Alessio Figalli

Curriculum Vitae

Department of Mathematics
ETH Zürich
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Professor of Mathematics & FIM Director
Phd, SNS Pisa and ENS Lyon, 2007

Personal information

Place and date of birth	Rome (Italy), April 2, 1984
Language skills	Italian (native), English and French (fluent), Spanish (intermediate), German (basic)
Citizenship	Italian citizen, Swiss permanent resident
Civil status	married

Position held

Sep 2019 – present	*FIM Director*, ETH Zürich (Zurich, Switzerland)
Sep 2016 – present	*Chaired Professor*, ETH Zürich (Zurich, Switzerland)
Sep 2013 – Aug 2016	*Full Professor and R. L. Moore Chair*, The University of Texas at Austin (Austin, TX, USA)
Sep 2011 – Aug 2013	*Full Professor*, The University of Texas at Austin (Austin, TX, USA)
Sep 2010 – Aug 2011	*Associate Professor*, The University of Texas at Austin (Austin, TX, USA)
Sep 2009 – Aug 2010	*Associate Professor and Harrington Faculty Fellow*, The University of Texas at Austin (Austin, TX, USA)
Oct 2008 – Aug 2009	*Professor* (Professeur Hadamard), École Polytechnique (Palaiseau, France)
Oct 2007 – Sep 2008	*Researcher* (Chargé de recherche CNRS), University of Nice (Nice, France)

Formation

Feb 17, 2009	Habilitation à Diriger de Recherche (French habilitation) Mémoire HDR (in english): *Optimal transport, Euler equations, Mather and DiPerna-Lions theories*
Nov 2006 – Sep 2007	PhD student at the Scuola Normale Superiore of Pisa (Italy) and at the École Normale Supérieure of Lyon (France). Advisors: Luigi Ambrosio and Cédric Villani. PhD degree obtained Oct. 24, 2007 (italian grade: 70/70 cum laude; french grade: mention trés honorable). Phd thesis (in english): *Optimal transportation and action-minimizing measures*
Oct 2002 – Oct 2006	Student of mathematics at the Scuola Normale Superiore of Pisa (Italy) Master degree obtained the Jun 23, 2006 (grade: 110/110 cum laude). Master thesis (in english): *Trasporto ottimale su varietà non compatte* Bachelor degree obtained Nov 29, 2004 (grade: 110/110 cum laude). Degree thesis (in italian): *Il problema di Bernstein e una congettura di De Giorgi*

Honors, Prizes and Awards

Prizes

2024 *UIMP Medal*

2023 *Frontiers of Science Awards*

2020 *Falling Walls Award in Engineering and Technology*

2020 *Girolamo Cardano International Prize*

2019 Prize *I numeri UNO* of "The Italian Chamber of Commerce for Switzerland"

2019 *Gili Agostinelli Prize* of the "Accademia delle Scienzedi Torino"

2018 *Fields Medal*

2017 *Feltrinelli Prize* of "Accademia Nazionale dei Lincei"

2016 *O'Donnell Award in Science* of "The Academy for Medicine, Engineering, & Science of Texas (TAMEST)"

2015 *Stampacchia Gold Medal* of the Italian Mathematical Union

2012 *European Mathematical Society (EMS) Prize*

2011 – 2012 *Peccot-Vimont Prize* and *Cours Peccot* of the "Collège de France"

2010 *Gioacchino Iapichino Prize* of the "Accademia Nazionale dei Lincei"

2010 *Anile Prize* of the "Associazione Angelo Marcello Anile" and the "Consorzio Catania Ricerche"

2008 *Carlo Miranda Prize* of the "Accademia di Scienze Fisiche e Matematiche" of Naples

2008 *Giuseppe Borgia Prize* of the "Accademia Nazionale dei Lincei"

2006 – 2007 *Benedetto Sciarra Prize* of the "Scuola Normale Superiore" of Pisa

Honors

2022 – present *Asteroid 438523 Figalli (2007 SC12)*

2018 – present *Knight of the Order of Merit of the Italian Republic*

2009 – 2010 *Harrington Faculty Fellowship*

Doctorates Honoris Causa

2022 *University of Sussex*

2019 *Universitat Politècnica de Catalunya*

2018 *Université Côte d'Azur*

Membership to Academies

2023 – present *Corresponding Member of the Accademia dei Lincei*

2022 – present *Corresponding Member of the Accademia delle Scienze di Torino*

2022 – present *Foreign Member of the Accademia Nazionale delle Scienze detta dei XL*

2021 – present *Foreign Member of the Istituto Lombardo - Accademia di Scienze e Lettere*

2021 – present *Honorary Member of Real Sociedad Matemática Española (RSME)*

2019 – present *Member of Academia Europaea*

2019 – present *Foreign Member of the Academy of Sciences of Bologna*

2018 – present *Foreign Member of the Royal Spanish Academy of Sciences*

2017 – present *Fellow and Honorary Member of the European Academy of Sciences*

Grants

2024 – 2028 *SNF Sinergia Grant*, "From single disease reductionist research to informed Machine Learning: a new research paradigm for multimorbidity"

2017 – 2023 *ERC Grant*, "Regularity and Stability in Partial Differential Equations (RS)"

2014 – 2017 *NSF Grant DMS-1361122*, "FRG: Collaborative Research: Vectorial and geometric problems in the calculus of variations"

2013 – 2018 *NSF Grant DMS-1262411*, "Regularity and stability results in variational problems"

2010 – 2013 *NSF Grant DMS-0969962*, "Analytical and geometrical problems in calculus of variations and partial differential equations"

Selected Invited Talks

May 2024 *Euler Lecture 2024*, University of Potsdam, Potsdam, Germany

Apr 2024 *Weierstrass Lecture 2024*, Paderborn University, Paderborn, Germany

Oct 2023 *Plenary Talk at Panorama of Mathematics II*, at the University of Bonn, Bonn, Germany

Aug 2022 *9th International Congress of Chinese Mathematicians, ICCM2022*, Distinguished Speaker, Nanjing, China - *online*

Jul 2022 *2nd Joint Congress of Mathematics AMS-EMS-SMF 2022*, Plenary Speaker, Grenoble, France - *online*

Dec 2021 *Conference on Neural Information Processing Systems*, Plenary Speaker, New Orleans, USA - *online*

Sep 2021 *15th International Conference on Free Boundary Problems*, Plenary Speaker, Berlin, Germany - *online*

Jun 2021 *James Perry Browne Sussex Mathematics Colloquium* at the University of Sussex, Brighton, UK - *online*

May 2021 *Göran Gustafsson Lectures* at the KTH, Plenary Speaker, Stockholm, Sweden - *online*

Sep 2019 *Dynamics, Equations and Applications (DEA 2019)* Plenary Speaker, Krakow, Poland

Jul 2019 *Equadiff 2019* Plenary Speaker, Leiden, Netherlands

Feb 2019 *PIMS-UBC Math Distinguished Colloquium* at the University of British Columbia, Vancouver, Canada

Feb 2019 *Joseph D'Atri Memorial Lectures* at Rutgers University, New Brunswick, NJ, USA

Oct 2018 *John von Neumann Lecture* at Münster University, Münster, Germany

Aug 2018 *International Congress of Mathematicians (ICM),* Plenary Speaker, Rio de Janeiro, Brazil

Jun 2018 *Bourbaki seminar* at IHP Paris, France

May 2018 *Rouse Ball Lecture* at the University of Cambridge, Cambridge, UK

Feb 2018 *Harold J. Gay Lecture*, Worcester, MA, USA

Jun 2017 *23rd Rolf Nevanlinna Colloquium* at ETH Zürich, Zurich, Switzerland

Nov 2016 *Leonardo Da Vinci Lectures* Milan, Italy

Sep 2015 *XX Congress of the Italian Mathematical Union*, Plenary Speaker, Siena, Italy

Mar 2015 *Thomas Wolff Memorial Lectures in Mathematics* at Caltech, Pasadena, CA, USA

Fall 2014 *Nachdiplom-Vorlesungen* at ETH Zürich, Zurich, Switzerland

Aug 2014 *International Congress of Mathematicians (ICM)*, Invited Speaker, Soul, Korea

Jul 2014 *XV International Conference on Hyperbolic Problems*, Plenary Speaker, Rio de Janeiro, Brazil

May 2014 *1st Nirenberg Lectures in Geometric Analysis* at CRM, Montreal, Canada

Apr 2014 *AMS Spring Central Regional Meeting* at Texas Tech University, Plenary Speaker, Lubbock, TX, USA

Dec 2013 *SIAM Conference on Analysis of Partial Differential Equations*, Plenary Speaker, Lake Buena Vista, Florida, USA

Jun 2013 *INdAM Day*, Invited Speaker, Palermo, Italy

Jul 2012 *European Congress of Mathematics (ECM)*, Invited Speaker, Kraków, Poland

Apr 2010 *2009-2010 Salomon Bockner Lectures in Mathematics*, Houston, Texas, USA

Jun 2009 *Bourbaki seminar* at IHP, Paris, France

Mentoring

Postdocs

2022 – present	*André Guerra,* ETH Zürich
2021 – 2024	*Hyunju Kwon,* ETH Zürich
2020 – 2021, 2022 – 2024	*Christoph Kehle,* ETH Zürich
2020 – 2023	*João Pedro Gonçalves Ramos,* ETH Zürich
2018 – 2021	*Hardy Chan,* ETH Zürich
2019 – 2020	*Yi Zhang,* ETH Zürich
2016 – 2018	*Joaquim Serra,* ETH Zürich
2016 – 2018	*Connor Mooney,* UT Austin - ETH Zürich
2015 – 2016	*Brian Krummel,* UT Austin (coadvised with Francesco Maggi)
2014 – 2015	*Begoña Barrios,* UT Austin
2014 – 2016	*Xavier Ros-Oton,* UT Austin
2013	*Shibing Chen,* MSRI.
2012	*Filippo Cagnetti,* UT Austin (coadvised with Luis Caffarelli)
2010 – 2011	*Clayton Bjorland,* UT Austin (coadvised with Luis Caffarelli)

PhD Students

2024 – present	*Gemei Liu,* ETH Zürich
2024 – present	*Susanna Bertolini,* ETH Zürich (coadvised with Joaquim Serra)
2022 – present	*Giacomo Colombo,* ETH Zürich
2020 – 2024	*Lauro Silini,* ETH Zürich
2019 – 2024	*Federico Franceschini,* ETH Zürich (coadvised with Joaquim Serra)
2018 – 2022	*Federico Glaudo,* ETH Zürich
2015 – 2020	*Xavier Fernández-Real,* UT Austin - ETH Zürich
2014 – 2018	*Yash Jhaveri,* UT Austin - ETH Zürich
2013 – 2017	*Javier Morales,* UT Austin
2013 – 2017	*Robin Neumayer,* UT Austin (coadvised with Francesco Maggi)
2012 – 2015	*Maria Colombo,* UT Austin - SNS Pisa (coadvised with Luigi Ambrosio)
2011 – 2016	*Rohit Jain,* UT Austin (coadvised with Luis Caffarelli)
2011 – 2012	*Levon Nurbekyan,* UT Austin - IST Lisbon (coadvised with Diogo Gomes)
2010 – 2013	*Diego Marcon Farias,* UT Austin - IST Lisbon (coadvised with Diogo Gomes)
2009 – 2013	*Emanuel Indrei,* UT Austin
2009 – 2012	*Eric Baer*, UT Austin

Master/Bachelor Students

As a Professor at the Department of Mathematics at ETH, I supervise several Bachelor's and Master's theses

Scientific and administrative responsibilities

Current editorial work

2024 – present	Editor of *Journal of Convex Analysis*
2021 – present	Editor of Transactions of the *LMS*
2021 – present	Editor of *Publ. Math. Inst. Hautes Études Sci.*
2016 – present	Editor of *Arch. Ration. Mech. Anal.*
2014 – present	Editor of *Duke Math. J.*
2013 – present	Editor of *J. Ecole Polytechnique*
2011 – present	Editor of *AIMS Series on Applied Mathematics*

Past editorial work

2015 – 2022	Editor of *Probab. Theory Related Fields*
2013 – 2022	Advisory Board Member for *Lecture Notes in Math.*
2013 – 2019	Editor of *Anal. PDE*
2016 – 2018	Editor of *Commun. Contemp. Math.*
2015 – 2017	Editor of *Appl. Math. Res. Express. AMRX*
2013 – 2017	Associate Editor of *ESAIM: Control Optim. Calc. Var.*
2012 – 2016	Managing Editor of *Discrete Contin. Dyn. Syst. - Series A*
2011 – 2018	Editor of *Discrete Contin. Dyn. Syst. - Series A*
2010 – 2016	Corresponding Editor of *Acta Appl. Math.*

Conference organization

Sep 2022 – Dec 2022	Co-organizer of the thematic problem on "Geometric Aspects of Nonlinear Partial Differential Equations" at the Institute Mittag-Leffler (Djursholm, Sweden)
Jun 2021	Co-organizer of the conference on "Calculus of Variations and PDEs: recent developments and future directions" at ETH (Zurich, Switzerland)
Aug 2020	Co-organizer of the workshop on "Calculus of Variations" at the MFO (Oberwolfach, Germany)
Apr 2019 – Jun 2019	Co-organizer of the thematic program on "Optimal transport" at the Erwin Schrödinger Institute (Vienna, Austria)
Oct 2018 – Nov 2018	Co-organizer of the conference on "PDEs and Geometric Measure Theory" at ETH (Zurich, Switzerland)
Aug 2018	Co-organizer of the workshop on "Calculus of Variations" at the MFO (Oberwolfach, Germany)
Jul 2016	Co-organizer of the workshop on "Calculus of Variations" at the MFO (Oberwolfach, Germany)
Jul 2016	Co-organizer of the session on "Quantitative geometric and functional inequalities and new trends in nonlinear PDEs" at the 11th AIMS Conference (Orlando, FL, USA)
Oct 2015	Co-organizer of the workshop "Analysis in Lyon" (Lyon, France)
Sep 2015 – Dec 2015	Co-organizer of the program "Fall Semester 2015 in Analysis" (Lyon, France)
May 2015	Co-organizer of the program "Calculus of Variations and Nonlinear Partial Differential Equations" (Austin, TX, USA)
Nov 2014	Co-organizer of the Fields Medal Symposium "The many facets of entropy: Kinetic Theory, Optimal Transport, Geometry" in honor of Cédric Villani at the Fields Institute (Toronto, Canada)
Oct 2014	Co-organizer of the Thematic day on "Optimal transport and sub-Riemannian manifolds" at IHP (Paris, France)
Apr 2014 – May 2014	Co-organizer of the "UT Austin Workshop: Kinetics, non-standard diffusion and multiscale phenomena: emerging challenges in the sciences" (Austin, TX, USA)
Aug 2013 – Dec 2013	Co-organizer of the MSRI program on "Optimal Transport: Geometry and Dynamics" (Berkeley, CA, USA)
Aug 2013	Co-organizer of the "Introductory Workshop on Optimal Transport: Geometry and Dynamics" (Berkeley, CA, USA)
May 2012	Co-organizer of the Workshop "Optimal transportation and differential geometry" at BIRS (Banff, Canada)
Jun 2011	Co-organizer of the CoLab Mathematics Summer School and Workshop "Aubry Mather Theory and Optimal Transport (Summer School) - Nonlinear PDEs (Workshop)" (Lisbon, Portugal)
Jan 2011	Co-organizer of the conference "Kynetic theory, optimal transport, probability, geometry: old and new" in the honor of Cédric Villani, Fields medalist 2010 (ENS Paris, France)

Jul 2010 Organizer of the minisymposium "Geometric Measure Theory and Calculus of Variations" at IHES Asian-French Summer school on "Singularities in PDE" (IHES, France)

Apr 2010 Co-organizer of Workshop "Optimal transportation and applications" at BIRS (Banff, Canada)

Apr 2010 Organizer of the Workshop "Nonlinear Analysis and PDEs" at the University of Texas at Austin (Austin, TX, USA), sponsored by the Harrington Foundation

May 2009 Organizer of the minisymposium "Transport optimal et applications" at the SMAI Conference (La Colle sur Loup, France)

Research

Published/Accepted papers

1) The Monge problem on non-compact manifolds, *Rend. Sem. Mat. Univ. Padova* 117 (2007), 147-166.
2) Existence, uniqueness and regularity of optimal transport maps, *SIAM J. Math. Anal.* 39 (2007), no. 1, 126-137.
3) High action orbits for Tonelli Lagrangians and superlinear Hamiltonians on compact configuration spaces" (with A. Abbondandolo), *J. Differential Equations* 234 (2007), no. 2, 626-653.
4) Strong displacement convexity on Riemannian manifolds (with C. Villani), *Math. Z.* 257 (2007), no. 2, 251-259.
5) On the regularity of the pressure field of Brenier's weak solutions to incompressible Euler equations" (with L. Ambrosio), *Calc. Var. Partial Differential Equations* 31 (2007), no. 4, 497-509.
6) Existence and uniqueness of martingale solutions for SDE with rough or degenerate coefficients, *J. Funct. Anal.* 254 (2008), no. 1, 109-153.
7) A simple proof of the Morse-Sard theorem in Sobolev spaces, *Proc. Amer. Math. Soc.* 136 (2008), no. 10, 3675-3681.
8) Synchronized traffic plans and stability of optima (with M. Bernot), *ESAIM Comtrol Optim. Calc. Var.* 14 (2008), 864-878.
9) Invariant measures of Hamiltonian systems with prescribed asymptotic Maslov index (with A. Abbondandolo), *J. Fixed Point Theory Appl.* 3 (2008), no. 1, 95-120.
10) Absolute continuity of Wasserstein geodesics in the Heisenberg group (with N. Juillet), *J. Funct. Anal.* 255 (2008), no. 1, 133-141.
11) An approximation lemma about the cut locus, with applications in optimal transport theory (with C. Villani), *Methods Appl. Anal.* 15 (2008), no. 2, 149-154.
12) Convergence to the viscous porous medium equation and propagation of chaos (with R. Philipowski), *ALEA Lat. Am. J. Probab. Math. Stat.* 4 (2008), 185-203.
13) Generalized solutions for the Euler equations in one and two dimensions (with M. Bernot and F. Santambrogio), *J. Math. Pures Appl.* 91 (2008), no. 2, 137-155.
14) Geodesics in the space of measure-preserving maps and plans (with L. Ambrosio), *Arch. Ration. Mech. Anal.* 194 (2009), no. 2, 421-462.
15) A geometric lower bound on Grad's number, *ESAIM Control Optim. Calc. Var.* 15 (2009), no. 3, 569-575.
16) On the Hausdorff Dimension of the Mather quotient (with A. Fathi and L. Rifford), *Comm. Pure Appl. Math.* 62 (2009), no. 4, 445-500.
17) On flows associated to Sobolev vector fields in Wiener spaces: an approach à la DiPerna-Lions (with L. Ambrosio), *J. Funct. Anal.* 256 (2009), no. 1, 179-214.
18) A note on Cheeger sets (with F. Maggi and A. Pratelli), *Proc. Amer. Math. Soc.* 137 (2009), no. 6, 2057-2062.

19) C^1 regularity in 2 dimension for potentials of the optimal transport problem (with G. Loeper), *Calc. Var. Partial Differential Equations* 35 (2009), no. 4, 537-550.

20) A note on the regularity of the free boundaries in the optimal partial transport problem, *Rend. Circ. Mat. Palermo* 58 (2009), no. 2, 283-286.

21) Continuity of optimal transport maps and convexity of injectivity domains on small deformations of $\mathbb{S}^2$ (with L. Rifford), *Comm. Pure Appl. Math.* 62 (2009), no. 12, 1670-1706.

22) A refined Brunn-Minkowski inequality for convex sets (with F. Maggi and A. Pratelli), *Ann. Inst. H. Poincaré Anal. Non Linéaire* 26 (2009), no. 6, 2511-2519.

23) Some new well-posedness results for continuity and transport equations, and applications to the chromatography system (with L. Ambrosio, G. Crippa and L. V. Spinolo), *SIAM J. Math. Anal.* 41 (2009), no. 5, 1890-1920.

24) Optimal transportation on non-compact manifolds (with A. Fathi), *Israel J. Math.* 175 (2010), no. 1, 1-59.

25) The optimal partial transport problem *Arch. Ration. Mech. Anal. 195* (2010), no. 2, 533-560.

26) Mass Transportation on Sub-Riemannian Manifolds (with L. Rifford), *Geom. Funct. Anal.* 20 (2010), no. 1, 124-159.

27) On flows of $H^{3/2}$-vector fields on the circle, *Math. Ann.* 347 (2010), no. 1, 43-57.

28) Regularity properties of optimal maps between nonconvex domains in the plane, *Comm. Partial Differential Equations* 35 (2010), no. 3, 465-479.

29) A new transportation distance between non-negative measures, with applications to gradients flows with Dirichlet boundary conditions (with N. Gigli), *J. Math. Pures Appl.* 94 (2010), no. 2, 107-130.

30) On the Ma-Trudinger-Wang curvature on surfaces (with L. Rifford and C. Villani), *Calc. Var. Partial Differential Equations* 39 (2010), no. 3-4, 307-332.

31) Almost everywhere well-posedness of continuity equations with measure initial data (with L. Ambrosio), *C. R. Acad. Sci. Paris* 348 (2010), no. 5-6, 249-252.

32) Partial regularity of Brenier solutions of the Monge-Ampère equation (with Y.-H. Kim), *Discrete Contin. Dyn. Syst.* 28 (2010), no. 2, 559-565.

33) A mass transportation approach to quantitative isoperimetric inequalities (with F. Maggi and A. Pratelli), *Invent. Math.* 182 (2010), no. 1, 167-211.

34) Local semiconvexity of Kantorovich potentials on non-compact manifolds (with N. Gigli), *ESAIM Control Optim. Calc. Var.* 17 (2011), no. 3, 648-653.

35) A variational method for a class of parabolic PDEs (with W. Gangbo and T. Yolcu), *Ann. Scuola Norm. Sup. Pisa Cl. Sci.* (5) 10 (2011), no. 1, 207-252.

36) Global-in-time weak measure solutions and finite-time aggregation for nonlocal interaction equations (with J. A. Carrillo, M. Di Francesco, T. Laurent and D. Slepčev), *Duke Math. J.* 156 (2011), no. 2, 229-271.

37) Fine properties of minimizers of mechanical Lagrangians with Sobolev potentials (with V. Mandorino), *Discrete Contin. Dyn. Syst.* 31 (2011), no. 4, 1325-1346.

38) On the shape of liquid drops and crystals in the small mass regime (with F. Maggi), *Arch. Ration. Mech. Anal.* 201 (2011), no. 1, 143-207.

39) Surface measures and convergence of the Ornstein-Uhlenbeck semigroup in Wiener spaces (with L. Ambrosio), *Ann. Fac. Sci. Toulouse Math.* (6) 20 (2011), no. 2, 407-438.

40) When is multidimensional screening a convex program? (with Y.-H. Kim and R. J. McCann), *J. Econom. Theory* 146 (2011), no. 2, 454-478.

41) Tangent cut loci on surfaces (with L. Rifford and C. Villani), *Differential Geom. Appl.* 29 (2011), no. 2, 154-159.

42) Semiclassical limit of quantum dynamics with rough potentials and well posedness of transport equations with measure initial data (with L. Ambrosio, G. Friesecke, J. Giannoulis and T. Paul), *Comm. Pure Appl. Math.* 64 (2011), no. 9, 1199-1242.

43) Necessary and sufficient conditions for continuity of optimal transport maps on Riemannian manifolds (with L. Rifford and C. Villani), *Tohoku Math. J.* (2) 63 (2011), no. 4, 855-876.

44) Nearly round spheres look convex (with L. Rifford and C. Villani), *Amer. J. Math.* 134 (2012), no. 1, 109-139.

45) Non-Local Tug-of-War and the Infinity Fractional Laplacian (with C. Bjorland and L. Caffarelli), *Comm. Pure Appl. Math.* 65 (2012), no. 3, 337-380.

46) Isoperimetric-type inequalities on constant curvature manifolds (with Y. Ge), *Adv. Calc. Var.* 5 (2012), no. 3, 251-284.

47) Confinement in nonlocal interaction equations (with J. A. Carrillo, M. Di Francesco, T. Laurent, and D. Slepcev), *Nonlinear Anal.* 75 (2012), no. 2, 550-558.

48) Semiclassical limit for mixed states with singular and rough potentials (with M. Ligabò and T. Paul), *Indiana Univ. Math. J.* 61 (2012), no. 1, 193-222.

49) Total Variation Flow and Signed Fast Diffusion in one dimension (with M. Bonforte), *J. Differential Equations* 252 (2012), no. 8, 4455-4480.

50) Existence of Eulerian solutions to the semigeostrophic equations in physical space: the 2-dimensional periodic case (with L. Ambrosio, M. Colombo, and G. De Philippis), *Comm. Partial Differential Equations* 37 (2012), no. 12, 2209-2227.

51) Non-Local Gradient Dependent Operators (with C. Bjorland and L. Caffarelli), *Adv. Math.* 230 (2012), no. 4-6, 1859-1894.

52) Regularity of optimal transport maps on multiple products of spheres (with Y.-H. Kim and R. J. McCann), *J. Eur. Math. Soc. (JEMS)* 15 (2013), no. 4, 1131-1166.

53) A stability result for the relative isoperimetric inequality inside convex cones (with E. Indrei), *J. Geom. Anal.* 23 (2013), no. 2, 938-969.

54) Regularity of solutions to the parabolic fractional obstacle problem (with L. Caffarelli), *J. Reine Angew. Math.* 680 (2013), 191-233.

55) $W^{2,1}$ regularity for solutions of the Monge-Ampère equation (with G. De Philippis), *Invent. Math.* 192 (2013), no. 1, 55-69.

56) Sharp stability theorems for the anisotropic Sobolev and log-Sobolev inequalities on functions of bounded variation (with F. Maggi and A. Pratelli), *Adv. Math.* 242 (2013), 80-101.

57) Stability for a GNS inequality and the Log-HLS inequality, with application to the critical mass Keller-Segel equation (with E. Carlen), *Duke Math. J.* 162 (2013), no. 3, 579-625.

58) On the isoperimetric problem for radial log-convex densities (with F. Maggi), *Calc. Var. Partial Differential Equations* 48 (2013), no. 3-4, 447-489.

59) Asymptotics of the s-perimeter as $s \searrow 0$ (with S. Dipierro, G. Palatucci and E. Valdinoci), *Discrete Contin. Dyn. Syst.* 33 (2013), no. 7, 2777-2790.

60) A note on interior $W^{2,1+\varepsilon}$ estimates for the Monge-Ampère equation (with G. De Philippis and O. Savin), *Math. Ann.* 357 (2013), no. 1, 11-22.

61) Second order stability for the Monge-Ampère equation and strong Sobolev convergence of optimal transport maps (with G. De Philippis), *Anal. PDE* 6 (2013), no. 4, 993-1000.

62) On sets of finite perimeter in Wiener spaces: reduced boundary and convergence to half-spaces (with L. Ambrosio and E. Runa), *Atti Accad. Naz. Lincei Cl. Sci. Fis. Mat. Natur. Rend. Lincei (9) Mat. Appl.* 24 (2013), no. 1, 111-122.

63) Hölder continuity and injectivity of optimal maps (with Y.-H. Kim and R. J. McCann), *Arch. Ration. Mech. Anal.* 209 (2013), no. 3, 747-795.

64) Sobolev regularity for Monge-Ampère type equations (with G. De Philippis), *SIAM J. Math. Anal.* 45 (2013), no. 3, 1812-1824.

65) On supporting hyperplanes to convex bodies (with Y.-H. Kim and R. J. McCann), *Methods Appl. Anal.* 20 (2013), no. 3, 261-271.

66) A geometric approach to correlation inequalities in the plane (with F. Maggi and A. Pratelli), *Ann. Inst. Henri Poincaré Probab. Stat.* 50 (2014), no. 1, 1-14.

67) Bootstrap regularity for integro-differential operators, and its application to nonlocal minimal surfaces (with B. Barrios and E. Valdinoci), *Ann. Sc. Norm. Super. Pisa Cl. Sci.* (5) 13 (2014), no. 3, 609-639.

68) A global existence result for the semigeostrophic equations in three dimensional convex domains (with L. Ambrosio, M. Colombo, and G. De Philippis), *Discrete Contin. Dyn. Syst.* 34 (2014), no. 4, 1251-1268.

69) WKB analysis of Bohmian dynamics (with C. Klein, P. Markowich, and C. Sparber), *Comm. Pure Appl. Math.* 67 (2014), no. 4, 581-620.

70) Regularity results for very degenerate elliptic equations (with M. Colombo), *J. Math. Pures Appl.* (9) 101 (2014), no. 1, 94-117.

71) How to recognize convexity of a set from its marginals (with D. Jerison), *J. Funct. Anal.* 266 (2014), no. 3, 1685-1701.

72) An excess-decay result for a class of degenerate elliptic equations (with M. Colombo) *Discrete Contin. Dyn. Syst. Ser. S* 7 (2014), no. 4, 631-652.

73) Higher integrability for minimizers of the Mumford-Shah functional (with G. De Philippis), *Arch. Ration. Mech. Anal.* 213 (2014), no. 2, 491-502.

74) A general class of free boundary problems for fully nonlinear elliptic equations (with H. Shahgholian), *Arch. Ration. Mech. Anal.* 213 (2014), no. 1, 269-286.

75) Strongly nonlocal dislocation dynamics in crystals (with S. Dipierro and E. Valdinoci), *Comm. Partial Differential Equations* 39 (2014), no. 12, 2351-2387.

76) Closing Aubry sets I (with L. Rifford), *Comm. Pure Appl. Math.* 68 (2015), no. 2, 210-285.

77) Closing Aubry sets II (with L. Rifford), *Comm. Pure Appl. Math.* 68 (2015), no. 3, 345-412.

78) Optimal regularity of the convex envelope (with G. De Philippis), *Trans. Amer. Math. Soc.* 367 (2015), no. 6, 4407-4422.

79) A general class of free boundary problems for fully nonlinear parabolic equations (with H. Shahgholian), *Ann. Mat. Pura Appl.* (4) 194 (2015), no. 4, 1123-1134.

80) Quantitative stability for sumsets in $\mathbb{R}^n$ (with D. Jerison), *J. Eur. Math. Soc. (JEMS)* 17 (2015), no. 5, 1079-1106.

81) Generic hyperbolicity of Aubry sets on surfaces (with G. Contreras and L. Rifford), *Invent. Math.* 200 (2015), no. 1, 201-261.

82) Isoperimetry and stability properties of balls with respect to nonlocal energies (with N. Fusco, F. Maggi, V. Millot, and M. Morini), *Comm. Math. Phys.* 336 (2015), no. 1, 441-507.

83) Partial regularity for optimal transport maps (with G. De Philippis), *Publ. Math. Inst. Hautes Études Sci.* 121 (2015), 81-112.

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86) A note on the dimension of the singular set in free interface problems (with G. De Philippis), *Differential Integral Equations* 28 (2015), 523-536.

87) Transport maps for β-matrix models and universality (with F. Bekerman and A. Guionnet), *Comm. Math. Phys.* 338 (2015), no. 2, 589-619.

88) Existence and uniqueness of maximal regular flows for non-smooth vector fields (with L. Ambrosio and M. Colombo), *Arch. Ration. Mech. Anal.* 218 (2015), no. 2, 1043-1081.

89) BMO-type norms related to the perimeter of sets (with L. Ambrosio, J. Bourgain, and H. Brezis), *Comm. Pure Appl. Math.* 69 (2016), no. 6, 1062-1086.

90) On the density function on moduli spaces of toric 4-manifolds (with Á. Pelayo), *Adv. Geom.* 16 (2016), no. 3, 291-300.

91) Nonlinear bounds in Hölder spaces for the Monge-Ampère equation (with Y. Jhaveri and C. Mooney), *J. Funct. Anal.* 270 (2016), no. 10, 3808-3827.

92) Stability results on the smoothness of optimal transport maps with general costs (with S. Chen), *J. Math. Pures Appl.* (9) 106 (2016), no. 2, 280-295.

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94) Universality in several-matrix models via approximate transport maps (with A. Guionnet), *Acta Math.* 217 (2016), no. 1, 81-176.

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97) Rigidity and stability of Caffarelli's log-concave perturbation theorem (with G. De Philippis), *Nonlinear Anal.* 154 (2017), 59-70.

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125) Optimal regularity and structure of the free boundary for minimizers in cohesive zone models (with L. Caffarelli and F. Cagnetti), *Arch. Ration. Mech. Anal.*, 237 (2020), no. 1, 299–345.

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131) A sharp Freiman type estimate for semisums in two and three dimensional Euclidean spaces (with D. Jerison), *Ann. Sci. Éc. Norm. Supér.*, *(4)* 54 (2021), no. 1, 235–257.

132) The power of quantum neural networks (with A. Abbas, D. Sutter, C. Zoufal, A. Lucchi, and S. Woerner), *Nat. Comput. Sci.*, 1 (2021), 403–409.

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144) Global sensitivity analysis via optimal transport (with E. Borgonovo, E. Plischke and G. Savaré), *Management Science*, to appear

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Submitted papers

1) Complete classification of global solutions to the obstacle problem (with S. Eberle and G.S. Weiss)

2) Effective dimension of machine learning models (with A. Abbas, D. Sutter, and S. Woerner)

3) Sharp stability for Sobolev and log-Sobolev inequalities, with optimal dimensional dependence (with J. Dolbeault, M. J. Esteban, R. L. Frank, M. Loss)

4) Constraint maps with free boundaries: the obstacle case (with S. Kim, H. Shahgholian)

5) Strong stability of convexity with respect to the perimeter via a quantitative Alexandrov theorem with optimal decay (with Y. Ru-Ya Zhang)

6) Regularity theory for nonlocal obstacle problems with critical and subcritical scaling (with X. Ros-Oton and J. Serra)

7) Constraint maps with free boundaries: the Bernoulli case (with A. Guerra, S. Kim and H. Shahgholian)

8) Sharp quantitative stability of the Brunn-Minkowski inequality (with P. van Hintum and M. Tiba)

9) A two-scale complexity measure for deep learning models (with M. Datres, G. Leonardi, and D. Sutter)

10) On optimal transport maps between 1/d-concave densities (with G. Carlier, and F. Santambrogio)

11) Serrin's overdetermined problem in rough domains (with Y. Ru-Ya Zhang)

Surveys and lecture notes

1) Optimal transport, Euler equations, Mather and DiPerna-Lions theories, *Mémoire d'Habilitation à Diriger de Recherche* (HDR). Nice, 2009.

2) Cédric Villani reçoit un prix de la Société Mathématiques Européenne. (French) [Cédric Villani, 2008 European Mathematical Society Prize] (with L. Desvillettes), *Gaz. Math.* No. 120 (2009), 76-81

3) Regularity of optimal transport maps [after Ma-Trudinger-Wang and Loeper], *Séminaire Bourbaki. Vol. 2008/2009. Exposés 997-1011. Astérisque* No. 332 (2010), Exp. No. 1009, ix, 341-368.

4) Optimal Transport. Old and New. [book review], *Bull. Amer. Math. Soc.* (N.S.) 47 (2010), no. 4, 723-727.

5) Almost everywhere well-posedness of continuity equations with measure initial data (with L. Ambrosio), *C. R. Math. Acad. Sci. Paris* 348 (2010), no. 5-6, 249-252.

6) Optimal Transport and Curvature (with C. Villani), *Nonlinear PDE's and applications, 171-217, Lecture Notes in Math.* 2028, Springer, Heidelberg, 2011.

7) Quantitative isoperimetric inequalities, with applications to the stability of liquid drops and crystals, *Concentration, functional inequalities and isoperimetry, 77-87, Contemp. Math. 545, Amer. Math. Soc.* Providence, RI, 2011.

8) Existence and uniqueness results for the continuity equation and applications to the chromatography system (with L. Ambrosio, G. Crippa, and L. V. Spinolo), *Nonlinear conservation laws and applications, 195-204, IMA Vol. Math. Appl.* 153, Springer, New York, 2011.

9) Stability in geometric and functional inequalities, *Proceedings of the 6th European Congress of Mathematics,* 2012.

10) Variational models for the incompressible Euler equations (with S. Daneri), *HCDTE lecture notes. Part II. Nonlinear hyperbolic PDEs, dispersive and transport equations, 51 pp., AIMS Ser. Appl. Math., 7, Am. Inst. Math. Sci. (AIMS)*, Springfield, MO, 2013.

11) Aubry sets, Hamilton-Jacobi equations, and Mañé Conjecture (with L. Rifford), *Geometric analysis, mathematical relativity, and nonlinear partial differential equations, 83-104, Contemp. Math.* 599, Amer. Math. Soc., Providence, RI, 2013.

12) Lecture notes on variational models for incompressible Euler equations (with L. Ambrosio), *Optimal transportation, 58-71, London Math. Soc. Lecture Note Ser.* 413, Cambridge Univ. Press, Cambridge, 2014.

13) Sobolev regularity for the Monge-Ampère equation, with application to the semi-geostrophic equations, *Zap. Nauchn. Sem. S.-Peterburg. Otdel. Mat. Inst. Steklov. (POMI) 411 (2013), Teoriya Predstavleniĭ Dinamicheskie Sistemy, Kombinatornye Metody. XXII, 103-118, 242; translation in J. Math. Sci. (N. Y.)* 196 (2014), no. 2, 175-183.

14) The Monge-Ampère equation and its link to optimal transportation (with G. De Philippis), *Bull. Amer. Math. Soc. (N.S.)* 51 (2014), no. 4, 527-580

15) Partial regularity results in optimal transportation (with G. De Philippis), *Trends in Contemporary Mathematics*, Springer INdAM Series, Volume 8, (2014), 293-307

16) Quantitative stability results for the Brunn-Minkowski inequality, *Prooceedings of the International Congress of Mathematicians,* 2014.

17) Stability results for the Brunn-Minkowski inequality, *Colloquium De Giorgi 2013 and 2014, 119-127, Colloquia* 5, Ed. Norm., Pisa, 2014.

18) Perimeter of sets and BMO-type norms (with L. Ambrosio, J. Bourgain, and H. Brezis), *C. R. Math. Acad. Sci. Paris* 352 (2014), no. 9, 697-698.

19) An overview of unconstrained free boundary problems (with H. Shahgholian), *Philos. Trans. A* 373 (2015), no. 2050, 20140281, 11 pp.

20) A transportation approach to universality in random matrix theory, *Boll. Unione Mat. Ital.* 10 (2017), no. 1, 55-74.

21) Regularity theory for local and nonlocal minimal surfaces: an overview (with M. Cozzi), *Nonlocal and nonlinear diffusions and interactions: new methods and directions,* 117-158, Lecture Notes in Math., 2186, Fond. CIME/CIME Found. Subser., *Springer, Cham,* 2017.

22) Global existence for the semigeostrophic equations via Sobolev estimates for Monge-Ampère, *Partial differential equations and geometric measure theory,* 1-42, Lecture Notes in Math., 2211, Fond. CIME/CIME Found. Subser., *Springer, Cham,* 2018.

23) Regularity of interfaces in phase transitions via obstacle problems, *Prooceedings of the International Congress of Mathematicians,* 2018.

24) On the Monge-Ampère equation, *Séminaire Bourbaki.* Vol. 2017/2018. Exposé 1136-1150 (2019), Exp. No. 1148, 477–504.

25) Free boundary regularity in obstacle problems, *Journées EDP,* 2018 to appear

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26) The continuous formulation of shallow neural networks as wasserstein-type gradient flows, *Preprint* 2020

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27) An introduction to optimal transport and Wasserstein gradient flows, *Preprint* 2023

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28) A short review on improvements and stability for some interpolation inequalities, Proceedings of ICIAM 2023

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Books

1) Optimal transportation and action-minimizing measures. *Thesis, Scuola Normale Superiore, Pisa, 2007. Tesi. Scuola Normale Superiore di Pisa (Nuova Series) [Theses of Scuola Normale Superiore di Pisa (New Series)], 8. Edizioni della Normale, Pisa, 2008. xx+254 pp.*

2) Autour des inégalités isopérimétriques. (French) [On isoperimetric inequalities] (with W. Bench, C. de Franchis, L. Deproit, S. Gilles, B. Oh, A. Tenne, K. Webster), *Edited and with a preface by Figalli. Éditions de l'École Polytechnique, Palaiseau, 2011. 124 pp.*

3) The Monge-Ampère Equation and its Applications. *Zürich Lectures in Advanced Mathematics. European Mathematical Society (EMS), Zurich, 2017.*

4) An Invitation to Optimal Transport, Wasserstein Distances, and Gradient Flows. (with F. Glaudo), *EMS Textbooks in Mathematics. European Mathematical Society (EMS), Zurich, 2021. 144pp*

Teaching

Undergraduate and graduate classes

2023 – 2024 (fall)	*Analysis I: One Variable*, undergraduate class (ETH Zürich)
2022 – 2023 (spring)	*Variational Problems and PDEs*, graduate class (ETH Zürich)
2021 – 2022 (fall)	*Harmonic Analysis*, graduate class (ETH Zürich)
2020 – 2021 (spring)	*An Introduction to the Calculus of Variations*, graduate class (ETH Zürich)
2019 – 2020 (fall)	*Optimal transport*, graduate class (ETH Zürich)
2018 – 2019 (spring)	*Topics in Partial Differential Equations*, graduate class (ETH Zürich)
2018 – 2019 (fall)	*Analysis III*, undergraduate class (ETH Zürich)
2017 – 2018 (fall)	*Analysis III*, undergraduate class (ETH Zürich)
2016 – 2017 (spring)	*Topics in the calculus of variations*, graduate class (ETH Zürich)
2016 – 2017 (fall)	*Free Boundary Problems*, graduate class (ETH Zürich)
2015 – 2016 (spring)	*Hamilton-Jacobi equations and dynamics*, graduate class (UT Austin)
2015 – 2016 (spring)	*PDE II*, graduate class (UT Austin)
2014 – 2015 (spring)	*PDE II*, graduate class (UT Austin)
2014 – 2015 (fall)	*The Monge-Ampère equation and its applications*, Nachdiplom Lectures (ETH Zürich)
2013 – 2014 (spring)	*Topics in nonlinear analysis*, graduate class (UT Austin)
2012 – 2013 (spring)	*Optimal transport*, graduate class (UT Austin)
2012 – 2013 (fall)	*Topics in Differential Equations*, graduate class (MIT)

2011 – 2012 (spring) *Calculus of Variations*, graduate class (UT Austin)

2011 – 2012 (spring) *PDE II*, graduate class (UT Austin)

2010 – 2011 (spring) *Geometric Measure Theory*, graduate class (UT Austin)

2010 – 2011 (spring) *PDE II*, graduate class (UT Austin)

2008 – 2009 (spring) *Transport optimal et applications* (in french), graduate class (Université Paris-Sud)

2008 – 2009 (fall) *Equations différentielles et systèmes dynamiques* (in french), undergraduate class (Ecole Polytechnique)

Invited graduate or research-level courses

Sep 2022 *An introduction to classical optimal transport*, Erdös Center - Alfréd Rényi Institute of Mathematics (Budapest, Hungary)

Jun 2018 *Free boundary regularity in obstacle problems*, Journées EDP 2018 (Obernai, France)

Nov 2017 *The obstacle problem*, Conference on Particle Systems and PDE's (Nice, France)

Sep 2017 *The obstacle problem*, "Summer School" at OxPDE (Oxford, UK)

Jul 2016 *Regularity results for local and non-local energy interactions*, CIME Summer School on "Nonlocal and nonlinear diffusions and interactions: new methods and directions" (Cetraro, Italy)

Feb 2016 *Flow of nonsmooth vector fields and applications*, "The 6th Korea PDE school" at NIMS (Daejeon, Korea)

Jul 2015 *Flow of nonsmooth vector fields and applications*, "International Workshop on Elliptic and Kinetic Partial Differential Equations" at IMPA (Rio de Janeiro, Brazil)

Mar 2015 *The Monge-Ampère equation*, "Thomas Wolff Memorial Lectures in Mathematics" at Caltech (Pasadena, CA, USA)

Dec 2014 *Nonlocal minimal surfaces*, School-Workshop "Nonlocal days in Basel" (Basel, Switzerland)

Jun 2014 *Regularity results in free boundary problems*, EMS Summer School on "Interactions between Dynamical Systems and Partial Differential Equations" (Barcelona, Spain)

Jun 2014 *Trasporto ottimale ed equazioni di tipo MongeAmpère*, 1° Corso Intensivo di Calcolo delle Variazioni (Catania, Italy)

Jun 2014 *Monge-Ampère type equations and applications*, CIME Summer School on "Partial Differential Equations and Geometric Measure Theory" (Cetraro, Italy)

May 2014 *Stability results for geometric and functional inequalities*, "Nirenberg Lectures in Geometric Analysis" at the CRM (Montreal, Canada)

May 2014 *Regularity for the Monge-Ampère equation, with applications to the semigeostrophic equations*, School-Workshop on "Kinetics, non standard diffusions and stochastics: emerging challenges in the sciences" (Austin, TX, USA)

Jul 2013 *Stability results for geometric inequalities*, Summer School on "Geometric Measure Theory and Optimal Transport" at ICTP (Trieste, Italy)

Jan 2012 *Stabilité dans les inégalités fonctionnelles, transport optimal et EDP*, Cours Peccot at the Collège de France (Paris, France)

Jun 2011 *Optimal transport, functional inequalities and Riemannian geometry*, Summer School on "Aubry Mather Theory and Optimal Transport" (Lisbon, Portugal)

Jun 2011 *Free boundaries in variational problems*, ERC-Summer School on "Calculus of Variations, Continuum Mechanics and Geometric Inequalities" (Ischia, Italy)

May 2011 *Variational models for the incompressible Euler equations*, Summer School during the Trimester Program on "Nonlinear Hyperbolic PDEs, Dispersive and Transport Equation: Analysis and Control" (Trieste, Italy)

Sep 2010 *Applications of optimal transport to isoperimetric inequalities and Riemannian geometry*, Summer School on "Optimal mass transport and geometric inequalities" (Haus Bergkranz, Austria)

Apr 2010 *Optimal transport and applications*, 2009-2010 Salomon Bockner Lectures in Mathematics (Houston, TX, USA)

Jun 2009 *Variational models for the incompressible Euler equations*, Summer School on "Optimal Transportation: Theory and Applications" (Grenoble, France)

Sep 2007 *Variational models for the incompressible Euler equations*, Summer School on "Optimal transportation structures, gradient flows and entropy methods for applied PDE's" (Vienna, Austria)

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