Midwest Topology Seminar – Spring 2017

University of Chicago

Saturday, May 13

9:30am Coffee

10:00am *Comparing equivariant infinite loop space machines*

Angélica Osorno (Reed College)

An equivariant infinite loop space machine is a functor that constructs genuine equivariant spectra out of simpler categorical or space level data. In the late 80's Lewis-May-Steinberger and Shimakawa developed generalizations of the operadic approach and the Γ-space approach respectively. In this talk I will describe recent work that aims to understand these machines conceptually and relate them to each other. This work is joint with Peter May and Mona Merling.

11:30am *Fukaya Moduli*

Eric Zaslow (Northwestern University)

Fukaya categories have interesting moduli spaces of objects. We study some Fukaya categories involving Lagrangian surfaces bounding Legendrian knots, and others involving Lagrangian three-folds bounding Legendrian surfaces. Both cases can be described explicitly with surface graphs, and both cases relate to cluster theory. We exploit this structure to make enumerative predictions about Lagrangian threefolds. In the interest of time and pedagogy, I will focus on examples.

This talk is a summary of several joint works with subsets of Shen, Shende, Treumann, and Williams, and incorporates prior works of many other researchers: Fock-Goncharov, Cecotti-Cordova-Vafa, Goncharov-Kenyon, Dimofte-Gabella-Goncharov, Aganagic-Klemm-Vafa, and Kontsevich-Soibelman, to name a few.

12:30pm Lunch

2:30pm *Algebraic topology and Hilbert's 13th Problem*

Benson Farb (University of Chicago)

Algebraic topology was created in order to understand algebraic functions. The subject soon took on a life of its own, and some of the original motivating problems were all but forgotten. One of these is Hilbert's 13th Problem. The purpose of this talk will be to describe some of the richness and beauty associated with this problem and to explain its fundamental topological nature. In particular I will explain why Hilbert's 13th Problem, widely believed to have been solved in 1957, is still open. This is an ongoing project with Jesse Wolfson.

4:00pm *Special values of L-functions and the height-shifting spectral sequence*

Andrew Salch (Wayne State University)

I will explain how to use formal groups with complex multiplication to assemble the cohomology of large-height Morava stabilizer groups out of the cohomology of small-height Morava stabilizer groups, using a new "height-shifting spectral sequence." I will describe some new computations of stable homotopy groups which have been made possible by this technique, and also one of the main motivations for making computations in this way: this approach is very natural for someone who is trying to give a description of orders of stable homotopy groups of Bousfield localizations of finite spectra in terms of special values of L-functions, generalizing Adams' 1966 description of im J in terms of denominators of special values of the Riemann zeta-function. I will explain, as much as time allows, both positive and negative results in that direction.

5:30pm Reception

Sunday, May 14

9:00am Coffee

9:30am *Motivic modular forms*

Nicolas Ricka (Wayne State University)

Motivated by the study of chromatic phenomenon in the classical and motivic Adams spectral sequence, we set up a machinery to build a spectrum (over $\mathrm{Spec}(\mathbb{R})$ or $\mathrm{Spec}(\mathbb{C})$) with a prescribed cohomology. We apply this technique to produce a spectrum that deserves to be called motivic modular forms (mmf). This answers positively a conjecture made by Dan Isaksen.

11:00am *A filtration of the equivariant motivic sphere*

Jeremiah Heller (University of Illinois at Urbana–Champaign)

We introduce a slice filtration on the C_2-equivariant stable motivic homotopy category; this is a mash-up of Voevodsky's filtration in motivic homotopy and Dugger/Hill-Hopkins-Ravenel's filtration in C_2-equivariant homotopy theory. In this talk I'll discuss some aspects of this filtration and a computation of the zero slice of the equivariant motivic sphere spectrum. This is joint work with P. A. Ostvaer.

12:00pm Lunch

1:30pm *Gross-Hopkins duals of higher real K-theory spectra*

Agnès Beaudry (University of Colorado Boulder)

In this talk, I will discuss the connection between $K(n)$-local dualities for higher real K-theory spectra and the non-triviality of the exotic $K(n)$-local Picard group. I will then describe a hands-on approach to computing the Gross-Hopkins duals of some higher real K-theories, accompanied with examples of such computations.

2:45pm *The telescope conjecture from the motivic point of view*

Mark Behrens (University of Notre Dame)

I will discuss a lift of the Mahowald-Ravenel-Shick approach to disprove the telescope conjecture to the stable complex motivic category. While this does not provide enough rigidity to complete the counterexample, it is enlightening. This is part of a joint project with Agnes Beaudry, Prasit Bhattacharya, Dominic Culver, Zhouli Xu, and Doug Ravenel.

The 2017 Namboodiri Lectures

University of Chicago

Friday, May 12

4:00pm
Ryerson
251

Evenness in algebraic topology

Mike Hill (University of California Los Angeles)

Complex projective space plays a fundamental role in algebraic topology as a space which simultaneously represents line bundles and the second cohomology group with integral coefficients. This space has an additional extremely useful feature: it has cells only in even dimensions (and homotopy only in even dimensions). This makes many algebraic topology constructions exceptionally easy. The Grassmanians of n-planes in $\mathbb{C}^\infty$ all also have cells only in even dimensions, meaning that the they share many of the properties of complex projective space. More surprisingly, Wilson in his thesis showed that the even spaces in the complex bordism spectrum have only even cells and only even homotopy groups. This talk will explore these classical results and their consequences before exploiting the natural C_2-equivariance of the spaces to describe a similar Real version.

Monday, May 15

4:00pm
Eckhart
202

Evenness in algebraic topology

Mike Hill (University of California Los Angeles)

Extending to larger groups: the norm, G-equivariant Wilson spaces, and the equivariant Steenrod algebra. Central to the Hill-Hopkins-Ravenel proof of the Kervaire invariant one problem was a well-behaved multiplicative induction functor, the norm. The norm of $MU_{\mathbb{R}}$ from C_2 to C_{2^n} was the basic object of study in that proof, and as a Thom spectrum, this encodes significant geometric information. Moreover, the Hill-Hopkins-Ravenel approach gave a way to understand various spectra built out of the norm of $MU_{\mathbb{R}}$, including the one giving the homology. This talk will describe this set-up together with how one can use this to vastly generalize the earlier results about the Real Wilson spaces and how one can compute the C_{2^n}-equivariant Steenrod algebra with constant coefficients.

Tuesday, May 16

4:30pm
Eckhart
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Towards $RO(G)$-graded algebraic geometry: explorations of duality for Galois covers via equivariant homotopy

Mike Hill (University of California Los Angeles)

The unifying theme from the first two talks is the lifting of ordinary, non-equivariant maps from spheres to equivariant maps from representation spheres. This procedure also arises in a surprising way in spectral algebraic geometry, where we can use these techniques to understand a spectral version of Serre duality for certain derived moduli problems. This talk will focus primarily on several examples related to the theory of topological modular forms with level structure, where the equivariance coming from the level, coupled with refinements of homotopy from $\mathbb{Z}$-graded maps to $RO(G)$-graded maps, gives a conceptual and computationally useful approach to duality.