

BERARDO RUFFINI

Dipartimento di Matematica di Bologna
Piazza di Porta S. Donato, 5, 40126 Bologna, Italy
web-page: <http://cvgmt.sns.it> --> Ruffini

PERSONAL DATA AND CONTACTS

- **Place of birth:** Fiesole (Florence)
- **Nationality:** Italian
- **e-mail:** berardo.ruffini@unibo.it

Current Position. Associate professor, Dipartimento di Matematica dell'Università di Bologna

Previous position.

2019 – 2022 Assistant professor (RTD B) at the Dipartimento di Matematica di Bologna

2015 – 2019 Maître de Conférences at the Université de Montpellier 2 (permanent position).

Qualifications.

- **February 2014** French qualification for the position of Maître de Conférences, Section 25 - Mathématiques *and* 26 - Mathématiques appliqués et applications des mathématiques.
- **July 2018** Italian qualification for the position of Professore Associato (Abilitazione Scientifica Nazionale). Section 01/A3 - Analisi Matematica, Probabilità e statistica matematica.
- **July 2022** Italian qualification for the position of Professore Ordinario (Abilitazione Scientifica Nazionale). Section 01/A3 - Analisi Matematica, Probabilità e statistica matematica.

EDUCATION AND FORMATION

- **January 2015– August 2015** Postdoc "Hadamard" at the Ecole Polytechnique (Palaiseau) under the supervision of A. Chambolle.
- **January 2014–December 2015** Postdoc of the ANR project GEOMETRYA in Grenoble under the supervision of H. Pajot.
- **November 2013** Perfezionamento at the Scuola Normale Superiore di Pisa (equivalent to the Ph.D. degrees), with the final degree 70/70 cum laude.
Title of the thesis: *Optimization problems for solutions of elliptic equations and stability issues*
Advisor: G. Buttazzo.
- **April 2010.** Master degree, magna cum laude, at the University of Florence. Title of the thesis: *"Riduzione al caso radiale per una versione quantitativa della disuguaglianza di Gagliardo-Nirenberg"* (*Reduction to the radial case for a quantitative version of the Gagliardo-Nirenberg inequality*). Advisor: F. Maggi

RESEARCH

My research interests are mainly in the areas of Calculus of Variations, Shape Optimization problems, Geometric Measure Theory, PDE, Optimal Transport Theory and non-local operators.

PAPERS

Publications on peer-reviewed international papers.

- (1) M. GOLDMAN, M. NOVAGA, B. RUFFINI. Rigidity of the ball for an isoperimetric problem with strong capacitary repulsion. **JEMS** accepted for publication.
- (2) C. B. MURATOV, M. NOVAGA, M., B. RUFFINI. Conducting Flat Drops in a Confining Potential **Arch. Ration. Mech. Anal.** 243 (2022), no. 3, 1773-1810.

- (3) M. GOLDMAN, M. NOVAGA, B. RUFFINI. Reifenberg flatness for quasi-minimizers of the perimeter under minimal assumptions **Proc. Amer. Math. Soc.** 150 (2022), no. 3, 1153–1165.
- (4) E. CINTI, R. OGNIBENE, B. RUFFINI, A quantitative stability inequality for fractional capacities. **Math. Eng.** 4 (2022), no. 5, Paper No. 044, 28 pp.
- (5) D. MAZZOLENI, B. RUFFINI A spectral shape optimization problem with a nonlocal competing term. **Calc. Var. PDE** 60 (2021), no. 3, Paper No. 114, 46 pp.
- (6) P. CASTILLON, B. RUFFINI A spectral characterization of geodesic balls in non-compact rank one symmetric spaces. **Ann. Sc. Norm. Super. Pisa Cl. Sci.** (5) 19 (2019), no. 4, 1359–1388.
- (7) M. GOLDMAN, M. NOVAGA, B. RUFFINI On minimizers of an isoperimetric problem with long-range interactions and convexity constraint. **Anal. PDE** 11 (2018), no. 5, 1113–1142.
- (8) C. MURATOV, M. NOVAGA, B. RUFFINI On equilibrium shapes of charged flat drops. **Comm. Pure Appl. Math.** 71 (2018), no. 6, 1049–1073.
- (9) L. BRASCO, G. FRANZINA, B. RUFFINI, Schrödinger operators with negative potentials and Lane-Emden densities. **J. Funct. Anal.** 274 (2018), no. 6, 1825–1863.
- (10) A. CHAMBOLLE, M. NOVAGA, B. RUFFINI, Some results on anisotropic fractional mean curvature flows. **Interfaces Free Bound.** 19 (2017), no. 3, 393–415.
- (11) J. AGHILI, D. A. DI PIETRO, AND B. RUFFINI A hp-Hybrid High-Order method for variable diffusion on general meshes. **Comput. Methods Appl. Math.** 17 (2017), no. 3, 359–376.
- (12) M. GOLDMAN, B. RUFFINI, M. Goldman, B. Ruffini, Equilibrium shapes of charged droplets and related problems: (mostly) a review. **Geom. Flows** 2 (2017), 94–104.
- (13) L. BRASCO, B. RUFFINI Compact Sobolev embeddings and torsion functions. **Ann. Inst. H. Poincaré Anal. Non Linéaire** 34 (2017), no. 4, 817–843.
- (14) M. GOLDMAN, M. NOVAGA, B. RUFFINI. Existence and stability for a non-local isoperimetric model of charged liquid drops. **Arch. Ration. Mech. Anal.** 217 (2015), no. 1, 1–36.
- (15) A. DI CASTRO, M. NOVAGA, B. RUFFINI, E. VALDINOCI. Non-Local Isoperimetric Problems. **Calc. Var. Partial Differential Equations** 54 (2015), no. 3, 2421–2464.
- (16) M. MARINI, B. RUFFINI, On a class of weighted Gauss-type isoperimetric inequalities and applications to symmetrization. **Rend. Semin. Mat. Univ. Padova** 133 (2015), 197–214.
- (17) G. BUTTAZZO, A. GEROLIN, B. RUFFINI, B. VELICHKOV, Spectral Optimization Problems for Schrödinger Operators, **J. Éc. polytech. Mat.**, 1 (2014), p. 71–100.
- (18) B. RUFFINI, Stability Theorems for Gagliardo-Nirenberg-Sobolev inequalities. **Rev. Mat. Complut.** 27 (2014), no. 2, 509–539.
- (19) M. NOVAGA, B. RUFFINI, Brunn-Minkowski inequality for the 1-Riesz capacity and level set convexity for the $1/2$ -Laplacian. **J. Convex Anal.** 22 (2015), no. 4, 1125–1134.
- (20) C. DE LELLIS, M. FOCARDI, B. RUFFINI, A note on the Hausdorff dimension on the singular set for minimizers of the Mumford-Shah Energy. **Adv. Calc. Var.** 7 (2014), no. 4, 539–545.

- (21) G. BUTTAZZO, B. RUFFINI, B. VELICHKOV, Shape Optimization Problems for Metric Graphs. **ESAIM Control Optim. Calc. Var.** 20 (2014), no. 1, 1–22.
- (22) L. BRASCO, G. DE PHILIPPIS, B. RUFFINI, Spectral optimization for the Stekloff–Laplacian: the stability issue, **J. Funct. Anal.** 262 (11), (2012), 4675–4710.

PROCEEDINGS

- (1) B. RUFFINI Optimization problems with non-local repulsion **Bruno Pini Math. Anal. Semin.**, 12(1) Università di Bologna, Alma Mater Studiorum, Bologna, 2022, 101–121.

SOME TALKS

- *Spectral stability for the Stekloff-Laplacian and for a class of weighted perimeters*, XXII Convegno Nazionale di Calcolo delle Variazioni. Levico, February 2012.
- *Shape optimization problems for graphs* Seminario di Analisi Dipartimento di Matematica “L. Tonelli”. Pisa, May 2012.
- *Stability of optimal shapes for the Stekloff-Laplacian* Seminario di Analisi, Dipartimento di Matematica “U. Dini”, Firenze, March 2012.
- *Spectral Optimization for the Laplacian with Robin Boundary condition*. Seminario informale di analisi delle Classi di Perfezionamento della Scuola Normale Superiore. October 2012.
- *Optimal potentials for Schrödinger operators*. Ph.D. research Seminar , Dipartimento di Matematica. “U. Dini”, Firenze, March 2013.
- *Optimization of Schrödinger operators*. Analysis Research Seminar, Erlangen, March 2013.
- Two short talks during the thematic sessions on *Shape optimization problems* and on *Optimal transportation and applications* during a summer school in Benasque in August 2013.
- *Variational problems with non-local energies*. Séminaire de l’équipe EDP-MOISE, Grenoble, January 2014.
- *Problemi variazionali non locali*. XXIV Convegno Nazionale di Calcolo delle Variazioni. Levico, January 2014.
- *Stabilité pour problèmes isopérimétriques avec poids et applications*. Rencontres de l’ANR, Orsay (Paris), Mars 2014.
- *Optimal Potentials for Schrödinger Operators*. GB60 (A workshop in honor of the 60th birthday of Giuseppe Buttazzo), Pise, May 2014.
- *A non-local variational model of charged liquid drops*, Séminaire d’analyse appliquée de l’I2M, Marseille, June 2014.
- *Isoperimetric problems with non-local penalization terms*, Isoperimetric Problems Between Analysis and Geometry, Pise, June 2014.
- *Non-Local isoperimetric problems*, Seminario di Analisi, Dipartimento di Matematica “U. Dini”, Firenze, October 2014.
- *On some non-local isoperimetric problems*, Séminaire du groupe de Travail CalVa, Paris, March 2015.
- *Non-local isoperimetric problems*, Seminario di Analisi Dipartimento di Matematica “L. Tonelli”. Pisa, June 2015.
- *Inégalités isopérimétriques, inégalités fonctionnelles et trou spectral*, Séminaire du groupe DARBOUX, Montpellier, September 2015.
- *Sur un modèle isopérimétrique d’une goutte liquide chargée*. Séminaire du groupe ACSIOM, Montpellier, October 2015.
- *On fractional isoperimetric problems* One-day conference on Calculus of Variations, Lille, October 2015.

- Compact Sobolev embedding and torsion function , Geometric aspects of PDE's and functional inequalities, Cortona, May 2016.
- *A variational model for charged liquid drops*, short talk at PICO, Autrans, June 2016.
- *Compact Sobolev embedding and torsion function*, Séminaire commune d'Analyse Géométrique, Luminy, September 2016.
- *On a variational model for charged liquid drops*, "GMT, Shape Optimizations and Free Boundaries". SISSA, Trieste, October 2016.
- *Compact Sobolev embedding and torsion function*, XXVII Convegno Nazionale di Calcolo delle Variazioni. Lecco, February 2017.
- *Some results on a variational model for the equilibria of a charged liquid drop*. Séminaire du laboratoire J. Coulombe, département de Physique. Montpellier, February 2017.
- *On the consistency of a BMO-type scheme and convexity preservation for a fractional mean curvature flow*. Curves and networks in geometric analysis, Pisa, June 2017.
- *Some results on an isoperimetric model for charged liquid drops*. Seminario di Analisi Matematica, Ferrara, February 2018.
- *Some results on an isoperimetric model for charged liquid drops* Seminario di Analisi, Dipartimento di Matematica "U. Dini", Firenze, March 2018.
- *Some results on a isoperimetric model for charged drops* Workshop in Calculus of Variations at Paris Diderot, June 2018.
- *The Brock-Weinstock inequality on harmonic manifolds*, séminaire commun d'analyse géométrique. Luminy, September 2018.
- *Some results on an isoperimetric model for charged liquid drops* , Bologna, November 2018.
- *Sobolev immersions and Torsion functions* Variational and pde problems in geometric analysis, II. Bologna, May 2019.
- *Charged drops, a variational model part II* . Short communication at Convegno nazionale UMI. Pavia, September 2019.
- *An isoperimetric problem for charged liquid drops*, Mynisimposium for the short conference: Recent developments in nonlocal geometric variational problems. ICIAM 2019, Valencia. July 2019
- *Perimeter vs Capacity* Winter School on Reaction Diffusion PDE's and Optimization, Dipartimento di Matematica e Fisica, Univ. Cattolica di Brescia. January 2020
- *Optimal design problems with repulsive term* Seminario Pini, Dipartimento di Matematica di Bologna. May 2021
- *Non-local isoperimetric problems*, Isoperimetric problems, Pisa, June 2022
- *News about an isoperimetric problem with strong capacitary repulsion* Anisotropic isoperimetric problems & related topics, Rome, September 2022
- *Spectral energies with repulsion* Seminario Pini, Dipartimento di Matematica di Bologna. June 2023
- *Dimensional estimates in a branched transport model for type-I superconductors* Calculus of Variations in Siena, February 2024.
- *From energy bounds to dimensional estimates in a branched transport model for type-I superconductors* CalVaFer - Calculus of Variations in Ferrara, March 2024
- *Shape optimization for Hartree energies* Calculus of Variations and Free Boundary Problems VIII, April 2024
- *An open problem around the Kohler-Jobin inequality* 50 Anni di Calcolo delle Variazioni, May 2024

SOME VISITS

- *University of Pavia*, Pavia. Invited by Prof. Aldo Pratelli, September 2012

- *Department Matematik*, Erlangen. Invited by Prof. Aldo Pratelli, March 2013
- *Max Planck Institut*, Leipzig. Invited by Dr. Michael Goldman, April 2013
- *University of Florence*, Florence. Invited by Dr. Chiara Bianchini, October 2014.
- *University of Pise*, Pise. Invited by Prof. Matteo Novaga, February 2015.
- *Université de Paris 7*, Paris. Invited by M. Goldman, CNRS. July 2016.
- *SISSA*, Trieste. Invited by Prof. G. De Philippis. June 2017.
- *NJIT*, New York. Invited by Prof. C. Muratov. May 2018.
- *University of Florence*, Florence. Invited by Prof. C. Bianchini. June 2018.
- *Università di Pisa*, Pisa. Invited by Prof. M. Novaga. February 2022.
- *Paris 7*, Paris. Invited for 3 weeks by Prof. M. Goldman via a MOVEON program. Mars 2022.
- *Paris, Ecole Polytechnique*, Paris. Invited for 2 weeks by Prof. M. Goldman. Mars 2023.
- *Rome, Sapienza*, invited by M. Ponsiglione. June 2023.

COMMITTEE MEMBER FOR THE PH.D. DEFENSE

2023 Angelo Ninno (Roma, Sapienza).

2023 Paolo De Donato (Roma, Sapienza).

TEACHING

I performed some exercises classes during my Ph.D in Pise, and my first postdoc in Grenoble. Since September 2015 I taught about 190 hours per year at the University of Montpellier at every undergraduate level. Since September 2019 I taught 90 hours per year first at the first academic year of Ingegneria, Bologna. Details are given below.

- 2012-Teaching assistant for the course (given by Prof. L. De Pascale) “Analisi Matematica 1” (Calculus 1), Faculty of Engineering, University of Pisa (25 hours).
- 2013-Teaching assistant for the course (given by Prof. M. Novaga) “Analisi Matematica 1” (Calculus 1), Faculty of Engineering, University of Pisa (25 hours).
- 2014 (september-december) Lectures in “Mathematics for the Biology”, University of Grenoble (30 hours).
- 2015 (september-december) Exercise classes in “Mathematics for the Biology”, University of Montpellier (32 hours).
- 2015 (september-december) Exercise classes in Algebre and Analysis I. University of Montpellier (48 hours).
- 2015 (september-december) Exercise classes in Analysis 3, University of Montpellier (39 hours).
- 2016 (september-december) Exercise classes in “Mathematics for the Biology”, University of Montpellier (32 hours).
- 2016 (september-december) Exercise classes in Algebre and Analysis I. University of Montpellier (48 hours).
- 2016 (september-december) Exercise classes in Analysis 3, University of Montpellier (39 hours).
- 2016 (september-december) Lectures for a Master 1 course in Functional analysis (Master 1). University of Montpellier (30 hours).
- 2017 (january) Lectures for Master 2 and Ph.D. students on Gamma-convergence theory, University of Montpellier (14 hours).
- 2017 (september-december) Exercise classes in “Mathematics for the Biology”, University of Montpellier (32 hours).
- 2017 (september-december) Exercise classes in Algebre and Analysis I, University of Montpellier (48 hours).
- 2017 (september-december) Lectures (and exercises classes) for the second year undergraduate course in Analysis 3, University of Montpellier (36+39 hours).
- 2017 (september-december) Lectures for a Master 2 course on Elliptic PDE (24 hours).

- 2018 (september-december) Exercice classes in "Mathematics for the Biology", University of Montpellier (32 hours).
- 2018 (september-december) Exercice classes in Algebre and Analysis I, University of Montpellier (48 hours).
- 2018 (september-december) Lectures (and exercices classes) for the second year undergraduate course in Analysis 3, University of Montpellier (36+39 hours).
- 2018 (september-december) Lectures for a Master 2 course on Elliptic PDE (24 hours).
- 2019-2023 (september-december) Courses on Analisi Matematica I, Ingegneria Chimica e Biochimica, Università di Bologna.
- 2022-2023 Course on Calculus of Variations (24h).
- 2023 Courses on Analisi Matematica, Fisica, Università di Bologna.

1. TUTORIAL AND ORGANIZING ACTIVITY

- Advisor of the Magistrale thesis of Lucia Rota Bulò. "Around optimal transport". 2024
- Co-organiser of the conference NON-pub23, Bologna, June 2023.
- Co-organiser of the conference "Shape Optimization, related topics and applications", Roskoff, June 2022
- Co-organiser of the conference "Variational methods and applications", Centro De Giorgi, Pisa, September 2021.
- Co-organiser of the conference "Rencontre ANR". Montpellier, June 2019.
- Co-organiser of a meeting conference between the Montpellier and the Toulouse Mathematical labs. April 2019.
- Organizer of the seminars of analysis and PDE at the IMAG, Université de Montpellier
- Advisor of the Master 2 Thesis of Mohamad Wehbe. Argument: "Optimal constants for the quantitative Sobolev inequality".
- Member of the jury of 2 sessions of Master 2-thesis (Juin 2018, September 2018).

PARTICIPATION IN RESEARCH PROJECTS AND GRANTS

- PI of the project GNAMPA PACE CUP-E55F22000270001, grant of 4500 euros.
- Member at the 65% and local coordinator of the three-years French ANR project SHAPO ANR-18-CE40-0013 (Grant of approximately 480k euros, 2018-2021). Principal investigator: J. Lamboley.
- Winner of a PEDR (Prime d'Encadrement Doctoral et de Recherche) with an annual grant of 5000 euros per year (for the 4-years 2017-2021).
- Winner of three (consecutive) grants PEPS-Jeunes chercheurs, with M. Goldman with a research grant of 6000 euros, in the years 2016, 2017 and 2018.

REVIEWING

Referee for "Annales Academiae Scientiarum Fennicae", "Nonlinear Analysis Series A: Theory, Methods & Applications", "Applicable Analysis", "JMAA", "Geometric Flows", "COCV", "Trans. AMS", "Calc. Var. & PDE", "JMAA", "CPAA", "Ann. Global An. and Geom.". Reviewer on Mathscinet.

LANGUAGE SKILLS

- Italian, native
- English, fluent
- French, fluent

Last updated: February 27, 2025