Description for the general public

This project concerns the *Geometric Group Theory*, where we study groups using geometric, topological and analytical methods.

The main objects of our interest will be *Artin groups* – a classical family of groups that in recent years became of central importance in Geometric Group Theory and beyond. The main appeal of Artin groups lies in their exceptional richness: there are multiple subclasses of interest, each of them capturing a different phenomenon visible in group theory at large. For each such phenomenon, Artin groups provide the perfect testing grounds for conjectures and ideas, since Artin groups are not only rich but also well-behaved due to the combinatorial structure that controls them.

There are five main subclasses that we wish to focus on in this project: Artin groups of *type FC*, of *classical type*, of *Euclidean type*, as well as 2-*dimensional* and *right-angled* Artin groups. For each of these, we have separate routes of inquiry:

For Artin groups of type FC and classical type, and for 2-dimensional ones, we wish to establish the *Farrell–Jones Conjecture*. The conjecture relates the algebraic K-theory of a group with the homology of a classifying space for the family of virtually cyclic subgroups of the group; more specifically, the conjecture stipulates that a certain assembly map is an isomorphism.

For Artin groups of classical and Euclidean type, we will look into the higher generation by subgroups. In the context of *braid groups* (which are Artin groups of classical type) it was shown that higher generation is intimately connected with connectivity of the so-called matching complexes. We will explore this connection for all Artin groups of classical and Euclidean types, with the aim of generalising the braid groups results.

Right-angled Artin groups (RAAGs) are perhaps the simplest and best understood among Artin groups. Their automorphisms however are extremely interesting because of the interpolation between automorphisms of free-abelian and free groups that they provide. We will focus on two aspect of automorphisms of RAAGs, one geometric, and one topological. On the geometric side, we will investigate the Nielsen Realisation problem, that is, we will attempt to prove that finite groups of outer automorphisms of a RAAG A_Γ act on 'slanted' cube complexes with fundamental group A_Γ in such a way that the induced outer action on the fundamental group agrees with the algebraic action we started with.

On the topological side, we will probe the rigidity of $\mathrm{Aut}(A_\Gamma)$ in the context of maps from Čech complete groups (this class includes all Polish groups and all locally compact groups). More specifically, we will attempt to prove that every homomorphism from a Čech complete group to $\mathrm{Aut}(A_\Gamma)$ is continuous and open, provided that its image is 'large' (e.g., contains an element of infinite order). This result will be the starting point for further inquiries in this direction.

We expect that the research proposed here will open new vistas on Artin groups by shedding fresh light on multiple phenomena for representative subclasses. The proposed project will fully realise the synergy potential of bringing together the German and Polish researchers involved, and will combine their unique expertise and perspectives to maximise the impact on the development of Geometric Group Theory.

Several of the research directions proposed here are meant as PhD projects. The students should benefit greatly from being part of the varied yet focused research environment formed by the research team of this project.