Graduate Student Topology Seminar

Fall 2018

Geometric group theory is a collection of tools used to explore algebraic properties of groups by studying the geometry of spaces on which they act. My goal for the mini-course is to introduce several of the more classical tools used in geometric group theory, and hopefully give you a feel for the vastness of the subject. I will start by talking about free groups and groups acting on trees. Then, I plan on talking about quasi-isometries and hyperbolic groups. There are several places to go after that, but potential topics I've considered are ends of groups, mapping class groups, or outer automorphisms of free groups.

I've compiled a list of sources from which you might pull topics for further talks:

- "Office Hours with a Geometric Group Theorist" by Clay and Margalit
  - Some interesting further topics such as Ends of Groups, Growth of Groups, and all of Part 4 which delves into particular examples of groups (Coxeter groups, RAAG's, Lamplighter groups, Mapping Class groups, Braid groups).
- "Groups, Graphs and Trees: An Introduction to the Geometry of Infinite Groups" by John Meier
  - Similar to "Office Hours".
- "Topics in Geometric Group Theory" by Pierre de la Harpe
  - Contains some deeper topics. A few chapters on topics related to finitely-generated/presented groups. A nice discussion on the growth of a group. A section about the first Grigorchuk group.
- "Metric Spaces of Non-Positive Curvature" by Bridson and Haefliger.
  - For the more geometrically-minded of you. Perhaps most relevent is Part III: Aspects of the Geometry of Group Actions, which discusses δ-hyperbolic spaces, non-positive curvature and group theory, complexes of groups, and groupoids of local isometries.
- "Fuchsian Groups" by Svetlana Katok
  - A nice, fairly short overview of Fuchsian Groups (discrete subgroups of $\mathrm{PSL}(2,\mathbb{R})$). Lots of hyperbolic geometry.
- "Cohomology of Groups" by Kenneth Brown.
  - For the more algebraically-inclined. Discusses group (co)homology. The most pertinent topic to this seminar is Chapter VIII on Finiteness Conditions. This may require a bit of spectral sequences.
- "Bounded Cohomology of Discrete Groups" by Frigerio (available on the arXiv)
  - More topologically-flavored. Introduces group cohomology, but it might be good to have a standalone talk on group cohomology first. This would be a good opportunity for a couple/few people to team up and give a series of talks on this topic.

- "A Primer on Mapping Class Groups" by Farb and Margalit
  - I gave a talk in the last GSTS about mapping class groups, but there's a lot more material for another/more talks. Furthermore, Part 2 of this book is about Teichmüller Space and Moduli Space, and Part 3 discusses the Nielsen-Thurston classification of mapping classes and Pseudo-Anosov maps.