Fall 2016

For questions contact Christoforos Neofytidis

- **September 8**
  Speaker: **Phillip Wesolek** (SUNY at Binghamton)
  Title: **Elementary amenable groups and the space of marked groups** *Abstract:* (joint work with J. Williams.) The space of marked groups is a compact totally disconnected space that parameterizes all countable groups. This space allows for tools from descriptive set theory to be applied to study group-theoretic questions. In this talk, we consider the collection of elementary amenable marked groups. The class of elementary amenable groups is the smallest class that contains the abelian groups and the finite groups and that is closed under group extension, taking subgroups, taking quotients, and taking countable directed unions. We give a characterization of elementary amenable groups in terms of a chain condition. We then show the set of elementary amenable marked groups is not in the Borel sigma algebra of the space of marked groups. This gives a new, non-constructive proof of a theorem of Grigorchuk: There are finitely generated amenable non-elementary amenable groups.

- **September 29**
  Speaker: **Wiktor Mogilski** (SUNY at Binghamton)
  Title: **L^2-cohomology: Conjectures Abound!** *Abstract:* I will present a brief introduction to L^2-cohomology and then discuss some conjectures lurking amidst us, as well as their implications. I will then survey some recent results and developments.

- **October 6**
  Speaker: **Wiktor Mogilski** (SUNY at Binghamton)
  Title: **L^2-cohomology: Conjectures Abound! (Part II)**

- **October 13**
  Speaker: **Steve Ferry** (SUNY at Binghamton and Rutgers University)
  Title: **Distance functions, data, and comparison geometry** *Abstract:* We show that there are homotopy equivalences $h:N\to M$ between closed manifolds which are induced by cell-like maps $p:N\to X$ and $q:M\to X$ but which are not homotopic to homeomorphisms. The phenomenon is based on construction of cell-like maps that kill certain L-classes. The image space in these constructions is necessarily infinite-dimensional. In dimension >6 we classify all such homotopy equivalences. As an application, we show that such homotopy equivalences are realized by deformations of Riemannian manifolds in Gromov-Hausdorff space preserving a contractibility function, an observation that has consequences in topological data analysis.

- **October 20**
  Speaker: **Thomas Barthelmé** (Queen's University)
  Title: **Counting orbits of Anosov flows in free homotopy classes** *Abstract:* (Joint work with Sergio Fenley) Since Margulis and Bowen gave an estimate of the growth rate of periodic orbits of Anosov flow, there has been a lot of research furthering counting questions. If one consider only Anosov flows, these developments have been either into giving more precise estimates or into counting periodic orbits given a homological constraint, i.e., counting periodic orbits that are in the same fixed homology class. I will talk here about a third direction: Despite what one might think when considering the most classical examples of Anosov flows, a lot of Anosov flows (maybe most) in 3-manifolds are such that some periodic orbits are freely homotopic to infinitely many other. It is therefore legitimate to ask whether one can give an estimate of the growth rate of periodic orbits inside an infinite

free homotopy class. I will explain how one can use the geometry and topology of Anosov flows in 3-manifolds to obtain such estimates. As a corollary, we get an answer to the following question, asked by Plante and Thurston in 1972: If M is a manifold supporting an Anosov flow, does the number of conjugacy classes in the fundamental group grows exponentially fast with the length of the shortest orbit representative?

- **October 27**
  Dean's Lecture in Geometry and Topology.
  Speaker: **Boris Hasselblatt** (Tufts University)
  Title: **Statistical properties of deterministic systems by elementary means** *Abstract:* The Maxwell-Boltzmann ergodic hypothesis aimed to lay a foundation under statistical mechanics, which is at a microscopic scale a deterministic system. Similar complexity was discovered by Poincaré in celestial mechanics and by Hadamard in the motion of a free particle in a negatively curved space. We start with a guided tour of the history of the subject from various perspectives and then discuss the central mechanism that produces pseudorandom behavior in these deterministic systems, the Hop argument. It has been known to extend well beyond the scope of its initial application in 1939, and we show that it also leads to much stronger conclusions: Not only do time averages of observables coincide with space averages (which was the purpose for making the ergodic hypothesis), but any finite number of observables will become decorrelated with time. That is, the Hopf argument does not only yield ergodicity but mixing, and often mixing of all orders.

- **November 3**
  Speaker: **William Menasco** (SUNY at Buffalo)
  Title: **Efficient geodesics and an effective algorithm for distance in the complex of curves** *Abstract:* This talk will present joint work with Dan Margalit and Joan Birman, an algorithm for determining the distance between two vertices of the complex of curves. While there already exist such algorithms, for example by Leasure, Shackleton, and Webb, this approach is new, simple, and more effective for all distances accessible by computer. The method gives a new preferred finite set of geodesics between any two vertices of the complex, called efficient geodesics, which are different from the tight geodesics introduced by Masur and Minsky.

- **November 3**
  Colloquium (4:30-5:30 pm): **William Menasco** (SUNY at Buffalo)

- **November 10**
  Speaker: **Bena Tshishiku** (Harvard University)
  Title: **Obstructions to Nielsen realization** *Abstract:* Let M be a manifold, and let Mod(M) be its mapping class group. The Nielsen realization problem for diffeomorphisms asks, “Can a given subgroup G<Mod(M) be lifted to the diffeomorphism group Diff(M)?” This question about group actions is related to a question about flat connections on fiber bundles with fiber M. In the case M is a closed surface, the answer is “yes” for finite G (by work of Kerckhoff) and “no” for G=Mod(M) (by work of Morita). For most infinite G<Mod(M), we have no idea. I will discuss some obstructions that can be used to show that certain groups don’t lift. Some of this work is joint with Nick Salter.

- **November 17 (Joint with Combinatorics Seminar)**
  Note special time and room: Time: 1:15 - 2:15, Room: WH-329
  Speaker: **Eric Babson** (U. C. Davis)
  Title: **Gaussian Random Knots** *Abstract:* A model for random knots or links is obtained by fixing an initial curve in some n-dimensional Euclidean space and projecting the curve to random three dimensional subspaces. By varying the curve we obtain different models of random links. I will study how the second moment of the average linking numbers change as a function of the initial curve. This is based on work of Christopher Westenberger.

- **November 17**

  Speaker: **Todd Fisher** (Brigham Young University)

  Title: **Unique equilibrium states for geodesic flows in nonpositive curvature** *Abstract:*The geodesic flow for a compact Riemannian manifold with negative curvature has a unique equilibrium state for every Holder continuous potential function. This is no longer true if the curvature is only nonpositive. We show that there is a large class of potentials with unique equilibrium states. Specifically, we prove that for compact rank 1 surfaces of nonpositive curvature that the a scalar times geometric potential has a unique equilibrium state for the scalar less than 1. Furthermore, if a potential satisfies a bounded range hypothesis for compact rank 1 manifolds with nonpositive curvature, then there will be a unique equilibrium state. This is joint work with Keith Burns, Vaughn Climenhaga, and Dan Thompson.