Maxime Herda

Research Scientist in Applied Mathematics

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Last update 01/2026

Current professional situation

Since 2018 **"Chargé de recherche" (Research scientist)**, *Inria centre at the University of Lille*, France.
Permanent member of the Inria research team RAPSODI (Reliable Approximation of Dissipative Systems). Also affiliated to the research team ANEDP (Numerical Analysis and Partial Differential Equations) of the Laboratoire Paul Painlevé (University of Lille).

Previous research positions

2017–2018 **FSMP postdoc**, *Jacques-Louis Lions Laboratory*, Sorbonne Université, Paris, France.

2014–2017 **Research assistant (PhD)**, *Camille Jordan Institute*, University of Lyon, Villeurbanne, France.

Research interests

I am interested in the analysis of partial differential equations and the conception of structure preserving schemes for their numerical resolution.

Keywords: partial differential equations (PDEs), numerical analysis, kinetic PDEs, parabolic PDEs, asymptotic behaviors, entropy methods, hypocoercivity, macroscopic limits, finite volume schemes, positive polynomials, plasma physics, particle accelerator physics, semiconductors, life sciences.

Education

2014 – 2017 **PhD in applied mathematics**, *University of Lyon*, Villeurbanne, France.
Advisors : Francis Filbet and L. Miguel Rodrigues

Thesis title:
"Asymptotic and numerical analysis of kinetic and fluid models for the transport of charged particles"

Publicly defended on September 20, 2017 before the jury composed of:

Claire Chainais-Hillairet	Professor, Lille 1 University	President
Clément Mouhot	Professor, University of Cambridge	Reviewer
Sylvie Benzoni-Gavage	Professor, University of Lyon	Examiner
Daniel Han-Kwan	CNRS researcher, École Polytechnique	Examiner
Pauline Lafitte	Professor, Centrale Paris	Examiner
Francis Filbet	Professor, Toulouse 3 University	PhD advisor
L. Miguel Rodrigues	Professor, Rennes 1 University	PhD advisor

After reviews of the manuscript by:

Ansgar Jüngel	Professor, Technische Universität Wien
Clément Mouhot	Professor, University of Cambridge

2013–2014 **MSc in mathematical engineering**, *University of Lyon*, Villeurbanne, France.
Master Thesis supervised by Francis Filbet and L. Miguel Rodrigues.
Subject : "Modeling, analysis and numerical simulations in kinetic theory of magnetized plasmas"

2010–2014 **Engineering degree from Centrale Lyon**, Centrale Lyon, Écully, France.
General engineering with speciality in applied mathematics (Num. analysis, PDE and stochastic modeling)

2012–2013 **Graduate Certificate in Mathematics**, University College Dublin, Dublin, Ireland.
Master-level course in pure mathematics (Algebra, Analysis)

Teaching experience

Since 2021 **Part-time lecturer**, *École Centrale de Lille*, Villeneuve d'Ascq.
Undergraduate introductory course on scientific computing (2021, 16h; since 2024, 28h/year)

2019–2023 **Part-time lecturer**, *University of Lille*, Villeneuve d'Ascq.
- Refresher course in modeling, scientific computing master's program (2022, 18h; 2023, 18h)
- Introduction to kinetic theory, research master's program (2022, 21h)
- Tutorials on calculus and topology for 2nd year math undergraduates (2021, 36h)
- Mathematical topics in signal processing, professional master's program (2019, 24h)

2014–2017 **Teaching assistant**, *University of Lyon*, Villeurbanne.
- Oral assessments on measure theory and integration for 3rd year math students (14h)
- Oral assessments on algebra and analysis for 1st and 2nd year engineering students (77h)
- Tutorials on sequences and series of functions for undergraduate math students (36h)
- Tutorials on basic mathematics for undergraduate physics, chemistery and engineering students (66h)

Scientific publications

Prepublications

[A25] M. Herda, M. Pegon, and I. Tristani, Fractional hypocoercivity in bounded domains in the anomalous diffusion limit. arXiv preprint 2512.20222 (2025).

[A24] D. Abdel, A. Blaustein, C. Chainais-Hillairet, M. Herda, and J. Moatti. Existence of solutions and uniform bounds for the stationary semiconductor equations with generation and ionic carriers. *Submitted*, arXiv preprint 2511.23250 (2025).

[A23] C. Cancès, M. Herda, and A. Massimini. Convergence and long-time behavior of finite volumes for a generalized Poisson-Nernst-Planck system with cross-diffusion and size exclusion. *Submitted*, arXiv preprint 2411.11583 (2024).

[A22] P. Gervais and M. Herda. Well-posedness and long-time behavior for self-consistent Vlasov-Fokker-Planck equations with general potentials. *Submitted*, arXiv preprint 2408.16468 (2024).

Accepted or published in journals

[A21] M. Alfaro, M. Herda, A. Natale. Infinitely many saturated travelling waves for a degenerate Fisher-KPP equation not in divergence form. *Journal of Differential Equations* 453, Part 3, Article ID 113890, 23 p. (2026).

[A20] M. Herda, A. Trescases, and A. Zurek. A finite volume scheme for the local sensing chemotaxis model. *SMAI Journal of Computational Mathematics* 11, 637-676 (2025).

[A19] D. Abdel, M. Herda, M. Ziegler, C. Chainais-Hillairet, B. Spetzler, and P. Farrell. Numerical analysis and simulation of lateral memristive devices: Schottky, ohmic, and multi-dimensional electrode models. *Computers & Mathematics with Applications*, 199, 286-308 (2025).

[A18] M. Herda, A. Jüngel, and S. Portisch. Charge transport systems with Fermi-Dirac statistics for memristors. *Journal of Nonlinear Science* 35, No. 2, Paper No. 44, 37 p. (2025).

[A17] M. Herda, P. Monmarché, and B. Perthame. Wasserstein contraction for the stochastic Morris-Lecar neuron model. *Kinetic and Related Models* 18, No. 1, 1-18 (2025).

[A16] L. Cesbron and M. Herda. On a Vlasov-Fokker-Planck equation for stored electron beams. *Journal of Differential Equations* 404, 316-353 (2024).

[A15] Dilara Abdel, Claire Chainais-Hillairet, Patricio Farrell, and Maxime Herda. Numerical analysis of a finite volume scheme for charge transport in perovskite solar cells. *IMA Journal of Numerical Analysis* 44, No. 2, 1090-1129 (2024).

[A14] M. Herda and A. Zurek. Study of an entropy dissipating finite volume scheme for a nonlocal cross-diffusion system. *ESAIM: Mathematical Modelling and Numerical Analysis* 57, No. 3, 1589-1617 (2023).

[A13] N. Ayi, M. Herda, H. Hivert, and I. Tristani. On a structure-preserving numerical method for fractional Fokker-Planck equations. *Mathematics of Computation* 92, No. 340, 635-693 (2023).

[A12] C. Chainais-Hillairet, M. Herda, S. Lemaire, and J.Moatti. Long-time behaviour of hybrid finite volume schemes for advection-diffusion equations: linear and nonlinear approaches. *Numerische Mathematik* 151, No. 4, 963-1016 (2022).

[A11] P. Degond, M. Herda, and S. Mirrahimi. A Fokker-Planck approach to the study of robustness in gene expression. *Mathematical Biosciences and Engineering* 17, No. 6, 6459-6486 (2020).

[A10] C. Cancès, C. Chainais-Hillairet, M. Herda, and S. Krell. Large time behavior of nonlinear finite volume schemes for convection-diffusion equations. *SIAM Journal on Numerical Analysis* 58, No. 5, 2544-2571 (2020).

[A9] N. Ayi, H. Hivert, M. Herda, and I. Tristani. A note on hypocoercivity for kinetic equations with heavy-tailed equilibrium. *Comptes Rendus. Mathématique* 358, No. 3, 333-340 (2020).

[A8] B. Després and M. Herda. Computation of sum of squares polynomials from data points. *SIAM Journal on Numerical Analysis* 58, No. 3, 1719-1743 (2020).

[A7] M. Campos Pinto, F. Charles, B. Després, and M. Herda. A projection algorithm on the set of polynomials with two bounds. *Numerical Algorithms* 85, No. 4, 1475-1498 (2020).

[A6] M. Bessemoulin-Chatard, M. Herda, and T. Rey. Hypocoercivity and diffusion limit of a finite volume scheme for linear kinetic equations. *Mathematics of Computation* 89, No. 323, 1093-1133 (2020).

[A5] C. Chainais-Hillairet and M. Herda. Large-time behavior of a family of finite volume schemes for boundary-driven convection-diffusion equations. *IMA Journal of Numerical Analysis* 40, No. 4, 2473-2504 (2020).

[A4] M. Herda and L. M. Rodrigues. Anisotropic Boltzmann-Gibbs dynamics of strongly magnetized Vlasov-Fokker-Planck equations. *Kinetic and Related Models* 12, No. 3, 593-636 (2019).

[A3] M. Herda and L. M. Rodrigues. Large-time behavior of solutions to Vlasov-Poisson-Fokker-Planck equations: From evanescent collisions to diffusive limit. *Journal of Statistical Physics* 170, No. 5, 895-931 (2018).

[A2] F. Filbet and M. Herda. A finite volume scheme for boundary-driven convection-diffusion equations with relative entropy structure. *Numerische Mathematik* 137, No. 3, 535-577 (2017).

[A1] M. Herda. On massless electron limit for a multispecies kinetic system with external magnetic field. *Journal of Differential Equations* 260, No. 11, 7861-7891 (2016).

Conference proceedings

[P3] C. Cancès, M. Herda, and A. Massimini. Finite volumes for a generalized Poisson-Nernst-Planck system with cross-diffusion and size exclusion. Finite volumes for complex applications X – Volume 1. Elliptic and parabolic problems.

FVCA 10, Strasbourg, France, October 30 – November 3, 2023. Invited contributions. Cham: *Springer. Springer Proc. Math. Stat.* 432, 57-73 (2023).

[P2] C. Chainais-Hillairet and M. Herda. L^∞ bounds for numerical solutions of noncoercive convection-diffusion equations. Finite volumes for complex applications IX – methods, theoretical aspects, examples. FVCA 9, Bergen, Norway, June 15–19, 2020. In 2 volumes. Volume I and II. Cham: *Springer. Springer Proc. Math. Stat.* 323, 153-161 (2020).

[P1] M. Badsi and M. Herda. Modelling and simulating a multispecies plasma. In CEMRACS 2014-numerical modeling of plasmas, volume 53 of *ESAIM Proceedings and Surveys*, pages 22-37. EDP Sci., Les Ulis, 2016.

Other publications

[E1] B. Després, M. Herda. Correction to: Polynomials with bounds and numerical approximation. *Numerical Algorithms* 77, No. 1, 309-311 (2018). (Original paper by B. Després: *Numerical Algorithms* 76, No. 3, 829-859 (2017).)

Memoirs

[M1] M. Herda. Analyse asymptotique et numérique de quelques modèles pour le transport de particules chargées. *PhD thesis* (2017).

Grants

2025-2027 **Principal Investigator of the Inria ARISE associate team**, French-German bilateral partnership with NUMSEMIC team at WIAS Berlin (co-PI: Patricio Farrell).
Funding of $\sim$ 8k€/year for research visits.

2021-2022 **Principal Investigator of a PHC Amadeus**, French-Austrian bilateral partnership with TU Wien (co-PIs: Ansgar Jüngel, Antoine Zurek).
Funding of $\sim$ 2k€/year for research visits.

May-Jul 2019 **Fellowship**, *Hausdorff research Institute for Mathematics*, Bonn, Germany.
Acceptation of a research project (theoretical and numerical study of the fractional kinetic Fokker-Planck equation) for the Junior Trimester Program in kinetic theory. Seven weeks research stay financed by HIM.

2017-2018 **Laureate of the FSMP postdoc program**, *FSMP*, Paris, France.
One-year postdoctoral fellowship funded by the "Fondation Sciences Mathématiques de Paris".

2014-2017 **PhD Scholarship**, *University of Lyon*, France.
Funded by the French ministry of higher education and research.

International research visits

Jan 2025 **IRL CRM-CNRS**, *3 weeks*, Montréal, Canada.
Invitation at the CNRS-Univ. Montreal International Research Lab.

Nov 2022 **TU Wien**, *1 week*, Vienna, Austria.
Invitation in the group of Ansgar Jüngel in the framework of PHC Amadeus project.

May-Jul 2019 **Hausdorff research Institute for Mathematics**, *7 weeks*, Bonn, Germany.
Junior trimester program in kinetic theory

Feb 2019 **Imperial College London**, *1 week*, UK.
Invited by Pierre Degond thanks to the CNRS-Imperial "Abraham de Moivre" UMI

Reviewing activities

- **Numerical analysis and scientific computing**: Numerische Mathematik, Mathematics of Computation, SIAM Journal on Numerical Analysis, Foundations of Computational Mathematics, IMA Journal of Numerical Analysis, SIAM Journal of

Scientific Computing, Calcolo, ESAIM: Mathematical Modelling and Numerical Analysis, Journal of Scientific Computing, Journal of Computational Physics

- **Analysis of PDEs and mathematical physics**: Communications in Mathematical Physics, Journal of Differential Equations, Nonlinearity, Discrete and Continuous Dynamical Systems, Communications in Pure and Applied Analysis, Kinetic and Related Models, Acta Applicandae Mathematicae
- **Other**: ESAIM Proceedings and Surveys

Supervisions / mentoring

Postdocs

2023–2025 **Pierre Gervais**, *Now assistant professor (maître de conférence) at University of Toulouse.*
Subject: Large-time behavior of self-consistent Vlasov-Fokker-Planck equations.
Funded by CPER Wavetech

Jan–Aug 2020 **Igor Honoré**, *Now assistant professor (maître de conférence) at University of Lyon.*
Subject: Large-time behavior of numerical schemes for kinetic equations via probabilistic methods
Funded by Inria centre at the University of Lille.

PhD students

Since Nov 2024 **Abdoul-Aziz Diallo**.
Subject: Numerical computation of unstable orbits in Vlasov-Fokker-Planck equations.
Co-supervision ($\frac{1}{3}$) with S. Bielawski ($\frac{1}{3}$) and C. Évain ($\frac{1}{3}$).
Funded by LabEx CEMPI.

Oct 2020–Sep 2023 **Julien Moatti**, *Now assitant professor (maître de conférence) at ENSEIRB-MATMECA (Bordeaux) after a postdoc at TU Wien.*
Subject: Development and numerical analysis of high order schemes for convection-diffusion models, study of the large-time behavior. Defended on September 26, 2023.
Co-supervision ($\frac{1}{3}$) with C. Chainais-Hillairet ($\frac{1}{3}$) and S. Lemaire ($\frac{1}{3}$).
Funded by Inria centre at the University of Lille.

Master students

Apr–Sep 2023 **Sam Dossin**, *M2 Internship.*
Subject: *A model describing the within-vector dynamics of infection by arboviruses.* Co-supervision with Andrea Natale and Gaël Beaunée in the framework of the INRAE project MIDIIVEC.

Jun–Jul 2023 **Ivan Tagliaferro de Oliveira Tezoto**, *M1 Internship.*
Subject: *A nonlocal diffusion model in epidemiology.* Co-supervision with Andrea Natale

Jun–Jul 2021 **Léonie Cleenewerck**, *M1 Internship.*
Subject: *Implementation of numerical schemes for simulations in population dynamics.*

Apr–Jul 2020 **Julien Moatti**, *M2 Internship.*
Subject: *Large-time behavior and entropy methods for hybrid finite volume schemes.*
Co-supervision with C. Chainais-Hillairet and S. Lemaire.

Undergraduate students

Apr–May 2019 **Guillaume Helebecque**.

Organisation of Scientific events

Seminars

Oct 2019 – Jul 2022 **Numerical Analysis and PDE seminar**, *Laboratoire Paul Painlevé*, Lille.
Co-organiser of the weekly seminar of the ANEDP (numerical analysis and partial differential equations) team in the Laboratoire Paul Painlevé (Univ. Lille).

Conferences

Jun 2026 **ABPDE6**, *Lille*, France.
Co-organiser of 6th edition of the conference "Asymptotic Behavior of systems of PDE arising in physics and biology: theoretical and numerical points of view".

Jun 2024 **New Trends in the Numerical Analysis of PDEs (NAPDE)**, *Lille*, France.
Co-organiser of first edition of the conference "New Trends in the Numerical Analysis of PDEs" (NAPDE).

Jun 2023 **ABPDE5**, *Lille*, France.
Co-organiser of 5th edition of the conference "Asymptotic Behavior of systems of PDE arising in physics and biology: theoretical and numerical points of view".

Oct 2021 **ABPDE4**, *Lille*, France.
Co-organiser of 4th edition of of the conference "Asymptotic Behavior of systems of PDE arising in physics and biology: theoretical and numerical points of view".

Mini-conferences and mini-symposia

Nov 2025 **ARISE team meeting**, *Berlin*.
Co-organiser of a one week bilateral French-German team meeting with two-day workshop.

Oct 2025 **Applied Analysis day in Hauts-de-France**, *Lille*.
Co-organiser of a one-day conference co-organized by all the math laboratories of the Hauts-de-France region.

Mar 2024 **Mini-symposium at ALGORITMY 2024**, *High Tatra Mountains*, Slovakia.
Co-organiser of the mini-symposium *Advanced numerical methods for dissipative systems.*

Nov 2022 **Applied Analysis day in Hauts-de-France**, *Lille*.
Co-organiser of a one-day conference co-organized by all the math laboratories of the Hauts-de-France region.

Oct 2019 **Journée de la Fédération de Recherche Mathématique du Nord-Pas-de-Calais**, *Lille*.
Co-organiser of the one-day conference co-organized by all the math laboratories of the Nord-Pas-de-Calais region.

Other events

Mar 2023 **Opening of a photo exhibition "Mathématiques, informatiques ...avec elles !"**, *Lille*.
Half-day gathering of students, teachers, and university staff to exchange on the place of women in jobs related to mathematics. The event consisted of a conference by a historian of mathematics, a round table with testimonies from women practicing math professions (academic and private), and closed with the opening of the photo exhibition "Mathematics, computer science...with them!". Link here.

Administrative duties

Since 2025 **Nominated member of the Lille Inria work group on staff training**.

2021–2024 **In charge of the annual Inria activity report of the RAPSODI team**.
Coordination and writing of a public report on the annual activity of the Inria project-team RAPSODI.

Since 2021 **Substitute member to the Lille Inria center committee**.

Since 2021 **Nominated member of the Lille Inria work group on the use of IT resources**.

2020–2025 **Elected member of the Paul Painlevé laboratory council and "commission mixte"**.

Communications

Talks in conferences, worshops and summer schools

- 11/2025 - "ARISE associate team meeting" workshop, WIAS, Berlin, Germany.

- 09/2025 - "Gradient flows face-to-face 5th edition", Universidad de Granada, Granada, Spain.
- 09/2025 - "Workshop on Mathematical Models for Quantum and Semiclassical Dynamics", Università di Firenze, Florence, Italy.
- 11/2025 - "The International Conference on emerging aspects of kinetic theory, nonlocal equations, and related applications", Wuhan University, Wuhan, China.
- 10/2024 - "Modeling, theory and numerics for PDEs (kinetic and hyperbolic systems)" workshop - Aussois, France.
- 09/2024 - "The many facets of Kinetic Theory" workshop - ICMS, Edinburgh, UK.
- 09/2024 - "Applied Mathematics and Simulation for Semiconductor Devices" workshop (AMaSiS 2024), WIAS, Berlin, Germany.
- 03/2024 - "Theoretical and Analytical Aspects of Kinetic equations in Plasmas" workshop - CIRM, Marseille, France.
- 03/2022 - SIAM Conference on Analysis and PDEs, mini-symposium "Challenges in the Kinetic Modelling of Complex Systems" - Berlin, Germany (online).
- 03/2022 - ANR Mohycon workshop: Numerical methods for multiscale problem - Pornichet, France
- 07/2021 - Multi-scale modeling for pattern formation in biological systems - Mittag-Leffler Institute, Sweden (online).
- 04/2021 - Workshop MOME ("Modelisation Mathématique en Ecologie"), Amiens, France (online).
- 07/2019 - 9th International Congress on Industrial and Applied Mathematics (ICIAM 2019) - Valencia, Spain.
- 06/2019 - Analytical and Computational Problems for Mixtures and Plasma Dynamics Workshop - Hausdorff Research Institute For Mathematics, Bonn, Germany.
- 10/2018 - Applied Mathematics and Simulation for Semiconductors (AMaSiS 2018) - Berlin, Germany.
- 06/2018 - French numerical analysis congress (CANUM) - Cap d'Agde, France.
- 03/2018 - Young researcher PDE days 2018 - Nancy, France.
- 02/2018 - Conference "Young Researchers Workshop: Kinetic models in biology and social sciences" - School of Math. and Statistical Sciences - Arizona State University, USA.
- 11/2017 - Workshop "Kinetic Theory and Fluid Mechanics" - IMT - Toulouse 3 University, France.
- 09/2017 - Workshop "Dynamics in multi-component systems" - Paul Painlevé Laboratory - Lille 1 University, France.
- 06/2017 - Mini-symposium "MULTIKIN" - SMAI congress 2017 - La Tremblade, France.
- 04/2017 - "KiNeMa" Summer School - IESC - Cargèse, France.
- 07/2015 - "Nonlinear evolutions" Summer school - Hausdorff Center for Mathematics - Universität Bonn, Germany.
- 06/2015 - Mini-symposium "Kinetic equations" - SMAI congress 2015 - Les Karellis, France.
- 08/2014 - CEMRACS 2014 - CIRM - Luminy, France.

Talks in seminars

- 12/2025 - MAC seminar, IMT, Université de Toulouse, France.
- 01/2025 - Applied Mathematics Seminar, CRM, McGill University and Univ. Montreal, Canada.
- 06/2024 - Numerical analysis and PDEs seminar, LJAD, Université Côte d'Azur, France.
- 11/2023 - Inverse Problem and Numerical Analysis seminar, LMAC, UTC, France.
- 05/2023 - MAC seminar, IMT, Université de Toulouse, France.
- 05/2023 - MACS seminar, ICJ, Université de Lyon, France
- 01/2023 - Applied math seminar, LMJL, Université de Nantes, France.
- 10/2022 - PDE seminar, CMAP, Ecole Polytechnique, France
- 05/2022 - Applied Analysis seminar, Université de Picardie Jules Verne, France.
- 05/2022 - EMA team seminar, Université Littoral Côte d'Opale, France.
- 06/2020 - Kinetic Coffee - Cambridge University, UK (online seminar).
- 02/2019 - Applied mathematics seminar - Imperial College London - UK.
- 10/2018 - Day of the Nord Pas de Calais Mathematics Research Federation, Lille, France.
- 12/2017 - PDE seminar - J.A. Dieudonné Laboratory - Nice Sophia Antipolis University, France.
- 11/2017 - PDE seminar - Jean Kuntzmann Laboratory - Grenoble Alpes University, France.
- 03/2017 - PDE seminar - Paul Painlevé Laboratory - Lille 1 University, France.
- 03/2017 - Applied mathematics seminar - Jean Leray Laboratory - Nantes University, France.

- 11/2016 - PDE seminar - IRMA - Strasbourg University, France.
- 10/2015 - PDE seminar - IRMAR - Rennes 1 University, France
- 10/2015 - MMCS days- Camille Jordan Institute - University of Lyon, France.
- 09/2015 - ITER seminar - Jacques-Louis Lions Laboratory - Paris 6 University, France.
- 09/2015 - C.A.K.E. seminar - Center for Mathematical Sciences - University of Cambridge, UK.

Talks for scientific diffusion

- 01/2019 - 30 minutes of science - Inria Lille - Nord Europe.

Poster presentations in congresses and conferences

- 06/2020 (online conference) - FVCAIX - Bergen, Norway
- 10/2018 - Symposium EDP-Normandie 2017 - Nicolas Oresme Laboratory - Caen-Normandie University, France.
- 06/2016 - ABPDE conference - Paul Painlevé Laboratory - Lille 1 University, France.
- 05/2016 - MATKIT conference - Center for Mathematical Sciences - University of Cambridge, UK.
- 11/2013 - Second International Workshop on Reduced Basis, POD and PGD model - Blois, France.

Languages

French	**Mother tongue**
English	**Fluent**
Italian	**Basic knowledge**

Computer skills

Programming:	Python, C++
Web:	HTML5, CSS
Office:	LaTeX, MS Office
Scientific:	Matlab / Scilab / Octave, Numpy / Scipy, Pytorch, SAGE, R, VisIt, Gnuplot, COMSOL
OS:	GNU/Linux, MS Windows, Mac OS