DAVID LAFONTAINE

(French, born in 1990 in Montpellier, France)
https://www.math.univ-toulouse.fr/~dlafonta/ ◇ david.lafontaine@math.univ-toulouse.fr

OVERVIEW OF MY RESEARCH INTERESTS

I study qualitative properties of wave equations arising from physics. The goal of my work is to understand the relationship between the behaviour of a wave, possibly non-linear, and the geometry it propagates in. In particular, I am interested in the long-time asymptotics and dispersive properties of linear and non-linear Schrödinger and wave equations in domains with boundaries and in non homogeneous settings, and in questions coming from the numerical analysis of the Helmholtz equation.

EMPLOYMENT

Chargé de recherche (CRCN) *2021–*
CNRS, based at Institut de Mathématiques de Toulouse.

Research Associate (post-doctoral position) *2018– 2021*
University of Bath, Department of Mathematical Sciences.
Funded by the EPSRC Grant EP/R005591/1 of Euan Spence.

EDUCATION

Ph.D, LJAD, Université Côte d'Azur, France *2015–2018*
"Dispersive effects and long time asymptotics for wave equations in exterior domains"
Supervised by Fabrice Planchon.
Defended the 25th September 2018.
Referees: Nicolas Burq, Jared Wunsch.
Jury: Nicolas Burq, Jean-Marc Delort, Thomas Duyckaerts, Isabelle Gallagher, Oana Ivanovici, Fabrice Planchon, Pierre Raphaël.

Pre-doctoral research year, SNS Pisa, Italy *2014–2015*
Supervised by Nicola Visciglia.

Elève normalien at ENS Cachan, France (now ENS Paris-Saclay) *2011–2015*

PAPERS

Submitted

1. Sharp bounds on Helmholtz impedance-to-impedance maps and application to overlapping domain decomposition,
with Euan Spence,
https://arxiv.org/abs/2211.14659,
Submitted, 2022
2. The *hp*-FEM applied to the Helmholtz equation with PML truncation does not suffer from the pollution effect,
with Jeffrey Galkowski, Euan Spence and Jared Wunsch,
https://arxiv.org/abs/2207.05542,
Submitted, 2022
3. Strichartz estimates without loss outside many strictly convex obstacles,
https://arxiv.org/abs/1811.12357
Submitted, 2018
4. Strichartz estimates without loss outside two strictly convex obstacles,
https://arxiv.org/abs/1709.03836,
Submitted, 2017

Published or accepted for publication

5. Local absorbing boundary conditions on fixed domains give order-one errors for high-frequency waves,
   with Jeffrey Galkowski and Euan Spence,
   https://arxiv.org/abs/2101.02154,
   IMA Journal of Numerical Analysis, to appear
6. Decompositions of high-frequency Helmholtz solutions via functional calculus, and application to the finite element method,
   with Euan Spence and Jared Wunsch,
   https://arxiv.org/abs/2102.13081,
   SIAM Journal on Mathematical Analysis, to appear
7. Perfectly-matched-layer truncation is exponentially accurate at high frequency,
   with Jeffrey Galkowski and Euan Spence,
   https://arxiv.org/abs/2105.07737,
   SIAM Journal on Mathematical Analysis, to appear
8. Convergence of parallel overlapping domain decomposition methods for the Helmholtz equation,
   with Shihua Gong, Martin Gander, Ivan Graham and Euan Spence,
   https://arxiv.org/abs/2106.05218,
   Numerische Mathematik, 2022
9. Wavenumber-explicit convergence of the hp-FEM for the full-space heterogeneous Helmholtz equation with smooth coefficients,
   with Euan Spence and Jared Wunsch,
   https://arxiv.org/abs/2010.00585,
   Computers & Mathematics with Applications, 2022
10. A sharp relative-error bound for the Helmholtz h-FEM at high frequency,
    with Euan Spence and Jared Wunsch,
    https://arxiv.org/abs/1911.11093,
    Numerische Mathematik, 2021
11. Scattering for critical radial Neumann waves outside a ball,
    with Thomas Duyckaerts,
    http://arxiv.org/abs/2004.08576,
    Revista Matemática Iberoamericana, 2021
12. About the wave equation outside two strictly convex obstacles,
    https://arxiv.org/abs/1711.09734
    Communications in PDE, 2021
13. For most frequencies, strong trapping has a weak effect in frequency-domain scattering,
    with Euan Spence and Jared Wunsch,
    https://arxiv.org/abs/1903.12172,
    Communications on Pure and Applied Mathematics, 2020
14. Scattering for NLS with a sum of two repulsive potentials,
    http://arxiv.org/abs/1812.04968
    Annales de l'Institut Fourier, 2020
15. Scattering for NLS with a potential on the line,
    https://arxiv.org/abs/1609.01993,
    Asymptotic Analysis, 2016

PROCEEDINGS

- Decompositions of high-frequency Helmholtz solutions and application to the finite element method,
  https://slsedp.centre-mersenne.org/articles/10.5802/slsedp.152/,
  Séminaire Laurent Schwartz — EDP et applications, 2022

TALKS

2023

- "Scattering for critical nonlinear waves outside two strictly convex obstacles", *Bilbao Analysis and PDE Seminar*, June 2023
- "Scattering for critical nonlinear waves outside two strictly convex obstacles", *Séminaire MACS, Institut Camille Jordan - Unité de Mathématiques Pures et Appliquées, Lyon*, May 2023
- "Sharp bounds on Helmholtz impedance-to-impedance maps and application to overlapping domain decomposition", *Séminaire de l'équipe EDP, IECL, Nancy*, February 2023

2022

- "Sharp bounds on Helmholtz impedance-to-impedance maps and application to overlapping domain decomposition", *Workshop "Journées singulières", Nice*, November 2022
- "Ondes non-linéaires dans des géométries captantes instables", *Conférence en souvenir de Jacques Lafontaine, Montpellier*, October 2022
- "Decompositions of high-frequency Helmholtz solutions and application to the finite element method", *Workshop "At the Interface between Semiclassical Analysis and Numerical Analysis of Wave Scattering Problems", Oberwolfach*, September 2022
- "Les conditions au bord absorbantes du type impédance donnent une erreur O(1) pour les ondes à hautes fréquences", *Séminaire Modélisation, Analyse, Calcul, Institut de Mathématiques de Toulouse*, May 2022
- "Decompositions of high-frequency Helmholtz solutions via functional calculus, and application to the finite element method", *Séminaire Laurent Schwartz, IHES*, April 2022
- "Decompositions of high-frequency Helmholtz solutions via functional calculus, and application to the finite element method", *Workshop "Hamiltonian PDEs and nonlinear waves", La Thuile, Italy*, February 2022
- "Sharp bounds on Helmholtz impedance-to-impedance maps and application to overlapping domain decomposition" (digital), *Conference on Mathematics of Wave Phenomena, Karlsruhe – Mini-symposium "High Frequency Scattering and Wave Propagation: the Semiclassical/Numerical Analysis Interface"*, February 2022
- "Decompositions of high-frequency Helmholtz solutions via functional calculus, and application to the finite element method" (digital), *Conference on Mathematics of Wave Phenomena, Karlsruhe – Mini-symposium "Discretization Methods for Indefinite Wave Propagation Problems"*, February 2022

2021

- "Decompositions hautes-fréquences des solutions de l'équation de Helmholtz via le calcul fonctionnel, et application aux éléments finis" (digital), *Analysis seminar, LJAD, Nice*, May 2021
- "Decompositions hautes-fréquences des solutions de l'équation de Helmholtz via le calcul fonctionnel, et application aux éléments finis" (digital), *Analysis seminar, Laboratoire de Mathématiques Jean Leray, Nantes*, April 2021
- "Local absorbing boundary conditions on fixed domains give order-one errors for high-frequency waves" (digital), *PDE team seminar, IECL, Nancy*, January 2021

2020

- "Propagation des ondes: aspects linéaires, non-linéaires, et applications à l'analyse numérique" (digital), *SPHINX team seminar, INRIA Grand-Est, Nancy*, November 2020
- "Application de l'analyse semi-classique à trois problèmes provenant de l'analyse numérique de l'équation de Helmholtz", *POEMS team seminar, ENSTA*, January 2020

2019

- "Linear and non-linear waves in unstable trapping geometries", *Junior Analysis Seminar, Imperial College London*, November 2019

- "Scattering for NLS with a sum of two repulsive potentials", *Analysis seminar, Heriot-Watt University, Edinburgh*, November 2019
- "For most frequencies, strong trapping has a weak effect in frequency domain scattering", talk given jointly with E. Spence, *Industrial and Applied Mathematics Seminar and Wave Chaos Seminar, University of Nottingham*, October 2019
- "Scattering for NLS with a sum of two repulsive potentials", *WAVES 2019 (contributed talk), Vienna*, August 2019
- "For most frequencies, strong trapping has a weak effect in frequency domain scattering", *The British Applied Mathematics Colloquium 2019 – Mini-symposium "New applications and advances in the analysis of wave scattering", Bath*, April 2019
- "Linear and non-linear waves in unstable-trapping geometries", *PDE team seminar, University of Besançon*, April 2019
- "Ondes linéaires et non linéaires dans des géométries captantes instables", *"Young researchers in PDEs days", Rennes*, March 2019
- "About wave and Schrödinger equations in the exterior of many strictly convex obstacles", *Geometric Analysis and Partial Differential Equations seminar, University of Cambridge*, February 2019

2018

- "For most frequencies, strong trapping has a weak effect in frequency domain scattering", *Reading waves meeting: "A wave in a manger"*, December 2018
- "About wave and Schrödinger equations in the exterior of many strictly convex obstacles", *Analysis seminar, University of Cardiff*, December 2018
- "Scattering for non-linear waves equations in non-trapping and unstable trapping geometries", *Asymptotics, Operators and Functionals seminar, University of Bath*, November 2018
- "About wave and Schrödinger equations in the exterior of many strictly convex obstacles", *ERC Workshop in Rome: Nonlinear Dispersive PDE's*, October 2018
- "About wave and Schrödinger equations in the exterior of many strictly convex obstacles", *Analysis seminar, University of Bath*, October 2018
- "A propos des équations des ondes et de Schrödinger en dehors de plusieurs obstacles convexes", *Workshop "Jeunes Chercheurs en Analyse des équations Dispersives", Université Paris 13*, June 2018
- "About wave and Schrödinger equations outside two strictly convex obstacles", *Workshop "Dynamics of Hamiltonian PDEs", La Thuile*, February 2018

2017

- "Strichartz estimates without loss outside two strictly convex obstacles", *LAGA team seminar, Université Paris 13*, December 2017
- "Wave equations outside obstacles", *Rencontres doctorales Lebesgue 2017*, Rennes, October 2017
- "Scattering for NLS with a potential", *ACSIOM team seminar*, Montpellier, March 2017
- "Description of the lack of compactness in some functional embeddings and applications to PDE's", *INRIA Ph.D. seminar*, Sophia-Antipolis, February 2017

2015

- "Scattering for critical waves outside some non-trapping obstacles", *Young researchers seminar, SNS Pisa*, Pisa, April 2015

ORGANIZED EVENTS

- Workshop "Hamiltonian PDEs and nonlinear waves", *La Thuile (Italy), 26th February – 4th March 2023*, co-organized with Oana Ivanovici, Fabrice Planchon, and Nicola Visciglia, funded by ERC ANADEL, https://anadel.math.cnrs.fr/la-thuile2023/.
- Workshop "Hamiltonian PDEs and nonlinear waves", *La Thuile (Italy), 20th-26th February 2022*, co-organized with Oana Ivanovici, Fabrice Planchon, and Nicola Visciglia, funded by ERC ANADEL, https://anadel.math.cnrs.fr/workshops-and-conferences/lathuile2022/.
- Workshop "Semi-classical analysis meets Numerical Analysis", to be originally held in Bath in July 2020, cancelled due to the sanitary crisis; co-organized with Jeffrey Galkowski, Euan Spence, and Jared Wunsch, funded by the EPSRC Grant EP/R005591/1.
- Workshop "Hamiltonian PDEs and nonlinear waves", *La Thuile (Italy), 10th-16th February 2019*, co-organized with Oana Ivanovici, Fabrice Planchon, Pierre Raphaël, and Nicola Visciglia, funded by ERC ANADEL, ERC SINGWAVES and University of Pisa, http://anadel.math.cnrs.fr/index.php/workshops-and-conferences/workshop-thuile/.
- Young researchers colloquium of LJAD, *Barcelonnette, 12th-14th May 2017*, co-organized with Julie Llobell.

SCIENTIFIC EXPERTISE

- Regular referee for peer-review journals.
- Expert for the ANR (2023).
- 2022: Member of the Jury for the Ph.D defense of Van tin Phan (Ph.D advisor Stefan Le Coz)

GRANTS

- 2023: INSMI Grant "PEPS Jeunes Chercheurs et Jeunes Chercheuses"

TEACHING

- 2023: Instructor for the "Problems solving" undergraduate course (L3) at Université Paul Sabatier (50h).
- October 2020 – December 2020 and October 2019 – December 2019: I was a tutor for the unit Analysis 2A at the University of Bath.
- August 2019: I was the teaching assistant for the course on scattering theory lectured by Maciej Zworski during the "Summer Northwestern Analysis Program 2019" summer school in Northwestern University.
- 2015 – 2018: I gave 64 hours a year of exercices courses (mainly logic and set theory, maths for economists, and maths for biologists) to first and second year students at the Université Côte d'Azur.
- 2013 – 2014: I provided 2 hours a week of guidance (so-called "khôlles") to students preparing for oral entrance exams to french "grandes écoles", at Lycée d'Orsay.

MISCELLANEOUS

Spoken languages	French (native), English (fluent, TOEIC: 970/990), Italian (fluent)
Computer skills	Advanced use of LaTeX, basic knowledge of C, C++ and Python
Theater	Amateur actor (with a few months of experience in a professional play in Nice)

Last update: 4th September 2023