

Curriculum Vitae

Personal information

Date of birth July 29, 1992, Genoa (Italy)
Address Via Roentgen 1, 20136 Milano (MI), Italy
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Current research area

Geometric analysis, namely questions of geometric flavor studied with analytic methods, using techniques from elliptic PDEs and geometric measure theory.

Specifically, I have been working on the variational construction and regularity theory of unstable minimal submanifolds in codimension higher than one, exploring different energies approximating the area. More recently, I am also working on Ricci limit spaces. Less recently, I also worked in sub-Riemannian geometry.

Appointments

since 2023 **Tenure-Track Assistant Professor** at Bocconi University
2020 – 2022 **Courant Instructor/Assistant Professor** at the Courant Institute of Mathematical Sciences (New York University) and **Morawetz Postdoctoral Fellow**

Education

2016 – 2020 **PhD**
Zürich Graduate School in Mathematics, ETH Zürich
Dissertation topic: *New min-max frameworks for minimal submanifolds in dimension two or codimension two*
Advisor: Prof. Tristan Rivière (ETH Zürich)

2014 – 2016 **Master Degree in Mathematics**
University of Pisa, 110/110 cum laude
Dissertation topic: *New regularity results for sub-Riemannian geodesics*
Advisors: Prof. Luigi Ambrosio (SNS), Prof. Davide Vittone (University of Padua)

2011 – 2014 **Bachelor Degree in Mathematics**
University of Pisa, 110/110 cum laude
Dissertation topic: *The kissing number of spheres in Euclidean spaces*
Advisor: Prof. Giovanni Alberti (University of Pisa)

2011 – 2016 **Diploma**
Scuola Normale Superiore (SNS)

Publications, preprints and surveys

Sorted according to date of completion:

- with T. Rivière: **Parametrized Hamiltonian stationary Legendrian varifolds into the Heisenberg group \mathbb{H}^2 : the sequential weak closure.** *arXiv preprint* 2405.06955, 2024.
- with G. De Philippis and A. Halavati: **Decay of excess for the abelian Higgs model.** *arXiv preprint* 2405.13953, 2024.
- with E. Bruè and D. Semola: **Topological regularity and stability of noncollapsed spaces with Ricci curvature bounded below.** *arXiv preprint* 2405.03839, 2024.
- with G. De Philippis: **Nondegenerate minimal submanifolds as energy concentration sets: a variational approach.** To appear in *Comm. Pure Appl. Math.*
- with D. Parise and D. Stern: **The parabolic $U(1)$ -Higgs equations and codimension-two mean curvature flows.** To appear on *Geom. Funct. Anal.*
- with D. Stern: **Quantization and non-quantization of energy for higher-dimensional Ginzburg–Landau vortices.** *Ars Inveniendae Analytica*, 2023
- **Surviving without monotonicity: anisotropic Michael–Simon inequality** (survey). *Oberwolfach Reports: Partial Differential Equations (workshop 2130)*, 2021.
- with D. Parise and D. Stern: **Convergence of the self-dual $U(1)$ -Yang–Mills–Higgs energies to the $(n - 2)$ -area functional.** *Comm. Pure Appl. Math.* 77 (2024), no. 1, pp. 670–730.
- **The viscosity method for min-max free boundary minimal surfaces.** *Arch. Rational Mech. Anal.* 244 (2022), pp. 391–441.
- **Codimension two min-max minimal submanifolds from PDEs** (survey). *Oberwolfach Reports: Partial Differential Equations (workshop 1930)*, 2019.
- with D. Stern: **Minimal submanifolds from the abelian Higgs model.** *Invent. Math.* 223 (2021), 1027–1095. This paper was chosen as the topic of the London Geometric Analysis Reading Seminar for an entire term.
- **Parametrized stationary varifolds and the multiplicity one conjecture** (survey). *Oberwolfach Reports: Calculus of Variations (workshop 1831)*, 2018.
- with T. Rivière: **A proof of the multiplicity one conjecture for min-max minimal surfaces in arbitrary codimension.** *Duke Math J.* 169 (2020), no. 11, 2005–2044.
- with T. Rivière: **The regularity of parametrized integer stationary varifolds in two dimensions.** *Comm. Pure Appl. Math.* 73 (2020), no. 9, 1981–2042.
- with F. Da Lio: **Free boundary minimal surfaces: a nonlocal approach.** *Ann. Sc. Norm. Super. Pisa Cl. Sci. (5) XX* (2020), no. 2, 437–489.
- with R. Monti and D. Vittone: **On tangent cones to length minimizers in Carnot–Carathéodory spaces.** *SIAM J. Control Optim.* 56 (2018), no. 5, 3351–3369.
- with R. Monti and D. Vittone: **Existence of tangent lines to Carnot–Carathéodory geodesics.** *Calc. Var. PDE* 57 (2018), art. 75.

Invited talks

August 2024 *Calculus of Variations*, Oberwolfach (Germany)

July 2024 *AMS–UMI Joint Meeting*, Palermo (Italy)

July 2024 *Geometric analysis and PDEs*, Warwick (United Kingdom)

- June 2024 Mini-course in *Special Geometric Structures and Analysis*, Moraga (United States)
- June 2024 *Challenges in Analysis and Geometry*, Zürich (Switzerland)
- January 2024 *New Trends in Nonlinear PDEs, Physics and Geometry*, Granada (Spain)
- March 2024 *Analysis seminar at Sapienza University*, Roma (Italy)
- May 2024 *Geometric Analysis and Differential Geometry seminar at PoliMi*, Milano (Italy)
- November 2023 *Recent advances in geometric analysis*, Marseille (France)
- August 2023 Mini-course in *Summer School in Geometric Analysis*, Brussels (Belgium)
- June 2022 *Geometric analysis and calibrated geometries*, Zürich (Switzerland)
- May 2022 *NCTS International Geometric Measure Theory Seminar (online)*
- May 2022 *Geometric analysis seminar at the University of Chicago*, Chicago (United States)
- April 2022 *PDE seminar at the University of Maryland*, College Park (United States)
- March 2022 *KIT Geometric analysis seminar (online)*, Karlsruhe (Germany)
- January 2022 *Analysis seminar at Johns Hopkins University*, Baltimore (United States)
- January 2022 *Variational aspects of minimal surfaces*, Paris (France)
- September 2021 *Geometry and analysis seminar at Columbia University (online)*, New York (United States)
- July 2021 *Partial Differential Equations (online)*, Oberwolfach (Germany)
- June 2021 *OLGA (Oxford–London Gauge Assembly) 2021 (online)*, London (United Kingdom)
- December 2020 *Analysis seminar at EPFL (online)*, Lausanne (Switzerland)
- December 2020 *Online workshop in Geometric Analysis (online)*, Pisa (Italy)
- December 2020 *Analysis seminar at CIMS – New York University (online)*, New York (United States)
- November 2020 *Geometry seminar at Stanford University (online)*, Stanford (United States)
- July 2020 *International Conference on PDEs and Geometric Analysis at SJTU (online)*, Shanghai (China)
- October 2019 *Analysis seminar at Queen Mary University*, London (United Kingdom)
- July 2019 *Partial Differential Equations*, Oberwolfach (Germany)
- June 2019 *Workshop on Geometric Measure Theory*, Alba di Canazei (Italy)
- March 2019 *Variational approaches to PDE's*, Roma (Italy)
- December 2018 *Workshop in Geometric Analysis*, Paris (France)
- July 2018 *Calculus of Variations*, Oberwolfach (Germany)
- June 2018 *Geometric Measure Theory in Verona*, Verona (Italy)
- April 2018 *Analysis seminar at University of Padua*, Padova (Italy)
- November 2017 *Analysis seminar at ETH Zürich*, Zürich (Switzerland)

Teaching

- Spring 2024 Convex Analysis and Differential Geometry (instructor)
- Fall 2023 Ordinary Differential Equations (instructor)
- Spring 2023 Convex Analysis and Differential Geometry (instructor)
- Fall 2022 Partial Differential Equations (instructor)
- Spring 2022 Algebra (instructor)
- Fall 2021 Partial Differential Equations (instructor)

- Spring 2021 Analysis (instructor)
- Fall 2020 Harmonic Analysis (instructor)
- Spring 2020 Analysis Aspects of Minimal Surfaces (co-organizer, speaker)
- Spring 2019 Differential Geometry II (teaching assistant)
- Fall 2018 Fourier Analysis in Function Space Theory (teaching assistant)
- Spring 2018 Functional Analysis II (teaching assistant)
- Fall 2017 Functional Analysis I (teaching assistant)
- Spring 2017 Products and Nonlinearities in Function Space Theory (co-organizer, speaker)
- Fall 2016 Functional Analysis I (teaching assistant)

Mentoring of master and graduate students

- since 2021 Aria Halavati (PhD, co-advised with Guido De Philippis)
- 2021 Shengwei Qiu (master thesis)
- 2021 Tianrui Sheng (summer research project)
- 2019 Michael Egretzberger (semester project)

Referee activity

I refereed papers for leading journals in pure mathematics (*Journal of the AMS*, *Journal of the EMS*, *Ars Inveniendi Analytica*, *Archive for Rational Mechanics and Analysis*, *Journal of the London Mathematical Society*, *Advances in Mathematics*, *Journal of Functional Analysis*, *Proceedings of the AMS*, *Calculus of Variations and Partial Differential Equations*, *Advances in Calculus of Variations*)

Other informal seminars

- Fall 2021 The Yang–Mills–Higgs energy for $U(1)$ bundles and codimension two area
- Spring 2020 Lectures on the regularity theory of area-minimizing hypersurfaces
- November 2019 Uhlenbeck compactness and applications to $SU(2)$ instantons
- November 2019 Inverse mean curvature flow: uniqueness of weak solutions and short time existence
- April 2018 Gunther’s proof of the isometric embedding theorem
- Spring 2018 Lectures on minimal surfaces: existence of infinitely many minimal hypersurfaces in positive Ricci curvature, Gromov’s width, Weyl’s law for minimal hypersurfaces
- Spring 2017 Lectures on the real Hardy space
- November 2015 Immersions of S^2 with prescribed mean curvature
- September 2015 The Cheeger–Gromoll soul theorem
- July 2015 Oseledec’s multiplicative ergodic theorem
- April 2015 Convex integration techniques and counterexamples to Korn’s inequality
- February 2015 Malgrange–Ehrenpreis theorem and Paley–Wiener theorems
- October 2014 The spectral theorem for bounded and unbounded self-adjoint operators
- September 2014 A polynomial version of Van der Waerden’s theorem
- May 2014 The central limit theorem and the monotonicity of entropy

Programming languages

- General purpose C++, Python

Markup LaTeX, HTML, CSS

Languages

Native Italian

Fluent English

Basic French, German

Honors and awards

April 2024 Shortlisted for the ERC Starting Grant

October 2021 Morawetz Postdoctoral Fellowship, «awarded annually to an outstanding Courant Instructor»

July 2011 Silver medal at the International Mathematical Olympiad, held in Amsterdam, Netherlands

May 2011 Bronze medal at the Balkan Mathematical Olympiad, held in Iassy, Romania

May 2011 Gold medal at the Italian Mathematical Olympiad, held in Cesenatico, Italy

May 2010 Gold medal at the Italian Mathematical Olympiad, held in Cesenatico, Italy