Paul-Henry Leemann

Researcher in Pure Mathematics

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Personal Information

Date of Birth April 12, 1987

Citizenship Switzerland

Main areas of research

My research interests lie at the intersection of geometric and combinatorial group theory, graph theory and symbolic dynamic. I am particularly interested in groups acting on rooted trees and their (weakly) maximal subgroups, limits and coverings of (Schreier) graphs, rigidity phenomenon in Cayley and Schreier graphs and graphs associated to dynamical systems.

Employment

Since August 2022 **Xi'an Jiaotong-Liverpool University, Suzhou, China**, *Assistant Professor*, in Department of Pure Mathematics

2021–2022 **Université de Neuchâtel, Switzerland**, *Scientific collaborator*, in Institut de mathématiques

2020–2021 **Université de Neuchâtel, Switzerland**, *Post-Doc*, in Institut de mathématiques, with Alain Valette

2018–2020 **ENS-Lyon, France**, *Post-Doc*, in Unité de Mathématiques Pures et Appliquées, with Mikael de la Salle
Post-Doc Labex MILYON

2016–2018 **ENS-Lyon, France**, *Post-Doc*, in Unité de Mathématiques Pures et Appliquées, with Mikael de la Salle
Early Postdoc.Mobility grant supported by the Swiss National Science Foundation

Education

2011–2016 **Université de Genève, Switzerland**, *Ph.D. in Mathematics*, "On Subgroups and Schreier Graphs of Finitely Generated Groups", advisor: Tatiana Smirnova-Nagnibeda
Mention very good. **Vacheron Constantin prize for the best thesis in sciences, of the Université de Genève**

2013–2015 **Université de Genève, Switzerland**, *Basic Certificate of Didactic in Mathematics and in Educational Science*

2009–2011 **Université de Genève, Switzerland**, *M. Sc. in Mathematics*, Master-thesis: "Caractères irréductibles des groupes de Coxeter finis", advisors: Pierre de la Harpe and Tatiana Smirnova-Nagnibeda
grades: 6/6 (Master-thesis) and 5.7/6 (courses)

2006–2009 **Université de Genève, Switzerland**, *B. Sc. in Mathematics*

Publications

1. *Wreath products of groups acting with bounded orbits*, with G. Schneeberger. Accepted in l'Enseignement mathématiques (to appear in 2024). https://arxiv.org/abs/2102.08001
2. *Most rigid representation and Cayley index of finitely generated groups*, With M. de la Salle. The Electronic Journal of Combinatorics, Vol. 29 Issue 4 (2022). https://doi.org/10.37236/10512
3. *Property FW and wreath products of groups: a simple approach using Schreier graphs*, with G. Schneeberger. Expositiones Mathematicae, Vol. 40 Issue 4 (2022). https://doi.org/10.1016/j.exmath.2022.07.001
4. *Cayley graphs with few automorphisms: the case of infinite groups*, with M. de la Salle. Annales Henri Lebesgue Vol. 5 (2022). https://doi.org/10.5802/ahl.118
5. *Up to a double cover, every regular connected graph is isomorphic to a Schreier graph.* Bulletin of the Belgian Mathematical Society – Simon Stevin Vol. 28, Issue 3 (2022). https://doi.org/10.36045/j.bbms.210416
6. *Finitely generated subgroups of branch groups and subdirect products of just infinite groups*, with R. Grigorchuk and T. Nagnibeda. Izvestia: Mathematics Vol. 85 (2021). https://doi.org/10.1070/IM9101
7. *Cayley graphs with few automorphisms*, with M. de la Salle. Journal of Algebraic Combinatorics Vol. 53 (2021). https://doi.org/10.1007/s10801-020-00956-1
8. *Schreier graphs: Transitivity and Coverings.* International Journal of Algebra and Computation Vol. 26, Issue 1 (2016). https://doi.org/10.1142/S021819671650003X
9. *Weakly maximal subgroups in regular branch groups*, with K. Bou-Rabee and T. Nagnibeda. Journal of Algebra Vol. 455 (2016). https://doi.org/10.1016/j.jalgebra.2016.02.009
10. *Lamplighter groups, de Bruijn graphs, spider-web graphs and their spectra*, with R. Grigorchuk and T. Nagnibeda. Journal of Physics A: Mathematical and Theoretical Vol. 49, Number 20 (2016). https://doi.org/10.1088/1751-8113/49/20/205004

Preprints

11. *Limits of Rauzy graphs of languages with subexponential complexity*, with T. Nagnibeda, A. Skripchenko and G. Veprev. (2024). https://arxiv.org/abs/2402.15877
12. *On the structure of finitely generated subgroups of branch groups*, with D. Francoeur, R. Grigorchuk and T.Nagnibeda. (2024). https://arxiv.org/abs/2402.15496
13. *Subgroup induction property for branch groups*, with D. Francoeur. (2020). https://arxiv.org/abs/2011.13310
14. *Weakly maximal subgroups of branch groups.* (2020). Preprint: https://arxiv.org/abs/1910.06399

Prizes and Grants

2024-2026 *Groups acting on rooted trees and their subgroups. XJTLU Research Development Fund (China).*

2023-2027 *Subgroup separability and rigidity of Cayley graphs.* Bourse Beatriz Galindo (junior). 4 years research position at the Universidad del País Vasco (Bilbao, Spain). Declined.

2021–2022 *Group theory, topology and dynamics: Russian-Swiss collaboration.* Co-investigator, 2 years collaboration

2018–2020 *Local and global geometry of graphs, groups and their actions.* Labex MILYON Postdoc grant

2016–2018 *Local and global geometry of graphs, groups and their actions.* Early Postdoc.Mobility grant supported by the Swiss National Science Foundation

2017 Vacheron Constantin prize for the best thesis in sciences, *Université de Genève, Switzerland*

Conferences organisation

June 2022 Self-similarity of groups, trees and fractals, co-organizer, 30 May-3 June, Institut Henri Poincaré, Paris, France

October 2021 Kervaire seminar "Baum-Connes conjecture", co-organizer, 24-29 Octobre, Les Diablerets, Switzerland

March 2013 Kervaire seminar "Géométrie des groupes 2013", local organizer, 10-15 March, Les Diablerets, Switzerland

Talks

Conferences:

August 2021 World Of Group Craft, online conference, *Wreath product of groups acting with bounded orbits.*

June 2018 Trees Dynamics and Locally Compact Groups, Heinrich Heine University, Dusseldörf, Germany. *Profinite completion of weakly maximal subgroups of branch groups.*

January 2017 Rencontre GAMME, Sète, France. *Weakly maximal subgroups of the Grigorchuk group. Existence and construction of IRS.*

November 2014 Paroles aux jeunes chercheurs en géométrie et dynamique, GDR Platon, Université de Bordeaux, France. *A criterion for the transitivity of Schreier graphs.*

June 2014 Workshop in Algebra and Geometry, University of Bern, Switzerland. *Transitivity of Schreier graphs and strongly simple groups.*

September 2013 Geometric and Analytic Group Theory, Ventotene, Italy. *Transitivity of Schreier graphs.*

Seminars (since 2019):

November 2023 Topology seminar, University of Fudan, Shanghai, China. *Rigidity of Cayley graphs.*

October 2023 Mathematics Colloquium, National Taiwan University, Taipei, Taiwan. *Random walks on infinite groups: some applications.*

September 2022 Pure Math seminar, XJTLU, Suzhou, China. *Cayley graphs with few automorphisms.*

March 2022 Colloquium of the Université de Fribourg, Switzerland. *Cayley graphs with few automorphisms.*

June 2021 Journées Neuchâtel-Besançon d'Analyse Fonctionnelle, Université de Neuchâtel, Switzerland. *Produit en couronne et groupes agissant avec des orbites bornées.*

May 2021 Séminaire Groupes et Géométrie, Université de Genève, Switzerland. *Produit en couronne et groupes agissant avec des orbites bornées.*

April 2021 Algebra Seminar, Lincoln University, United-Kingdom. *Branch groups and the subgroup induction property.* Slides: http://www.leemann.website/slides/subgroupinduction.pdf

April 2021 Séminaire Géométrie, Algèbre, Algèbre d'opérateurs, Université de Clermont-Ferrand, France. *Graphes de Cayley avec peu d'automorphismes.* Slides (in French): http://www.leemann.website/slides/clermont-ferrand.pdf

March 2021 Group theory seminar, ENS, Paris, France. *De Bruijn graphs, spider web graphs and Lamplighter groups.* Slides: http://www.leemann.website/slides/bruijn.pdf

February 2021 Symmetry in Newcastle, University of Newcastle, Australia. *Rigidity of Cayley graphs.* Slides: http://www.leemann.website/slides/newcastle.pdf

December 2020 Séminaire Groupes et Analyse, Université de Neuchâtel, Switzerland. *Property FW and wreath products, the median graphs point of view*

November 2020 Colloque du département de mathématiques, Université de Neuchâtel, Switzerland. *Groups and graphs: rigidity phenomena.* Slides (in French): http://www.leemann.website/slides/rigidity.pdf

March 2020 Séminaire Groupes et Géométrie, Université de Genève, Switzerland. *Weakly maximal subgroups of branch groups.* Slides: http://www.leemann.website/slides/weaklymaximal.pdf

October 2019 Séminaire de Géométrie, Groupes et Dynamiques, ENS Lyon. *Rigidity of Cayley graphs.*

Teaching Experiences

Since 2022 Lecturer at XJTLU:
- 2x Engineering Mathematics
- 2x Introduction to the Methods of Applied Mathematics
- 8x Supervisor of Final Year Projects (Bachelor)

2020–2021 In Neuchâtel:
- 1x "Branch groups", a 6 hours mini-course for doctoral students

2016–2020 In ENS Lyon:
- 3x Teaching assistant of "Coverings and fundamental groups" (master)
- 1x Teacher of "Introduction to LaTeX" (3rd year class)

2011–2016 Teaching assistant at the University of Genève:
- 1x Advanced course on Combinatorics (master)
- 3x Algebra II: groups, rings, fields, Galois theory (2nd year class)
- 2x Algebra I: linear algebra (1st year class)
- 1x Analysis I: basics of logic and set theory, real analysis (1st year class)
- 1x General mathematics: 1st year class for students of other departments
- 1x Tutoring for first year students

2009–2010 Graduate teaching assistant at the University of Genève: tutoring for first year students

2006–2011 Private tutor in mathematics for high school students

Scientific popularization

2018 MATHαLYON: interactive workshop in Junior High School, Lyon, France

2015 Facilitator at the "Science's night", Genève, Switzerland

2012–2014 Facilitator at the University "Open Day", Genève, Switzerland

2011–2012 Mathematics' facilitator in Junior High School and High School classes, Genève, Switzerland

2009–2010 Mentor in the "boussole"curriculum (one week of immersion in the mathematics' department, for High School's students), Genève, Switzerland

Administrative duties

2022–2023 Global Engagement Officer, Department of Pure Mathematics, XJTLU, China

2022–2023 Member of the School International Committee, School of Mathematics and Physic, XJTLU, China

2022–2023 Member of the School International Strategy Working Group Committee, School of Mathematics and Physic, XJTLU, China

Memberships in panels and scientific reviewing activities

I have been an external expert for the OPUS-21 grant funding scheme of the National Science Centre Poland.
I am a rewiever for Mathematical Reviews/MathSciNet.
I have been a referee for the following journals: Journal of Algebra, International Journal of Algebra and Computation, L'enseignement mathématiques, Expositiones Mathematicae, Journal of Algebra and its Applications, Panorama et Synthèses (SMF), Australasian Journal of Combinatorics.

Languages

French: native English: fluent German: basics

Computer skills

(LA)TEX and Ti*k*Z: advanced HTML/CSS:basics GAP: basics