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Date Submitted: 2011-06-09 13:20
Title: Spring 2011 Cascade Topology Seminar
Event Type: Conference-Workshop

Location:
University of Victoria

Dates:
April 16th and 17th, 2011

Topic:
The Cascade Topology Seminar is a bi-annual, regional topology seminar intended largely for the people interested in topology the greater area of the Cascade Mountains. Recent topics of interest in the general area of topology, taken in a broad sense is the focus of the meeting. This meeting primarily focused on geometric topology topics.

Methodology:
We employed a traditional lecture format, with time between lectures for people to talk with each other. Some speakers used chalk boards, some used a digital projector. I don't think either is really considered novel.

Objectives Achieved:
The objectives were relatively modest -- dissemination of information. I think it's fair to say we achieved those goals.

Scientific Highlights:
Jesse Johnson's result has been described by some as "the holy grail" for the subject of Heegaard splittings of 3-manifolds. I believe Jesse's talk at the Cascade meeting was the first public announcement of the result. The result is the first sharp bound on the number of stabilizations required to find a common Heegaard splitting for two Heegaard splittings of a given 3-manifold.

Organizers:
Budney, Ryan, Math & Stats, Victoria Sinha, Dev, Math, Oregon Rolfsen, Dale, Math, UBC

Speakers:
Tom Church (Math. Chicago / Stanford) -- Representation theory and homological stability. Homological stability is a remarkable phenomenon where for certain sequences X_n of groups or

spaces -- for example $SL(n,\mathbb Z)$, the braid group B_n, or the moduli space M_n of genus n curves -- it turns out that the homology groups $H_i(X_n)$ do not depend on n once n is large enough. But for many natural analogous sequences, from pure braid groups to congruence groups to Torelli groups, homological stability fails horribly. In these cases the rank of $H_i(X_n)$ blows up to infinity, and in the latter two cases almost nothing is known about $H_i(X_n)$; indeed it's possible there is no nice “closed form" for the answers. While doing some homology computations for the Torelli group, we found what looked like the shadow of an overarching pattern. In order to explain it and to formulate a specific conjecture, we came up with the notion of “representation stability" for a sequence of representations of groups. This makes it possible to meaningfully talk about “the stable homology of the pure braid group" or “the stable homology of the Torelli group" even though the homology never stabilizes. This work is joint with Benson Farb. In this talk I will explain our broad picture and describe a number of connections to other areas of math, including two major applications. One is a surprisingly strong connection between representation stability for certain configuration spaces and arithmetic statistics for varieties over finite fields, joint with Jordan Ellenberg and Benson Farb. The other is representation stability for the homology of the configuration space of n distinct points on a manifold M. //Jing Tao (Math. Utah) -- Diameter of the thick part of moduli space. We study the shape of the moduli space of a surface of finite type. In particular, we compute the asymptotic behavior of the Teichmuller diameter of the thick part of moduli space. For a surface S of genus g with b boundary components, we show that the diameter grows like logarithm of the Euler characteristic. This is joint with Kasra Rafi. Ian Agol (Math. Berkeley) -- Presentation length and Simon's conjecture. We show that any knot group maps onto at most finitely many knot groups. This gives an affirmative answer to a conjecture of J. Simon. We also bound the diameter of a closed hyperbolic 3-manifold linearly in terms of the presentation length of its fundamental group, improving a result of White. //Yi Liu (Math. Berkeley) -- A Jorgensen-Thurston theorem for homomorphisms. In this talk, we describe the structure of homomorphisms from a finitely generated group to torsion-free Kleinian groups of uniformly bounded covolume. This is an analogy of the Jorgensen-Thurston theorem to homomorphisms. //Johanna Mangahas (Math. Brown) -- The geometry of right-angled Artin subgroups of mapping class groups. I'll describe joint work with Matt Clay and Chris Leininger. We give sufficient conditions for a finite set of mapping classes to generate a right-angled Artin group quasi-isometrically embedded in the mapping class group. Moreover, under these conditions, the orbit map to Teichmueller space is a quasi-isometric embedding for both of the standard metrics. As a consequence, we produce infinitely many genus h surfaces (h at least 2) in the moduli space of genus g surfaces (g at least 3) for which the universal covers are quasi-isometrically embedded in the Teichmueller space. //Alexandra Pettet (Math. UBC, Oxford, Chicago) -- Fully irreducible outer automorphisms of the outer automorphism group of a gree group. The outer automorphism group $Out(F)$ of a free group F of finite rank shares many properties with linear groups and the mapping class group $Mod(S)$ of a surface, although the techniques for studying $Out(F)$ are often quite different from the latter two. Motivated by analogy, I will present some results about $Out(F)$ previously well-known for the mapping class group, and highlight some of the features in the proofs which distinguish it from $Mod(S)$. //Jesse Johnson (Math. Oklahoma) -- Common stabilization of Heegaard splittings. A Heegaard splitting is a decomposition of a 3-manifold into two simple pieces called handlebodies. It has long been known that any two Heegaard splittings of the same 3-manifold are related by repeating a construction called stabilization. However, the early proofs of this fact gave no suggestion of how many stabilizations might be needed to turn one Heegaard splitting into another. I will describe a new upper bound on the necessary number of stabilizations.

Links:
http://rybu.org/?q=Cascade_2011