

Union College Math Conference: Algebraic Topology

June 3–5, 2022

FRIDAY PROGRAM

4:30–5:30pm: Reception and registration (Olin Rotunda)

~~**5:30–6:30pm:** Plenary talk — Tai Melcher (Olin 115)~~ Rescheduled to Saturday, 8:00am

SATURDAY PROGRAM

7:30–8:00am: Coffee & pastries, registration (Olin Rotunda)

8:00–9:00am: Plenary talk — Tai Melcher (Olin 115)

9:00–10:30am: Session II (Bailey 207)

- 9:00–9:20 Nick Gurski: *A Boardman–Vogt tensor product for generalized multicategories*
- 9:30–9:50 Rhiannon Griffiths: *Cofibrantly generated model structures for functor calculus*
- 10:00–10:20 Duncan Clark: *Goodwillie derivatives of the identity in structured ring spectra*

10:30–11:00am: Coffee break (Olin Rotunda)

11:00am–12:00pm: Plenary talk — Yusu Wang (Olin 115)

12:00–2:00pm: Lunch break / Women in Mathematics lunch panel (Bailey 207)

2:00–4:00pm: Session III (Bailey 207)

- 2:00–2:20 Andrew Senger: *\mathbb{E}_∞ -ring structures on Johnson–Wilson spectra*
- 2:30–2:50 Ishan Levy: *The K -theoretic telescope conjecture away from p*
- 3:00–3:50 Featured talk — Kate Ponto: *Euler characteristics in algebra and topology*

4:00–4:30pm: Coffee break (Olin Rotunda)

4:30–5:30pm: Plenary talk — Claude LeBrun (Olin 115)

6:00–8:30pm: Conference dinner (Hale House)

SUNDAY PROGRAM

8:00–9:00am: Coffee & pastries (Olin Rotunda)

9:00–11:00am: Session IV (Bailey 207)

- 9:00–9:20 Cary Malkiewich: *A Farrell–Jones isomorphism for scissors congruence K -theory*
- 9:30–9:50 Adela YiYu Zhang: *Inertia groups of $(n - 1)$ -connected $2n$ -manifolds*
- 10:00–10:20 J.D. Quigley: *Towards the homotopy primary β -family*
- 10:30–10:50 Matthew Carr: *Retractive operadic algebras in spectra and completions*

11:00–11:30am: Coffee break (Olin Rotunda)

11:30am–12:30pm: Plenary talk — Sergio Lopez-Permouth (Olin 115)

ABSTRACTS

Matthew Carr (Ohio State University)

Retractive operadic algebras in spectra and completions

Working in the context of operadic algebras in modules over the sphere spectrum, we study completions with respect to invariants centered away from $*$ (i.e., centered at a fixed operadic algebra). In particular, we obtain results on strongly convergent homotopy spectral sequences associated to a variety of completion towers.

Duncan Clark (Milwaukee School of Engineering)

The Goodwillie derivatives of the identity in structured ring spectra

Functor calculus was introduced by Tom Goodwillie as a means to give meaningful approximations to a homotopy-invariant functor between the categories of spaces and spectra. These approximations assemble into a “Taylor tower” which in many ways resembles the usual notion of a Taylor series in calculus and real analysis. In particular, the Taylor tower of a functor is in some sense “controlled” by a certain sequence of spectra called the derivatives of the functor.

In this talk, we begin with an overview of the construction of Taylor towers and derivatives of functors of structured ring spectra. Particular emphasis will be given to the identity functor in the category of algebras over an operad \mathcal{O} in spectra. Additionally, we will discuss the ideas and constructions behind our recent result: that the derivatives of such identity functor naturally come equipped with a “highly homotopy coherent” operad structure, which moreover is naturally equivalent to the operad structure on \mathcal{O} .

Rhiannon Griffiths (Cornell University)

Cofibrantly generated model structures for functor calculus

Many objects of interest in algebraic topology may be viewed as functors, which often makes them difficult to analyze directly. Functor calculus provides a means by which to approximate a certain type of functor F with a tower of ‘degree n ’ functors under F that is analogous to the Taylor series of a function. However, each type of functor calculus differs in its notion of what it means for a functor to be degree n , and in the type of functor to which it applies.

I will present results necessary for developing a more universal framework for functor calculus. As a first example we show how the discrete functor calculus of Bauer, Johnson, and McCarthy may be placed into the context of simplicial model categories, allowing for a direct comparison to Goodwillie’s original functor calculus.

This is joint work with Julia Bergner, Lauren Bandklayder, Brenda Johnson, and Rekka Santhanam.

Nick Gurski (Case Western Reserve University)

A Boardman–Vogt tensor product for generalized multicategories

The Boardman–Vogt tensor product was originally constructed for symmetric operads, and shares many features with the tensor product of abelian groups. For operads P, Q , the tensor product $P \otimes Q$ is generated by the operations of P and Q separately subject to an additional operadic form of commutativity: for all $p \in P(n), q \in Q(m)$, the equation

$$(q, q, \dots, q) \circ p = (p, p, \dots, p) \circ q$$

holds in $(P \otimes Q)(mn)$. With some careful consideration for sources and targets, this is easily extended from symmetric operads to symmetric multicategories. A thematically similar construction is the tensor product of symmetric monoidal categories, but the tensor product of symmetric monoidal categories does not agree with the Boardman–Vogt tensor product when

the symmetric monoidal categories are viewed as representable symmetric multicategories. In ongoing work with Eugenia Cheng, I have been studying a higher categorical analogue of the Boardman–Vogt tensor product on a 2-category of generalized multicategories that includes the 2-categories of both symmetric multicategories and symmetric monoidal categories, but not in such a way that the latter is a sub-2-category of the former. This talk will be an exposition of that study, and in particular an attempt to relate work of Leinster on generalized T -multicategories, Hyland and Power on pseudocommutative structures, and Garner and Lopez-Franco on commuting tensor products.

Ishan Levy (Massachusetts Institute of Technology)

The K -theoretic telescope conjecture away from p

I will explain work joint with Robert Burklund on understanding algebraic K -theory away from the characteristic. One of our main results is the K -theoretic telescope conjecture away from p : namely that the K -theory of compact $T(n)$ -local spectra is the same as that of compact $K(n)$ -local spectra after inverting p . The main idea is that $T(n)$ -locally, MU behaves like a p -pro-Galois extension of the sphere, allowing us to reduce to MU , for which the telescope conjecture is true. We moreover compute the p -inverted K -theory of many things including the E_n -local sphere, BP , Morava E -theory, Johnson–Wilson theory. There are two main ingredients here: one is a formality result about p -inverted K -theory which uses trace methods and devissage, and the other is a canonical action of $K(\mathbb{F}_p)$ on the p -inverted K -theory of any \mathbb{E}_1 -ring for which a power of p is 0.

Cary Malkiewich (Binghamton University, State University of New York)

A Farrell–Jones isomorphism for scissors congruence K -theory

I’ll describe a new trace map out of scissors congruence K -theory, along with recent work that uses this trace to prove that the assembly map in this setting is an equivalence. There are many corollaries of this result — one is that the computation of higher scissors congruence K -theory groups in the Euclidean case can be reduced to a (still very difficult!) calculation of group homology.

Kate Ponto (University of Kentucky)

Euler characteristics in algebra and topology

There is a shockingly easy to prove theorem that is very useful for describing how Euler classes for modules interact with Morita invariance and how Euler characteristics for spaces behave for fibrations. I’ll show you this really helpful theorem and explain how to apply it in these disparate settings.

J.D. Quigley (Cornell University)

Towards the homotopy primary β -family

Homotopy Greek letter elements form infinite, periodic families in the stable homotopy groups of spheres. The homotopy α -family has been completely calculated, and is closely related to the J -homomorphism and topological K -theory. The homotopy β -family has been analyzed extensively at odd primes by Behrens, Mahowald–Ravenel, and Sadofsky, as well as in low dimensions at the prime two by Behrens. In this talk, I will discuss a project to completely compute the homotopy β -family at the prime two. Time permitting, I will explain some potential applications to the existence of exotic spheres.

Andrew Senger (Harvard University)

\mathbb{E}_∞ -ring structures on Johnson–Wilson spectra

In this talk, I will explain how recent advances in p -adic Hodge theory can be applied to show that Johnson–Wilson spectra admit the structure of \mathbb{E}_∞ -ring spectra at all heights and primes.

Adela YiYu Zhang (Massachusetts Institute of Technology)

Inertia groups of $(n - 1)$ -connected $2n$ -manifolds

We provide a complete determination of the inertia groups of $(n - 1)$ -connected $2n$ -manifolds for $n > 2$. We also show that their homotopy inertia groups and concordance inertia groups vanish. Our computation builds on works of Wall, Stolz, Burklund–Hahn–Senger, Burklund–Senger, Nagy, and makes heavy use of Pstrągowski’s category of synthetic spectra. This is joint work with Andrew Senger.