture posits a connection between left-orderability of the fundamental group of a prime 3-manifold, whether or not the manifold admits a co-orientable taut foliation, and whether or not the manifold is a Heegaard Floer homology L-space. There is also a relative version of this conjecture for manifolds with torus boundary, which posits a connection between the boundary behaviours of these structures—tracking this boundary behaviour is known as “slope detection”.

For knots in S^3 that admit L-space Dehn fillings, also known as L-space knots, I will explain how checking the expected boundary behaviour of left-orderings can be broken down into a two-step process, and explain how to complete step one. This is a joint work in progress with Junyu Lu.

OCTAV CORNEA, Université de Montréal

Triangulated persistence categories and symplectic topology

I will discuss how mixing persistence (in the sense of persistence modules familiar in data science) and triangulation (in the sense of triangulated categories) leads to natural notions of approximability that have significant applications to symplectic topology. The talk is based on joint work with G. Ambrosioni and P. Biran (both from ETH)

MARTIN FRANKLAND, University of Regina

Enriched model categories and the Dold-Kan correspondence

If we start with a model category enriched in simplicial abelian groups and we normalize each hom complex, what kind of structure do we obtain? In joint work with Arnaud Ngopnang Ngompé, we show that changing the enrichment along (the right adjoint of) a weak monoidal Quillen pair results in a “weak” enriched model category. The main issue is that we lose the tensoring and cotensoring, but we retain a weak form thereof.

TYRONE GHASWALA, University of Waterloo

Mapping class groups admit a unique Polish topology

Suppose you are given a topological group. You may wonder about how much the group structure determines the topology. At first glance, the answer appears to be “not very much at all”, since every topological group admits the discrete topology, and the trivial topology, both of which are compatible with the group operation.

Big mapping class groups (mapping class groups of infinite-type surfaces) come equipped with a Polish topology. We can ask a refinement of the above question: How much does the group structure of a mapping class group determine its Polish topology?

This talk is about showing the answer is, perhaps surprisingly, ‘entirely’! That is, that mapping class groups admit a unique Polish topology. This is joint work with Sumun Iyer, Robbie Lyman, and Nick Vlamis.

NATHAN KERSHAW, Western University

Topological data analysis using discrete homology

Persistent homology is a tool of Topological Data Analysis commonly used to detect the shape of data. When the data of interest comes from a metric space, for example a finite subset of \mathbb{R}^n , the method is generally noise resistant. We show that this is not the case when the data fails the triangle inequality.

To solve this issue, we propose a new method: persistence discrete homology. This method uses discrete cubical homology, which is a homology theory for simple undirected graphs. This allows us to take homology over a filtration of graphs rather than the filtration of simplicial complexes normally used.

In this talk, we will introduce the classical method of persistent homology, discuss discrete cubical homology and how it can be used for persistence, and compare the two methods. We show that persistent discrete homology is better suited to analyze data not coming from metric spaces.

This talk is based on joint work with Chris Kapulkin, and the corresponding paper can be found here: arxiv.org/html/2506.15020.

GEUNYOUNG KIM, McMaster University
Heegaard diagrams for 5-manifolds

In three dimensions, Heegaard diagrams are a powerful combinatorial tool for studying 3-manifolds, as they encode a 3-manifold using circles on a surface. In this talk, I will describe how to extend this idea to 5-manifolds by introducing a higher-dimensional version of Heegaard diagrams. I will discuss the construction and present several examples to illustrate how these diagrams can be used to understand the topology of 5-manifolds.

ALEXANDER KUPERS, University of Toronto Scarborough
Mapping class groups of exotic tori

The d -dimensional torus is a topological manifold that often admits many smooth structures. How does its mapping class group (isotopy classes of diffeomorphisms) depend on the smooth structure? I will explain a partial answer to this question that appears in joint work with Bustamante, Krannich, and Tshishiku, give some geometric applications, and state some open problems.

ÇAĞATAY KUTLUHAN, University of Buffalo

JEFFREY MARSHALL-MILNE, McMaster University
An invitation to alternating links and the Greene-Howie Theorem

Alternating links are a particularly well-behaved family of links. From a (reduced) alternating diagram of a link L , one can read off the crossing number of L , its prime factors, and its split components. Moreover, alternating links are highly sensitive to the invariants of knot theory. In short, an alternating link wears its heart on its sleeve. There is, however, one major source of dissatisfaction in the theory of alternating links: their definition is diagrammatic, dependent on a particular picture of the link. This concern was famously voiced by Ralph Fox, who asked "What is an alternating link?" Fox sought a topological interpretation of the alternating condition, one devoid of the notion of diagram. The matter was finally put to rest in a pair of seminal 2017 papers by Joshua Greene and Joshua Howie. In this talk, we discuss the history and basic properties of alternating links, the Greene-Howie Characterisation Theorem for alternating links, and its implications and extensions. Ongoing work in this area is discussed.

DUNCAN MCCOY, UQAM
Cusps of arithmetic hyperbolic manifolds

The Margulis thick-thin decomposition implies that a non-compact n -dimensional hyperbolic manifold can be decomposed into a compact piece along with a collection of cusps, which are subsets diffeomorphic to the product of a flat $n-1$ -manifold with an open interval. One natural question is thus to ask which combinations of flat manifolds can be realized as cusp cross-sections in some hyperbolic manifold. I will discuss some aspects of this question with an emphasis on the case of arithmetic hyperbolic manifolds. In particular, I will explain how one can characterize which flat manifolds arise as a cusp cross-section in a given commensurability class of arithmetic hyperbolic manifolds and, time permitting, some mildly interesting examples. This is joint work with Connor Sell.

LELAND MCINNES, Tutte Institute for Mathematics and Computing
Persistent Homology in High Dimensions

Persistent homology has proven itself to be a powerful tool for topological data analysis. It allows for shape analysis of "point-cloud" data in varying dimensions. In practice many applications of persistent homology have been on relatively low dimensional data. With the rise of deep learning, vast new troves of data have been unlocked – either through "embedding vectors" associated to unstructured datasets, or through the patterns of activations of the neural network itself. Such data sets typically have hundreds or thousands of dimensions. How well does persistent homology perform in such cases? What methods can we use to improve the results of persistent homology for such data? In this talk we'll explore these questions with simple example cases, and look at two different methods to make persistent homology more effective in high dimensions.

WILLIAM MENASCO, University of Buffalo
A construction of minimal coherent filling pairs

Let S_g denote the genus g closed orientable surface. A *coherent filling pair* of simple closed curves, (α, β) in S_g , is a filling pair that has its geometric intersection number equal to the absolute value of its algebraic intersection number. A *minimally intersecting* filling pair, (α, β) in S_g , is one whose intersection number is the minimal among all filling pairs of S_g . In this talk, we give a simple geometric procedure for constructing minimally intersecting coherent filling pairs on S_g , $g \geq 3$, from the starting point of a coherent filling pair of curves on a torus. Coherent filling pairs have a natural correspondence to square-tiled surfaces, or *origamis*, and we discuss the origami obtained from the construction.

This work is joint with Hong Chang [Beijing International Center for Mathematical Research (BICR)].

PATRICK NAYLOR, McMaster University
Four-dimensional Murasugi sum

In this talk, I will describe different constructions of spanning solids for knotted surfaces in the 4-sphere, several of which will use a 4-dimensional analogue of Murasugi sum. In particular, I will describe notions of arborescent surface-links and state solids for broken surface diagrams. There will be lots of examples and pictures!

B. DOUG PARK, University of Waterloo
Symplectic geography problem

By Freedman's seminal work, the homeomorphism type of a closed simply connected 4-dimensional manifold (4-manifold for short) is determined by its intersection form on the second homology group. The "symplectic geography problem" asks when a symmetric bilinear form (form for short) can be realized as the intersection form of a symplectic 4-manifold. The problem has been answered when the form has negative signature. We will discuss the current state of the problem when the signature is nonnegative, with a special focus on realizability by spin symplectic 4-manifolds.

DORETTE PRONK, Dalhousie University
A tom Dieck Fundamental Groupoid for Orbifolds

In this talk I will introduce a version of the tom Dieck fundamental groupoid for orbifolds.

This fundamental groupoid was first introduced in the context of equivariant homotopy theory, as part of the Bredon approach (which provides finer invariants than the Borel approach). It provides more information about the fixed-point manifolds than the Borel fundamental group, and it provides the right object to define Bredon cohomology with twisted/local coefficients.

Each orbifold can be written as the quotient of a manifold by a compact Lie group but this representation is only unique up to Morita equivalence. So if we want to use invariants from equivariant homotopy theory, we need to show that they are Morita invariant and functorial with respect to orbifold maps.

So I will describe the tom Dieck fundamental groupoid for orbifolds, give some of its properties, sketch that it is indeed an orbifold invariant and give a number of examples for low dimensional orbifolds. As time permits, I will discuss the use in Bredon cohomology with twisted coefficients.

MARTINA ROVELLI, University of Ottawa

Towards a complicit set of cobordisms

Using a lot of pictures, we will explore a higher category whose k -morphisms are k -dimensional manifolds with boundary, interpreted as morphisms from their incoming to their outgoing boundary components. Higher categories of this kind provide the natural domains for topological quantum field theories. We will explain how the full structure of this higher category, which is truly an (∞, ∞) -category, can be encoded in an efficient way as a marked simplicial set.

NICK ROZENBLYUM, University of Toronto

String topology and the cyclic Deligne conjecture

I will describe a new approach to genus zero operations in string topology via noncommutative geometry. Specifically, I will explain the cyclic version of the Deligne conjecture which gives an action of the framed E_2 operad on the Hochschild cochains of a Calabi-Yau category. In the setting of relative Calabi-Yau structures, this gives a generalization of the string topology operations to manifolds with boundary. Moreover, this structure has a natural interpretation in terms of deformation theory which gives a vast generalization of Turaev's theorem relating the Lie algebra of loops on a Riemann surface to the Poisson algebra of functions on the character variety. This is joint work with Christopher Brav.

ANDREW SALCH, Wayne State University

Number theory and stable homotopy groups of spheres

This will be a short survey talk. I will sketch the basic ideas and techniques for computing stable homotopy groups of spheres, and other finite CW-complexes, by means of the group cohomology of Morava stabilizer groups, i.e., the automorphism groups of one-dimensional formal group laws. Then I will review the cases in which such computations result in a formula which describes the orders of some part (given by a Bousfield localization) of the stable homotopy groups of some finite CW-complex, in terms of number-theoretic data: special values of an L-function, e.g. the Riemann zeta-function. This gives a compact and digestible way to describe the orders of various periodic families in the stable homotopy groups of finite CW-complexes, especially spheres.

YVON VERBERNE, The University of Western Ontario

Graphs of quasicircles

The curve graph of a surface was introduced by Harvey and is defined as the simplicial complex where vertices are isotopy classes of essential simple closed curves in the surface, and edges are pairs of disjoint curves. Work of Ivanov proves that the group of automorphisms of the curve graph is isomorphic to the extended mapping class group of the corresponding surface. In this talk, we will introduce the graph of quasicircles, and discuss an analogue of the result of Ivanov for the graph of quasicircles. This work is joint with Katherine Williams Booth and Alex Nolte.

C.M. MICHAEL WONG, University of Ottawa

A profinite tensor product of vector spaces and bimodules

Based on a computation using bordered Floer bimodules, it seems that the sutured Floer homology of the infinite cyclic cover of the exterior of a knot, if it made sense, would take the form of an infinite tensor product of bimodules. But such objects do not behave well at all. In this talk, I will outline the construction of a profinite tensor product of vector spaces and bimodules, corresponding to profinite cyclic covers, which will have much better properties. This is joint work in progress with David Treumann.