

2024 Shanghai Geometric Group Theory Workshop Schedule

@Gu Lecture Hall SCMS (2nd floor)

| | 7.8 Monday | 7.9 Tuesday | 7.10 Wednesday | 7.11 Thursday | 7.12 Friday |
|----------------------|--|-------------------------------------|--------------------------------------|---------------------------------------|------------------------------------|
| 8:45-9:00 | Opening | | | | |
| 9:00-10:00 | Fujiwara chair Wenyuan Yang | Lafont Qiang Zhang | Baik Enxin Wu | Lafont Hao Liang | Lei Chen Ruifeng Qiu |
| 10:20-11:20 | Huang chair Zhi Chen | Baik Zhiyun Cheng | Jankiewicz Robert Tang | Fujiwara Xiangdong Xie | Sun Shicheng Wang |
| 11:30 – 12:30 | | | Fujiwara Qing Liu | | Lafont Ying Zhang |
| Lunch break | | | | | |
| 14:00-15:00 | Baik chair Yi Liu | Skipper Jianchun Wu | Free afternoon | Lvzhou Chen Ying Hu | Free afternoon |
| 15:20-16: 20 | Xu chair Hongyu Wang | Han Xiaoming Du | | Problem Session | |
| 16:30 – 17:30 | Connell chair Chao Wang | Darbinyan Yanqing Zou | | | |
| 18:00-20:00 | Dinner | Dinner | | Banquet 18:30-21:00 | |

Wifi network: eduroam

username: 2024sggtw@guest password: Scmsguest

See [How to set this up](#)

- ① You can register either on Jul. 7th from 1pm to 6pm at the Frasers Place Wujiaochang Shanghai (上海五角场辉盛坊公寓酒店) or at SCMS during the workshop

Titles and abstracts

Harry Hyungryul Baik, Korea Advanced Institute of Science and Technology

Title: Flows and foliations in 3-manifolds from the viewpoint of group actions on the circle or plane

Abstract: We will first briefly go over basics of (pseudo-)Anosov flows and taut foliations in 3-manifolds. In both cases, such structures yield the fundamental group action on the circle with a transverse pair of invariant laminations. Under some suitable assumptions, one can in fact go backward and reconstruct the 3-manifold with flow/foliation from the pair of invariant laminations. Such a construction goes through so-called a bifoliated plane. As a motivating example, we will discuss the case of surfaces as well. Surface groups always admit infinitely many invariant laminations and this can be used to reconstruct the surface.

Lei Chen, Chinese Academy of Sciences

Title: Mapping class groups of circle bundles over a surface

Abstract: In this talk, we study the algebraic structure of mapping class group $\text{Mod}(M)$ of 3-manifolds M that fiber as a circle bundle over a surface. We prove an exact sequence, relate this to the Birman exact sequence, and determine when this sequence splits. We will also discuss the Nielsen realization problem for such manifolds and give a partial answer. This is joint work with Bena Tshishiku and Alina Beaini.

Lvzhou Chen, Purdue University

Title: Rigidity of big mapping class groups acting on the circle

Abstract: Surfaces of infinite type, such as the plane minus a Cantor set, occur naturally in dynamics. However, their mapping class groups are much less understood compared to the mapping class groups of surfaces of finite type. For the mapping class group G of the plane minus a Cantor set, we show that any nontrivial G -action on the circle is semi-conjugate to its action on the so-called simple circle. I will also explain what happens in the more general situation where we replace the plane by a once-punctured surface of finite genus. This involves joint work with Danny Calegari and Francesco Fournier Facio.

Chris Connell, Indiana University Bloomington

Title: The natural flow and homological vanishing in nonpositively curved manifolds

Abstract: We introduce a flow on nonpositively curved manifolds inspired by the natural maps of Besson, Courtois and Gallot for which the Morse theoretic data can be computed in terms of the geometric structure of the manifold. We present several applications of this flow, including conditions for the nonexistence of complex subvarieties and estimates of the Cheeger constant on such manifolds. Most importantly, we show the vanishing of the homology of discrete subgroups of isometries of a Hadamard space above a certain threshold which is computable from the geometry the Hadamard space and the critical exponent of the representation of the fundamental group. Time permitting, we will present some examples including those arising from Anosov representations in higher rank lie groups. This is joint work with Shi Wang and Ben McReynolds.

Arman Darbinyan, University of Southampton

Title: Exotic residual finiteness growth functions

Abstract: A method of quantifying residually finite groups is via residually finiteness growth (RFG), which was introduced by Bou Rabee and henceforth generated much interest within group theory. While much research is done towards understanding RFG, many natural questions still remain open. My talk will address some of those questions. In particular, I will discuss the first examples of residually finite groups with intermediate RFG. Additionally, I will discuss residual finiteness growth functions with various computability properties and sketch some applications.

Koji Fujiwara, Kyoto University

Title: The rates of growth in hyperbolic groups

Abstract: Let $e(G,S)$ be the exponential growth rate of a finite generated group G with a finite generating set S . Let $\xi(G)$ be the set $\{e(G,S)\}$ for all finite generating sets S of G . Sela and I proved that if G is a non-elementary hyperbolic group, then $\xi(G)$ is well-ordered. I also plan to discuss the set of growth rates for a family of groups. That is a joint work with Breuillard.

Xiaolong Han, Shanghai Institute for Mathematics and Interdisciplinary Sciences

Title: The geometry of fibrations, the Thurston norm, and Lipschitz maps

Abstract: We start with some basic geometry of fibration of hyperbolic 3-manifolds. We then talk about the connection between the Thurston norm, best Lipschitz circle-valued maps, and maximal stretch laminations. We show that the distance between a level set and its translation is the reciprocal of the Lipschitz constant, bounded by the topological entropy of the pseudo-Anosov monodromy if M fibers.

Jingyin Huang, The Ohio State University

Title: The $K(\pi,1)$ -conjecture for Artin groups via combinatorial non-positive curvature

Abstract: The $K(\pi,1)$ -conjecture for reflection arrangement complements, due to Arnold, Brieskorn, Pham, and Thom, predicts that certain complexified hyperplane complements associated to infinite reflection groups are Eilenberg MacLane spaces. We establish a connection between simple properties about short cycles in graphs, solving equations over certain groups, and the $K(\pi,1)$ -conjecture, via elements of non-positively curvature geometry. We also propose a new approach for studying the $K(\pi,1)$ -conjecture. As a consequence, we deduce a large number of new cases of Artin groups which satisfies the $K(\pi,1)$ -conjecture.

Kasia Jankiewicz, University of California Santa Cruz

Title: Right-angled Artin subgroups of graph braid groups

Abstract: Crisp-Paris proved that the squares of the standard generators of an Artin group generate the "obvious" right-angled Artin subgroup. In a joint work with Schreve, we proposed that a larger set of naturally defined elements should generate another "obvious" right-angled Artin subgroup. More recently, Schreve and I studied a similar question for graph braid groups, which are the fundamental groups of configuration spaces of particles in a graph. As an application, we compute the topological complexity of graph braid groups with sufficiently many particles.

Jean-François Lafont, The Ohio State University

Title: Cubulating strict hyperbolizations

Abstract: The first lecture will give an introduction to CAT(0) spaces, with a focus on the theory of (special) cube complexes. The second lecture will introduce hyperbolization procedures, and will discuss applications of these to produce groups and/or spaces with various pathological behaviors. The third lecture will outline the proof of a recent result with Ruffoni, explaining why groups obtained via the Charney-Davis hyperbolization are (special) cubulable.

Rachel Skipper, The University of Utah

Title: Maximal Subgroups of Thompson's group V

Abstract: Maximal subgroups of a group provide a range of information about the group. First, maximal subgroups correspond to primitive actions of a group. Secondly, in a finitely generated group every proper subgroup is contained in a maximal one. In this talk, we will discuss some ongoing work with Jim Belk, Collin Bleak, and Martyn Quick to understand and classify maximal subgroups of Thompson's group V.

Hongbin Sun, Rutgers University

Title: NonLERFness of arithmetic hyperbolic manifold groups

Abstract: We show that any arithmetic lattice $\Gamma \leq \text{Isom}^+(\mathbb{H}^n)$ with $n \geq 4$ is not LERF (locally extended residually finite), including type III lattices in dimension 7. One key ingredient in the proof is the existence of totally geodesic 3-dim submanifolds, which follows from the definition if Γ is in type I or II, but is much harder to prove if Γ is in type III. This is a joint work with Bogachev and Slavich.

Binbin Xu, Nankai University

Title: Periodic directions on translation surfaces of genus 2

Abstract: One generalization of flat structure on torus to oriented closed surface of genus greater than 1 is called translation surface structure. When a surface is equipped with such a structure, we call it a translation surface. Given a translation surface S, like on a flat torus, there is a globally well-defined notion of direction on S, and geodesics on S along a same direction are disjoint from each other, hence induces a flow on S. Such flows and their dynamical properties are important in the study of the symmetry group of S which is called Veech group. In particular, when the flow on S along one direction has only periodic regular orbits, we call this direction a periodic direction of S. In a joint-work with Anja Randecker, using the close relation between interval exchange transformations and flows on surfaces, we obtain a full classification of translation surfaces of genus 2 with one singularity according to the size of their periodic directions sets. In this talk, I will first give some necessary background, then I will explain our result and give the rough idea of the proof.