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FOUNDATION COMPOSITIO MATHEMATICA
SPP 1786 Homotopy Theory and Algebraic Geometry
NSF
Copenhagen Center for Geometry and Topology
Danmarks Grundforskningsfond Danish National Research Foundation
CARLSBERGFONDET

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General information

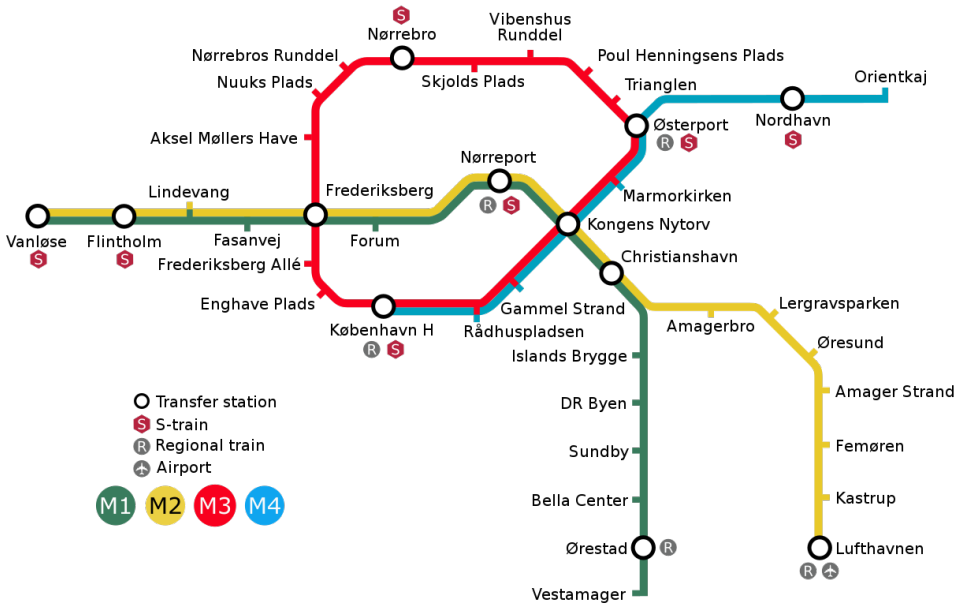
Travel information

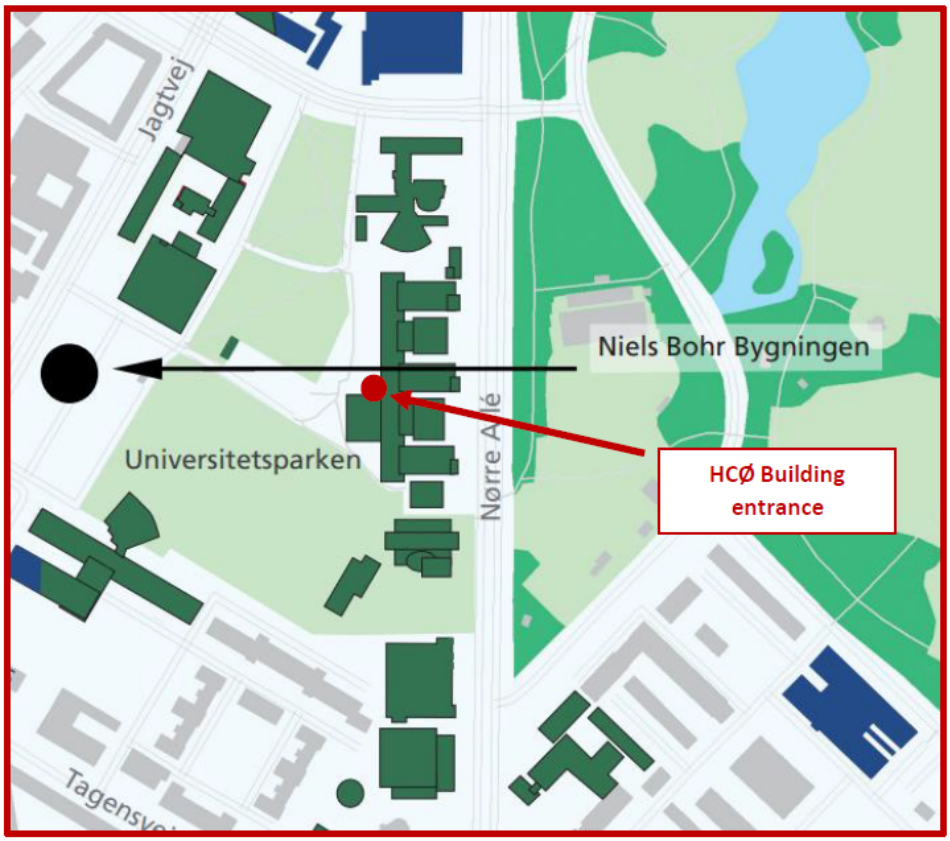
Public transport will get you anywhere you wish to go in the capital region. Your easiest option is the metro system (please see the metro map on the next page). Both the airport and the central train station are served by a metro stop, **København H** and **Lufthavnen**, respectively.

- All talks take place in the HCØ building, located at **Universitetsparken 5**. We have marked the entrance of the builind on the map on the next page. The nearest metro stop is **Vibenshus Runddel**.
- The Urban Camper accommodation, located at **Lygten 2C**, is very close to **Nørrebro** station.
- For the canal tour, we assemble at **Nyhavn 71**, which is within walking distance from **Kongens Nytorv**.
- The dinner in Tivoli takes place in restaurant Bryggeriet, **Vesterbrogade 3**, which is very close to both **København H** and **Rådhuspladsen**.
- The major tourist centre is at **Kongens Nytorv**.

Tickets can be bought in ticket machines on all train and metro stations, and single tickets can be bought on buses as well.

Maps





Acknowledgements and sponsors

We would like to thank our sponsors for their financial support.

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The booklet design is based on AMCOS_booklet as found at `https://github.com/maximelucas/AMCOS_booklet`.

Organising committee

Dagur Asgeirsson
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Maxime Ramzi
Vignesh Subramanian
Jan Tapdrup (centre administrator)

Schedule

Monday

08:30–09:20	Registration	
9:20–9:30	Opening address *Auditorium 1, HCØ building*	
9:30–10:05	**Coline Emprin** *Auditorium 1* Operadic calculus and formality criteria	**Jannes Bantje** *Auditorium 4* Spaces of positive scalar curvature metrics and parametrised Morse theory
10:05–10:40	**Leon Hendrian** *Auditorium 1* Monoidal structures in Orthogonal Calculus	**Kelly Maggs** *Auditorium 4* Signal compression and reconstruction on chain complexes using agebraic discrete Morse theory
10:40–11:00	Coffee / Tea	
11:00-11:35	**Thomas Brazelton** *Auditorium 1* Abstract Enumerative Geometry	**Adrian Dawid** *Auditorium 4* Floer Homology: Linking Topology and Dynamics
11:35–12:10	**Bastiaan Cnossen** *Auditorium 1* Characterizations of the category of genuine G-spectra	**Arturo Espinosa** *Auditorium 4* Topological complexity in presence of symmetries
12:10–13:30	Lunch	
13:30–14:30	**Gijs Heuts** *Auditorium 1* Unstable chromatic homotopy theory, I	
14:30–15:00	Coffee / Tea	
15:00–16:00	**Natàlia Castellana Vila** *Auditorium 1* Stratification and support techniques for classification problems in tt-categories, I	
16:30–18:00	Games *Auditoria 1 and 4*	
18:00–	Pizza reception *Vandrehallen, HCØ building*	

Tuesday

09:30–10:30	**Natàlia Castellana Vila** *Auditorium 1* Stratification and support techniques for classification problems in tt-categories, II	
10:30–11:00	Coffee / Tea	
11:00–12:00	**Gijs Heuts** *Auditorium 1* Unstable chromatic homotopy theory, II	
12:00–13:30	Lunch	
13:30–14:05	**Danika Van Niel** *Auditorium 1* Twisted topological Hochschild homology and Mackey functor fields	**Louis Martini** *Auditorium 4* Internal higher category theory
14:05–14:40	**Sebastian Chenery** *Auditorium 1* A Homotopy Theoretic Analogue to Wall's Theorem	**Julian Brüggemann** *Auditorium 4* On Merge Trees and Discrete Morse Functions on Trees
14:40–15:10	Coffee / Tea	
15:10–15:45	**Peter Marek** *Auditorium 1* Computing with Synthetic Spectra	**Ismael Sierra** *Auditorium 4* Splitting Complexes
15:45–16:20	**Liam Keenan** *Auditorium 1* The cyclotomic structure of $\mathrm{THH}(A + M)$	**David Beers** *Auditorium 4* The Fiber of Persistent Homology for Morse Functions
16:20–16:30	Short break	
16:30–	Poster session with drinks *Vandrehallen*	

Wednesday

09:30–10:30	**Gijs Heuts** *Auditorium 1* Unstable chromatic homotopy theory, III	
10:30–11:00	Coffee / Tea	
11:00–11:35	**Andrea Lachmann** *Auditorium 1* Localization for algebraic K-theory of stable infinty-categories	**Anna Sopena-Gilboy** *Auditorium 4* Filtered A-infinity structures in Complex Geometry
11:35–12:10	**Vera Gahlen** *Auditorium 1* Quaternionic line bundles over spin 7-manifolds	**Nicholas Sale** *Auditorium 4* Detecting Vortices with Persistent Homology
12:10–13:30	Lunch	
13:30–14:30	**Robert Ghrist** *Auditorium 1* Cellular Sheaves, Cohomology, & Applications, I	
14:30–15:00	Coffee / Tea	
15:00-15:35	**Luciana Basualdo Bonatto** *Auditorium 1* Grothendieck–Teichmüller theory and modular operads	**Dennis Nguyen** *Auditorium 4* Vector fields and complex cobordisms
15:35–16:10	**Alicia Lima** *Auditorium 1* On Brauer Groups of Lubin–Tate Spectra	**Sebastiano Cultrera di Montesano** *Auditorium 4* Persistence of 1D Maps: Geometric Characterization of Critical Point Pairs
18:00–	Canal tour *Nyhavn 71*	

Thursday

9:30–10:30	**Natàlia Castellana Vila** *Auditorium 1* Stratification and support techniques for classification problems in tt-categories, III	
10:30–11:00	Coffee / Tea	
11:00–11:35	**Robin Stoll** *Auditorium 1* The stable cohomology of self-equivalences of connected sums of products of spheres	**Rhea Palak Bakshi** *Auditorium 4* KBSM of the Connected Sum of Handlebodies and Chebyshev Polynomials
11:35–12:10	**Christian Kremer** *Auditorium 1* Manifold Models for the Classifying Space of Proper Actions	**Maria Simkova** *Auditorium 4* Are two finite H-spaces homotopy equivalent?
12:10–13:30	Lunch	
13:30–14:30	**Robert Ghrist** *Auditorium 1* Cellular Sheaves, Cohomology, & Applications, II	
14:30–15:00	Coffee / Tea	
15:00-15:35	**Carissa Slone** *Auditorium 1* Pullbacks and the Slice Filtration	**David White** *Auditorium 4* Symplectic instanton knot homology
15:35–16:10	**William Hornslien** *Auditorium 1* $\mathbb{A}^1$-homotopy classes of endomorphism of the projective line	**Álvaro Torras Casas** *Auditorium 4* Barcode Bases for computing Spectral Sequences, the impact of Local Data Changes and Induced Matchings
18:00–	Conference dinner *Bryggeriet, Vesterbrogade 3*	

Friday

9:30–10:05	**Konrad Bals** *Auditorium 1* Periodic Cyclic Homology of Derived Schemes	**Erik Lindell** *Auditorium 4* Stable Cohomology of $\mathrm{Aut}(F_n)$ with Twisted Coefficients
10:05–10:40	**Agnese Mantione** *Auditorium 1* Dependence of $\mathcal{R}^+(M)$ on the 2-type of M	**Jarl G. Taxerås Flaten** *Auditorium 4* Ext groups over a space
10:40–11:00	Coffee / Tea	
11:00–11:35	**Max Blans** *Auditorium 1* The Goodwillie tower of the identity at an odd sphere	**Tom Dove** *Auditorium 4* A fixed point decomposition of twisted equivariant K-theory
11:35–12:10	**Julie Rasmusen** *Auditorium 1* Introduction to Poincaré infinity-categories	**Abigail Hickok** *Auditorium 4* Theory and computation of persistence diagram bundles: A multidimensional generalization of vineyards
12:10–13:30	Lunch	
13:30–14:30	**Robert Ghrist** *Auditorium 1* Cellular Sheaves, Cohomology, & Applications, III	
14:30–15:30	Coffee / Tea	

Lecture series

Gijs Heuts

Unstable chromatic homotopy theory

The chromatic viewpoint on homotopy theory grew out of the desire to understand periodic families of elements in the homotopy groups of spheres. This viewpoint breaks homotopy theory up into "layers", each of which sees only families of a specific periodicity. The bottom layer corresponds to rational homotopy theory, and the next one is closely related to Bott periodicity in topological K-theory.

Since the work of Serre, Quillen, and Sullivan, the rational homotopy theory of spaces is well understood: it can be described algebraically, either in terms of differential graded Lie algebras or ("Koszul dually") in terms of commutative differential graded algebras. In these lectures we will first review rational homotopy theory from a present-day perspective. Then we will discuss a generalization to all of the chromatic layers of homotopy theory. This time the algebraic model involves "spectral Lie algebras", which are a lift of the theory of Lie algebras to higher algebra. We'll also look into the Koszul duality between these Lie algebras and the theory of commutative ring spectra.

I will not assume knowledge of chromatic homotopy theory from the audience, but some familiarity with the basic language of infinity-categories will be helpful. There are plenty of good introductions around, but let me mention Lurie's Kerodon website and Land's "Introduction to infinity-categories

Natàlia Castellana Vila

Stratification and support techniques for classification problems in tt-categories

Classifying objects up to isomorphism can be a very hard problem, even impossible in certain situations. When the category has more structure, e.g. tensor-triangulated, one can try to obtain a classification up to a weaker notion by understanding when an object is 'built' from another, that is, classifying thick and localizing tensor ideals.

Some classical examples are in the work of Benson–Carlson–Rickard in modular representation theory or Hopkins–Smith in stable homotopy theory. In both contexts, there is a notion of support associated to an object which is essential in the classification.

In a more general framework, Benson, Iyengar, and Krause developed a theory of support for compactly generated triangulated categories equipped with an action of a graded noetherian commutative ring which takes values in the spectrum of the ring. With this notion at hand, they described conditions which they called stratification implying such a classification for thick and localizing tensor ideals. This theory has been applied in many different situations and descent techniques have been developed, e.g. in Barthel–Castellana–Heard–Valenzuela.

More conceptually, for certain tensor triangulated categories Balmer introduced a topological space, the Balmer spectrum, based on thick tensor ideals which essentially solves the classification problem for thick tensor ideals in a universal way. Then, Balmer and Favi introduced a notion of support with values in the Balmer spectrum providing a more conceptual framework which relates to the previous ones. Recent work of Barthel, Heard and Sanders describes the stratification

conditions in this context which allow a classification for localizing tensor ideals when they are satisfied.

This minicourse will be an introduction to the formal theory and we will also see some concrete example applications coming from the classical study of classifying spaces in algebraic topology. No prior knowledge of tensor-triangulated geometry is assumed for this course.

Robert Ghrist

Cellular Sheaves, Cohomology, & Applications

This mini-course will provide a self-contained introduction to cellular sheaf theory and its applications. Sheaves are data structures over spaces, and, like spaces, they have a natural cohomology theory which characterizes qualitative features. Cellular sheaves are especially simple to work with, making them easy both to learn and to use. After introducing the basics of cellular sheaf theory, a number of applications will be given, from topological data analysis to optimization, modelling social dynamics, distributed consensus, and more. These applications will be seen to prompt several interesting new theoretical issues and challenges for defining sheaf cohomology with nonabelian coefficients.

There are no prerequisites for the course other than basic simplicial or cellular homology and cohomology. In particular, sheaf theory is not required: we will develop everything needed in the mini-course. It might help to have seen persistent homology in the context of topological data analysis (for which there are numerous survey papers and texts).

Contributed talks

Monday

Coline Emprin

Operadic calculus and formality criteria

A differential graded algebraic structure A (e.g. a dg associative algebra, a dg Lie algebra, a dg operad, etc.) is formal if it is connected to its homology H(A) by a zig-zag of quasi-isomorphisms preserving the type of algebraic structure. The formality of an algebraic structure actually reflects an intrinsic feature: the vanishing of some higher structure.

The aim of this talk is first to make precise the previous statement using the operadic calculus. I will then present how the equivalent characterization of formality thus obtained can be exploited to derive new formality criteria.

Jannes Bantje

Spaces of positive scalar curvature metrics and parametrised Morse theory

Scalar curvature is a purely geometric notion by definition. But it turns out, that there are topological obstructions to admitting a Riemannian metric of positive scalar curvature (psc). These obstructions can tell you a lot about the question of existence of psc metrics.

In my talk I want to focus on the natural follow-up question of uniqueness. This is correctly phrased as studying the homotopy type of the space of positive scalar curvature metrics. In particular I want to explain how methods of geometric topology pioneered by Madsen–Weiss and Galatius–Randal-Williams enter into a proof of nontriviality of these spaces. This will contain some new improvements by myself, that allow the incorporation of the fundamental group via group C*-algebras and higher index theory, while also dealing with the 5-dimensional case, that escaped previous methods.

Leon Hendrian

Monoidal structures in Orthogonal Calculus

Functor calculi such as Goodwillie Calculus or Orthogonal Calculus are tools in homotopy theory which allow the approximation of certain functors by so-called "n-polynomial functors" (for any n). In analogy with Taylor series of real-valued differentiable functions, they assemble into a "Taylor tower" of functors which "converges" in good situations to the original functor. One can thus try to reduce questions about the original functor to questions about its polynomial approximations, which are hopefully easier to describe.

Orthogonal Calculus is a specific form of calculus which assigns to a functor from the category of real vector spaces to the category of spaces its n-polynomial approximation functors. The most important examples of such functors are S^V, $BO(V)$, $BTOP(V)$.

This talk will first give a short introduction to functor calculus and then explain a type of multiplicative structures which were not previously incorporated in the theory. The language of symmetric monoidal infinity-categories will play a role but should not be essential for following the

talk.

Kelly Maggs

Signal compression and reconstruction on chain complexes using agebraic discrete Morse theory

In this work, we provide an approach to signal compression and reconstruction on chain complexes that leverages the tools of algebraic discrete Morse theory. The main goal is to reduce and reconstruct a based chain complex together with a set of signals on its cells via deformation retracts, with the aim of preserving parts of the global topological structure of both the complex and the signals.

We show that any deformation retract of real degree-wise finite-dimensional based chain complexes is equivalent to a Morse matching. We then study how the signal changes under particular types of Morse matching, showing its reconstruction error is trivial on specific components of the Hodge decomposition. Furthermore, we provide an algorithm to compute Morse matchings which locally minimizes reconstruction error.

This is joint work with Stefania Ebli and Celia Hacker.

Thomas Brazelton

Abstract Enumerative Geometry

Enumerative geometry asks questions of the form "how many?" and expects integral answers. For example: many circles are tangent to three circles lying in the plane? How many lines are on a cubic surface? By the dawn of the 20th century, Schubert's principle of conservation was widely accepted: that we should expect unified answers to problems, independent upon initial parameters (e.g. there exist 27 lines on any smooth cubic surface). His conservation of number might be topologically phrased as the fact that a top Chern class can be computed as Poincaré dual to any generic section of a bundle. We might abstractly expect to see enumerative geometry wherever homotopy theory lives. Morel and Voevodsky's $\mathbb{A}^1$-homotopy theory has led to an explosion of results in enumerative geometry over arbitrary fields, spearheaded by Levine, Wickelgren, and others. This body of work produces refined answers to enumerative questions, given by symmetric matrices over a field whose invariants reveal information about the underlying geometry. In this talk we will outline progress in a new direction of enumerative geometry: producing refined answers to enumerative questions when there is ambient symmetry arising from the action of a finite group.

Adrian Dawid

Floer Homology: Linking Topology and Dynamics

Since its inception a little more than three decades ago, Floer homology has become one of the most important tools in symplectic topology. This expository talk will introduce the key ideas and intuitions behind Floer homology. The theory was originally developed to prove the Arnold conjecture, which proposes the sum of the Betti numbers as a lower bound on the number of fixed points of a Hamiltonian diffeomorphism on a symplectic manifold. The idea of this proof will be outlined in a special case. However, Floer homology has since become a topic of independent interest. Another aspect that will be presented is the natural persistence structure of Floer homology. This allows for a fruitful application of methods originating from topological data

analysis to problems in Floer theory.

Bastiaan Cnossen

Characterizations of the category of genuine G-spectra

Given a compact Lie group G, the genuine G-spectra are the objects representing ($RO(G)$-graded) cohomology theories on G-spaces. The (∞-)category of these objects is known to be obtained from pointed G-spaces by either 1) universally forcing smashing with representation spheres $S^V = V \cup \{\infty\}$ to be an equivalence for all f.d. G-representations V, or 2) universally forcing stability and forcing all finite G-CW-complexes to become dualizable. We discuss a third characterization, using the language of parameterized category theory: the G-category of genuine G-spectra is obtained from pointed G-spaces by universally forcing stability and asking certain *Wirthmüller morphisms/twisted norm maps* $\mathrm{ind}_H^G(X \wedge D_{G/H}) \to \mathrm{coind}_H^G(X)$ to be equivalences.

Arturo Espinosa

Topological complexity in presence of symmetries

Topological complexity was introduced by Michael Farber as a tool to tackle the motion planning problem in robotics from a topological perspective, and it quickly proved to be an interesting invariant in its own right. In this talk we introduce two topics of research in the field. First, the task of studying the topological complexity of aspherical spaces, for which we offer the approach of characterizing the TC of a group G in terms of the A-genus in the sense of Clapp and Puppe. Second, the study of how symmetries can help in the analysis of configuration systems in topological robotics. We will make a short review on equivariant and invariant notions of TC, to focus later on the notion of effective topological complexity, first defined by Błaszczyk and Kaluba, and develop an analogue of LS-category to the effective setting, which allows us to study fundamental properties of effective TC. This is a work in progress jointly with Dr. Błaszczyk and Dr. Viruel.

Tuesday

Danika van Niel

Twisted topological Hochschild homology and Mackey functor fields

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

Louis Martini

Internal higher category theory

Internal higher category theory is the study of categories internal to an ∞-topos $\mathscr{B}$, or equivalently

of sheaves of ∞-categories on $\mathcal{B}$. Such structures often arise when doing (higher) algebra and geometry in which the objects of interest carry additional data that can be captured through a parametrisation by the ∞-topos $\mathcal{B}$, for example in form of a condensed/pyknotic structure. Studying these objects through the lens of internal higher category theory allows one to ignore this additional structure and to treat them in the same fashion as their unparametrised counterparts. In my talk I report on recent progress in the development of this framework and discuss some possible applications in algebra and geometry.

Sebastian Chenery

A Homotopy Theoretic Analogue to Wall's Theorem

It is a well-known result of C.T.C. Wall's that one may decompose a simply connected 6-manifold as a connected sum of two simpler manifolds. Recent work of Beben and Theriault on decomposing based loop spaces of highly connected Poincaré Duality complexes has yielded new methods for analysing the homotopy theory of manifolds. In this talk we will expand upon these methods, which we will then apply to prove a higher dimensional homotopy theoretic analogue to Wall's Theorem.

Julian Brüggemann

On Merge Trees and Discrete Morse Functions on Trees

Discrete Morse Theory is a versatile tool to analyze regular CW complexes and, in particular, simplicial complexes in many contexts. We focus on the sublevel filtration induced by a discrete Morse function and on the persistent connectivity of said filtration. The combinatorial data of persistent connectivity can be tracked by the induced merge tree. In this talk, I will give an introduction to merge trees and discuss the case of discrete Morse functions on trees. For that case, I will discuss sublevel-symmetry equivalences and component-merge equivalences under which the induced merge tree turns out to be invariant. These notions of equivalence lead to a classification result for discrete Morse functions on trees: Any discrete Morse function on a tree is up to matched cells, symmetry equivalences, and component-merge equivalences uniquely determined by the isomorphism class of its induced Morse-labeled merge tree.

Peter Marek

Computing with Synthetic Spectra

In recent years, our understanding of stable homotopy groups of spheres at $p = 2$ increased drastically due to work of Isaksen, Wang, and Xu. A primary method they used is the "cofiber-of-tau philosophy" in the stable infinity category of 2-complete C-motivic spectra. To a sufficiently nice spectrum E, Pstragowski produced an infinity-categorical deformation of spectra called "E-synthetic spectra," which exhibits and generalizes the cofiber-of-tau phenomena seen in C-motivic spectra. E-synthetic spectra are closely related to the E-Adams spectral sequence and this relation has had many applications in recent years for Adams spectral sequence calculations.

In this talk, we discuss some of the basic calculational features of synthetic spectra in the case of $E = HF_2$, including how to compute bigraded synthetic homotopy groups and their applications to classical Adams spectral sequence calculations for $p = 2$. In particular, we discuss our computation of the bigraded synthetic homotopy groups of 2-complete tmf, the connective topological modular

forms spectrum.

Ismael Sierra
Splitting complexes
I will talk about certain semisimplicial spaces associated to manifolds called splitting complexes. The study of these is a substantial part in understanding homological stability of diffeomorphism groups from the perspective of E_k algebras, and in the talk I would outline which properties of these complexes are relevant and how to understand them.

Liam Keenan
The cyclotomic structure of $\mathrm{THH}(A + M)$
One of the key steps in the proof of the Dundas–Goodwillie–McCarthy theorem, is an analysis of the topological cyclic homology of a trivial square-zero extension of ring spectra. This permits one to calculate the Goodwillie derivative of topological cyclic homology. As an intermediary step, it is necessary to understand the structure of topological Homology homology as a cyclotomic spectrum. In this talk, I will explain how to obtain the cyclotomic structure of $\mathrm{THH}(A + M)$ entirely in terms of THH with coefficients, and how this can be used to identify the Goodwillie derivatives of both topological cyclic homology and topological restriction homology.

David Beers
The Fiber of Persistent Homology for Morse Functions
Persistent homology (PH) is a landmark algorithm in topological data analysis which takes as input a topological space equipped with a real valued function and returns a barcode, a multiset of intervals in the real line. It is natural to ask how much information is lost by applying PH: what is the space of functions on a fixed topological space whose persistent homology is a given barcode? We provide a partial answer when the topological space is a compact manifold and we restrict our attention to Morse functions. In this setting, each path component is exactly the orbit of any of its elements under the action of the identity component of the diffeomorphism group. Using this identification we derive properties of the fiber of PH in certain cases, in particular computing the homotopy type of its path components for Morse functions on compact orientable surfaces.

Wednesday

Andrea Lachmann
Localization for algebraic K-theory of stable infinty-categories
The Localization Theorem is a classical result by Quillen, which for any localization of rings yields a long exact sequence of K-groups. In this talk we will generalize this result to the language of the algebraic K-theory functor from stable infinity-categories to spaces or ring spectra. (Previous knowledge about infinity-categories is not required.)
This talk is based on my master's thesis and joint work with Fabian Hebestreit.

Anna Sopena-Gilboy
Filtered A-infinity structures in Complex Geometry

I will present a filtered version of the Homotopy Transfer Theorem, which gives an A-infinity algebra structure on any page of the spectral sequence associated to a filtered dg-algebra. We apply this theory to the study of the geometry and topology of complex manifolds by considering the Frölicher spectral sequence.
On a complex manifold, the Hodge filtration gives rise to the Frölicher spectral sequence, which connects the Dolbeault cohomology (an analytic invariant) with the de Rham cohomology (a topological invariant). In this talk, we will explore this connection from the multiplicative viewpoint: the main objective is to understand how products (and higher products) on de Rham cohomology behave with respect to the bigradings of this spectral sequence.

Vera Gahlen
Quaternionic line bundles over spin 7-manifolds
Real and complex line bundles are classified by their characteristic classes in ordinary cohomology. This fails to be true for quaternionic line bundles because their classifying space is not an Eilenberg-MacLane space.
We begin with a brief introduction to quaternionic line bundles and their classification in the 'stable range', that is over cell complexes of dimension at most 5. Beyond this range, the talk will then focus on certain spin 7-manifolds as base spaces. We will discuss two different ways to decompose the base manifolds and how these decompositions jointly allow for a classification of quaternionic line bundles.

Nicholas Sale
Detecting Vortices with Persistent Homology
Topological objects lie at the heart of some of the most fascinating phase transitions in physics. I will argue that persistent homology provides a good means to detect these objects and perform quantitative analysis of phase transitions. I will introduce the idea with vortices in the XY model before moving onto recent work looking at the influence of center vortices in $SU(2)$ lattice gauge theory.

Luciana Basualdo Bonatto
Grothendieck–Teichmüller theory and modular operads
The absolute Galois group of the rationals $\mathrm{Gal}(\mathbb{Q})$ is one of the most important concepts in number theory. Although we cannot explicitly describe more than two elements in this infinite group, we know it acts on well-known algebraic and topological objects in compatible ways. Grothendieck–Teichmüller theory uses these representations to study this Galois group. One of the most important representations comes from the compatible actions of $\mathrm{Gal}(\mathbb{Q})$ on all the profinite mapping class groups of surfaces. In this talk, I would introduce an algebraic tool called an infinity modular operad and use it to construct an infinity modular operad of surfaces capturing the compatibility structure above. We show this admits an action of $\mathrm{Gal}(\mathbb{Q})$, translating the Grothendieck–Teichmüller program into the theory of infinity modular operads, which provides new ideas and tools to approach this problem. This is joint work with Marcy Robertson.

Dennis Nguyen
Vector fields and complex cobordisms

The classifying space of the cobordism category was determined by Galatius, Tillmann, Madsen and Weiss to have the homotopy type of a Thom spectrum. Bokstedt and Svane gave an interpretation of the homotopy groups of the cobordism category as cobodism groups where all manifolds are equipped with sections of the tangent bundle. Bokstedt, Dupont and Svane computed these groups in a few cases. I repeated these results for almost complex manifolds and used them to prove several theorems about complex cobordism theory.

Alicia Lima

On Brauer Groups of Lubin–Tate Spectra

Fix a perfect field k of characteristic $p > 0$ and G_0 a height n (finite) over k. Lubin and Tate showed that the formal group G_0 admits a universal deformation G over a complete local ring R with residue field k. Let E be the spectrum obtained by applying Landweber exact functor theorem to the pair (R, G)– one calls E the Lubin–Tate ring spectrum (which is closely related to the Morava $E(n)$-theory). In their paper, "On Brauer Groups of Lubin–Tate Spectra I", Lurie and Hopkins compute the Brauer group $\mathrm{Br}(E)$ of E up to a filtration. In this talk, I will go over main computation (and techniques) in this paper.

Sebastiano Cultrera di Montesano

Persistence of 1D Maps: Geometric Characterization of Critical Point Pairs

We characterize critical points of 1-dimensional maps paired in persistent homology geometrically and this way get elementary proofs of theorems about the symmetry of persistence diagrams and the variation of such maps. In particular, we identify branching points and endpoints of networks as the sole source of asymmetry and relate the cycle basis in persistent homology with a version of the stable marriage problem. Our analysis provides the foundations of fast algorithms for maintaining collections of interrelated sorted lists together with their persistence diagrams. Joint work with R. Biswas, H. Edelsbrunner and M. Saghafian.

Thursday

Robin Stoll

The stable cohomology of self-equivalences of connected sums of products of spheres

I will explain an identification of the cohomology of the stable classifying space of homotopy automorphisms (relative to an embedded disk) of connected sums of $S^k \times S^l$, where $2 < k < l < 2k - 1$. The result is expressed in terms of Lie graph complex homology, the construction of which I will recall.

Rhea Phalak Bakshi

KBSM of the Connected Sum of Handlebodies and Chebyshev Polynomials

Skein modules were introduced by Józef H. Przytycki as generalisations of the Jones and HOMFLYPT polynomial link invariants in the 3-sphere to arbitrary 3-manifolds. The Kauffman bracket skein module (KBSM) is the most extensively studied of all. However, computing the KBSM of a 3-manifold is known to be notoriously hard, especially over the ring of Laurent polynomials. With the goal of finding a definite structure of the KBSM over this ring, several

conjectures and theorems were stated over the years for KBSMs. We show that some of these conjectures, and even theorems, are not true. In this talk I will briefly discuss a counterexample to Marche's generalisation of Witten's conjecture. I will show that a theorem stated by Przytycki in 1999 about the KBSM of the connected sum of two handlebodies does not hold. I will also give the exact structure of the KBSM of of the connected sum of two solid tori and show that it is isomorphic to the KBSM of a genus two handlebody modulo some specific handle sliding relations. Moreover, these handle sliding relations can be written in terms of Chebyshev polynomials.

Christian Kremer

Manifold Models for the Classifying Space of Proper Actions

For many discrete groups Γ, the classifying space of proper Γ-actions has a natural manifold model, e.g. Teichmüller space for mapping class groups. But the question, whether for a given discrete group Γ, the classifying space of proper actions admits a cocompact manifold model, and if such models are unique, is quite hard to answer.

This problem is an equivariant version of the now well-tested Borel-Conjecture, and it also has applications to the high-dimensional Nielsen realization problem.

We describe some relations of the problems described above and state some current results, the newest of which being due to Davis–Lück (2022). In particular, we describe a strategy how to attack a construction of the classifying space of proper actions and sketch our own progress on certain steps of the strategy. We heavily rely on surgery theory and affirmative answers to the Farrell–Jones conjecture for large classes of groups.

Maria Simkova

Are two finite H-spaces homotopy equivalent?

This talk proposes an algorithm that decides if two simply connected spaces represented by finite simplicial sets of finite k-type and finite dimension d are homotopy equivalent. If the spaces are homotopy equivalent, the algorithm finds a homotopy equivalence between their Postnikov stages in dimension d. As a consequence, we get an algorithm deciding if two spaces represented by finite simplicial sets are stably homotopy equivalent.

Carissa Slone

Pullbacks and the Slice Filtration

The slice filtration focuses on producing certain spectra, called slices, from a genuine G-spectrum X over a finite group G. There are several constructions which inflate a G/N-spectrum X to a G-spectrum, which generally do not coincide. We will examine three such constructions, when they coincide, and how this relates to slices of Eilenberg-Mac Lane spectra over C_4 and Q_8.

David White

Symplectic instanton knot homology

There have been a number of constructions of Lagrangian Floer homology invariants for 3-manifolds defined in terms of symplectic character varieties arising from Heegaard splittings. We develop a relative variant of one of these, due to H. Horton, for a knot or link K in a closed, oriented 3-manifold Y, which we call symplectic instanton knot homology (SIK). This

work draws upon the already extensive study done on the symplectic properties of character varieties with suitable holonomy restrictions. The nature of our construction is motivated in large part by the aim of allowing the result to be alternatively obtained as the quilted Floer homology associated to a Cerf decomposition of Y and concomitant tangle decomposition of K, making use of work toward a Floer field theory for tangles by Wehrheim and Woodward.

William Hornslien

$\mathbb{A}^1$-homotopy classes of endomorphism of the projective line.

A fundamental problem in algebraic topology is the study of homotopy groups of spheres. In classical topology, the projective line over $\mathbb{R}$ is a 1-sphere, and the projective line over $\mathbb{C}$ is a 2-sphere. $\mathbb{A}^1$-homotopy theory is a homotopy theory for smooth algebraic varieties, and the projective line is a sphere in this homotopy theory. Due to the algebraic nature of varieties, we can describe all endomorphisms of the projective line, which in turn makes it easier to study its homotopy classes. This is joint work with Viktor Barth, Gereon Quick, and Glen Wilson

Álvaro Torras Casas

Barcode Bases for computing Spectral Sequences, the impact of Local Data Changes and Induced Matchings

One of the main strengths in persistent homology is that a persistent module is uniquely determined—up to isomorphism—by its interval decomposition. This, however, does not hold for multiple persistence parameters, and in particular, persistence morphisms or "ladder modules". In this talk, I will describe bases of persistence modules which are characterised by generation and linear independence; in an analogous way to traditional linear algebra. In this context, a persistence morphism is encoded by a single matrix and one might reduce it by using "pivots" that differ from the traditional definition. This allows computing images, kernels and quotients of persistence modules in an optimal way. As an illustrative example, we will review the Bauer–Lesnick Structure Theorem of Submodules and Quotients from this viewpoint.

As the main example, I will explain how to use this machinery to compute the Persistence Mayer–Vietoris spectral sequence, as well as a generalised version that computes the homology of a construction which is very similar to a homotopy colimit. This can be used to parallelize persistent homology computations on Vietoris–Rips complexes.

In addition, I will explain an application to understanding the impact of local data changes on persistent homology. This work is part of my thesis at Cardiff University, supervised by Dr. Ulrich Pennig. If time permits, I will briefly describe a further application developed at Universidad de Sevilla for obtaining matchings induced by persistence morphisms; this is joint work with Manuel Soriano-Trigueros and Prof. Rocío González-Díaz.

Friday

Konrad Bals

Periodic Cyclic Homology of Derived Schemes

The periodic cyclic homology of derived schemes over Q-algebras can be explicitly described. This discription, moreover, gives a precise condition on when the HKR-filtration first constructed

by Antieau and later by Bhatt–Lurie is exhaustive.

Erik Lindell

Stable cohomology of $\mathrm{Aut}(F_n)$ *with twisted coefficients*

The group $\mathrm{Aut}(F_n)$ acts on $H := H_1(F_n, Q)$, so we may study the group cohomology $H^*(\mathrm{Aut}(F_n); \mathrm{Hom}_Q(H^{\otimes}p, H^{\otimes q}))$ for non-negative p and q. When n is sufficiently large in comparison to p, q and the cohomological degree, these groups have been computed by Randal-Williams in the cases where either p or q is zero. A conjectural description of the stable cohomology groups for all p and q has been given by Djament. It has also been shown by Kawazumi and Vespa that in the stable range, these groups assemble into a so-called wheeled PROP and in these terms the conjecture by Djament can be stated as saying that this wheeled PROP is free on one generator. I want to talk about how this conjecture can be proven, by essentially pushing the methods of Randal-Williams a bit further.

Agnese Mantione

Dependence of $\mathcal{R}^+(M)$ *on the 2-type of* M

In this talk we will introduce the space of positive scalar curvature metrics on a closed manifold M of dimension greater than 4, and then discuss a conjecture that asserts the latter space only depends on the 2-type of M. Finally we give a sketch of the proof of the conjecture for certain 2-types.

Jarl G. Taxerås Flaten

Ext groups over a space

Any space X has its own logic. Constructions carried out in this logic produce spaces over X, and the definition of some structure produces the space of all such structures over X. After a brief introduction to this logic, we will define the notion of short exact sequence (s.e.s.) of abelian groups, thus obtaining the space of such sequences. A s.e.s. induces a fibre sequence whose long exact sequence of homotopy groups is the familiar six-term exact sequence of Ext groups from a first course in homological algebra. If X is simply a point, then we literally recover the classical six-term exact sequence. If X is pointed and connected, then ours is a sequence of $\pi_1(X)$-modules. In general, ours is a six-term exact sequence of "local" (or "internal") Ext groups, which we end by explaining.

Most of what I'll present has been formalized in Homotopy Type Theory, and is joint work with Dan Christensen.

Max Blans

The Goodwillie tower of the identity at an odd sphere

It is a classical theorem by Serre that $S^{2n+1} \to \Omega^\infty \Sigma^\infty S^{2n+1}$ induces an isomorphism on rational homotopy groups. I will explain a vast generalization of this result, due to Arone and Mahowald. A part of this explanation will consist of a crash course in Goodwillie calculus and v_n-periodic homotopy theory.

Tom Dove

A fixed point decomposition of twisted equivariant K-theory

Mathematicians' interest in twisted K-theory is largely the result of a flow of ideas between mathematics and physics over the past few decades. This talk is about its generalisation to spaces with symmetries, twisted equivariant K-theory, which gained attention in the work of Freed, Hopkins, and Teleman due to its relationship with the representation theory of loop groups. Based on joint work with Thomas Schick and Mario Velásquez, I'll present a generalisation of a theorem by Atiyah and Segal, who proved that for finite groups one can rationally decompose equivariant K-theory into the K-theory groups of fixed point spaces. This plays on a common theme in the study of spaces with group actions; one can learn a lot by looking at the fixed points.

Julie Rasmusen

Introduction to Poincaré infinity-categories

Andrew Ranicki's theory of algebraic surgery played a central role in linking manifold theory, algebraic K-theory and L-theory. In recent years work by Calmès-Dotto-Harpaz-Hebestreit-Land-Moi-Nardin-Nikolaus-Steimle have moved this theory into the modern framework of stable infinity-categories. In this expository talk I will give a short introduction to this new approach using Poincaré infinity-categories, with the goal being to understand the universal property of the L-theory and Groethendieck-Witt spectra in this setting.

Abigail Hickok

Theory and computation of persistence diagram bundles: A multidimensional generalization of vineyards

In topological data analysis, we use algebraic topology to analyze the shape and global structure of a data set (e.g., a point cloud). In particular, we use persistent homology (PH) to study how the topology of a data set changes as a "scale parameter" changes. Developing new methods for analyzing how the topology changes as multiple parameters vary is a very active area of research. For example, if a point cloud evolves over time, then one might be interested in using time as a second parameter. In nature, common examples of time-evolving point clouds include swarming or flocking animals whose positions and/or velocities are represented by points. In many of these dynamical systems, distinct topological features arise in different parameter regimes. When there are only two parameters (e.g., a scale parameter and time), one can efficiently compute a "vineyard", which encodes how PH changes over time. In this work, I generalize the concept of a vineyard to a "persistence diagram bundle", in which PH varies over an arbitrary topological space T. For example, T may be a sunset of $\mathbb{R}^n$ over which an arbitrary number of parameters vary. In the special case where T is an interval in $\mathbb{R}$, a persistence diagram bundle is equivalent to a vineyard. Another special case ($T = S^n$) is the persistent homology transform, which can be used to study the shape of an object in $\mathbb{R}^{n+1}$ from the perspective of all possible directions. I will discuss an algorithm for efficiently computing piecewise-linear PD bundles.

Posters

Alba Sendón Blanco

Simple Homotopy Type and Rings

In an attempt to study homotopy theory of polyhedra in a combinatorial way, Whitehead introduced the notions of simplicial collapse and expansion at the end of the 1930s. These movements preserve the homotopy type of the complex, but in general the converse does not hold: not any two homotopy equivalent complexes can be connected by a chain of expansions and collapses. Therefore, the notion of simple homotopy type became famous and widely studied among a lot of topologists. Apart from this, the relation of finite simplicial complexes with polynomial rings has proved to be fruitful for studying topological features such as their homology. In our case, we will choose three finite simplicial complexes with different (simple) homotopical characteristics, and try to analyze the impact of these differences in some mathematical objects related to these polynomial rings. From this study, we will try to extract some naive conjectures that might lead to further work.

Thomas Blom

Goodwillie calculus and the functional derivate

Goodwillie calculus is a method in homotopy theory for approximating functors by so-called polynomial functors, which are often simpler to work with than the original functor. This can be seen as an analogue of approximating a real-valued function using its Taylor series. On this poster, I describe the Goodwillie calculus of functors between categories of diagrams. Taking the analogy with real analysis very seriously, this should be a categorification of some kind of "calculus for functionals". It turns out that this is indeed the case, and that concepts such as the functional derivative admit analogues in Goodwillie calculus.

Prerak Deep

Contact surgery

We will discuss the concept of contact Dehn surgery. Contact Dehn surgery is a Dehn surgery on some contact 3-manifold such that the resultant manifold has contact structure. Later, we will see some motivation for exploring the contact analogue of the Kirby theorem.

Kaya Ferendo

FI calculus and representation stability

Let FI be the category of finite sets and injections. We define a flavor of functor calculus for functors from FI to an arbitrary stable presentable ∞-category $\mathcal{V}$ (henceforth we suppress the "∞-"). Our notion of FI calculus is analogous to and has some features in common with Michael Weiss' orthogonal calculus. We show that FI calculus can be precisely understood as a homotopical elaboration of the phenomenon of representation stability.

Our main results are that the "coefficients" of a "formal Taylor tower" admit natural transformations between them that turn these coefficients, considered in aggregate, into an FI-$\mathcal{V}$-object themselves; that a certain subcategory of formal Taylor towers is equivalent to a corresponding subcategory of

FI-$\mathcal{V}$-objects (and for some $\mathcal{V}$, this equivalence applies to the entire categories respectively); and that for $\mathcal{V}$ the category of rational chain complexes, representation stability phenomena in the homology of an FI-chain complex can be read off from its coefficients.
Our techniques allow us to extract information about the interaction between homological dimensions in the representation stable part of an FI-chain complex. When $\mathcal{V}$ is monoidal, we also construct novel monoidal structures on a subcategory of FI-$\mathcal{V}$-objects which turn the aggregate coefficient functor into a monoidal functor.

Tomas Mejia Gomez

A topological Rasmussen spectral sequence

There is a stable homotopy link invariant, called the symmetry breaking spectrum by Kitchloo, defined by geometrically lifting the Soergel bimodule construction of HOMFLY-PT homology. Under a suitable twisting of Borel equivariant cohomology, one may obtain a link invariant and a spectral sequence converging to it from HOMFLY-PT homology. In this work, we show how this turns out to be a version of the Rasmussen spectral sequence which converges to $\mathrm{sl}(n)$ link homology. This topological formulation opens up new avenues for refined link invariants, such as the additional structure afforded by cohomology operations, or the possible consideration of other cohomology theories.

Davide Gurnari

Extensions of Mapper-type algorithms and their applications to knot theory

Mapper-type algorithms are useful tools for revealing the shape of high dimensional data and visualising functions over them. In this poster, I will present new versions of such algorithms that incorporate the symmetries within the data and provide ways to compare various descriptors. Inspiration for these extensions came from the analysis of knot theory data that I will use as an example throughout the presentation. This is joint work with Paweł Dłotko and Radmila Sazdanovic.

Niklas Hellmer

Topology of Random Geometric Complexes and Applications to Statistical Hypothesis Testing

It is a classical task in statistics to decide whether a point cloud X was sampled from a certain distribution P. We propose a novel approach to this problem using ideas from computational topology. Specifically, we compare the Euler characteristic of the Cech complex built on top of the point cloud X with the expected Euler characteristic of a sample from P. We study the power of this test procedure in both theory and numerical experiments.

Magai German Igorevich

Geometric and topological properties of the internal representation of neural networks

The purpose of this work is to describe and justify the geometric and topological views on the learning process of neural networks. Our attention is focused on the internal representation of neural networks and on the dynamics of changes in the topology and geometry of a set of data on different layers of neural network models. We also propose a method for assessing the generalizing ability of neural networks based on topological descriptors. In this work, we use the concepts of topological data analysis (TDA) and intrinsic dimension (fractal homological persistence

dimension) and present a wide range of experiments with different configurations of convolutional neural network architectures.

Shai Keidar

The telescopic Galois, Picard and Brauer groups

Using the periodic structure of $T(n)$-local spectra we construct $2(p^n - 1)$-torsion elements of its Picard group. These lift, using higher Kummer theory, to new examples of Galois extensions of the $T(n)$-local sphere. We then use cyclic Galois extensions to construct cyclic Azumaya algebras and prove that for $T(n)$ and $K(n)$-local spectra these algebras are non-trivial Brauer elements.

Evgeniya Lagoda

Configuration spaces and where to find them

How many distinct periodic billiard trajectories of length k are there in a smooth convex body in $\mathbb{R}^d$? What is the smallest dimension of $\mathbb{R}^N$ such that there exists a function f from $\mathbb{R}^d$ to $\mathbb{R}^N$, which sends any k distinct points in $\mathbb{R}^d$ to linearly independent vectors in $\mathbb{R}^N$? Can every convex polygon in the plane be partitioned into any prescribed number k of convex pieces that have equal area and equal perimeter?

In this poster, we will see how configuration spaces of k distinct points in $\mathbb{R}^d$ help us in answering the above questions.

Sil Linskens

Global spectra via partially lax limits

Global stable homotopy theory is a formalism which admits applications to orbifold cohomology, elliptic cohomology and importantly equivariant stable homotopy theory. Many important equivariant spectra admit global refinements, and these refinements have led to theoretical advances and have aided in calculations. However not only does global homotopy theory admit applications to equivariant homotopy theory, but it seems reasonable to expect that global stable homotopy theory is in some sense determined by equivariant stable homotopy theory. For example, there exist a restriction functor which sends a global spectrum to a G-spectrum for every compact Lie group G. Furthermore these collectively form a conservative family of functors. I will present a result which explains exactly how the infinity category of global spectra is built from the infinity categories of G-spectra. It says that the infinity category of global spectra is a partially lax limit of a diagram indexing the infinity categories of G-spectra for all G, lax on the surjections and strict on the injections. (The work presented is joint with Denis Nardin and Luca Pol.)

Pedro Magalhães

Rational homotopy and Hodge theory in Kähler geometry

The interaction of Hodge structures with rational homotopy theory is a powerful tool to provide restrictions on the homotopy types of Kähler manifolds and of complex algebraic varieties. An example is the well-known result of Deligne, Griffiths, Morgan and Sullivan, stating that compact Kähler manifolds are formal. In the simply connected case, it implies, for instance, that the rational homotopy groups of such manifolds are a formal consequence of the cohomology. Despite this fact, the mixed Hodge structure on their rational homotopy groups is not, in general, a formal

consequence of the Hodge structures on cohomology. In order to understand this phenomenon, we will begin by introducing basic concepts of rational homotopy theory and then look into a stronger notion of formality which solves this problem. This stronger formality arises from studying homotopy theory in diagram categories and combining the classical notion of formality with filtered versions. We will also take a look into possible obstructions to this strong formality, generalizing the classical ones, and see where one could apply this theory to study, for instance, almost complex manifolds.

Ajay Raj

Structure set of sphere bundles over sphere

The structure set of a manifold M classifies manifolds upto homeomorphism that are homotopy equivalent to M. For example the structure set of S^3 is trivial by Poincare Conjucture. I shall discuss about structure set of shpere bundles over sphere using surgery exact sequence. A surgery exact sequence consists of L-group, normal invatriant and structure set.

Thomas Read

G-typical Witt vectors with coefficients and the norm

The norm is an important construction in stable equivariant homotopy theory, developed by Hill, Hopkins and Ravenel in their work on the Kervaire invariant one problem. Given a spectrum Z and a finite group G, the norm $N_e^G Z$ is a G-spectrum whose underlying spectrum is the smash product of $|G|$ copies of Z. Witt vectors are an algebraic construction first used for Galois theory in the 1930s, but later found to arise naturally in the study of topological Hochschild homology. This topological connection motivated Dotto et al. to define a more general notion of Witt vectors with coefficients in a module. Another generalisation is given by Dress and Siebeneicher, who introduced G-typical Witt vectors for G a profinite group. We build on these ideas to define G-typical Witt vectors with coefficients, and show that they give a purely algebraic description of the zeroth equivariant stable homotopy group of the norm of a connective spectrum.

Jordi Daura Serrano

Determining the structure of 2-step nilmanifolds using finite group actions

A natural problem in the theory of finite transformation groups is to find which finite groups can act effectively on a given closed manifold. We can also consider the inverse question, given a collection of groups acting effectively on a closed manifold M, is it possible to determine M?

In general, the answer is no since there are plenty of examples of non-homeomorphic manifolds which do not admit any effective finite group action. However, we can get affirmative results if we restrict the class of manifolds we study and we assume that the collection of groups contains arbitrarily large groups. For example, if we assume that M is a closed nilmanifold of dimension n which supports actions of $(\mathbb{Z}/a)^n$ for arbitrarily large a, then M is homeomorphic to a torus.

In this poster we present some consequences of having large finite group actions on 2-step nilmanifolds, which can be seen as the total space of principal torus bundles over tori. In particular, we present a splitting result for 2-step nilmanifolds as a first step towards finding analogous results to the torus case.

Maximilian Stegemeyer

Geodesic complexity of Riemannian manifolds

Geodesic complexity is a geometric version of Farber's topological complexity for Riemannian manifolds with motion planners taking values only in the set of length-minimizing geodesics. It turns out that geodesic complexity strongly depends on the cut locus of the manifold. In joint work with Stephan Mescher we study conditions on cut loci of Riemannian manifolds which guarantee upper and lower bounds, respectively, on geodesic complexity. We use these bounds to explicitly determine the geodesic complexity of certain examples.

Eunice Sukarto

On the K-theory of pullbacks

This is an expository introduction to Land–Tamme's paper of the same title. Unlike topological K-theory, excision fails in the algebraic setting. Land–Tamme's main result says that for every pullback square of ring spectra, there is a new ring spectrum which can be used to describe the failure of excision in algebraic K-theory. Indeed, it describes the failure of excision for any localizing invariant and improves previously known results. Moreover, when applied to certain pullback squares of discrete rings called Milnor squares, we get a long exact excision sequence of K-groups extending a classical one which stops at degree one.

Otto Sumray

Multiscale spectral methods for feature selection in single cell data

Advances in single cell RNA-sequencing techniques enables the analysis of variations in gene expression levels of cells to unprecedented detail. As well as distinct clustering into overarching cell types, continuous patterns of transcriptional variation become visible that are associated with differentiation pathways and individual cell behaviour. Classical methods for detection of gene or feature markers driving variation between populations of cells often rely on pre-defining clusters and computing the features that discriminate them (i.e., differential gene expression). The complexity found in modern single cell transcriptomics datasets calls for more intricate methods that can cope with the continuous structure as well as discrete clustering and identify coherent gene expression patterns of interest on multiple scales in the dataset.

We propose topologically-motivated methods for unsupervised and semi-supervised feature selection that consider discrete and continuous transcriptional patterns on equal footing across multiple scales simultaneously, based on the mathematics of spectral graph theory.

List of participants

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