

Cyril Letrouit

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Born on April 7, 1996



Employment

- 2023- **CNRS researcher**, *Laboratoire de mathématiques d'Orsay*, Université Paris-Saclay
Recruited in April 2022.
- 2022-2023 **Postdoctoral associate**, *Massachusetts Institute of Technology*
- 2019-2022 **Teaching assistant**, *Département de mathématiques et applications*, École Normale Supérieure (Paris)

Education

- 2018-2021 **PhD in mathematics**, *Laboratoire J.-L. Lions (LJLL)*, Sorbonne Université, Paris
Under the supervision of Emmanuel Trélat and Yves Colin de Verdière.
- 2018 **M.A. in mathematics**, *Sorbonne Université (Jussieu)*, Paris, with highest honors
- 2016 **B.A. in mathematics**, *Université Paris VI (Jussieu)*, Paris, with highest honors
- 2015-2019 **Studies in Mathematics at the École Normale Supérieure (Paris)**
Admission in 2015, concours Maths-Physique, ranked 1st.
- 2013 - 2015 **Classes préparatoires MPSI/MP***, *Lycée Louis le Grand*, Paris

Publications and submitted papers

13. **Generic controllability of equivariant systems and applications to particle systems and neural networks**, with Andrei Agrachev.
Preprint arxiv:2404.08289 (2024), submitted.
12. **A mathematical perspective on Transformers**, with Borjan Geshkovski, Yury Polyanskiy and Philippe Rigollet.
Preprint arxiv:2312.10794 (2023), submitted.
11. **Maximal multiplicity of Laplacian eigenvalues in negatively curved surfaces**, with Simon Machado.
Preprint arXiv:2307.06646 (2023), submitted.
10. **The emergence of clusters in self-attention dynamics**, with Borjan Geshkovski, Yury Polyanskiy and Philippe Rigollet.
NeurIPS (2023).
9. **Nodal sets of eigenfunctions of sub-Laplacians**, with Suresh Eswarathanan.
International Mathematics Research Notices (2023).
8. **Quantum limits of sub-Laplacians via joint spectral calculus**.
Documenta Mathematica (2023).
7. **Propagation of singularities for subelliptic wave equations**.
Communications in Mathematical Physics (2022).
6. **Propagation of well-prepared states along Martinet singular geodesics**, with Yves Colin

de Verdière.

Journal of Spectral Theory (2022).

5. **Observability of Baouendi-Grushin-type equations through resolvent estimates**, with Chenmin Sun.
Journal de l'Institut Mathématique de Jussieu (2023).
4. **Observability and controllability for the Schrödinger equation on quotients of groups of Heisenberg type**, with Clotilde Fermanian Kammerer.
Journal de l'École Polytechnique (2021).
3. **Subelliptic wave equations are never observable**.
Analysis and PDEs (2023).
2. **Catching all geodesics of a manifold with moving balls and application to controllability of the wave equation**.
Annali della Scuola Normale Superiore di Pisa Cl. Sci. (2023).
1. **From internal to pointwise control for the 1D heat equation and minimal time**.
Systems and Control Letters (2019).

Other writings

- **Exact observability properties of subelliptic wave and Schrödinger equations**.
Actes du séminaire de Théorie Spectrale et Géométrie.
- **On a new generalization of the Droz-Farny line**.
Forum Geometricorum (2016).

Talks at conferences and workshops

- Jan. 2025 **Workshop “Physics of AI algorithms – PHAIA”**, *Les Houches*
- Nov. 2024 **Workshop “Random hyperbolic surfaces and random graphs”**, *CIRM, Marseille*
- Jul. 2024 **Workshop “Paris-Padova sub-Riemannian geometry”**, *Università di Padova*
- Mar. 2024 **Workshop “Particle systems in dynamics, optimization and learning”**, *Lagrange Center, Paris*
- Dec. 2023 **Conference NeurIPS@Paris 2023**, *Sorbonne Center on Artificial Intelligence*
- Sept. 2023 **Meeting of the ANR Adyct**, *Nice*
- Aug. 2023 **High frequency analysis: from operator algebras to PDEs**, *Angers*
- Oct. 2022 **Workshop on control problems**, *TU Dortmund (Germany), Online*
- Mar. 2022 **Journées Jeunes EDPistes**, *Institut Camille Jordan, Lyon*
- Feb. 2022 **14èmes rencontres du GDR Dynamique Quantique**, *Toulouse*
- Feb. 2022 **Mathematics of Wave Phenomena**, *Karlsruhe Institute of Technology (Germany), Online*
- Nov. 2021 **Conference in memory of Geneviève Raugel**, *LMO, Orsay*
- Oct. 2020 **Spectral theory and geometry**, *Chalès*
- Sept. 2020 **Sub-Riemannian Geometry and Interactions**, *Paris*

Talks in seminars

- May 2024 **Analysis seminar**, *Laboratoire Jean Leray, Nantes*
- Apr. 2024 **Groupe de travail Neural networks**, *Université Paris-Cité*
- Apr. 2024 **Harmonic analysis seminar**, *LMO, Orsay*
- Apr. 2024 **Machine Learning and Signal Processing**, *ENS Lyon*
- Mar. 2024 **Probability and statistics seminar**, *Laboratoire Jean Dieudonné, Nice*
- Feb. 2024 **FLAIR seminar**, *EPFL (Switzerland)*
- Feb. 2024 **CSD (Centre de science des données) seminar**, *ENS Paris*

- Feb. 2024 **Geometry and topology seminar**, *Institut de Mathématiques de Jussieu*
- Jan. 2024 **Applied Analysis seminar**, *Institut de Mathématiques de Marseille*
- Jan. 2024 **PDE seminar**, *Institut de Mathématiques de Bordeaux*
- Jan. 2024 **SISSA seminar**, *Trieste (Italie)*
- Nov. 2023 **Spectra and Moduli seminar**, *Durham University (England)*
- Oct. 2023 **Harmonic Analysis e-Seminar**, *Online*
- Oct. 2023 **GdT Transport Optimal, EDP et Machine Learning**, *LMO, Orsay*
- Sep. 2023 **Spectral geometry in the clouds seminar**, *Online*
- Mar. 2023 **Analysis and PDE seminar**, *University of North Carolina, Chapel Hill (USA)*
- Feb. 2023 **Analysis and PDE seminar**, *MIT, Cambridge (USA)*
- Feb. 2023 **PDE seminar**, *Brown University, Providence (USA)*
- Jan. 2023 **CRM/Montreal/Québec Analysis Seminar**, *UQàM, Montreal (Canada)*
- Nov. 2022 **Analysis Seminar**, *Northwestern University (USA)*
- Mar. 2022 **Analysis seminar**, *University of Bologna (Italy), Online seminar*
- Oct. 2021 **PDE seminar**, *Laboratoire Jean Dieudonné, Nice*
- June 2021 **Semiclassical analysis and representation theory seminar**, *Dep. of Math. and Computer Sc., Cologne (Germany), Online seminar*
- May 2021 **Applied analysis seminar**, *I2M, Marseille, Online seminar*
- Mar. 2021 **Analysis seminar**, *IMT, Toulouse*
- Feb. 2021 **Webinar “Control in Time of Crisis”**, *Online seminar*
- Dec. 2020 **“Applications of mathematics” seminar**, *ENS Rennes, Online seminar*
- Nov. 2020 **Analysis seminar**, *IRMA, Strasbourg, Online seminar*
- June 2020 **PhD students seminar**, *LMO, Orsay, Online seminar*
- Apr. 2020 **Open PDE & Analysis Seminar**, *LMO, Orsay, Online seminar*
- Mar. 2020 **Analysis seminar**, *Laboratoire Jean Leray, Nantes*
- Mar. 2020 **PDEs and Spectral theory seminar**, *LAREMA, Angers*
- Jan. 2020 **Spectral theory and geometry seminar**, *Institut Fourier, Grenoble*
- Apr. 2019 **Seminar of the Inria team CAGE**

Other talks

- Oct. 2023 **Journée de rentrée de l'équipe d'analyse du LMO**
- Nov. 2021 **LJLL “Journée Interne”**
- Dec. 2019 **Talk for students of classes préparatoires scientifiques visiting ENS**
- Nov. 2019 **Talk at the master/PhD meeting of LJLL**
- Oct. 2019 **ENS maths department “Journée de rentrée de l'équipe d'analyse”**
- Oct. 2019 **ENS maths department “Journée de rentrée”**
- Feb. 2019 **LJLL PhD students workshop**

Referee

Referee for the following journals: Duke Mathematical Journal, Communications in Mathematical Physics, Proceedings of the AMS, Advanced Nonlinear Studies, Revista Matematica Iberoamericana, Vietnam Journal of Mathematics, SIAM Journal on Control and Optimization, ESAIM: COCV ($\times 4$), Quarterly of Applied Mathematics.

Quick opinion for the following journals: Analysis and PDEs, Journal de l'École Polytechnique.

Teaching

- 2023-2024 **Teaching Assistant**
Intégration, L3 Double Diplôme Orsay (24h).

- 2021-2022 **Adviser of a bachelor thesis**
 “Eigenvalues, curvature and heat equation”, after McKean and Singer.
- 2021-2022 **Reading seminar**
 “Variational problems, optimization and control”. Following the book “Numerical analysis and optimization” by Grégoire Allaire. For 1st year students at ENS.
- 2019-2022 **Organisation of the “Maths-industry workshop” at ENS**
 Every year from 2019 to 2022, with Bertrand Maury, we submitted problems raised by industrials to master students at ENS and we supervised their work. Problems came from transport industries (Vallée Sud, Urbanloop, IFPEN), PharmaTech industry (Aqemia), bio industry (Greenweez, Tenko), big companies (EDF, Michelin, Criteo, Google).
- 2019-2020 **Reading seminar**
 “Celestial mechanics, N -body problem and optimal control”. For 1st year students at ENS.
- 2019-2021 **Teaching assistant**
 Teaching assistant for the Partial Differential Course at ENS (by Cyril Imbert), master level.
- 2019-2020 **Jury for the diploma defense of 4th year students at ENS**
- 2019-2022 **Tutor of 6 students per year at ENS**
- 2018-2019 **Teaching assistant at Sorbonne Université (Jussieu)**
 “Vectorial analysis and multiple integrals” and “Linear algebra II, affine geometry” (for 2nd year Bachelor).

Responsibilities

- 2023- **Organizer of the Analysis and PDEs seminar in Orsay (LMO)**
 2023- **Member of the scientific committee of GDR Tétraèdre**
 2015-2017 **Representative of the students at the département of mathematics (ENS)**

Member of committees

- 2024 **Member of the jury for the PhD defense of Adam Arras**
 2023 **“Comité de suivi” of 1 PhD thesis, jury for the defense of 2 master thesis**

Organization of conferences

- 2024 **Organizer of the Festum Pi summer school and conference, Chania (Crete)**

Outreach activities

- 2016-2017 **Organizer and speaker at the “Math for all” seminar at ENS**
 2015-2018 **Lectures at a maths club for high school students called Parimaths**
 On functional equations, polynomials, interpolation, Markov chains, differential equations.