Topology
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KRISTINE BAUER, University of Calgary

Operad structures in the abelian functor calculus tower

This is joint work with Brenda Johnson and Sarah Yeakel.

In 2005, Ching showed that the derivatives of the Goodwillie tower of the identity functor of spaces form an operad. This implied that the derivatives of all homotopy functors have extra algebraic structure, and was used most notably by Arone and Ching to show that the Goodwillie derivatives satisfy a (higher order) chain rule.

In 2016 Johnson, Osborne, Riehl and Tebbe and I showed that abelian functor calculus (a version of functor calculus established by Johnson and McCarthy) is an example of a cartesian differential category - the type of category which axiomatizes classical calculus. A higher order chain rule followed.

In this talk, I will explain that the derivatives of certain abelian functor calculus towers also form an operad, and explain to what extent this is a result of the fact that the category of abelian categories is a differential category. This is closely related to the work of Cockett and Seely which established a Faa di Bruno formula for differential categories.

JOHN BERMAN, University of Texas at Austin

Rational Euler Characteristic

The Euler characteristic is a beloved invariant of spaces which are finite in homology. On the other hand, Baez and Dolan's homotopy cardinality is an invariant of spaces which are finite in homotopy, with applications from group theory to mathematical physics. Although no nontrivial space has both invariants well-defined, nonetheless Baez wonders whether they are two faces of the same coin. We will answer Baez's question by constructing an Euler characteristic on a class of p-complete spaces which generalizes both the Euler characteristic and homotopy cardinality, and we also show that there can be no such invariant unless we complete at a prime.

HANS BODEN, McMaster University

The Gordon-Litherland pairing for virtual links

This talk is a report on joint projects with M. Chrisman and H. Karimi. The Gordon-Litherland form is a symmetric bilinear pairing on $H_1(F)$, where F is a virtual spanning surface for a virtual link. Using the Gordon-Litherland pairing and a correction term, one can define signature invariants for virtual links. The invariants defined this way are related to signatures of almost classical links previously defined in terms of the Seifert pairing in the case F is oriented, and they are also related to the checkerboard signatures defined in terms of Goeritz matrices by Im, Lee, and Lee. We will discuss applications of these invariants to virtual knot concordance and report on a program for generalizing a result of J. Greene to the virtual setting. Greene's theorem provides a geometric characterization of alternating links in terms of the definite spanning surfaces that they bound.

ADAM CLAY, University of Manitoba

Circular orderings and amalgamation

Motivated by examples from 3-manifold topology, I will introduce circular orderings of groups and explain the cohomological obstructions to obtaining a left-ordering from a circular ordering. I'll also explain how a recent result with Ty Ghaswala concerning circular orderings of free products with amalgamation is tied to creating circular and left-orderings of fundamental groups of non-geometric 3-manifolds (an essential component of the so-called L-space conjecture).

MARTIN FRANKLAND, University of Regina
Towards the dual motivic Steenrod algebra in positive characteristic

Several tools from classical topology have useful analogues in motivic homotopy theory. Voevodsky computed the motivic Steenrod algebra and its dual over a base field of characteristic zero. Hoyois, Kelly, and Østvær generalized those results to a base field of characteristic p, as long as the coefficients are mod ℓ with $\ell \neq p$. The case $\ell = p$ remains conjectural.

In joint work with Markus Spitzweck, we show that over a base field of characteristic p, the conjectured form of the mod p dual motivic Steenrod algebra is a retract of the actual answer. I will sketch the proof and possible applications. I will also explain how this problem is closely related to the Hopkins–Morel–Hoyois isomorphism, a statement about the algebraic cobordism spectrum MGL.

CHRIS HERALD, University of Nevada, Reno
Traceless character varieties, the pillowcase and Khovanov cohomology

This talk will describe recent joint work with Matthew Hedden, Matthew Hogancamp, and Paul Kirk.

For a diagram of a 2-stranded tangle in the 3-ball we define a twisted complex of compact Lagrangians in the triangulated envelope of the Fukaya category of the smooth locus of the pillowcase. We show that this twisted complex is a functorial invariant of the isotopy class of the tangle, and that it provides a factorization of Bar-Natan's functor from the tangle cobordism category to chain complexes. In particular, the hom set of our invariant with a particular non-compact Lagrangian associated to the trivial tangle is naturally isomorphic to the reduced Khovanov chain complex of the closure of the tangle. Our construction comes from the geometry of traceless SU(2) character varieties associated to resolutions of the tangle diagram, and was inspired by Kronheimer and Mrowka's singular instanton link homology.

RICK JARDINE, Univ. of Western Ontario
Fuzzy presheaves

Michael Barr (1986) showed that fuzzy sets can be identified with sheaves of monomorphisms on a locale. The Veitoris-Rips complexes $s \mapsto V_s(X)$ for a data cloud X in topological data analysis form a simplical fuzzy set, or a simplicial sheaf of monomorphisms on a locale defined by the parameter s. There is an underlying theory of presheaves of monomorphisms (fuzzy presheaves) that will be described in this talk, along with potential applications.

ALLISON MOORE, University of California, Davis
Surgery on links and the d-invariant

The d-invariants are a set of rational numbers associated to the Heegaard Floer homology of a rational homology sphere. These invariants are quite useful and have many important applications in low-dimensional topology. We will describe a formula to compute the d-invariants of integral surgeries on two-component L–space links of linking number zero in terms of the h-function. This generalizes a formula of Ni-Wu in the case of knots, and relies on the Manolescu-Ozsvath link surgery complex. For linking number zero links, we will also describe the behavior of the d-invariants invariants under crossing changes, concordance, and mention some related results on the characterization of L-space surgery slopes. This is joint work with E. Gorsky and B. Liu.

LISA PICCIRILLO, University of Texas at Austin
The Conway knot is not slice

Knots in S^3 are slice if they bound a smooth properly embedded disk in B^4. For some classes of knots it can be especially difficult to obstruct sliceness. Positive mutation is an operation taking knots to knots, and it is difficult, though generally possible, to obstruct the sliceness of a knot which is a positive mutant of a slice knot. It is also difficult, but generally possible, to obstruct the sliceness of a topologically slice knot. The Conway knot is the smallest knot which is both topologically slice and a positive mutant of a slice knot, and all sliceness invariants in the literature vanish for the Conway knot. In this talk I will use a new argument to show that the Conway knot is not slice.

JONATHAN RUBIN, UCLA
Norms on G-categories

Let G be a finite group. The theory of N_∞ algebras was originally motivated by the homotopy coherent systems of transfers that appear on G-spectra over incomplete universes, and on localizations of commutative ring G-spectra. In this talk, I will explain how such structure can be modeled on small G-categories. I will give a Mac Lane-style presentation of an equivariantization of ordinary symmetric monoidal structure, and then sketch applications as time permits.

WILLIAM RUSHWORTH, McMaster University
Ascent sliceness

A virtual link is an equivalence class of embeddings $\bigsqcup S^1 \hookrightarrow \Sigma_g \times I$, up to self-diffeomorphism of $\Sigma_g \times I$ and certain handle (de)stabilisations of Σ_g.

A cobordism between classical knots is a surface, properly embedded in $S^3 \times I$, which cobounds the knots. A cobordism between virtual knots $K : S^1 \hookrightarrow \Sigma_g \times I$ and $K' : S^1 \hookrightarrow \Sigma_{g'} \times I$ is a pair (S, M), for M a compact oriented 3-manifold with $\partial M = \Sigma_g \sqcup \Sigma_{g'}$, S an oriented surface properly embedded in $M \times I$ with $\partial S = K \sqcup K'$. If the genus of S is zero then (S, M) is a concordance. We may therefore ask new questions about the complexity of the 3-manifolds appearing in cobordisms between K and K'.

We outline one such question regarding the 3-manifolds appearing in concordances between virtual knots and the unknot. Roughly, given a virtual knot $K \hookrightarrow \Sigma_g$ and concordance (S, M) from K to the unknot, place a Morse function on M; the level sets are surfaces Σ_l. If there exists a level set Σ_l such that $l > g$ then the concordance is *ascent*. Does there exist a slice virtual knot such that every concordance between it and the unknot is ascent?

DANIEL SHEINBAUM, University of British Columbia
Quasi-adiabatic stability of Fermi surfaces and K-theory

I will present a classification of Fermi surfaces of non-interacting, discrete translation-invariant systems from electronic band theory, quasi-adiabatic evolution and their topological interpretations. For systems on a half-space and with a gapped bulk, this derivation naturally yields a K-theory classification. Given the $d-1$-dimensional surface Brillouin zone X_s of a d-dimensional half-space, this result implies that different classes of globally stable Fermi surfaces belong in $K^{-1}(X_s)$. I will also mention how to include symmetries through equivariant methods. This is based on joint work with A.Adem, O.Antolín-Camarena and G.W. Semenoff.

PAUL ARNAUD SONGHAFOUO TSOPMENE, University of Regina
Cosimplicial models for manifold calculus

Manifold calculus is a tool developped by Goodwillie and Weiss which enables to approximate a contravariant functor, F, from the category of m-manifolds to the category of spaces (or alike), by its "Taylor approximation", $T_\infty F$. I will explain how to construct a fairly explicit and computable cosimplicial model of $T_\infty F(M)$ out of a simplicial model of the manifold M (i.e. out of a simplicial set whose realization is M). This cosimplicial model in degree p is then equivalent to the evaluation of F on a disjoint union of as many m-disks as p-simplices in the simplicial model of M.

As an example, we apply this construction to the functor $F(M) = \mathsf{Emb}(M, W)$ of smooth embeddings in a given manifold W ; in that case our cosimplicial model in degree p is then just the configuration space of all the p-simplices of M in W product with a power of a Stiefel manifold. When $\dim(W) > \dim(M) + 2$, a theorem of Goodwillie-Klein implies that our explicit cosimplicial space is a model of $\mathsf{Emb}(M, W)$. This generalizes Sinha's cosimplicial model for the space of long knots which was for the special case when M is the real line. (This is joint work with Pedro Boavida de Brito, Pascal Lambrechts, and Daniel Pryor)

BIJI WONG, CIRGET

A Floer homology invariant for 3-orbifolds via bordered Floer theory

Using bordered Floer theory, we construct an invariant $\widehat{HFO}(Y^{\mathsf{orb}})$ for 3-orbifolds Y^{orb} with singular set a knot that generalizes the hat flavor $\widehat{HF}(Y)$ of Heegaard Floer homology for closed 3-manifolds Y. We show that for a large class of 3-orbifolds $\widehat{HFO}$ behaves like $\widehat{HF}$ in that $\widehat{HFO}$, together with a relative $\mathbb{Z}_2$-grading, categorifies the order of H_1^{orb}. When Y^{orb} arises as Dehn surgery on an integer-framed knot in S^3, we use the $\{-1, 0, 1\}$-valued knot invariant ε to determine the relationship between $\widehat{HFO}(Y^{\mathsf{orb}})$ and $\widehat{HF}(Y)$ of the 3-manifold Y underlying Y^{orb}.