



# JACOB LEYGONIE

born in 02/04/1995

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## EDUCATION

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- Early Career Fellow** | *Topological Data Analysis* Apr. 2018 – Sep. 2022  
Inria Saclay. Collaboration with Steve Oudot. Funded by London Mathematical Society (LMS) Paris, France
- DPhil of Mathematics** | *Topology group* Oct. 2018 – Mar. 2022  
Mathematical Institute. Supervised by Ulrike Tillmann and Heather Harrington Oxford, United Kingdom
- Bachelor and Master of Science** | *Mathematics & Computer Science* Sep. 2015 – Apr. 2018  
École Polytechnique Paris, France

## PREPRINTS & PUBLICATIONS

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- The Fiber of Persistent Homology for Trees**  
David Beers, Jacob Leygonie. 2023  
Preprint. 21 pages | [online version](#)
- Algorithmic Reconstruction of the Fiber of Persistent Homology on Cell Complexes**  
Jacob Leygonie, Gregory Henselman-Petrusek. 2021.  
Under revisions at *Journal of Applied and Computational Topology*. 22 pages | [online version](#)
- A Gradient Sampling Algorithm for Stratified Maps with Applications to Topological Data Analysis**  
Jacob Leygonie, Mathieu Carrière, Théo Lacombe and Steve Oudot. 2021.  
Appeared in *Mathematical Programming*. 30 pages | [online version](#)
- Fiber of Persistent Homology on Morse Functions**  
Jacob Leygonie and David Beers. 2021.  
Appeared in *Journal of Applied and Computational Topology*. 6 pages | [online version](#)
- The Fiber of Persistent Homology for Simplicial Complexes**  
Jacob Leygonie and Ulrike Tillmann. 2021.  
Appeared in *Journal of Pure and Applied Algebra*. 38 pages | [online version](#)
- Optimisation of Spectral Wavelets for Persistence-based Graph Classification**  
Ka Man Yim and Jacob Leygonie. *arXiv preprint arXiv:2101.05201*, 2021.  
Appeared in *Frontiers in Applied Mathematics and Statistics*. 22 pages | [online version](#)
- A Framework for Differential Calculus on Persistence Barcodes**  
Jacob Leygonie, Steve Oudot, and Ulrike Tillmann. 2019.  
Appeared in *Foundations of Computational Mathematics*. 63 pages | [online version](#)
- Adversarial Computation of Optimal Transport Maps**  
Jacob Leygonie, Jennifer She, Amjad Almahairi, Sai Rajeswar, and Aaron Courville. 2019.  
Preprint. 34 pages | [online version](#)
- Signed Particles and Neural Networks, towards efficient simulations of Quantum Systems**  
Jean Michel Sellier, Gaétan Marceau Caron, and Jacob Leygonie. 2018.  
Appeared in *Journal of Computational Physics*. 8 pages | [online version](#)
- Machine Learning and Signed Particles, an alternative and efficient way to simulate Quantum Systems**  
Jean Michel Sellier, Kristina G Kapanova, Jacob Leygonie, and Gaétan Marceau Caron. 2018  
Appeared in *International Journal of Quantum Chemistry*. 10 pages | [online version](#)

## TEACHING EXPERIENCE

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<b>Teaching Assistant in Homological Algebra (Master level)</b> Mathematical Institute. Course given by Pr. Andre Henriques	Michaelmas 2019 Oxford, United Kingdom
<b>Teaching Assistant in Algebraic Topology (Master level)</b> Mathematical Institute. Course given by Pr. Christopher Douglas	Michaelmas 2018 Oxford, United Kingdom
<b>Founder of a private teaching company for undergraduate students</b> Private lessons in mathematics for a total of 60 students, partnering with 2 other teachers	Apr. 2016 – Apr. 2018 Paris, France
<b>Teaching Assistant at Beihang university (Bachelor level)</b> Taught Mathematics and Physics for two groups of 40 Chinese students Drew exams, wrote corrections, taught the class and organized training sessions	Oct. 2015 – Apr. 2016 Beijing, China

## RESEARCH EXPERIENCE IN DEEP LEARNING

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<b>Research Intern in Deep Learning</b> <i>Element AI</i> . Supervised by Dr. Amjad Almahairi	Nov. 2018 – Apr. 2019 London, United Kingdom
<ul style="list-style-type: none"><li>Used Generative Adversarial Networks to address the task of Domain Adaptation</li></ul>	
<b>Research Intern in Deep Learning</b> Montreal Institute for Learning Algorithm ( <i>MILA</i> ). Supervised by Pr. Aaron Courville	Apr. 2018 – Nov. 2018 Montreal, Canada
<ul style="list-style-type: none"><li>Derived new links between Generative Adversarial Networks and Optimal Transport theory</li><li>Employed deep learning architectures to solve fundamental equations of quantum physics</li><li>Analyzed neural networks' expressiveness by means of the Mean Field approximation</li></ul>	
<b>Six months Research Project in Reinforcement Learning</b> École Polytechnique. Supervised by Pr. Olivier Pietquin (Google DeepMind)	Sep. 2017 – Mar. 2018 Paris, France
<ul style="list-style-type: none"><li>Statistical analysis and improvement of a Deep Reinforcement Learning model for <i>visual question answering</i>.</li></ul>	
<b>BioTech internship at <i>Owkin</i></b> École Polytechnique. Supervised by founders Gilles Wainrib and Thomas Clozel	Jun. 2017 – Aug. 2017 Paris, France
<ul style="list-style-type: none"><li>Extracted and processed data from public <i>medical database</i></li><li>Trained Machine Learning algorithms to predict results of clinical trials</li></ul>	

## CONFERENCES AND PRESENTATIONS

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<b>Two fiber problems for Persistent Homology</b> Weekly ATiA seminar. University at Albany, SUNY	Feb. 2022
<b>Inverse Problems for Persistent Homology</b> GEOTOP-A seminar. Web-seminar series on Applications of Geometry and Topology	Dec. 2021
<b>The Fiber of Persistent Homology for Simplicial Complexes</b> Weekly Applied Topology seminar. University of Munich, Germany	Jul. 2021
<b>Stratification of Barcodes for Persistence Fiber</b> Weekly Algebraic Geometry seminar. University of Regensburg, Germany	May 2021
<b>The Fiber of Persistent Homology for Simplicial Complexes</b> Annual conference of Oxford's Center for Topological Data Analysis. Oxford, United Kingdom	Sep. 2020
<b>A Framework for Differential Calculus on Persistence Diagrams</b> Talk at the ATMCS/AATRN online conference ( <a href="#">video</a> )	Jun. 2020
<b>A Framework for Differential Calculus on Persistence Diagrams</b> Weekly seminar of the EPFL's Applied Topology group. EPFL, Switzerland	Mar. 2020
<b>A Framework for Differential Calculus on Persistence Diagrams</b> Inria's annual internal seminar. Porquerolles, France	Oct. 2019
<b>Theory of Multi-Dimensional Persistent Homology</b> TopApp workshop of Computational Topology. IST Austria	Apr. 2019

## COMMUNITY INVOLVEMENT

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**Co-founder of *Share***

A platform to easily write and share scientific contents

Sep. 2018 – Present

Paris, France

**Co-founder of *Astarte***

A program to help students taking their first steps in the world of start-ups and innovation.

Sep. 2016 – Aug. 2017

Paris, France

## SKILLS

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**Languages:** French (native), English and Russian

**Programming:** Rust, C, C++, Java, Python, Typescript OCaml, Coq, Prolog, Latex

**Music:** Completed 2nd cycle in music theory and piano at French Conservatoire