

## 【Grant-in-Aid for Scientific Research (S)】

### Science and Engineering (Mathematical and Physical Sciences)



Title of Project : Geometric Group Theory

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Research Project Number : 15H05739 Researcher Number : 60229078

Research Area : Geometry

Keyword : Hyperbolic geometry, Discrete groups, Riemannian geometry, Mapping class groups

#### 【Purpose and Background of the Research】

Group theory has a branch of Mathematics, and it has a long history. In Geometry it plays an essential role to describe the symmetry of a geometric object. Group theory has lots of applications. For example the theory of Lie groups is an important tool in Physics.

In our project, we study non-commutative, infinite, discrete groups. Max Dehn did a pioneer work about 100 years ago. The important idea in his approach was to use Geometry in the study of groups.

In the 80's Gromov wrote a seminal paper "Hyperbolic groups" and used hyperbolic geometry to study infinite groups. Following his ideas, many important theorems have been obtained since then, and it created a new field called Geometric group theory by now.

We study various subjects in Geometric group theory, for example, mapping class groups.

#### 【Research Methods】

We form a research group of a small number of people. We also organize international conferences and research programs.

We will hire young researchers, in particular, for the research using computers.

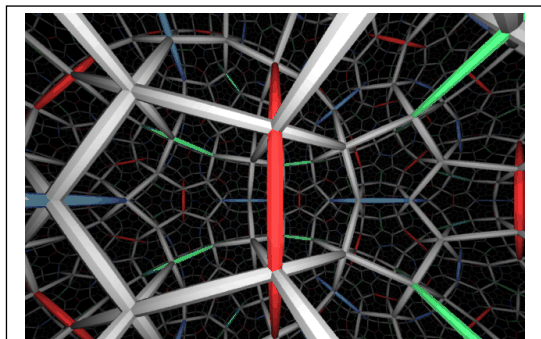


Figure 1

3-dimensional  
hyperbolic space  
(Geometry center)

#### 【Expected Research Achievements and Scientific Significance】

Fujiwara established a theory of "Projection complex" in his recent work with Bestvina and Bromberg and proved several important results. It is expected that the theory will play an important role in Geometric group theory, and find further applications.

Recently, Agol proved several very important theorems in the study of 3-dimensional hyperbolic manifolds/Kleinian groups. The key tool in his work is the work by Wise on CAT(0) cube complexes. Our project aims to study CAT(0) cube complexes as well.



The convex hull of a Kleinian group  
(MSRI)

#### 【Publications Relevant to the Project】

- [1] Mladen Bestvina, Kenneth Bromberg, Koji Fujiwara. Constructing group actions on quasi-trees and applications to mapping class groups. *Publ. IHES*, published online, 2014
- [2] Mladen Bestvina, Koji Fujiwara, Bounded cohomology of subgroups of mapping class groups. *Geometry and Topology*, Volume 6 (2002) 69--89.

【Term of Project】 FY2015-2019

【Budget Allocation】 60,800 Thousand Yen

#### 【Homepage Address and Other Contact Information】

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