

Louis Garrigue

Researcher in
mathematical physics

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Positions

- Feb 2023 – **Tenure track**, Cergy's university, laboratory “analysis, geometry and modeling”
Oct 2022 – Jan 2023 **Postdoc**, Stuttgart's university, in the team of Benjamin Stamm
2020 – 2022 **Postdoc**, École des ponts, Cermics, in the team of Éric Cancès

Education

- 2017 – 2020 **Doctorate in mathematical quantum physics**, university Paris-Dauphine, supervised by Mathieu Lewin, on mathematical aspects of Density functional theory
2016 – 2017 **Master's degree in fundamental mathematics**, university Paris-Diderot
2014 – 2016 **Master's degree in theoretical physics**, École normale supérieure, Paris
2012 – 2017 **Student and civil servant at the École normale supérieure, Paris**

Preprints

- [10] L. Garrigue, B. Stamm. On reduced basis methods for eigenvalue problems, and on its coupling with perturbation theory (arxiv:2408.11924), preprint (2024).
[9] G. Dusson, L. Garrigue, B. Stamm. A multipoint perturbation formula for eigenvalue problems (arxiv:2305.08151), preprint (2023).

Publications

- [8] L. Garrigue. Mixed state representability of entropy-density pairs (arxiv:2203.16441), Journal of Mathematical Physics (2024).
[7] É. Cancès, L. Garrigue, D. Gontier. A simple derivation of moiré-scale continuous models for twisted bilayer graphene (arxiv:2206.05685), Physical Review B (2023).
[6] É. Cancès, L. Garrigue, D. Gontier. Second-order homogenization of periodic Schrödinger operators with highly oscillating potentials (arxiv:2112.12008), SIAM Journal on Mathematical Analysis (2022).
[5] L. Garrigue. Building Kohn-Sham potentials for ground and excited states (arxiv:2101.01127), Archive for Rational Mechanics and Analysis (2022).
[4] L. Garrigue. Some properties of the potential-to-ground state map in quantum mechanics (arxiv:2012.04054), Communications in Mathematical Physics (2021).
[3] L. Garrigue. Unique continuation for many-body Schrödinger operators and the Hohenberg-Kohn theorem. II. The Pauli Hamiltonian (arxiv:1901.03207), Documenta Mathematica (2020).
[2] L. Garrigue. Hohenberg-Kohn theorems for interactions, spin and temperature (arxiv:1906.03191), Journal of Statistical Physics (2019).
[1] L. Garrigue. Unique continuation for many-body Schrödinger operators and the Hohenberg-Kohn theorem (arxiv:1804.07564), Mathematical Physics, Analysis and Geometry (2018).

Contributed talks

- Sep 20, 2024 **Mathematical and numerical analysis of electronic structure models**, *Stuttgart, Germany*
- Jul 4, 2024 **International congress on mathematical physics**, *Strasbourg, France*
- May 9, 2024 **Workshop on material modeling**, *Benguerir, Morocco*
- Nov 27, 2023 **Seminar analysis and PDE**, *Cergy, France*
- Apr 15, 2023 **Seminar of the physics laboratory**, *Cergy, France*
- Feb 1, 2023 **Quantum dynamics GDR, 15th meeting**, *Rennes, France*
- Jan 24, 2023 **Seminar PDE and mathematical physics**, *Bordeaux, France*
- Dec 13, 2022 **Mathematical physics seminar**, *Stuttgart, Germany*
- Dec 8, 2022 **PDE seminar**, *Besançon, France*
- Sep 26, 2022 **Conference Aspect'22, Asymptotic Analysis & Spectral Theory**, *Oldenburg, Germany*
- Aug 17, 2022 **92nd annual meeting of the International association of applied mathematics and mechanics**, *Aachen, Germany*
- Jun 21, 2022 **Workshop at the Center for Advanced Study**, *Norwegian academy of sciences, Oslo, Norway*
- Apr 11, 2022 **Seminar of mathematical physics**, *Fourier institute, Grenoble, France*
- Mar 21, 2022 **Seminar of mathematical physics**, *Mathematics institute of Bourgogne, Dijon*
- Mar 7, 2022 **Seminar of spectral theory**, *Institut Henri Poincaré, Paris*
- Jan 12, 2022 **Quantum N-body problem GDR, 3rd meeting**, *online*
- Sep 17, 2021 **Seminar on mathematical modelling, analysis and simulation of molecular systems (MOANSI)**, *online*
- Aug 6, 2021 **International congress on mathematical physics**, *Geneva, Switzerland*
- Jun 14, 2021 **Seminar on multiscale problems in mathematical physics**, *Angers, France*
- Mar 31, 2021 **Seminar of mathematical physics of the Centre for theoretical physics**, *Toulon, France*
- Mar 3, 2021 **Seminar of the laboratory of mathematics of the university of Bourgogne**, *Dijon, France*
- Sep 15, 2020 **Conference Algorithms in Quantum Molecular Dynamics**, *CIRM, Marseille, France*
- Sep 15, 2020 **Seminar of the laboratory**, *Marseille, France*
- Nov 21, 2019 **Seminar on Lie theory, geometry and analysis**, *université de Lorraine, Metz, France*
- Oct 24, 2019 **The analysis of complex quantum systems**, *CIRM Marseille, France*
- Sep 22, 2019 **Density functionals for many-particle systems**, *university of Singapore*
- Apr 18, 2019 **PDE seminar of the laboratory of mathematics of Versailles**, *France*
- Jan 28, 2019 **Optimal transport methods in Density functional theory**, *Banff research station, Canada*
- Jul 20, 2018 **Young researchers symposium of ICMP**, *Montréal, Canada*, satellite event of the International congress of mathematical physics
- Jul 9, 2018 **Conference on DFT with magnetic potentials**, *Oslo, Norway*

Teaching

- Feb 2023 – **Tutorials and lectures**, *CY Cergy Paris university*
- Oct 2022 – Jan 2023 **Tutorials of exercices**, *Stuttgart's university*
- Master's degree course "Numerical methods for eigenvalue problems"

- Oct 2022 – Jan 2023 **Students seminar**, *Stuttgart's university*
Supervision of two coding and theoretical projects for bachelor's degree students
- Feb 2022 – Jun 2022 **Personal projects**, *École des ponts*
Presentation and management of a numerical project, coded by the students (first year, equivalent to L3)
- Sep 2017 – Jun 2020 **Tutorials of exercices**, *university Paris-Dauphine*
Sessions of exercices in analysis (L2), linear algebra (L1) and optimization (M1)
- Sep 2017 – Jun 2020 **Physics for all**, *École normale supérieure*
Three lectures for the class “Physics for all”, addressed to students of the ENS in humanities.
Notes at akrajenbrink.weebly.com/teaching.html
- 2016 – 2017 **Oral interrogations**, *college Stanislas*, in mathematics, to train students for competitive examinations for entrance in grandes écoles

Supervision of students

- Jun-Jul, 2024 **Research internship**, *Guillaume Guers, Ensta's student in first year of master's degree*

Participation to conferences

- Mar 9-14, 2025 **Mathematical Methods in Quantum Chemistry**, *Oberwolfach, Germany*
- Dec 2-6, 2024 **Workshop on Foundations and Extensions of DFT**, *Oslo, Norway*
- Nov 6-8, 2024 **Hands-on training on Quantum Computation for Quantum Chemistry**, *Montpellier, France*
- Sep 16-20, 2024 **Mathematical and numerical analysis of electronic structure models (Manuel)**, *Stuttgart, Germany*
- Jul 8-12, 2024 **Workshop on 2d quantum systems**, *Roscoff, France*
- Jul 1-6, 2024 **21th International congress on mathematical physics**, *Strasbourg, France*
- May 27-31, 2024 **Paris-Saclay conference in Analysis and PDE**, *Saclay, France*
- May 9-10, 2024 **Workshop on material modeling**, *Benguerir, Morocco*
- Jan 31-fev 2, 2024 **Quantum dynamics GDR, 16th meeting**, *Cergy, France*
- Nov 22-24, 2023 **GDR TeQ, first meeting**, *Montpellier, France*
- Jul 3-7, 2023 **26th general congress of the Société Française de Physique, subseminar on quantum technologies**, *Paris, France*
- Jun 26-28, 2023 **Frontiers in mathematical physics**, *CY Cergy Paris Université, France*
- Jun 12-14, 2023 **“Precision many-body physics” workshop**, *Collège de France, Paris, France*
- Feb 1-3, 2023 **Quantum dynamics GDR, 15th meeting**, *Rennes, France*
- Jan 9-13, 2023 **The analysis of relativistic quantum system**, *Cirm, Marseille*
- Sep 26-30, 2022 **Conference Aspect'22, Asymptotic Analysis & Spectral Theory**, *Oldenburg, Germany*
- Sep 21,23, 2022 **Workshop of the Collaborative research center (CRC) on “sparsity and singular structures”**, *Aachen, Germany*
- Aug 15-19, 2022 **92nd annual meeting of the International association of applied mathematics and mechanics**, *Aachen, Germany*
- Jun 20-24, 2022 **Workshop at the Center for Advanced Study**, *Oslo, Norway*
- Mar 28 - Apr 1, 2022 **Advancing quantum mechanics with mathematics and statistics, workshop 1: multiscale approaches in quantum mechanics**, *IPAM UCLA, Los Angeles*

- Feb 23-25, 2022 **Quantum dynamics GDR, 14th meeting**, *Toulouse, France*
- Jan 10-13, 2022 **Quantum N -body problem GDR, 3rd meeting**, *online*
- Sep 16-17, 2021 **Moansi annual meeting**, *online*
- Aug 25-27, 2021 **Solid Math 2021**, *École des ponts, France*
- Oct 27-29, 2021 **Congress of young researchers in applied mathematics**, *École polytechnique, France*
- Aug 2-7, 2021 **International congress on mathematical physics and Young researchers symposium**, *Geneva, Switzerland*
- Jun 14-16, 2021 **Seminar on multiscale problems in mathematical physics**, *Angers, France*
- May 17-28, 2021 **SIAM conference on mathematical aspects of material science**, *Bilbao, Spain, online*
- Mar 10-12, 2021 **Quantum dynamics GDR, 13th meeting**, *Dijon, France, online*
- Feb 8-12, 2021 **Quantum N -body problem GDR, 2nd meeting**, *online*
- Sep 14-18, 2020 **Algorithms in Quantum Molecular Dynamics**, *Cirm, Marseille, France*
- Sep 2-4, 2020 **New horizons in density functional theory**, *online*, Faraday discussions workshop
- Feb 5-7, 2020 **Quantum dynamics GDR, 12th meeting**, *Strasbourg, France*
- Jan 8-10, 2020 **Quantum N -body problem GDR, 1st meeting**, *Lille, France*
- Oct 21-25, 2019 **The analysis of complex quantum systems : large Coulomb systems and related matters**, *CIRM Marseille, France*
- Sep 23-27, 2019 **Density functionals for many-particle systems : mathematical theory and physical applications of effective equations**, *institute for mathematical sciences, university of Singapore*
- May 27-31, 2019 **Souriau 2019**, *University Paris-Diderot, France*, Conference in honour of Jean-Marie Souriau
- Feb 13-15, 2019 **Quantum dynamics GDR, 11th meeting**, *Bordeaux, France*
- Jan 28- Feb 1st, 2019 **Optimal transport methods in Density functional theory**, *Banff research station, Canada*
- Jul 20-28, 2018 **International congress on mathematical physics and Young researchers symposium**, *Montréal, Canada*
- Jul 9-13 2018 **Seminar on DFT with magnetic potentials**, *Oslo, Norway*
Entitled “Do electron current densities determine all there is to know ?”
- Feb 19-24, 2018 **Mathematical Challenges in Quantum Mechanics**, *Sapienza university, Roma, Italy*, workshop and winter school
- May 31th-Jun 7th, 2017 **Density functional theory meets Optimal transport**, *Jyväskylä, Finland*, workshop

Research internships

- Jan – Feb 2016 **Vacuums of a supersymmetric theory**, *laboratory of theoretical physics of the ENS, Paris*, supervised by Jan Troost
Seiberg-Witten theory and solving the structure of inequivalent vacuums of the supersymmetric $\mathcal{N} = 1^*$, $SU(4)$ theory.
- Feb – Jul 2015 **Cosmology**, *Berkeley’s laboratory of cosmology, USA*, supervised by Robert Cahn
Development and implementation of the algorithm of the assignement of fibers of the telescope to sky objects for the DESI project.

Jun 2013 **Quantum electrodynamics in cavity**, *laboratory Kastler-Brossel ENS, Paris*,
supervised by Igor Dotsenko
Sampling quantum measurements after time reversal of a Rydberg atom/photon system.

Miscellaneous

2009 **French mathematical olympiad**, *second prize of the region Auvergne*
Coding Julia, Python, C++, Javascript