Geometric Topology, pseudo-Anosov Maps, and Complex Dynamics
Topologie géométrique, applications pseudo-Anosov et dynamique complexe
(Org: **Mariam Alhawaj**, **Giulio Tiozzo** and/et **Abdul Zalloum** (University of Toronto))

MARIAM AL-HAWAJ, University of Toronto
Generalized pseudo-Anosov Maps and Hubbard Trees

The Nielsen-Thurston classification of the mapping classes proved that every orientation preserving homeomorphism of a closed surface, up to isotopy is either periodic, reducible, or pseudo-Anosov. Pseudo-Anosov maps have particularly nice structure because they expand along one foliation by a factor of $\lambda > 1$ and contract along a transversal foliation by a factor of $\frac{1}{\lambda}$. The number λ is called the dilatation of the pseudo-Anosov. Thurston showed that every dilatation λ of a pseudo-Anosov map is an algebraic unit, and conjectured that every algebraic unit λ whose Galois conjugates lie in the annulus $A_\lambda = \{z : \frac{1}{\lambda} < |z| < \lambda\}$ is a dilatation of some pseudo-Anosov on some surface S.

Pseudo-Anosovs have a huge role in Teichmuller theory and geometric topology. The relation between these and complex dynamics has been well studied inspired by Thurston.

In this project, I develop a new connection between the dynamics of quadratic polynomials on the complex plane and the dynamics of homeomorphisms of surfaces. In particular, given a quadratic polynomial, we show that one can construct an extension of it which is generalized pseudo-Anosov homeomorphism. Generalized pseudo-Anosov means the foliations have infinite singularities that accumulate on finitely many points. We determine for which quadratic polynomials such an extension exists. My construction is related to the dynamics on the Hubbard tree which is a forward invariant subset of the filled Julia set that contains the critical orbit.

GEORGE DOMAT, Rice University/Fields Institute
Coarse Geometry of Big Mapping Class Groups of Graphs

We will introduce an analogue of big mapping class groups as defined by Algom-Kfir and Bestvina that hopes to answer the question: What is "Big Out(F_n)"? This group will consist of proper homotopy classes of proper homotopy equivalences of locally finite, infinite graphs. We will then discuss some classification theorems related to the coarse geometry of these groups. This is joint work with Hannah Hoganson and Sanghoon Kwak.

SAMI DOUBA, Institut des Hautes Études Scientifiques
On regular subgroups of $\mathrm{SL}_3(\mathbb{R})$

Motivated by a question of M. Kapovich, we show that the $\mathbb{Z}^2$ subgroups of $\mathrm{SL}_3(\mathbb{R})$ that are *regular* in the sense of Kapovich–Leeb–Porti are precisely the lattices in minimal horospherical subgroups. By work of Oh, it then follows that a Zariski-dense discrete subgroup Γ of $\mathrm{SL}_3(\mathbb{R})$ contains a regular $\mathbb{Z}^2$ if and only if Γ is commensurable to a conjugate of $\mathrm{SL}_3(\mathbb{Z})$. In particular, a Zariski-dense regular subgroup of $\mathrm{SL}_3(\mathbb{R})$ contains no $\mathbb{Z}^2$ subgroups. This is joint work with Konstantinos Tsouvalas.

THOMAS HAETTEL, IRL CRM Montréal
Garside groups and nonpositive curvature

I will present Garside groups, with basic examples coming from braid groups. I will discuss nonpositive curvature properties of Garside groups, and I will mention recent results concerning Garside structures for some Artin groups, in joint work with Jingyin Huang.

ANNETTE KARRER, McGill University
From Stallings' Theorem to connected components of Morse boundaries of graph of groups

Every finitely generated group G has an associated topological space, called a Morse boundary. It was introduced by a combination of Cordes and Charney–Sultan and captures the hyperbolic-like behavior of G at infinity.

At the beginning of the talk, I will recap Stallings' theorem and an analogous statement for Gromov boundaries of Gromov-hyperbolic groups. As Morse boundaries generalize Gromov boundaries, it raises the question whether it is possible to formulate an analog for Morse boundaries. Motivated by this question, we will study connected components of Morse boundaries of graph of groups. We will focus on the case where the edge groups are undistorted and do not contribute to the Morse boundary of the ambient group. Results presented are joint with Elia Fioravanti.

ILYA KAZACHKOV, Ikerbasque - Basque Foundation for Science
Real Cubings

The theory of real trees and groups acting on them has had a deep impact on Group Theory by providing tools to attack new problems, by simplifying proofs of classical results, and by establishing new connections between group theory and geometry, topology, dynamical systems and model theory.

In this talk, we will introduce a new class of metric spaces, called real cubings, which we view as higher-dimensional real trees. We will describe their structure and characterise them from different viewpoints.

As hyperbolic groups are linked to real trees via their asymptotic cone, we will show that real cubings are connected to hierarchically hyperbolic groups, a class of groups that contains right-angled Artin groups and the mapping class groups of closed surfaces.

We will then speculate why we believe that a good theory of groups acting on real cubings is possible. The talk is based on joint work with Montserrat Casals-Ruiz and Mark Hagen.

ALICE KERR, University of Bristol
Loxodromic elements in right-angled Artin groups

The ability to quickly generate loxodromic elements in an action on a hyperbolic space is key to many statements about exponential type growth. In mapping class groups these elements are the pseudo-Anosovs acting on the associated curve graph, and here results of this type are already known. We will discuss how we can acheive similar results for the action of right-angled Artin groups on their associated extension graph, by using an embedding of these groups into mapping class groups.

RYLEE LYMAN, Rutgers University–Newark
CTs for Free Products

Parallel to the theory of pseudo-Anosov homeomorphisms is the theory of train track maps for free group automorphisms. Since free group automorphisms may admit more complicated behavior than surface mapping classes, more generally one considers relative versions of train track maps. These come in many flavors, the strongest of which are CTs. I will give the idea of a CT and discuss a generalization to free products.

MALAVIKA MUKUNDAN, University of Michigan
Twisting problems in complex dynamics

The problem of "twisting" in complex dynamics concerns the post-composition of a postcritically finite polynomial with an orientation-preserving homeomorphism that fixes the postcritical set pointwise. We give an introduction to twisting via the

original "twisted rabbit problem" and explore its connections to Teichmüller theory and geometric groups as we walk through a survey of solutions, generalizations and questions for the future.

HARRY PETYT, University of Oxford
ℓ^p nonpositive curvature

Many groups can be effectively studied using metric spaces modelled on ℓ^1, ℓ^2, or ℓ^∞ geometry. Motivated by this observation, in this talk we consider cell complexes equipped with an ℓ^p metric for arbitrary p. Based on joint work with Thomas Haettel and Nima Hoda.

MIREILLE SOERGEL, ETH Zürich
An introdution to Dyer groups

In this talk, we will introduce Dyer groups, a family of groups, which contains both, Coxeter groups and right-angled Artin groups. We will discuss some geometric and algebraic properties of Dyer groups.

KARL WINSOR, Fields Institute
Pseudo-Anosov homeomorphisms and interval maps

Thurston classified the topological entropies of post-critically finite self-maps of the unit interval, solving a 1-dimensional analogue of the problem of classifying stretch factors of pseudo-Anosov surface homeomorphisms. Motivated by this work, we will describe a natural class of pseudo-Anosov homeomorphisms whose dynamics are closely related to the dynamics of interval maps. Specifically, we will show that pseudo-Anosov homeomorphisms of a punctured sphere whose quadratic differential has a single zero induce interval maps via their action on certain train tracks. One application of this result is a uniform lower bound of $\sqrt{2}$ for the associated stretch factors, recovering a result of Boissy-Lanneau. This is joint work with Ethan Farber.

CHENXI WU, UW Madison
Sub shift of finite types induced by linear order

I will discuss some monotonicity results of the poles of Artin Mazur zeta functions for certain families of sub shifts of finite types, generalizing previous results I had with Kathryn Lindsey, Harrison Bray, Diana Davis and Giulio Tiozzo on the Galois conjugates of conjugates of polynomial core entropies. I will also discuss ongoing work that looks at possible applications to p-adic dynamics.

REILA ZHENG, University of Toronto
Sharkovsky's Ordering on the Mandelbrot Set

Sharkovsky's Theorem is the classical result on the forcing and existence of periodic orbits of a continuous interval map. In my talk I will describe the generalized Sharkovsky's ordering on the Mandelbrot set.