PROGRAM CURSO AVANZADO DE ÁLGEBRA

DOMINIK FRANCOEUR

Geometric group theory

The aim of this course is to introduce the fundamental notions of the modern theory of finitely generated infinite groups, with a particular emphasis on *geometric group theory.*

Geometric group theory is the study of groups by the use of geometric methods, either by considering group actions on geometric spaces, or by viewing groups themselves as geometric object. It is a beautiful theory with interesting applications to both algebra and geometry.

The course will cover the following topics:

- Free groups
- Group presentations
- Dehn's decision problems
- Group extensions, semi-direct products, free products, amalgamated products, wreath products
- Cayley graphs
- Group actions
- The Ping-Pong Lemma
- Quasi-isometries
- The Švarc-Milnor Lemma
- Word growth
- Groups of polynomial growth, Gromov's theorem
- Groups of intermediate growth, Grigorchuk's group
- Hyperbolic groups

Knowledge of algebraic topology could be useful, but the course will not assume any knowledge beyond basic group theory.

References

The following references will be used for the course.
Primary reference:

- Clara Löh. *Geometric group theory. An introduction.* Universitext. *Springer, Cham,* 2017. xi+389 pp. ISBN: 978-3-319-72253-5; 978-3-319-72254-2 .

Secondary references:

- Gilbert Baumslag. *Topics in Combinatorial Group Theory.* Lectures in Mathematics ETH Zürich. *Birkhäuser Verlag, Basel,* 1993. viii+164 pp. ISBN: 3-7643-2921-1.

- Pierre de la Harpe. *Topics in geometric group theory.* Chicago Lectures in Mathematics. *University of Chicago Press, Chicago, IL, 2000.* vi+310 pp. ISBN: 0-226-31719-6; 0-226-31721-8.
- Jean-Pierre Serre. *Trees.* Translated from the French by John Stillwell. *Springer-Verlag, Berlin-New York*, 1980. ix+142 pp. ISBN: 3-540-10103-9.