

Damien Galant

F.R.S.-FNRS Research Fellow

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I am a [F.R.S.-FNRS](#) Research Fellow in the [mathematics department](#) of the [Université de Mons \(UMONS, Mons, Belgium\)](#) and the [DMATHS department](#) of the [CERAMATHS laboratory](#) from [Université Polytechnique Hauts-de-France \(UPHF, Valenciennes, France\)](#) and [INSA Hauts-de-France](#).

I obtained my PhD on December 9th 2024 (supervisors: Prof. [Christophe Troestler \(UMONS\)](#) and Prof. [Colette De Coster \(CERAMATHS/DMATHS\)](#)).

I study partial differential equations and calculus of variations.

Education

2021–2024 **PhD in Mathematics**, *UMONS and UPHF*

The thesis is entitled “The nonlinear Schrödinger equation on metric graphs” (« L'équation de Schrödinger non-linéaire sur les graphes métriques ») and was supervised by Prof. Colette De Coster and Prof. Christophe Troestler. The public defense was held on Monday December 9th 2024 in Valenciennes. The manuscript is available [on my webpage](#).

2019–2021 **Master's degree in Mathematics**, *UMONS, Belgium*

Exchange year (Erasmus) at [Orsay's Mathematics Institute](#) (France) in 2019–2020. Average grade: 19.37/20, Award of the Department of Mathematics.

2016–2019 **Bachelor's degree in Mathematics**, *UMONS, Belgium*

Academic minor in Computer Science.
Average grade: 19.27/20, Award of the Department of Mathematics.

Current research interests

- Nonlinear elliptic partial differential equations (PDEs), in particular the nonlinear Schrödinger equation;
- Role played by the domain geometry in PDEs;
- Unidimensional aspects of PDEs: metric graphs, ODE techniques;
- Critical point theory;
- Variational problems with lack of compactness;
- Normalized solutions to nonlinear problems, including in the L^2 -supercritical case;
- Interface between nonlinear elliptic PDEs and fluid mechanics;
- Control theory of PDEs;
- Computer-assisted mathematics in the broad sense, including computer-assisted proofs in analysis (using interval arithmetic).

Publications and preprints

Links to my publications and preprints are also available on [my webpage](#). They are listed by decreasing order of recency of the associated preprint.

6. An action approach to nodal and least energy normalized solutions for nonlinear Schrödinger equations (with Colette De Coster, Simone Dovetta and Enrico Serra), 2024 ([arXiv preprint 2411.10317](#)).
5. Infinitely many normalized solutions of L^2 -supercritical NLS equations on noncompact metric graphs with localized nonlinearities (with Pablo Carrillo, Louis Jeanjean and Christophe Troestler), 2024 ([arXiv preprint 2403.10959](#)).
4. Constant sign and sign changing NLS ground states on noncompact metric graphs (with Colette De Coster, Simone Dovetta, Enrico Serra and Christophe Troestler), 2023 ([arXiv preprint 2306.12121](#)). *Under revision in Analysis & PDE*.
3. On the notion of ground state for nonlinear Schrödinger equations on metric graphs (with Colette De Coster, Simone Dovetta and Enrico Serra), [Calculus of Variations and Partial Differential Equations](#), Vol. 62, No. 159, 2023.
2. A note on optimal degree-three spanners of the square lattice (with Cédric Pilatte), [Discrete Mathematics, Algorithms and Applications](#). Vol. 14, No. 03, 2150124, 2022.
1. Geography of bilinearized Legendrian contact homology: Frédéric Bourgeois, Damien Galant, [Algebraic & Geometric Topology](#), Vol. 24, No. 7, 2024.

Dissertations

2. The nonlinear Schrödinger equation on metric graphs: PhD Thesis (directors: Prof. Colette De Coster and Prof. Christophe Troestler): defended on December 9th 2024. Available [here](#).
1. Ondes solitaires pour une équation de Schrödinger non-linéaire: Master's Thesis (in French, director: Prof. Christophe Troestler), UMONS, 2021. Available [here](#).

Talks

You may find the corresponding slides and lecture notes on [my webpage](#).

25. Seminar in the department of basic and applied sciences for engineering, Sapienza Università di Roma (Rome, Italy), Qualitative properties of solutions of the nonlinear Schrödinger equation on metric graphs: computer-assisted study of sign-changing solutions on the tetrahedron graph, 19 February 2025.
24. Séminaire doctorant du LAMFA (LAMFA, Université de Picardie Jules Verne, Amiens, France), Introduction to computer-assisted proofs in nonlinear analysis, 5 February 2025.
23. Séminaire "Doctorants et postdoctorants" du laboratoire Paul Painlevé (Université de Lille, Lille, France), Introduction to computer-assisted proofs in nonlinear analysis, 6 November 2024.
22. 18ème Journée des Doctorants en Mathématiques de la région Hauts-de-France (JDM 2024, Université de Lille, Lille, France), The nonlinear Schrödinger Equation on metric graphs, 20 September 2024.

21. Brussels Summer School of Mathematics (ULB, Brussels, Belgium), The nonlinear Schrödinger Equation on metric graphs, 30 August 2024.
20. Séminaire de l'équipe EMA du Laboratoire de Mathématiques Pures et Appliquées de l'Université du Littoral Côte d'Opale (LMPA, ULCO, Calais, France), Constant sign and sign changing NLS ground states on noncompact metric graphs, 30 May 2024.
19. Junior Colloquium de l'Institut de Recherche en Mathématiques et Physique (IRMP, UCLouvain, Belgium), The nonlinear Schrödinger equation on noncompact graphs: what is a solution?, 22 January 2024.
18. Nonlinear Quantum Graphs (Institut de Mathématiques de Toulouse, UPS, Toulouse, France), Qualitative properties of solutions of NLS on graphs, 16 January 2024.
17. Séminaire doctorant du laboratoire LAMFA (LAMFA, UPJV, Amiens, France), An introduction to variational methods, 6 December 2023.
16. Annual meeting of the COMPLEX doctoral School, edition 2023 (ULB, Brussels, Belgium), Study of the effect of parameters on the decay rate of a fourth order problem, 13 November 2023.
15. Control of Partial Differential Equations in Hauts-De-France 2023 (UPHF, Valenciennes, France), Study of the effect of parameters on the decay rate of a fourth order problem, 8 November 2023.
14. Young researchers in PDEs (ICMAT and UAM, Madrid, Spain), On the notion of "ground state" for the nonlinear Schrödinger equation on metric graphs, 2 October 2023.
13. Séminaire de mathématiques discrètes de l'ULiège (ULiège, Liège, Belgium), Optimal bounds for geometric dilation and computer-assisted proofs, 3 May 2023.
12. « Séminaire jeunes » des départements de mathématique et d'informatique (UMONS, Mons, Belgium), Équation de Schrödinger non-linéaire sur les graphes métriques (in French), 28 April 2023.
11. Séminaire EDP du Laboratoire de Mathématiques de Besançon (LMB, UBFC, Besançon, France), On the notion of ground state for the nonlinear Schrödinger equation on metric graphs, 16 March 2023.
10. Séminaire d'analyse appliquée A³ (LAMFA, UPJV, Amiens, France), On the notion of ground state for the nonlinear Schrödinger equation on metric graphs, 16 January 2023.
9. Séminaire de Mathématiques de Valenciennes (CERAMATHS/DMATHS, UPHF, Valenciennes, France), On the notion of ground state for the nonlinear Schrödinger equation on metric graphs, 15 December 2022.
8. COMPLEX Doctoral School (UMONS, Mons, Belgium), Nonlinear Schrödinger equation on metric graphs, 15 November 2022.
7. 18e Journées Montoises d'Informatique Théorique (Czech Technical University in Prague, Prague, Czech Republic), Optimal bounds for geometric dilation and computer-assisted proofs, 7 September 2022.

6. DEMAV Seminar (UPHF, Valenciennes, France), Blow-up phenomena for a Nonlinear Schrödinger Equation, 25 November 2021.
5. Séminaire d'Algèbre et Logique (UMONS, Mons, Belgium), Interactions entre l'apprentissage statistique et la théorie des modèles (part 2, in French), 5 February 2021.
4. Séminaire d'Algèbre et Logique (UMONS, Mons, Belgium), Interactions entre l'apprentissage statistique et la théorie des modèles (part 1, in French), 18 December 2020.
3. Symplectic Seminar (Institut Henri Poincaré, Paris, France), Effective computation of the bilinearized Legendrian contact homology, 8 November 2019.
2. « Séminaire sandwiches » (UMONS, Mons, Belgium), Dilation of regular polygons - Algorithmic aspects (in French), 24 October 2019.
1. Young Mathematicians Symposium of the Greater Region (ULiège, Liège, Belgium), The Minimum Dilation Triangulation Problem, 24 September 2019.

Posters

My posters are also available on [my webpage](#).

3. [Fluids@PoliMi](#) (Politecnico di Milano, Milano, Italy), An action approach to nodal and least energy normalized solutions for nonlinear Schrödinger equations, 9 January 2025.
2. [“Nonlinear Quantum Graphs” Summer school](#) (UPHF Campus Mont Houy, Valenciennes, France), The Nonlinear Schrödinger Equation on Metric Graphs, 18 June 2024.
1. [Mardi des Chercheurs 2024](#) (UMONS, Mons, Belgium), The Nonlinear Schrödinger Equation on Metric Graphs, 26 March 2024.

Organization of events

1. [“Nonlinear Quantum Graphs” Summer school](#) (UPHF Campus Mont Houy, Valenciennes, France), organizing Committee.

Supervision

“Bourses d’initiation à la recherche” (grants for student researcher positions during the summer, available (after application) for the students of UMONS willing to pursue their career in research)

1. Summer 2022, Naomi Desobry (currently doing research in AI)

Teaching

3. **Numerical Analysis Project** (Teaching assistant, 2022 – 2023)

Public: BA2 in Mathematics, Physics and Informatics, UMONS

Supervision of a numerical analysis project where students work together in small groups on a problem of applied mathematics, with the help of a computer.

2. **Elementary Mathematics** (Student teaching assistant, Sep-Nov 2018, 2020)
Public: BA1 in Mathematics, Physics and Informatics, UMONS
Supervision of in-class and remote (in 2020) exercise sessions, and test grading.
1. **Summer tutoring sessions organized by the Science faculty** (Student tutor, Aug 2017, 2018, 2019, 2021)
Public: Bachelor students, UMONS
Teaching of personalized math lessons to university students retaking an exam.

■ Popularization of mathematics

Talks

2. “Modélisation de quelques systèmes biologiques”, presentation of mathematical biology models to high school students from Lycée Kastler in Denain (France), 7 April 2022.
1. “Modélisation de quelques systèmes biologiques”, presentation of mathematical biology models to high school students from Lycée Professionnel François Mansart in Marly (France), 27 April 2022.

Supervision of students

2. In June 2022, 2023 and 2024, I supervised high school students (aged around 15/16) participating to the camp “Faire des maths autrement” (“*Doing math differently*”), see [here for more details \(in French\)](#). I was one of the people responsible for the research workshops in which students work in groups (of 2–5, usually) on some small research projects and present their results in front of their relatives and teachers at the end of the week.
1. In the academic year 2021–2022, I proposed a research subject to high school students (aged around 14/15) as part of the [MATH.en.JEANS](#) programme. I created the subject and did some follow-up during the year.

■ Olympiads

Mathematics, as a contestant

- I participated in the Belgian Mathematical Olympiad, I was qualified to the final every year and won the first prize in [2012 \(MINI category\)](#), [2014 \(MIDI category\)](#) and [2016 \(MAXI category\)](#).
- I participated in the Belgian Olympiad training camps for the International Mathematical Olympiad organized in Wépion in 2014, 2015 and 2016.
- I also participated in the French Mathematical Olympiad training camps in Montpellier in 2014 and [Valbonne in 2015](#).
- I was selected to the Belgian team for the [Benelux Mathematical Olympiad in Soest \(Netherlands\) in 2016 where I ended first and received a gold medal](#).
- I was selected to the Belgian team for the [International Mathematical Olympiad in Hong Kong in 2016 where I received a bronze medal](#).

- In 2016, I was selected in the [French team for the Romanian Masters in Mathematics 2016](#) (since Belgium does not participate in this contest, I was a member of the French team).

Mathematics, as a trainer

- From 2018 to 2024, I was a trainer for the Belgian training camps for the International Olympiad organized in Wépion. I gave a lecture on the scalar product, the Cauchy-Schwarz inequality, convexity and the Jensen inequality. I also gave problem sessions, mostly revolving around inequalities.

Informatics, as a contestant

- I participated in the [Belgian Informatics Olympiad](#) since I was in third grade in secondary school, I was qualified to the final every year and won the first prize in [2016](#).
- From 2014 to 2016, I was a member of the [beCP](#) Belgian training pools for the International Olympiad in Informatics (IOI).
- I participated in the [IOI at Taipei \(Taiwan\)](#) in 2014, at [Almaty \(Kazakhstan\)](#) in 2015 and at [Kazan \(Russia\)](#) in 2016. I won bronze medals in 2015 and 2016.

Informatics, as a trainer

- Since 2017, I am a trainer for [beCP](#). I gave several lectures and problem sessions to contestants training for IOI.
- I was a “deputy leader” of a team of 4 Belgian contestants for the [European Junior Olympiad in Informatics](#) which took place in Sofia (Bulgaria) in 2017.
- In 2020 I was a “deputy leader” of a team of 4 Belgian contestants for [IOI 2020](#) that I helped to organize at [UMONS](#) due to the sanitary conditions cause by the COVID-19 pandemic.
- I am a [board member](#) of the Belgian Olympiad in Informatics.

Informatics, team contests

- During my first year of bachelor at UMONS, I launched the group CPUMONS to participate in college-level programming contests.
- I participated with the team CPUMONS in the Benelux Programming Contest. We scored [3/51](#) in 2016, [5/40](#) in 2017, [3/44](#) in 2018 and [2/78](#) in 2020. I was not able to participate in 2019 since I was in Orsay.
- We also participated in the Northwestern Europe Regional Contest, a step of the [ACM-ICPC contest](#). We ended [12/114](#) in 2016, [55/118](#) in 2017, [32/118](#) in 2018.
- The CPUMONS organization is very active and involved in many activities surrounding programming at UMONS.

Administrative tasks and representative duties

3. "Secretary of the council of the Mathematics Department" [*In practice: this meant to write a few reunion reports for meetings internal to the members of the mathematics Department at UMONS. This task is always attributed to a scientific member of the Department and not to administrative personal at UMONS.*], Sep 2021 - Oct 2022, UMONS
2. Representative of Mathematics PhD students at the board of the DMATHS department and the CERAMATHS laboratory (at UPHF, Valenciennes, France), 2021 - 2024.
1. Representative of temporary personnel (PhD students and postdocs financed by research grants) at the council of the Mathematics Department (at UMONS, Mons, Belgium), 2021 - Present.

Languages

French (native), English (professional), Dutch (basic), Italian (basic)

Miscellaneous

I possess a European driving license.