Spring 2017

For questions contact Christoforos Neofytidis

- **January 26**
  Speaker: **Marco Varisco** (SUNY at Albany)
  Title: **Assembly maps for topological cyclic homology** *Abstract:* I will present recent joint work with Wolfgang Lück, Holger Reich, and John Rognes [arXiv:1607.03557], in which we use assembly maps to study the topological cyclic homology of group algebras. For any finite group G, for any connective ring spectrum A, and for any prime p, we prove that TC(A[G];p) is determined by TC(A[C];p) as C ranges over the cyclic subgroups of G. More precisely, we prove that for any finite group the assembly map with respect to the family of cyclic subgroups induces isomorphisms on all homotopy groups. For infinite groups, we establish pro-isomorphism, split injectivity, and rational injectivity results, as well as counterexamples to injectivity and surjectivity. In particular, for hyperbolic groups and for virtually finitely generated abelian groups, we show that the assembly map with respect to the family of virtually cyclic subgroups is split injective but in general not surjective—in contrast to what happens in algebraic K-theory.

- **February 2**
  Speaker: **Matt Zaremsky** (Cornell)
  Title: **Local to global: Discrete Morse theory and topological properties of infinite groups**
  Abstract: Discrete Morse theory is a tool for turning difficult global problems into easier local ones. For example, one might wish to know whether or not a certain cell complex is connected, simply connected, or n-connected for some higher n, or whether a filtration of a cell complex is homologically stable. Morse theory can reduce these difficult “global” problems to easier “local” questions about the so-called ascending or descending links of vertices. In this talk I will first discuss some background on discrete Morse theory and some historical applications to important questions in geometric group theory, and then describe some of my own contributions.

- **February 9**
  Speaker: **Wiktor Mogilski** (SUNY at Binghamton)
  Title: **The Strong Atiyah Conjecture and computations of L^2-Betti numbers** *Abstract:*The Strong Atiyah Conjecture predicts that for any group G with bounded torsion, the L^2-Betti numbers of any G-space are rational, with denominators determined by the order of the torsion subgroups. In this talk we will restrict ourselves to the setting of Coxeter groups, and I will present a special trick that, in many cases, improves the Strong Atiyah Conjecture prediction of the denominators of the L^2-Betti numbers. In many examples, this improvement (along with additional work) allows us to make complete computations of the L^2-Betti numbers. I will conclude by exploiting this trick to obtain new affirmative results regarding the Singer Conjecture for Coxeter groups. This is joint work with Kevin Schreve.

- **February 16**
  Speaker: **Tam Nguyen Phan** (SUNY at Binghamton)
  Title: **An analog of the Tits building in nonpositive curvature** *Abstract:*Locally symmetric manifolds (of noncompact type) form an interesting class of nonpositively curved manifolds. By Borel-Serre, the thin part of the universal cover of an arithmetic locally symmetric space is homotopically equivalent to the rational Tits building, which is homotopically a wedge of spheres of dimension q-1,

where Q is the Q-rank of the locally symmetric space. In general, q is less than or equal to n/2. We show that this is not an arithmetic coincidence in a weaker sense, which is that if M is a noncompact, bounded nonpositively curved manifold with finite volume and no arbitrarily small geodesic loops (so that M is tame), then any nontrivial homology cycle in the thin part of \tilde{M} must have dimension less than or equal to n/2 - 1. For each such cycle, we construct a complex at infinity of dimension less than n/2 that is an analog of the Tits building which we collapse the cycle onto. Simplices of such a complex consist of points whose Busemann functions are invariant under a group of parabolic isometries. You don't need to know what the Tits building is but some familiarity with nonpositively curved geometry will be helpful in understanding the talk.

- **February 23**
  Speaker: **Jason Manning** (Cornell University)
  Title: **k-fold triangle groups** *Abstract:* I'll introduce a generalization of classical triangle groups and use them to answer a question of Agol and Wise on possible extensions of Wise's Malnormal Special Quotient Theorem (a central tool in the theory of groups acting on cube complexes).

- **March 2**
  Speaker: **Alex Moody** (UT-Austin)
  Title: **Geography and classification of symplectic fillings of Legendrian surgeries** *Abstract:* Understanding the smooth topology of 4-manifolds is a notoriously hard problem. Due to a theorem of A.A. Markov, we cannot hope for similar classifications like those in the lower dimensional case. Due to exoticness, we cannot hope to understand 4-manifolds completely just by studying their algebraic topology as we can in the higher dimensional case. However, if we assume a 4-manifold admits a symplectic form and the boundary is a certain contact manifold (with a natural compatibility condition), classification problems suddenly become tractable. We will show how such classification results of Eliashberg, McDuff and Lisca in the case of lens spaces can be used to put topological restrictions (completely determining the Betti numbers and signature) on these symplectic fillings for a very large class of a contact 3-manifolds (infinitely many surgeries on every link in the 3-sphere is a subset). We will then give a conjectural answer about the classification of such fillings.

- **March 9**
  Speaker: **Caitlin Leverson (Georgia Tech)**
  Title: **Invariants of Legendrian Knots** *Abstract:* Given a plane field dz-ydx in R^3. A Legendrian knot is a knot which at every point is tangent to the plane at the point. One can similarly define a Legendrian knot in any contact 3-manifold (manifold with a plane field satisfying some conditions). In this talk, we will explore Legendrian knots in R^3, J^1(S^1), and #^k(S^1xS^2) as well as a few Legendrian knot invariants. We will also look at the relationships between a few of these knot invariants. No knowledge of Legendrian knots will be assumed.

- **March 16**
  Speaker: **Kamlesh Parwani** (Eastern Illinois University)
  Title: **Zero entropy subgroups of the mapping class group** *Abstract:* Let M be a compact surface with boundary. We are interested in the question of how a group action on M permutes a finite invariant set $X \subset int(M)$. More precisely, how the algebraic properties of the induced group of permutations of a finite invariant set affects the dynamical properties of the group. Our main result shows that in many circumstances if the induced permutation group is not solvable then among the homeomorphisms in the group there must be one with a pseudo-Anosov component. We formulate this in terms of the mapping class group relative to the finite set and show the stronger result that in many circumstances (e.g. if $\partial M \ne \emptyset$) this mapping class group is itself solvable if it

has no elements with pseudo-Anosov components. This is joint work with John Franks.

- **March 28 (Joint with Combinatorics Seminar)**
  Note special time: 1:15 - 2:15
  Speaker: **Caroline Klivans** (Brown)
  Title: **On the Connectivity of Three-Fimensional Tilings** *Abstract:*I will discuss domino tilings of three-dimensional manifolds. I will focus on the connected components of the space of tilings of such manifolds under local moves. Using topological techniques, I introduce two parameters of tilings: the flux and the twist. The main result characterizes, in terms of these two parameters, when two tilings are connected by local moves. I will not assume any familiarity with the theory of tilings.

- **March 30**
  Speaker: **Phillip Wesolek** (SUNY at Binghamton)
  Title: **Commensurated subgroups and periodic subgroups of tree almost automorphism groups.** *Abstract:* (Joint work with A. Le Boudec) The tree almost automorphism groups are non-discrete locally compact completions of the Higman-Thompson groups. The tree almost automorphism groups are independently interesting locally compact groups, and furthermore every group that almost acts on a sufficiently regular rooted tree embeds into one of these groups. We begin by introducing the almost automorphism groups and describing their relationship to the Higman-Thompson groups. We then consider the subgroups such that every element is contained in a compact subgroup; such groups are the topological analogue of torsion subgroups and are called periodic. We show every periodic subgroup is indeed locally elliptic - i.e. every finite set is contained in a compact subgroup. As applications, we recover a result for Thompson's group V as well as a new observation about the Röver group. We finally consider the commensurated subgroups of almost automorphism groups; these subgroups generalize normal subgroups. We show every commensurated closed subgroup of an almost automorphism group is either finite, compact and open, or equal to the entire group.

- **April 6**
  seminar cancelled

- **April 13**
  Spring break

- **April 20**
  Speaker: **Teddy Einstein** (Cornell)
  Title: **Hierarchies of Non-Positively Curved Cube Complexes** *Abstract:* Wise's malnormal special quotient theorem (MSQT) is a key ingredient in Agol's proof of the Virtual Haken Conjecture. The most important step in proving the MSQT is the construction of a hierarchy for hyperbolic compact special non-positively curved cube complexes. In this talk, I will explain what a hierarchy of a compact special non-positively curved cube complex is and discuss how to generalize a new proof of the MSQT by Agol, Groves and Manning to the relatively hyperbolic setting.

- **April 27**
  No Seminar, Hilton Lecture
  Title: *Abstract:*

- **May 4**
  Speaker: **Ilya Gekhtman** (Yale)
  Title: Word length asymptotics for actions of some automatic (e.g. relatively hyperbolic) groups.
  *Abstract:*Consider any nonelementary action of a hyperbolic group G on a not necessarily proper

Gromov hyperbolic space X. The action is not assumed to be discrete (for example, it could be a dense subgroup of SL_{2}\R) and X is not assumed to be proper (for example it could be the curve complex, on which the mapping class group acts with pseudo-Anosov elements acting as loxodromics). We prove certain asymptotic properties for the action, including the following. 1)With respect to the Patterson-Sullivan measure on the boundary of G, the image in X of almost every word-geodesic in G sublinearly tracks a geodesic in X. 2)The proportion of elements in a Cayley-ball of radius R in G which act loxodromically on X converges to 1 with R. A major tool is Cannon's theorem that hyperbolic groups admit geodesic automation. The same result hold for relatively hyperbolic groups with respect to generating sets which admit a geodesic automaton, including geometrically finite Kleinian groups, and more generally to automatic structures satisfying certain axioms related to growth tightness. We also obtain results for more general Markov processes, for example showing a *nonbacktracking* random walk on a group acting nonelementarily on a Gromov hyperbolic space hits loxodromic elements with This is based on completed and ongoing work with Sam Taylor and Giulio Tiozzo.