Cascade Topology Seminar
November 8 - 10, 2014

Coffee Breaks: As per daily schedule, in the foyer of the TransCanada Pipeline Pavilion (TCPL) (*included in workshop*)

***For meal options at the Banff Centre, there are food outlets on The Banff Centre campus such as Vistas Main Dining Room on the 4th floor of Sally Borden Building (breakfast: 7:00-9:30am; lunch: 11:30am-1:30pm; dinner: 5:30-7:30pm), Le Cafe (ground floor, Sally Borden Building) and the Maclab Bistro (Kinnear Centre). You will also find a good selection of restaurants in the town of Banff which is a 10-15 minute walk from Corbett Hall. Please note that there is no meal plan provided by BIRS for 2-day meetings.**)*

MEETING ROOMS

All lectures will be held in the lecture theater in the TransCanada Pipelines Pavilion (TCPL). An LCD projector, a laptop, a document camera, and blackboards are available for presentations.

SCHEDULE

Friday	
16:00	Check-in begins (Front Desk - Professional Development Centre - open 24 hours)
	Lecture rooms available after 16:00
Saturday	
7:00-9:00	Breakfast
9:45 - 10:45	Don Stanley: The LS category of products
10:45	Coffee Break, TCPL
11:00 - 12:00	Michael Lesnick: Universality of the Homotopy Interleaving Distance
12:00 - 2:00	Lunch
2:00 - 3:00	Trithang Tran: Configurations spaces and symmetric complements
3:00	Coffee Break, TCPL
3:15-4:15	Jack Morava: Big motives are enriched over little motives
4:15 - 5:15	Rick Jardine: Cocycles and pro-objects
	Dinner
	Informal Gathering in BIRS Lounge
Sunday	
7:00-9:00	Breakfast
9:00	Henrik Rueping: The Farrell-Jones conjecture and ist applications
10:00	Coffee break, TCPL
	Informal discussion in BIRS lounge
	Checkout by 12 noon.

** 2-day workshops are welcome to use BIRS facilities (2nd Floor Lounge, TCPL, Reading Room) until 15:00 on Sunday, although participants are still required to checkout of the guest rooms by 12 noon. There is no coffee break service on Sunday afternoon, but self-serve coffee and tea are always available in the 2nd floor lounge of Corbett Hall. **

Cascade Topology Seminar
November 8 - 10, 2014

ABSTRACTS
(in alphabetic order by speaker surname)

Speaker: **Rick Jardine** (University of Western Ontario)
Title: *Cocycles and pro-objects*
Abstract: For spaces (or simplicial presheaves) X and Y, the cocycle category $h(X,Y)$ is a translation category for a functor from the weak equivalences over X to sets, which takes a weak equivalence $U \to X$ to the set $hom(U,Y)$ of maps from U to Y. The set of path components of this category can be identified with the set of morphisms $[X,Y]$ from X to Y in the homotopy category.

If Y is locally fibrant, or a Kan complex in stalks, then the Verdier hypercovering theorem says that the set $[X,Y]$ can be identified with a filtered colimit of sets of simplicial homotopy classes of maps $\pi(U,Y)$, indexed over simplicial homotopy classes of hypercovers $U \to X$. This theorem is used in étale homotopy theory to define étale homotopy types as pro-objects in simplicial sets, and to calculate étale cohomology with constant coefficients.

These results will be discussed. I shall also present a description of the category of small diagrams of spaces, and of pro-weak equivalences in that context. A proper analysis of the homotopy theory for this framework is still work in progress, but it specializes to both the cocycle and hypercover descriptions of morphisms in the homotopy category. It can also be used to define analogues of étale homotopy types for arbitrary Grothendieck topologies, in a way which makes no use of either pro-objects or the theory of hypercovers.

Speaker: **Michael Lesnick** (Institute for Mathematics and its Applications, University of Minnesota)
Title: *Universality of the Homotopy Interleaving Distance*
Abstract: As part of an effort to establish homotopy-theoretic foundations for topological data analysis (TDA), we introduce and study homotopy interleavings" between filtered spaces. These are homotopy theoretic analogues of objects called interleavings, which are commonly used in TDA to articulate stability and inference theorems. Whereas ordinary interleavings can be interpreted as "approximate isomorphisms" between filtered spaces, homotopy interleavings can be interpreted as approximate weak equivalences."

Homotopy interleavings induce a pseudometric $d_H I$ on filtered spaces, which we call the "homotopy interleaving distance." Our main result is that $d_H I$ is the universal pseudometric satisfying natural stability and homotopy invariance axioms.

To motivate these axioms, we show that any pseudometric satisfying the axioms can be used to formulate lifts of several fundamental TDA theorems from the algebraic (homological) level to the level of filtered spaces. These lifts decouple the homotopy theoretic content of the theorems from the homological and algebraic content.

Joint work with Andrew Blumberg.

Speaker: **Jack Morava** (Johns Hopkins University)
Title: *Big motives are enriched over little motives*
Abstract: Blumberg, Gepner, and Tabuada [arXiv:1001.2282] have defined (several variant) categories enriched over spectra, whose objects are small stable ∞-categories (eg of perfect complexes of quasicoherent sheaves over a scheme, or modules in spectra over the S-dual of a finite complex). If $\mathcal{A}$ and $\mathcal{B}$ are two such objects, there is a small stable ∞-category of suitably exact functors from $\mathcal{A}$ to $\mathcal{B}$, and the spectrum of morphisms from $\mathcal{A}$ to $\mathcal{B}$ is (roughly) the Waldhausen K-theory of this functor category.

Such 'big' categories of motives are thus enriched over $K(S^0)$-module spectra. In [arXiv:1402.3693] I argue that a covariant form of Koszul duality [arXiv:1001.1556] maps such Hom-objects to comodules over a 'descent coring' $S^0 \wedge_{K(S^0)} S^0$ in the sense of Hess, and furthermore that, after tensoring with $\mathbb{Q}$, the resulting objects can be identified with representations of the motivic Galois group for Deligne and Goncharov's category [arXiv:math/0208144] of mixed Tate motives over $\mathbb{Z}$ (which, to be honest, are not so little).

Speaker:**Henrik Rueping** (University of British Columbia)
Title: *The Farrell-Jones conjecture and its applications*
Abstract: Algebraic K-theory and L-theory of Group rings plays an importart role in topology. Many obstructions live in the algebraic K-theory of Groups rings, such as Walls finiteness obstruction or the Whitehead Torsion. Surgery obstructions naturally live in the L-theory of group rings. Understanding the K-and L-theory of group rings will be very helpful in many situations. For example, the Borel-conjecture predicts that any homotopy equivalence of closed, aspherical manifolds will be homotopic to a homeomorphism. The Farrell-Jones conjecture makes a prediction about the K-and L-groups of group rings. If it holds for a certain group G, then the Borel conjecture holds for all aspherical manifolds with fundamental group G. In this talk I will state the conjectures, talk about some applications and about the status and the methods used in some of the proofs.

Speaker:**Don Stanley**(University of Regina)
Title: *The LS category of products*
Abstract: TBA

Speaker:**Trithang Tran**(University of Oregon)
Title: *Configurations spaces and symmetric complements* Abstract: In this talk, we discuss homological stability for spaces that are defined as the complements of the closures of certain strata in the n-fold symmetric product named "symmetric complements". Symmetric complements are closely related to configuration spaces where homological stability was previously known to hold. Homological stability for symmetric complements, in particular, answers a conjecture by Vakil and Wood, which goes part way to understanding the relationship between homological stability, and the existence of certain limits in the Grothendieck ring of varieties.

The talk will proceed by providing a brief introduction to homological stability using configuration spaces as an example. We will then discuss how to leverage stability for configuration spaces to obtain stability for symmetric complements. This is joint work with A. Kupers and J. Miller.