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EDUCATION

University of Oxford, United Kingdom October 2025 — Expected 2029
Doctor of Philosophy in Mathematics

University of Copenhagen, Denmark February 2025 — July 2025
Master Thesis under the supervision of Prof. Nathalie Wahl, Exchange Semester

Ecole Polytechnique Fédérale de Lausanne, Switzerland September 2023 — July 2025
MSc Mathematics with Minor in Quantum Science and Engineering

Ecole Polytechnique Fédérale de Lausanne, Switzerland September 2020 — July 2023
BSc Mathematics

PUBLICATIONS

Finite groups as homotopy self-equivalences of finite spaces, Grad. J. Math. 9 (2024), no. 2, 15–21

We study the realization problem of finite groups as the group of homotopy classes of self-homotopy equivalences of finite spaces. Let G be a finite group. Using an infinite family of pairwise non weakly homotopic asymmetric spaces we present a new construction of a finite space whose group of homotopy classes of self-homotopy equivalences is isomorphic to G.

PROJECTS

Homology of Sullivan diagrams, Master Thesis
Supervised by Prof. Nathalie Wahl.

We study the homology of the harmonic compactification of the moduli space of Riemann surfaces. This compactification admits a combinatorial model using metric fat graphs, known as Sullivan diagrams. First, we present new computations of the fundamental groups of spaces of Sullivan diagrams. Next, we provide a new proof of homological stability for Sullivan diagrams with respect to the number of boundary components. As part of this proof, we compute the stable homology of the spaces of Sullivan diagrams.

Homological Stability, Master Semester Project
Supervised by Prof. Jerome Scherer.

Understand categorical methods to obtain homological stability for families of automorphism groups, based on the article *Homological stability for automorphism groups* by Oscar Randal-Williams and Nathalie Wahl. I compare these results with the ones studied in my Bachelor project. Then I focus on the homological stability for mapping class groups of surfaces.

Riemannian Optimization for Quantum Tasks, Minor Semester Project
Supervised by Dr. Yudai Suzuki and Prof. Zoe Holmes.

Study the mathematical framework of different methods of Variational Quantum Eigensolvers (VQEs). I explain the link between Riemannian Gradient Flow, Double-Bracket Flow and Imaginary Time Evolution.

Homological Stability of Symmetric Groups, Bachelor Project
Supervised by Prof. Jerome Scherer.

Give all details of new techniques used to find stability ranges for symmetric groups with constant and twisted coefficients, based on the article *A new apprach to twisted homological stability, with applications to congruence subgroups* by Andrew Putman.

EXPERIENCE

Laboratory of Topology and Neuroscience, EPFL Lausanne, Switerland
Summer in the Lab internship, research intern Summer 2022

- Research in topology under the supervision of Prof. Kathryn Hess and Prof. Jerome Scherer.
- Develop Python code to perform topological computations: this allows to check hand-made computations.
- Give a new solution to a realization problem of finite groups as homotopy self-equivalences of finite spaces.

Chair of Number Theory, EPFL Lausanne, Switerland
Research intern Summer 2023

- Study a periodic configuration problem under the supervision of Prof. Maryna Viazovska.
- Progress in unsolved optimization problem (related to sphere packing) using analytical and combinatorial tools.

EPFL Lausanne, Switerland
Teaching Assistant February 2022 - January 2025

- Teaching Assistant for first-year and second-year university students.
- Teaching Assistant for Linear Algebra, Analysis, Computer Science, Group Theory, Discrete Mathematics, Algebraic Structures.
- Responsibilities include grading assignments and exams.

EPFL Lausanne, Switerland
Group Theory course MOOC developer September 2022 – July 2024

- Reorganize and cut class videos so that they are compatible with the platform.
- Create quiz questions for all videos of the course.
- Write the final evaluation for all sections of the MOOC.

TALKS AND SEMINARS

- **Riemannian Geometry of VQA** QIC Group Meeting EPFL, January 9th 2025
- **Homological stability of mapping class groups** Topology Workshop EPFL, January 7th 2025
- **Cohomology Ring of Dihedral Groups** Topology Reading Group EPFL, December 4th 2024
- **Spectral sequences for homological stability** Topology Reading Group EPFL, November 27th 2024
- **Quillen's small object argument** Topology Reading Group EPFL, October 30th 2024

SKILLS

Programming

- Python: intermediate
- MatLab: intermediate
- C++: intermediate
- Qiskit: beginner
- PennyLane: beginner
- Mathematica: beginner

Languages

- Spanish: native
- English: fluent
- French: fluent
- Portuguese: beginner

Transversal workshops

- **Leadership** Summer in the Lab EPFL, Summer 2022
- **Scientific communication** Summer in the Lab EPFL, Summer 2022

AWARDS AND ACHIEVEMENTS

- Best Swiss Matura at Colegio Helvetia, Colombia
- Colombian Mathematics Olympiads top 10 from 2015 to 2020, 1st place in 2016 semi-final
- Astronomy and astrophysics Colombian Olympiads 9th place 2018
- Swimmer in Cundinamarca's League, 45 medals (11 gold, 22, silver, 12 bronze)
- Marathon finisher: Copenhagen 2025, Lausanne 2023