

Xavier Fernández-Real

CONTACT INFORMATION	EPFL Institute of Mathematics, MA C2 567 Station 8 CH-1015 Lausanne, Switzerland.	https://sma.epfl.ch/~xafernan xavier.fernandez-real@epfl.ch
	Born: Barcelona, 1992	
EXPERIENCE	École polytechnique fédérale de Lausanne (EPFL), Postdoc Institute of Mathematics (with Prof. M. Colombo).	2020 - Present
EDUCATION	PhD in Mathematics, Swiss Federal Institute of Technology in Zurich (ETH Zurich), Advisor: Prof. A. Figalli.	2020
	Master of Advanced Study (M.A.St.) in Mathematics, University of Cambridge. <i>Part III of the Mathematical Tripos. Pass with distinction.</i>	2015
	Degree in Engineering Physics, Universitat Politècnica de Catalunya, BarcelonaTech. Ranked 1st.	2014
	Degree in Mathematics, Universitat Politècnica de Catalunya, BarcelonaTech. Ranked 1st.	2014
RESEARCH INTERESTS	Elliptic and parabolic PDE Integro-differential operators	Free boundary problems Optimal Transport and transport equations
ARTICLES AND PREPRINTS	<ul style="list-style-type: none">[1] Optimal regularity for the fully nonlinear thin obstacle problem (with M. Colombo, X. Ros-Oton), <i>preprint arXiv.</i>[2] Improved regularity of second derivatives for subharmonic functions (with R. Tione), <i>preprint arXiv.</i>[3] Stable cones in the thin one-phase problem (with X. Ros-Oton), <i>Amer. J. Math.</i>, accepted.[4] Free boundary regularity for almost every solution to the Signorini problem (with X. Ros-Oton), <i>Arch. Rat. Mech. Anal.</i> 240 (2021), 419-466.[5] On the obstacle problem for the 1D wave equation (with A. Figalli), <i>Mathematics in Engineering</i> 2 (2020), 584-597.[6] On the singular set in the thin obstacle problem: higher order blow-ups and the very thin obstacle problem (with Y. Jhaveri), <i>Anal. PDE</i>, 14 (2021), 1599-1669.[7] On global solutions to semilinear elliptic equations related to the one-phase free boundary problem (with X. Ros-Oton), <i>Discrete Contin. Dyn. Syst. A</i> 39 (2019), 6945-6959.[8] Regularity of minimal surfaces with lower dimensional obstacles (with J. Serra), <i>J. Reine Angew. Math.</i> 767 (2020), 37-75.	

- [9] The Lagrangian structure of the Vlasov-Poisson system in domains with specular reflection,
Commun. Math. Phys. 364 (2018), 1327-1406.
- [10] The obstacle problem for the fractional Laplacian with critical drift (with X. Ros-Oton),
Math. Ann. 371(3) (2018), 1683-1735.
- [11] $C^{1,\alpha}$ estimates for the fully nonlinear Signorini problem,
Calc. Var. Partial Differential Equations (2016), 55:94.
- [12] Regularity theory for general stable operators: parabolic equations (with X. Ros-Oton),
J. Funct. Anal. 270 (2017), no. 10, 4165-4221.
- [13] Boundary regularity for the fractional heat equation (with X. Ros-Oton),
Rev. Acad. Cienc. Ser. A Math. 110 (2016), 49-64.

SURVEYS AND
EXPOSITORY PAPERS

- [1] The continuous formulation of shallow neural networks as Wasserstein-type gradient flows (with A. Figalli),
submitted (available in personal website).
- [2] The thin obstacle problem: a survey,
Publ. Mat. 66 (2022), 3-55.

BOOKS

- [1] Regularity theory for elliptic PDE (with X. Ros-Oton),
submitted (available in personal website).

HONORS AND
AWARDS

- Dimitris N. Chorafas Prize 2021 (Awards for best doctoral students in the Hard Sciences).
- Vicent Caselles Prize 2021 from the Real Sociedad Matemática Española (Spanish award to best PhD Theses in Mathematics).
- ETH Medal for outstanding doctoral theses, 2021.
- National Award for Excellence in Academic Performance 2013-14, First Prize (*Premio Nacional de Fin de Carrera, Primer Premio*), 2018.
- Évariste Galois Prize 2016 from Societat Catalana de Matemàtiques SCM (Best graduate level essay award), 2016.
- Bronze Medal at International Mathematical Olympiad (IMO), 2010.

RESEARCH STAYS

University of Texas at Austin. August 2015–July 2016.

INVITED TALKS AT
CONFERENCES

- *PDEs in Presence Workshop*, Rome, Italy, February 2022.
- *Congreso Bienal RSME*, Special Session, Ciudad Real, Spain, January 2022.
- Mini-symposium *New Bridges between Mathematics and Data Science*, Valladolid, Spain, November 2021.
- *15th International Conference on Free Boundary Problems: Theory and Applications 2021 (FBP2021)*, Mini-symposium on Nonlocal free boundary problems, Berlin, Germany (virtual conference), September 2021.
- *V Encuentro Conjunto de la Sociedad Matemática Mexicana (SMM) y la Real Sociedad Matemática Española (RSME)*, special session, Guanajuato, Mexico (virtual conference), June 2021.
- *Barcelona Mathematical Days 2020 (BMD2020)*, *Geometric Analysis and PDE session*, Barcelona, Spain, October 2020.

- *Oberwolfach workshop “Calculus of Variations”*, Oberwolfach, Germany, August 2020.
- *Winter Workshop on Elliptic and Parabolic equations*, Madrid, Spain. December 2019.
- *Congress of young researchers of the RSME*, Special session on PDEs, Valencia, Spain, September 2017.

INVITED TALKS AT SEMINARS

- *Purdue University*. PDE Seminar. January 2022.
- *AIMS - Cameroon*. Research Center’s Colloquium. November 2021.
- *University of Barcelona*. Analysis Seminar. November 2021.
- *National University of Singapore*. PDE and Scientific Computing Seminar. October 2021.
- *Columbia University*. Geometry and Analysis Seminar. January 2021.
- *ICMAT*. Machine Learning Seminar. November 2020.
- *UC San Diego*. Geometric Analysis Seminar. October 2020.
- *Universitat Politècnica de Catalunya*. Analysis/PDE Seminar. April 2018.

TEACHING EXPERIENCE

- Instructor at EPFL
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| <i>Optimal transport</i> , MATH-476 | Spring 2022 |
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- Teaching Assistant at EPFL
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| <i>Optimal transport</i> , MATH-476 | Spring 2021 |
| <i>Mesure et intégration</i> , MATH-303 | Fall 2020 |
- Teaching Assistant at ETH Zurich
- | | |
|---|--------------------------|
| <i>Analysis III</i> (Coordinator), 401-0353-00L | Fall 2018, Fall 2019 |
| <i>Functional Analysis II</i> , 401-3462-00L | Spring 2017, Spring 2018 |
| <i>Functional Analysis I</i> , 401-3461-00L | Fall 2016 |

MENTORSHIP

- Florian Grün, Mentor for Master student, “Semester project”, EPFL 2022.
 Jingeon An, Mentor for Master student, “Semester project”, EPFL 2020.
 Giovanni Bezurghi, Mentor for Master student, “Semester project”, ETH 2019.
- Mathematical Olympiad Mentor/Instructor, 2010-2015.

FELLOWSHIPS

- Provost’s Graduate Excellence Fellowship from UT Austin, 2015-2016.
- Full fellowship from Obra Social “la Caixa” to extend graduate studies in the USA, 2014.

OTHER PUBLICATIONS

- Co-author in publications in “Biology/Medicine”:
- M. Arnoriaga–Rodriguez *et al.*, *Obesity Impairs Short-Term and Working Memory through Gut Microbial Metabolism of Aromatic Amino Acids*, *Cell Metabolism* 32 (4) (2020), 548-560. e7.
- M. Arnoriaga–Rodriguez *et al.*, *Obesity-related inhibitory control deficits are linked to gut microbiota-induced one carbon, tryptophan and histidine metabolism shifts*, *Gut* 70 (2021), 2283-2296.
- J. Mayneris–Perxachs *et al.*, *Iron status influences non-alcoholic fatty liver disease in obesity through the gut microbiome*, *Microbiome* (2021) 9:104.

LANGUAGES

Catalan (native), Spanish (native), English (fluent), French (intermediate), German (intermediate).