

# Spring 2020

- **February 13**

Speaker: **Cary Malkiewich** (Binghamton University)

Title: **The equivariant parametrized  $h$ -cobordism theorem** *Abstract:* The classical  $h$ -cobordism theorem plays a critical role in the classification of high-dimensional smooth manifolds up to diffeomorphism. The “parametrized” or “higher”  $h$ -cobordism theorem of Waldhausen gives access to the rest of the diffeomorphism group  $\text{Diff}(M)$  in a stable range, using algebraic  $K$ -theory. I will describe recent and ongoing work with Tom Goodwillie and Mona Merling on the  $G$ -equivariant form of Waldhausen's theorem when  $G$  is a finite group.

- **February 20**

Speaker: **Michael Ching** (Amherst College)

Title: **Tangent  $\infty$ -categories and Goodwillie calculus** *Abstract:* The theory of Goodwillie calculus uses an analogy between homotopy theory and differential geometry to make systematic decompositions of homotopy-theoretic functors into “polynomial” pieces. For example, a suitable functor (say from the category of topological spaces to itself) has a “Taylor tower”, a sequence of polynomial approximations that, in good cases, can be used to recover information about the original functor. Cockett and Cruttwell (following Rosický) have developed an abstract framework which axiomatizes the categorical properties of the tangent bundle functor on the category of smooth manifolds, and includes other “tangent bundle” constructions in areas such as algebraic geometry and synthetic differential geometry, among others. In this talk I will describe joint work with Kristine Bauer and Matthew Burke that puts Goodwillie calculus into this same “tangent category” framework (or, rather, its  $\infty$ -categorical counterpart) and thus makes precise the hitherto informal analogy developed by Goodwillie. I will argue, in particular, that the Taylor tower construction can be recovered in a formal way from this underlying tangent structure. This work sets the scene for importing other concepts from differential geometry, such as connections and curvature, into homotopy theory.

- **February 27**

Speaker: **James Hyde** (Cornell University)

Title: **Sufficient conditions for a group of homeomorphisms of the Cantor set to be 2-generated** *Abstract:* We say a group  $G$  of homeomorphisms of the Cantor set is vigorous if for any non-empty clopen set  $A$  and non-empty proper clopen subsets  $B$  and  $C$  of  $A$  there exists  $g$  in  $G$  wholly supported on  $A$  with  $Bg$  a subset of  $C$ . This talk represents joint work with Collin Bleak and Luke Elliott. We will also discuss some properties of vigorous simple groups of homeomorphisms of the Cantor set. In particular finitely generated vigorous simple groups of homeomorphisms of the Cantor set are 2-generated.

- **March 5** No seminar (Winter break)

- **March 12**

Speaker: **John Klein** (Wayne State University)

Title: **Hypercurrents** *Abstract:* This talk poses the question as to what a higher dimensional analog of a continuous time Markov chain might be, in which the time parameter is replaced by arbitrary smooth manifold. As a partial answer, we introduce the notion of a “protocol,” which consists of a space whose points are labeled by real numbers indexed by the set of cells of a fixed CW complex in prescribed degrees, where the labels are required to vary continuously. When the space is a one-dimensional

manifold, then a protocol determines a continuous time Markov process. In the presence of a homological gap condition, we associate to each protocol a 'characteristic' cohomology class which we call the hypercurrent. The hypercurrent comes in two flavors: one algebraic topological and the other analytical. For generic protocols we show that the analytical hypercurrent tends to the topological hypercurrent in the 'low temperature' limit. We also exhibit examples of protocols having nontrivial hypercurrent.

**The remaining talks were cancelled due to the coronavirus outbreak.**

- **March 19**

Speaker: **Kathryn Mann** (Cornell University)

Title: **TBA**

- **March 26**

Speaker: **John Lind** (California State University Chico)

Title: **TBA**

- **April 23**

Speaker: **Vitaly Lorman** (University of Rochester)

Title: **TBA**

- **PETER HILTON MEMORIAL LECTURE**

**SPECIAL TIME AND LOCATION: April 30, 3pm, LH009**

Speaker: **Robert Gompf** (University of Texas at Austin)

Title: **Exotic Smooth Structures on  $\mathbb{R}^4$**  *Abstract:* One of the most surprising discoveries in 4-manifold topology was the existence of smooth manifolds homeomorphic, but not diffeomorphic, to Euclidean 4-space. For fundamental reasons, this phenomenon can only occur in 4 dimensions. We will survey the subject, from its origin to recent developments regarding symmetries of such manifolds.

- **May 7**

Speaker: **Marco Varisco** (SUNY Albany)

Title: **TBA**

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