

CURRICULUM VITAE ET STUDIORUM

OF

Serena Dipierro

Born in Putignano (Italy), on October 23th, 1983.

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Current position Since June 2017: *Assistant Professor (Ricercatore tipo b)*, University of Milan.

Since May 2016: *Adjunct Research Fellow*, University of Western Australia.

Habilitation as Associate Professor in Italy (Abilitazione Scientifica Nazionale), from March 28, 2017, to March 28, 2023.

Habilitation as Full Professor in Italy (Abilitazione Scientifica Nazionale), from August 2, 2017, to August 2, 2023.

Previous positions

- July 2016 – May 2017
Lecturer (Level B6 position), University of Melbourne (Australia).
- May 2016– June 2016
Humboldt Research Fellowship, Weierstraß Institute for Applied Analysis and Stochastics, Berlin (Germany).
- July 2015–April 2016
Humboldt Research Fellowship, Otto-von-Guericke Universität, Magdeburg (Germany).
- November 2013–June 2015
Postdoctoral Research Associate position at School of Mathematics, University of Edinburgh (Scotland, UK).
- July 2013–August 2013
Visiting position at CMM - Center For Mathematical Modeling, Universidad de Chile, Santiago (Chile).
- March 2013–June 2013
Teaching assistantship at Politecnico di Milano (Italy).
- November 2012–March 2013
Visiting position at CMM - Center For Mathematical Modeling, Universidad de Chile, Santiago (Chile).

Education:

- *High School Degree:*
Obtained at: Liceo Scientifico E. Majorana di Rutigliano (BA, Italy), on July 2, 2002, (100/100).
- *Bachelor Degree (Laurea Triennale) in Mathematics:*
Obtained at: University of Bari (Italy), on March 16, 2006, (110/110 cum laude).
Thesis on: “*Existence and Non-existence of solutions for parabolic equations*”.
Advisor: Dr. *Lorenzo D’Ambrosio*.
- *Master Degree (Laurea Specialistica) in Mathematics:*
Obtained at: University of Bari (Italy), on March 13, 2008, (110/110 cum laude).
Thesis on: “*Hardy-type inequalities on Riemannian Manifolds*”.
Advisor: Dr. *Lorenzo D’Ambrosio*.
- November 2008–October 2012
PhD Student at International School for Advanced Studies of Trieste - SISSA (Italy).
Sector: Mathematical Analysis.
Advisor: Prof. *Andrea Malchiodi*.
Title of the Thesis: *Concentration phenomena for singularly perturbed elliptic problems and related topics*.
Date of the PhD dissertation: October 26, 2012, SISSA Trieste (Italy).

Research Interests: Nonlinear Analysis. Variational Methods. Concentration and blow-up phenomena. Functional inequalities. Nonlocal operators. Fractional minimal surfaces. Nonlocal dislocation dynamics in crystals. Free boundary problems. Qualitative properties of solutions to equations and systems.

Awards:

- May 2008: Best student award from the Faculty of Mathematics, Physics and Natural Sciences of the University of Bari for the academic year 2006/07.

Fellowships and job offers:

- June, 2013: Postdoctoral fellowship funded by **EPSRC grant** EP/K024566/1, *Monotonicity formula methods for nonlinear PDEs*.
- March, 2014: **Humboldt Research Fellowship** for Postdoctoral Researchers.
- January, 2016: Postdoctoral fellowship funded by **CAMGSD** Lisbon, Portugal (declined).
- February, 2016: offer of a “Level B” position from the University of Melbourne, Australia.
- February, 2016: offer of a position as “Lecturer in Mathematical Analysis” from the University of Birmingham, UK (declined).
- April, 2016: offer of a “Level C” position from the University of Western Australia, Perth, Australia (declined).
- April, 2016: offer of “Adjunct Research Fellow” from the University of Western Australia, Perth, Australia.
- June, 2017: offer of a “Level D” position from the University of Western Australia, Perth, Australia (declined).

Grants:

- May 9, 2013: **GNAMPA** (Istituto Nazionale di Alta Matematica) 2013.
Winner (with A. Di Castro, University of Pisa, and G. Palatucci, SISSA Trieste).
Title of the project: “Analisi di problemi frazionari non lineari” (Nonlinear fractional problems),
<http://palatucci.altervista.org/GNAMPA2013/>
3000 Euros.
- March, 2014: **GNAMPA** (Istituto Nazionale di Alta Matematica) 2014.
Winner (with P. Baroni, University of Uppsala, E. Cinti, University of Bologna, A. Di Castro, University of Pisa, and G. Palatucci, University of Parma).
Title of the project: “Operatori, norme ed equazioni non locali” (Nonlocal operators and equations).
3000 Euros.
- April, 2014: Postdoctoral and Early Career Researcher Exchanges (PECRE), funded by Edinburgh Research Partnership in Engineering and Mathematics (ERPem).
3000 GB Pounds.
- December, 2015: **DAAD** (Deutscher Akademischer Austausch Dienst - German Academic Exchange Service) grant, within the project “Joint Steps in Geometric Variational Problems and Related Functional Inequalities”.
1000 Euros.
- May, 2016: Intensive period **INDAM** (Host Institution: University of Bari).
Title of the period: “Contemporary research in elliptic PDEs and related topics”.
20000 Euros.
- November, 2016: Chief Investigator, **ARC** (Australian Research Council) Discovery Project 2017 (with Enrico Valdinoci).
Title of the project: “NEW – Nonlocal equations at work”, grant DP170104880.
286,000 Australian Dollars.
- November, 2016: financial support from the Institute of Mathematics, Polish Academy of Science for the organization of a conference at the Banach Center in Warsaw (with Tomasz Cieślak).
5400 PLN.
- January, 2017: financial support from AMSI and from AustMS for the organization of a conference at the University of Melbourne (with C. Bucur, A. McGann and E. Valdinoci).
4,057 Australian Dollars.
- February, 2017: Andrew Sisson fund 2017.
Title of the project: “Nonlocal equations and applications”.
12,500 Australian Dollars.
- March, 2017: **GNAMPA** (Istituto Nazionale di Alta Matematica) 2017.
Winner (with V. Franceschi, University of Padua, A. Pinamonti, University of Trento, G. Tralli, University of Bologna, and E. Vecchi, University of Bologna).
Title of the project: “Problemi nonlocal e degeneri nello spazio Euclideo” (Nonlocal and degenerate problems in the Euclidean space).
1800 Euros.
- June 2017: financial support for a MATRIX Program Proposal.

- November 2017: Chief Investigator, 2018 Discovery Early Career Research Award **DECRA**, supported by the Australian Research Council (ARC).
Title of the project: "Partial differential equations, free boundaries and applications", grant DE180100957. 339,328 Australian Dollars.

Publications

- Published papers:

- 1) S. Dipierro, *Concentration of Solutions for a Singularly Perturbed Neumann Problem in non smooth domains*, Ann. Inst. H. Poincaré (C) Anal. Non Linéaire 28 (2011), no. 1, 107–126, (available online: <http://www.sciencedirect.com/science/article/pii/S0294144910000806> doi:10.1016/j.anihpc.2010.11.003 <http://arxiv.org/abs/1010.0350>).
- 2) S. Dipierro, *Concentration of Solutions for a Singularly Perturbed Mixed Problem in non smooth domains*, J. Differential Equations 254 (2013), no. 1, 30–66, (available online: <http://www.sciencedirect.com/science/article/pii/S0022039612003312>, <http://dx.doi.org/10.1016/j.jde.2012.08.017> <http://arxiv.org/abs/1202.0975>).
- 3) S. Dipierro, A. Figalli, G. Palatucci, E. Valdinoci, *Asymptotics of the s -perimeter as $s \searrow 0$* , Discrete Contin. Dyn. Syst. 33 (2013), no. 7, 2777–2790, (available online: <http://www.aimsciences.org/journals/displayArticlesnew.jsp?paperID=8147> <http://arxiv.org/abs/1204.0750>).
- 4) S. Dipierro, G. Palatucci, E. Valdinoci, *Existence and symmetry results for a Schrödinger type problem involving the fractional Laplacian*, Matematiche (Catania), 68 (2013), no.1, 201–216, (available online: <http://www.dmi.unict.it/ojs/index.php/lematematiche/article/view/967> <http://arxiv.org/abs/1202.0576>).
- 5) S. Dipierro, *Geometric inequalities and symmetry results for elliptic systems*, Discrete Contin. Dyn. Syst. 33 (2013), no. 8, 3473–3496, (available online: <http://www.aimsciences.org/journals/displayArticlesnew.jsp?paperID=8220> <http://arxiv.org/abs/1207.4435>).
- 6) S. Dipierro, A. Pinamonti, *A geometric inequality and a symmetry result for elliptic systems involving the fractional Laplacian*, J. Differential Equations 255 (2013), no. 1, 85–119, (available online: <http://www.sciencedirect.com/science/article/pii/S0022039613001320> <http://arxiv.org/pdf/1211.2622.pdf>, <http://cvgmt.sns.it/paper/2025/>).
- 7) L. D’Ambrosio, S. Dipierro, *Hardy inequalities on Riemannian manifolds and applications*, Ann. Inst. H. Poincaré (C) Anal. Non Linéaire 31 (2014), no. 3, 449–475, (available online: <http://www.sciencedirect.com/science/article/pii/S0294144913000589> <http://dx.doi.org/10.1016/j.anihpc.2013.04.004>, <http://arxiv.org/abs/1210.5723>).
- 8) S. Dipierro, A. Figalli, E. Valdinoci, *Strongly nonlocal dislocation dynamics in crystals*, Comm. Partial Differential Equations 39 (2014), no. 12, 2351–2387, (available online: <http://arxiv.org/abs/1311.3549> <http://www.tandfonline.com/doi/abs/10.1080/03605302.2014.914536#.VCA1sPFwYfo>).
- 9) S. Dipierro, *Asymptotics of fractional perimeter functionals and related problems*, Rendiconti del Seminario Matematico di Torino, Proceedings of the Spring School on Rate-independent evolutions and hysteresis modelling 72 (2014), no. 1–2, 1–14.

- 10) S. Dipierro, G. Palatucci, E. Valdinoci, *Dislocation dynamics in crystals: a macroscopic theory in a fractional Laplace setting*, *Comm. Math. Phys.* 333 (2015), no. 2, 1061–1105,
(available online: http://www.wias-berlin.de/preprint/1847/wias_preprints_1847.pdf).
- 11) S. Dipierro, E. Valdinoci, *On a fractional harmonic replacement*, *Discrete Contin. Dyn. Syst.* 35 (2015), no. 8, 3377–3392,
(available online: http://www.wias-berlin.de/preprint/1928/wias_preprints_1928.pdf).
- 12) S. Dipierro, A. Pinamonti, *Symmetry results for stable and monotone solutions to fibered systems of PDEs*, *Commun. Contemp. Math.* 17 (2015), no. 4, 1450035, 22 pp.,
(available online: <http://arxiv.org/abs/1212.0408>, <http://cvgmt.sns.it/paper/2051/>).
- 13) S. Dipierro, E. Valdinoci, *A density property for fractional weighted Sobolev spaces*, *Atti Accad. Naz. Lincei Rend. Lincei Mat. Appl.* 26 (2015), 1–26,
(available online: <http://arxiv.org/pdf/1501.04918v1.pdf>).
- 14) J. Dávila, M. Del Pino, S. Dipierro, E. Valdinoci, *Concentration phenomena for nonlocal equations with Dirichlet datum*, *Anal. PDE* 8 (2015), no. 5, 1165–1235,
(available online: <http://arxiv.org/pdf/1403.4435.pdf>).
- 15) S. Dipierro, O. Savin, E. Valdinoci, *A nonlocal free boundary problem*, *SIAM J. Math. Anal.* 47-6 (2015), 4559–4605,
(available online: <http://arxiv.org/abs/1411.7971>).
- 16) J. Dávila, M. Del Pino, S. Dipierro, E. Valdinoci, *Nonlocal Delaunay surfaces*, *Nonlinear Partial Differential Equations*, in honor of Juan Luis Vázquez for his 70th birthday, *Nonlinear Anal.* 137 (2016), 357–380,
(available online: <http://arxiv.org/pdf/1501.07459.pdf>).
- 17) J. Brasseur, S. Dipierro, *Some monotonicity results for general systems of nonlinear elliptic PDEs*, *J. Differential Equations* 261 (2016), no. 5, 2854–2880,
(available online: <http://arxiv.org/abs/1511.01392>
<http://www.sciencedirect.com/science/article/pii/S0022039616300961>).
- 18) S. Dipierro, O. Savin, E. Valdinoci, *Graph properties for nonlocal minimal surfaces*, *Calc. Var. Partial Differential Equations* 55 (2016), no. 4, 55:86,
(available online: <http://arxiv.org/abs/1506.04281>
<http://link.springer.com.pros.lib.unimi.it/article/10.1007%2Fs00526-016-1020-9>).
- 19) S. Dipierro, L. Montoro, I. Peral, B. Sciunzi, *Qualitative properties of positive solutions to nonlocal critical problems involving the Hardy-Leray potential*, *Calc. Var. Partial Differential Equations* 55 (2016), no. 4, 55:99,
(available online: <http://arxiv.org/abs/1506.07317>
<http://link.springer.com.pros.lib.unimi.it/article/10.1007%2Fs00526-016-1032-5>).
- 20) S. Dipierro, X. Ros-Oton, E. Valdinoci, *Nonlocal problems with Neumann boundary conditions*, *Rev. Mat. Iberoam.* 33 (2017), no. 2, 377–416,
(available online: <http://arxiv.org/abs/1407.3313>).
- 21) S. Dipierro, O. Savin, E. Valdinoci, *All functions are locally s -harmonic up to a small error*, *J. Eur. Math. Soc. (JEMS)* 19 (2017), no. 4, 957–966, DOI: 10.4171/JEMS/684
(available online: <http://arxiv.org/pdf/1404.3652.pdf>).
- 22) S. Dipierro, S. Patrizi, E. Valdinoci, *Chaotic orbits for systems of nonlocal equations*, *Comm. Math. Phys.* 349 (2017), no. 2, 583–626,
(available online: <http://arxiv.org/abs/1511.06799>).
- 23) L. Caffarelli, S. Dipierro, E. Valdinoci, *A logistic equation with nonlocal interactions*, *Kinet. Relat. Models* 10 (2017), no. 1, 141–170, special issue - dedicated to the 60th birthday of Peter

Markowich,

(available online: <http://arxiv.org/abs/1601.05552>).

- 24) S. Dipierro, M. Medina, I. Peral, E. Valdinoci, *Bifurcation results for a fractional elliptic equation with critical exponent in \mathbb{R}^n* , *Manuscripta Math.* 153 (2017), no. 1–2, 183–230, DOI: 10.1007/s00229-016-0878-3,
(available online: <http://arxiv.org/pdf/1410.3076v1.pdf>).
- 25) M. Cozzi, S. Dipierro, E. Valdinoci, *Nonlocal phase transitions in homogeneous and periodic media*, *J. Fixed Point Theory Appl.* 19 (2017), no. 1, 387–405, special issue in honour of Paul Rabinowitz, DOI: 10.1007/s11784-016-0359-z
(available online: <https://arxiv.org/pdf/1605.03794.pdf>).
- 26) S. Dipierro, H.-C. Grunau, *Boggio's formula for fractional polyharmonic Dirichlet problems*, *Ann. Mat. Pura Appl.* 196 (2017), no. 4, 1327–1344, DOI: 10.1007/s10231-016-0618-z,
(available online: <https://arxiv.org/abs/1606.03110>).
- 27) S. Dipierro, E. Valdinoci, *Continuity and density results for a one-phase nonlocal free boundary problem*, *Ann. Inst. H. Poincaré (C) Anal. Non Linéaire* 34 (2017), no. 6, 1387–1428,
<http://dx.doi.org/10.1016/j.anihpc.2016.11.001>
(available online: <http://arxiv.org/abs/1504.05569>).
- 28) S. Dipierro, O. Savin, E. Valdinoci, *Boundary behavior of nonlocal minimal surfaces*, *J. Funct. Anal.* 272 (2017), no. 5, 1791–1851,
(available online: <http://arxiv.org/abs/1506.04282>).
- 29) S. Dipierro, M. Novaga, E. Valdinoci, *Rigidity of critical points for a nonlocal Ohta-Kawasaki energy*, *Nonlinearity* 30 (2017), no. 4, 1523–1535,
(available online: <https://arxiv.org/abs/1604.07219>).
- 30) S. Dipierro, A. Karakhanyan, E. Valdinoci, *New trends in free boundary problems*, *Adv. Nonlinear Stud.* 17 (2017), no. 2, 319–332, special Issue in honor of Irene Peral,
(available online: <https://arxiv.org/pdf/1701.07897.pdf>).
- 31) S. Dipierro, F. Maggi, E. Valdinoci, *Asymptotic expansions of the contact angle in nonlocal capillarity problems*, *J. Nonlinear Sci.* 27 (2017), no. 5, 1531–1550, doi:10.1007/s00332-017-9378-1
(available online: <https://arxiv.org/abs/1610.00075>).
- 32) M. Cozzi, S. Dipierro, E. Valdinoci, *Planelike interfaces in long-range Ising models and connections with nonlocal minimal surfaces*, *J. Stat. Phys.* 167 (2017), no. 6, 1401–1451,
doi:10.1007/s10955-017-1783-1
(available online: <https://arxiv.org/pdf/1605.06187.pdf>).
- 33) S. Dipierro, A. Karakhanyan, E. Valdinoci, *A class of unstable free boundary problems*, *Anal. PDE* 10 (2017), no. 6, 1317–1359,
(available online: <http://arxiv.org/abs/1512.03043>).
- 34) S. Dipierro, A. Karakhanyan, E. Valdinoci, *A nonlinear free boundary problem with a self-driven Bernoulli condition*, *J. Funct. Anal.* 273 (2017), no. 1, 3549–3615,
(available online: <https://arxiv.org/pdf/1611.00412.pdf>).
- 35) S. Dipierro, N. Soave, E. Valdinoci, *On fractional elliptic equations in Lipschitz sets and epigraphs: regularity, monotonicity and rigidity results*, *Math. Ann.* 369 (2017), no. 3–4, 1283–1326,
(available online: <https://arxiv.org/abs/1604.07755>).

- Accepted papers:

- 36) S. Dipierro, N. Soave, E. Valdinoci, *On stable solutions of boundary reaction-diffusion equations and applications to nonlocal problems with Neumann data*, Indiana Univ. Math. J. (2016), (available online: <http://arxiv.org/pdf/1509.04001.pdf>).
- 37) S. Dipierro, J. Serra, E. Valdinoci, *Nonlocal phase transitions: rigidity results and anisotropic geometry*, Rendiconti del Seminario Matematico di Torino, Proceedings of the BRU-TO conference (2017), (available online: <https://arxiv.org/abs/1611.03246>).
- 38) S. Dipierro, E. Valdinoci, *(Non)local and (non)linear free boundary problems*, Discrete Contin. Dyn. Syst. Ser. S (2017), (available online: <https://arxiv.org/pdf/1705.00326.pdf>).
- 39) S. Dipierro, O. Savin, E. Valdinoci, *Definition of fractional Laplacian for functions with polynomial growth*, Rev. Mat. Iberoam. (2017), (available online: <https://arxiv.org/abs/1610.04663>).
- 40) A. Cesaroni, M. Cirant, S. Dipierro, M. Novaga, E. Valdinoci, *On stationary fractional Mean Field Games*, J. Math. Pures Appl. (2017), (available online: <https://arxiv.org/abs/1705.10123>).
- Monographs and chapters of book:

41) S. Dipierro, M. Medina, E. Valdinoci, *Fractional elliptic problems with critical growth in the whole of \mathbb{R}^n* , Appunti. Scuola Normale Superiore di Pisa (Nuova Serie) [Lecture Notes. Scuola Normale Superiore di Pisa (New Series)], 15. Edizioni della Normale, Pisa, 2017. viii+152 pp. ISBN: 978-88-7642-600-1; 978-88-7642-601-8 35-02, (available online: <http://arxiv.org/pdf/1506.01748.pdf>).

42) S. Dipierro, E. Valdinoci, *Nonlocal minimal surfaces: interior regularity, quantitative estimates and boundary stickiness*, In: Kuusi, T., Palatucci, G. (eds.), Recent Developments in the Non-local Theory. Book Series on Measure Theory. De Gruyter, Berlin (2017). (available online: <https://arxiv.org/abs/1607.06872>).
 - Preprints:

43) S. Dipierro, A. Karakhanyan, *A new discrete monotonicity formula with application to a two-phase free boundary problem in dimension 2*, submitted, (available online: <http://arxiv.org/pdf/1509.00277.pdf>).

44) S. Dipierro, A. Karakhanyan, *Stratification of free boundary points for a two-phase variational problem*, submitted, (available online: <http://arxiv.org/pdf/1508.07447.pdf>).

45) S. Dipierro, O. Savin, E. Valdinoci, *Local approximation of arbitrary functions by solutions of nonlocal equations*, submitted, (available online: <https://arxiv.org/abs/1609.04438>).

46) S. Dipierro, L. Lombardini, P. Miraglio, E. Valdinoci, *The Phillip Island penguin parade (a mathematical treatment)*, submitted, (available online: <https://arxiv.org/pdf/1611.08715.pdf>).

47) S. Dipierro, J. Serra, E. Valdinoci, *Improvement of flatness for nonlocal phase transitions*, submitted, (available online: <https://arxiv.org/abs/1611.10105>).

48) S. Dipierro, A. Karakhanyan, E. Valdinoci, *Classification of irregular free boundary points for non-divergence type equations with discontinuous coefficients*, submitted, (available online: <https://arxiv.org/pdf/1701.03131.pdf>).

- 49) S. Dipierro, E. Valdinoci, *A simple mathematical model inspired by the Purkinje cells: from delayed travelling waves to fractional diffusion*, submitted,
(available online: <https://arxiv.org/abs/1702.05553>).
- 50) S. Dipierro, A. Farina, E. Valdinoci, *A three-dimensional symmetry result for a phase transition equation in the genuinely nonlocal regime*, submitted,
(available online: <https://arxiv.org/pdf/1705.00320.pdf>).
- 51) A. Cesaroni, S. Dipierro, M. Novaga, E. Valdinoci, *Minimizers for nonlocal perimeters of Minkowski type*, submitted,
(available online: <https://arxiv.org/pdf/1704.03195.pdf>).
- 52) S. Dipierro, E. Valdinoci, V. Vespri, *Decay estimates for evolutionary equations with fractional time-diffusion*, submitted,
(available online: <https://arxiv.org/pdf/1707.08278.pdf>).
- 53) S. Dipierro, A. Pinamonti, E. Valdinoci, *Rigidity results for elliptic boundary value problems*, submitted,
(available online: <https://arxiv.org/pdf/1709.07934.pdf>).
- 54) S. Dipierro, A. Farina, E. Valdinoci, *Density estimates for degenerate double-well potentials*, submitted,
(available online: <https://arxiv.org/pdf/1709.08888.pdf>).
- 55) S. Dipierro, M. Novaga, E. Valdinoci, *On a Minkowski geometric flow in the plane*, submitted,
(available online: <https://arxiv.org/pdf/1710.05236.pdf>).
- 56) S. Dipierro, A. Pinamonti, E. Valdinoci, *Classification of stable solutions for boundary value problems with nonlinear boundary conditions on Riemannian manifolds with nonnegative Ricci curvature*, submitted,
(available online: <https://arxiv.org/abs/1710.07329>).
- 57) S. Dipierro, S. Patrizi, E. Valdinoci, *Heteroclinic connections for nonlocal equations*, submitted,
(available online: <https://arxiv.org/abs/1711.01491>).
- Other publications:
 - 58) S. Dipierro, *Concentration phenomena for singularly perturbed elliptic problems and related topics*, PhD thesis, SISSA - International School for Advanced Studies of Trieste, 2012.
(available online: http://www.sissa.it/fa/download/phd_theses/Dipierro.pdf).
 - 59) S. Dipierro, *Fenomeni di concentrazione per problemi ellittici singolarmente perturbati e argomenti correlati*, Matematica nella società e nella cultura, 2013.

Teaching Experiences

- 2012/13: *Mathematical Analysis 2 (Civil Engineering)*.
At: Politecnico di Milano (Italy).
- September, 2013: “*An introduction to the Lyapunov-Schmidt method*”.
At: Department of Mathematics, University of Bologna (Italy).
BAD (Borsisti-Assegnisti-Dottorandi) informal seminar, organized by V. Martino.
- 2014/15: supervision of MIGSAA (*Maxwell Institute Graduate School in Analysis and its Applications*) miniproject.
At: School of Mathematics, University of Edinburgh (UK).

- 2014/15: *Mathematics for Science and Engineering 1b* (Engineering).
At: University of Edinburgh (UK).
- 2014/15: *MathsBase* (Engineering).
At: University of Edinburgh (UK).
- 2017: Coordinator of *Vector Calculus* (Mathematics).
At: University of Melbourne (Australia).
- 2017/18: *Mathematics* (Informatics).
At: University of Milan.
- 2017/18: *Mathematical Analysis I* (Physics).
At: University of Milan.

Activity as an organizer

- February 20–21, 2014, University of Pisa: Workshop on partial differential equations and applications, organized with A. Di Castro (University of Pisa) and G. Palatucci (SISSA, Trieste).
- February 17–18, 2015, WIAS Berlin: Mini workshop “Nonlocal equations and applications to crystal dislocations”, organized with S. Patrizi (WIAS Berlin) and E. Valdinoci (WIAS Berlin).
- March 14–16, 2016, Otto-von-Guericke-Universität Magdeburg: “Otto-von-Guericke School in Partial Differential Equations”, organized with E. Valdinoci (WIAS Berlin and University of Milan).
<https://www.ma.utexas.edu/users/enrico/OTTO-School.html>
- February 20, 2017, University of Melbourne: “PDE day in UniMelb”, organized with E. Valdinoci (University of Melbourne).
<https://www.ma.utexas.edu/users/enrico/miniworkshop-jan17.txt>
- April 10 – June 9, 2017, University of Bari: Intensive period INDAM “Contemporary research in elliptic PDEs and related topics”.
https://www.ma.utexas.edu/users/enrico/indam/bimestre_indam.pdf
- July 9–14, 2017, Shanghai Jiao Tong University: Theme session “Nonlocal nonlinear PDEs and free boundary problems” of the 14th International Conference on Free Boundary Problems, organized with L. Lombardini (University of Milan).
- September 18–19, 2017, University of Melbourne: “Workshop on Free Boundaries, Phase Transitions and Interfaces”, organized with C. Bucur (University of Melbourne), A. McGann (University of New South Wales) and E. Valdinoci (University of Milan).
<https://sites.google.com/site/melbournepdeworkshop/home>
- February 5–9, 2018, Murrumarang resort, Australia (scheduled): PIMS CRG “Conference on geometric and nonlinear partial differential equations”, organized with B. Andrews (ANU), J. Clutterbuck (Monash University), J. Liu (University of Wollongong), X.-J. Wang (ANU) and Z. Zhang (University of Sydney).
- July 2–3, 2018, Banach Center in Warsaw (scheduled): “Young PDEers at work”, organized with T. Cieślak (IMPAN).
<https://www.impan.pl/en/activities/banach-center/conferences/18-youngpdeers>

Also, I have organized some analysis seminars at the School of Mathematics and Statistics at the University of Melbourne, and the Department of Mathematics at the University of Milan.

Editorial activity

- Editor for a volume of the Springer INdAM Series, <http://www.springer.com/series/10283>.

Community services

- Staff, MATRIX program, "Doing Maths like a Research Mathematician", November 2016. <http://www.matrix-inst.org.au/events/facilitating-people-to-do-mathematics/>
- Scientists in Schools program, "Mathematicians in School", 2017.
- Research mentor, The Elizabeth Blackburn School of Sciences (EBSS), 2017.
- Member of the Postgraduate Programs Committee, University of Melbourne.
- Coordinator of *Vector Calculus* (Mathematics), University of Melbourne, 2017.
- Member of the panel Q&A for the Women in Mathematics at the "International Conference on PDEs, Geometric Analysis and Functional Inequalities", University of Sydney, 2017.
- Tutor for first year students, University of Milan, 2017/18.
- Member of the "Commissione Valutazione Seminario" (Bachelor degree), University of Milan, December 2017.

Elective offices

- October 2017 - present: Member of the *Mathematics Department Committee*, University of Milan.

Activity as a referee

- Referee for the following journals: Journal of the American Mathematical Society, Journal of Differential Geometry, Analysis and PDE, Nonlinearity, Journal of Functional Analysis, Communications in Partial Differential Equations, Mathematische Annalen, Calculus of Variations and Partial Differential Equations, Nonlinear Analysis, Journal of Geometric Analysis, Journal of Differential Equations, Journal of the London Mathematical Society, Discrete and Continuous Dynamical Systems, Annali di Matematica Pura e Applicata, Advances in Calculus of Variations, Journal of Nonlinear Science, ESAIM: Control, Optimisation and Calculus of Variations, Communications on Pure and Applied Analysis, Journal of Mathematical Analysis and Applications, Zeitschrift für angewandte Mathematik und Physik ZAMP, Discrete and Continuous Dynamical Systems Series S, Mathematische Nachrichten, Differential Integral Equations, Mediterranean Journal of Mathematics, Complex Variables and Elliptic Equations, Journal of Fractional Calculus and Applications, Mathematical Methods in the Applied Sciences, Studia Mathematica, Topological Methods in Nonlinear Analysis, Electronic Journal of Differential Equations, Boundary Value Problems, Differential Equations and Applications - DEA, Applicable Analysis, Proceedings of the Indian Academy of Sciences: Mathematical Sciences, Science China Mathematics, Mathematica Bohemica, Punjab University Journal of Mathematics, Computers and Mathematics with Applications.
- Referee for monographs and books edited by Wiley.
- Referee for the allocation of international research funds, such as FONDECYT competition of the Chilean National Science and Technology Commission (CONICYT - Chile), MATH-AmSud (France, Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela).
- External referee for the PhD thesis of Joshua Ching (University of Sydney).
- Reviewer for Mathematical Reviews and MathSciNet.

Visits

- October 24 - October 27, 2011: Department of Mathematics, University of Rome Tor Vergata (Italy).
- March 19 - April 1, 2012: Department of Mathematics, University of Texas at Austin (USA).
- July 17 - August 10, 2012: CMM - Center For Mathematical Modeling, Universidad de Chile, Santiago (Chile).
- August 11 - August 20, 2012: Universidade Federal do Ceará, Fortaleza (Brazil).
- May 13 - May 17, 2013: Otto-von-Guericke-Universität, Magdeburg (Germany).
- May 20 - May 24, 2013: Department of Mathematics, University of Padova (Italy).
- July 7 - July 12, 2013: Department of Mathematics, University of Padova (Italy).
- December 9 - December 15, 2013: Universidad Autónoma de Madrid (Spain).
- March 13 - March 20, 2014: Weierstraß Institute for Applied Analysis and Stochastics, Berlin (Germany).
- March 30 - April 14, 2014: Department of Mathematics, Columbia University (USA).
- July 10 - August 8, 2014: CMM - Center For Mathematical Modeling, Universidad de Chile, Santiago (Chile).
- September 8 - September 19, 2014: Otto-von-Guericke-Universität, Magdeburg (Germany).
- October 6 - October 9, 2014: Weierstraß Institute for Applied Analysis and Stochastics, Berlin (Germany).
- November 20 - December 7, 2014: Universidad Autónoma de Madrid (Spain).
- November 27 - November 30, 2014: Universidad de Granada (Spain).
- December 10 - December 20, 2014: Department of Mathematics, University of Turin (Italy).
- February 12 - February 20, 2015: Weierstraß Institute for Applied Analysis and Stochastics, Berlin (Germany).
- March 29 - May 16, 2015: Department of Mathematics, Columbia University (USA).
- May 24 - May 30, 2015: Departamento de Matemáticas, Facultad de Matemáticas, Pontificia Universidad Católica de Chile (Chile).
- October 6 - October 20, 2015: School of Mathematics, University of Edinburgh (UK).
- October 25 - November 21, 2015: Department of Mathematics, University of Texas at Austin (USA).
- December 7 - December 12, 2015: School of Mathematics and Statistics, University of Melbourne (Australia).
- January 20 - January 22, 2016: Mathematics Department, King's College London (UK).
- February 3 - February 5, 2016: School of Mathematics, University of Birmingham (UK).
- February 6 - February 13, 2016: Justus-Liebig-Universität, Giessen (Germany).

- February 14 - February 22, 2016: African Institute for Mathematical Science, Mbour (Senegal).
- March 17 - March 25, 2016: Department of Mathematics, University of Pisa (Italy).
- March 28 - April 2, 2016: University of Western Australia, Perth (Australia).
- April 3 - April 7, 2016: School of Mathematics, Queen Mary University of London (UK).
- April 9 - April 16, 2016: School of Mathematics, University of Edinburgh (UK).
- April 18 - April 21, 2016: School of Mathematics, University of Leeds (UK).
- April 27 - May 6, 2016: Department of Mathematics, University of Turin (Italy).
- May 16 - May 28, 2016: Department of Mathematics, Columbia University (USA).
- May 29 - June 9, 2016: Department of Mathematics, University of Texas at Austin (USA).
- August 21 - September 10, 2016: ICTP Trieste (Italy).
- September 11 - September 25, 2016: Department of Mathematics, Columbia University (USA).
- October 1 - October 28, 2016: Universidad de Chile, Santiago (Chile).
- January 8 - January 14, 2017: Department of Mathematics, University of Milan (Italy).
- January 15 - January 27, 2017: Department of Mathematics, University of Pisa (Italy).
- January 28 - February 1, 2017: University of Bath (UK).
- March 12 - March 26, 2017: Universidad de Chile, Santiago (Chile).
- March 27 - April 2, 2017: University of Sydney (Australia).
- June 12 - June 23, 2017: Universitat Politècnica de Catalunya (Spain).
- August 5 - September 2, 2017: Department of Mathematics, University of Texas at Austin (USA).
- September 18 - September 22, 2017: Department of Mathematics, University of Pisa (Italy).
- October 19 - October 27, 2017: Department of Mathematics, University of Bielefeld (Germany).

Invited Talks at Congresses

- October 5, 2012: “*Asymptotics of fractional perimeter functionals*”.
At: Workshop *Two days on nonlocal operators and applications*, Department of Mathematics, University of Parma, Parma (Italy).
- July 23, 2013: “*Asymptotics of fractional perimeter functionals*”.
At: Summer School *Non local equations of elliptic type*, Palazzone di Cortona (Italy).
- July 8, 2014: “*Concentration phenomena for a nonlocal Schrödinger equation*”.
At: *AIMS Conference Series on Dynamical Systems and Differential Equations*, Instituto de Ciencias Matemáticas and Universidad Autónoma de Madrid, Madrid (Spain).
- July 9, 2014: “*Dislocation dynamics in crystals*”.
At: *AIMS Conference Series on Dynamical Systems and Differential Equations*, Instituto de Ciencias Matemáticas and Universidad Autónoma de Madrid, Madrid (Spain).

- March 11, 2015: “*All functions are locally s -harmonic (up to a small error)*”.
At: Workshop “*Phase transition problems and nonlinear PDEs*”, Department of Mathematics, University of Bologna (Italy).
- June 1, 2015: “*Boundary properties of nonlocal minimal surfaces*”.
At: *The 3rd Scottish PDE Colloquium*, University of Strathclyde, Glasgow (UK).
- June 12, 2015: “*All functions are locally s -harmonic (up to a small error)*”.
At: *Joint International Meeting of the American, European and Portuguese Mathematical Societies (AMS-EMS-SPM)*, Porto (Portugal).
- February 15, 2016: “*All functions are locally s -harmonic (up to a small error) and applications*”.
At: *Spring School on Nonlocal Problems and Related PDEs*, African Institute for Mathematical Science, Mbour (Senegal).
- May 2, 2016: “*Chaotic orbits for systems of nonlocal equations*”.
At: *Bruxelles-Torino conference in PDE*, University of Turin (Italy).
- May 13, 2016: “*Dal laplaciano frazionario alla dislocazione atomica nei cristalli*”.
At: *EDP e dintorni*, University of Bari (Italy).
- May 26, 2016: “*Chaotic orbits for systems of nonlocal equations*”.
At: *Calculus of Variations and Nonlinear Partial Differential Equations*, Department of Mathematics, Columbia University (USA).
- June 30, 2016: “*All functions are locally s -harmonic (up to a small error)*”.
At: *3rd Conference on Nonlocal Operators and Partial Differential Equations*, Conference Centre of the Polish Academy of Sciences in Bedlewo (Poland).
- September 8, 2016: “*Boundary behavior and geometric properties of nonlocal minimal surfaces*”.
At: *Donne e ricerca in Matematica: il contributo della SISSA (Women and research in Mathematics: SISSA’s contributions)*, SISSA Trieste (Italy).
- September 29, 2016: “*Boundary behavior and graph properties of nonlocal minimal surfaces*”.
At: *Asymptotic Patterns in Variational Problems: PDE and Geometric Aspects*, BIRS-CMO (Banff International Research Station for Mathematical Innovation and Discovery and Casa Matemática Oaxaca), Casa Matemática Oaxaca (Mexico).
- December 7, 2016: “*Stable solutions of boundary reaction-diffusion equations*”.
At: Australian Mathematics Society’s annual meeting, Partial Differential Equations session, Canberra (Australia).
- December 8, 2016: “*Boundary behavior of nonlocal minimal surfaces*”.
At: Australian Mathematics Society’s annual meeting, Geometric Analysis session, Canberra (Australia).
- December 11, 2016: “*Nonlinear free boundary problems*”.
At: *Nonlinear and Geometric Partial Differential Equations*, Australian National University, Coastal Campus Kioloa (Australia).
- December 19, 2016: “*Nonlinear free boundary problems*”.
At: *Free boundary, partial differential equations and related topics*, WIAS Berlin (Germany).

- March 7, 2017: *Dislocation dynamics in crystals from a fractional perspective*.
At: *International Conference in PDE, Geometric Analysis, and Functional Inequalities*, University of Sydney (Australia).
- June 28, 2017: *Dislocation dynamics in crystals from a fractional perspective*.
At: *Analysis of Dislocation Models for Crystal Defects*, BIRS-CMO (Banff International Research Station for Mathematical Innovation and Discovery and Casa Matemática Oaxaca), Casa Matemática Oaxaca (Mexico).
- December 20-21, 2017: scheduled.
At: *Xmaths Workshop 2017*, University of Bari (Italy).
- May 25, 2018: scheduled.
At: *Brescia-Trento nonlinear days*, University of Brescia (Italy).
- July 23-27, 2018: scheduled.
At: ICM 2018 Satellite conference on Nonlinear Partial Differential Equations, Fortaleza, Ceará (Brazil).

Talks at Seminars

- April 13, 2012: *“Concentration of solutions for a singularly perturbed elliptic PDE problem in non-smooth domains”*.
At: Instituto Superior Técnico, Universidade Técnica de Lisboa (Portugal).
Invited by: D. Gomes.
- August 2, 2012: *“Asymptotics of fractional perimeter functionals”*.
At: Universidad de Chile, Santiago (Chile).
Seminario de Ecuaciones en Derivadas Parciales, organized by J. Dávila.
- January 31, 2013: *“Asymptotics of fractional perimeter functionals”*.
At: SISSA, Trieste (Italy).
Invited by: V. Martino.
- May 13, 2013: *“Asymptotics of fractional perimeter functionals”*.
At: Otto-von-Guericke-Universität, Magdeburg (Germany).
Invited by: H.-Ch. Grunau.
- May 22, 2013: *“Asymptotics of fractional perimeter functionals”*.
At: Department of Mathematics, University of Padova (Italy).
Invited by: A. Cesaroni.
- July 3, 2013: *“Asymptotics of fractional perimeter functionals”*.
At: Department of Mathematics, University of Bologna (Italy).
Invited by: V. Martino.
- August 14, 2013: *“Asymptotics of a reaction-diffusion equation driven by the fractional Laplacian”*.
At: Universidad de Chile, Santiago (Chile).
Seminario de Ecuaciones en Derivadas Parciales, organized by J. Dávila.
- December 11, 2013: *“Dislocation dynamics in crystals: a macroscopic theory in a fractional Laplace setting”*.
At: Universidad Autónoma de Madrid (Spain).
Invited by: I. Peral.

- February 10, 2014: *“Dislocation dynamics in crystals”*.
At: School of Mathematics, University of Edinburgh (UK).
Analysis seminar, organized by T. Oh.
- April 10, 2014: *“Concentration phenomena for the nonlocal Schrödinger equation”*.
At: Department of Mathematics, Columbia University, New York (USA).
Columbia Geometry and Analysis Seminar, organized by D. De Silva.
- October 2, 2014: *“Nonlocal problems with Neumann boundary conditions”*.
At: Heriot-Watt University, Edinburgh (UK).
Analysis seminars, organized by H. Gimperlein.
- December 11, 2014: *“A nonlocal free boundary problem”*.
At: Department of Mathematics, University of Turin (Italy).
Invited by: S. Terracini.
- February 9, 2015: *“Dislocation dynamics in crystals: nonlocal effects and a macroscopic theory in a fractional Laplace setting”*.
At: School of Mathematics, Cardiff University (United Kingdom).
Invited by: M. Cherdantsev.
- November 13, 2015: *“Boundary behavior of nonlocal minimal surface”*.
At: Department of Mathematics, University of Texas at Austin (USA).
Analysis seminars, organized by T. Chen, S. Patrizi and N. Pavlovic.
- December 10, 2015: *“Fractional Laplacian and atom dislocations in crystals”*.
At: School of Mathematics and Statistics, University of Melbourne (Australia).
School seminars.
- January 6, 2016: *“Chaotic orbits for systems of nonlocal equations”*.
At: Weierstraß Institute for Applied Analysis and Stochastics, Berlin (Germany).
Berliner Oberseminar Nichtlineare partielle Differentialgleichungen (Langebach–Seminar), organized by A. Glitzky, A. Mielke and J. Sprekels.
- January 21, 2016: *“Nonlocal equations and fractional minimal surfaces”*.
At: King’s College London (UK).
- January 25, 2016: *“Atom dislocations in crystals and symbolic dynamics for fractional equations”*.
At: Fakultät für Mathematik, Institut für Analysis un Numerik, Otto-von-Guericke-Universität Magdeburg (Germany).
Oberseminar, organized by H.-Ch. Grunau and M. Simon.
- February 4, 2016: *“Nonlocal equations and fractional minimal surfaces”*.
At: School of Mathematics, University of Birmingham (UK).
- February 11, 2016: *“Concentration phenomena for the nonlocal Schrödinger equation”*.
At: Justus-Liebig-Universität, Giessen (Germany).
Analysis seminars, invited by T. Bartsch.
- March 23, 2016: *“Boundary behavior and geometric properties of nonlocal minimal surfaces”*.
At: Department of Mathematics, University of Pisa (Italy).
Analysis seminar, organized by M. Novaga.
- April 5, 2016: *“Nonlocal equations and fractional minimal surfaces”*.
At: School of Mathematics, Queen Mary University of London (UK).

- April 19, 2016: "*From the fractional Laplacian to the Peierls-Nabarro model*".
At: School of Mathematics, University of Leeds (UK).
- August 16, 2016: "*Dislocation dynamics in crystals and oscillatory equilibria*".
At: Monash University, Melbourne (Australia).
Analysis, PDE and Geometry seminar, invited by Y. Bernard.
- October 17, 2016: "*Chaotic orbits for systems of nonlocal equations*".
At: Universidad de Chile, Santiago (Chile).
Afternoon session on PDEs, seminario CAPDE de EDPs, invited by C. Muñoz.
- January 19, 2017: "*Up to a small error, all functions are s -harmonic*".
At: University of Pisa (Italy).
Invited by M. Novaga.
- January 31, 2017: "*Dislocation dynamics in crystals from a fractional perspective*".
At: University of Bath (UK).
Invited by R. Moser.
- March 20, 2017: "*Nonlinear free boundary problems*".
At: Universidad de Santiago (Chile).
Afternoon session on PDEs, seminario CAPDE de EDPs, invited by M. Del Pino and C. Muñoz.
- March 29, 2017: "*An introduction to nonlocal minimal surfaces*".
At: University of Sydney (Australia).
Invited by H. Wu.
- September 22, 2017: "*Crystal dislocation, nonlocal equations and fractional dynamical systems*".
At: Scuola Normale Superiore di Pisa (Italy).
Invited by A. Malchiodi.
- October 20, 2017: "*Crystal dislocation, nonlocal equations and fractional dynamical systems*".
At: University of Bielefeld.
Analysis seminar, invited by M. Kassmann.
- November 27, 2017: scheduled.
At: Sapienza Università di Roma (Italy).
Invited by I. Birindelli.
- December 19, 2017: scheduled.
At: Politecnico di Milano (Italy).
Invited by N. Soave.

Other Talks

- June 13, 2011: "*Concentration of solutions for a singularly perturbed problem in non smooth domains*".
At: Workshop "*Geometric and Nonlinear Analysis: Meeting in Lorraine*", Institut Elie Cartan, Université Henri Poincaré, Nancy 1, (France).
- September 16, 2011: "*Concentration of solutions for a singularly perturbed problem in non smooth domains*".
At: "*XIX Congresso dell'Unione Matematica Italiana*", Dipartimento di Matematica, Università di Bologna, (Italy).

- April 20, 2012: "*Concentration of solutions for a singularly perturbed elliptic PDE problem in non-smooth domains*".
At: Workshop "*Variational and geometric methods in PDE's*", Università Politecnica delle Marche, Ancona (Italy).
- May 29, 2012: "*Concentration of solutions for a singularly perturbed elliptic PDE problem in non-smooth domains*".
At: Workshop "*Tenth workshop on interactions between dynamical systems and partial differential equations (JISD 2012)*", Universitat Politècnica de Catalunya, Barcelona (Spain).
- September 21, 2012: "*Asymptotics of fractional perimeter functionals*".
At: Workshop *ADMAT 2012 - PDEs for multiphase advanced materials*, Palazzone di Cortona, Cortona (Italy).
- May 27, 2013: "*Asymptotics of fractional perimeter functionals*".
At: Spring School *Rate-independent evolutions and hysteresis modelling*, Politecnico di Milano and University of Milano, Milano (Italy).
- December 1, 2015: "*Boundary behavior of nonlocal minimal surface*".
At: Conference *PDE 2015 - Theory and Applications of Partial Differential Equations*, Weierstraß Institute for Applied Analysis and Stochastics, Berlin (Germany).

Poster Sessions

- January 21, 2011: "*Concentration of solutions for a singularly perturbed Neumann problem in non smooth domains*".
At: Workshop "*Metodi variazionali e perturbativi per equazioni differenziali nonlineari*", Venice (Italy).
- June 17-22, 2013: "*Asymptotics of the nonlocal perimeter functionals*" (with G. Palatucci).
At: International School "*Recent advances in partial differential equations and applications*", Department of Mathematics, University of Milan (Italy).
Available at <http://palatucci.altervista.org/opera/dipierro-palatucci.pdf>
- June 28, 2013: "*Asymptotics of the nonlocal perimeter functionals*" (with G. Palatucci).
At: SIAM at PoliMi, Politecnico di Milano (Italy).

Major scientific achievements

Concentration phenomena at corners. We consider a nonlinear Schrödinger equation in a bounded, piecewise smooth domain, both with Neumann and mixed boundary conditions, and we prove the existence of solutions that concentrate at the corners of the domain (more precisely, at the points where the corners have the minimal or maximal opening). This phenomenon is related to the case of smooth domains, where the concentration occurs at critical points of the boundary mean curvature.

S. Dipierro, *Concentration of Solutions for a Singularly Perturbed Neumann Problem in non smooth domains*, Ann. Inst. H. Poincaré (C) Anal. Non Linéaire 28 (2011), no. 1, 107–126.

S. Dipierro, *Concentration of Solutions for a Singularly Perturbed Mixed Problem in non smooth domains*, J. Differential Equations 254 (2013), no. 1, 30–66.

Dislocation dynamics in crystals. We consider a problem of atom dislocation in crystals. We prove that the dislocation function evolves, at a macroscopic space and time scale, towards a sum of step functions, centered at points that evolve according to a suitable dynamical system, that is driven by a repulsive potential.

S. Dipierro, G. Palatucci, E. Valdinoci, *Dislocation dynamics in crystals: a macroscopic theory in a fractional Laplace setting*, Comm. Math. Phys. 333 (2015), no. 2, 1061–1105.

S. Dipierro, A. Figalli, E. Valdinoci, *Strongly nonlocal dislocation dynamics in crystals*, Comm. Partial Differential Equations 39 (2014), no. 12, 2351–2387.

Concentration phenomena for nonlocal equations. We prove the existence of concentrating solutions for a nonlinear Schrödinger equation in a bounded domain, driven by a nonlocal operator of fractional type. This is the first paper dealing with nonlocal Schrödinger equations with Dirichlet data.

J. Dávila, M. Del Pino, S. Dipierro, E. Valdinoci, *Concentration phenomena for nonlocal equations with Dirichlet datum*, Anal. PDE 8 (2015), no. 5, 1165–1235.

All functions are s -harmonic (up to a small error). Given any $s \in (0, 1)$, we prove that any $f \in C^k(\overline{B_1})$ can be approximated in the $C^k(\overline{B_1})$ -norm by a function $u : \mathbb{R}^n \rightarrow \mathbb{R}$ that satisfies $(-\Delta)^s u = 0$ in B_1 . This is quite a surprising result, compared with the classical case in which $s = 1$, since classical harmonic functions are very rigid and cannot locally approximate functions with peaks and oscillation. In a sense, this shows that the nonlocal setting is much richer than the local one.

We also generalize this density result by showing that any function can be locally approximated by solutions of prescribed linear equations of nonlocal type. In particular, every function is locally s -caloric, up to a small error. The case of non-elliptic and non-parabolic operators is taken into account as well.

S. Dipierro, O. Savin, E. Valdinoci, *All functions are locally s -harmonic up to a small error*, J. Eur. Math. Soc. (JEMS) 19 (2017), no. 4, 957–966.

S. Dipierro, O. Savin, E. Valdinoci, *Local approximation of arbitrary functions by solutions of nonlocal equations*,

<https://arxiv.org/abs/1609.04438>

Free boundary: monotonicity formulas and regularity properties. We consider free boundary problems in either nonlocal or singular/degenerate setting. We prove a series of results that include: monotonicity formulas, regularity theories, classification, blow-up results and density estimates.

In particular, we prove partial regularity of the free boundary in the two-phase Bernoulli type free boundary problem, extending to any $p \in (1, +\infty)$ a celebrated regularity result proved by Wilhelm Alt, Luis Caffarelli and Avner Friedman in 1984 for $p = 2$ and using a new method based on stratification of free boundary.

S. Dipierro, O. Savin, E. Valdinoci, *A nonlocal free boundary problem*, SIAM J. Math. Anal. 47-6 (2015), 4559–4605.

S. Dipierro, E. Valdinoci, *Continuity and density results for a one-phase nonlocal free boundary problem*, Ann. Inst. H. Poincaré (C) Anal. Non Linéaire 34 (2017), no. 6, 1387–1428.

S. Dipierro, A. Karakhanyan, *A new discrete monotonicity formula with application to a two-phase free boundary problem in dimension 2*, <http://arxiv.org/pdf/1509.00277.pdf>

S. Dipierro, A. Karakhanyan, *Stratification of free boundary points for a two-phase variational problem*, <http://arxiv.org/pdf/1508.07447.pdf>

A class of nonlinear free boundary problems. We consider a class of free boundary problems in which the energy functional is the nonlinear superposition of a Dirichlet energy and a volume or perimeter interface. This type of problems present some severe instability: namely, minimisers may not exist; when they exist, they may show a lack of regularity; and minimisers vary in general from scale to scale. We discuss these instability properties and present some regularity results.

As far as we know, this is the first case in which a nonlinear function of the perimeter is studied in this type of problems. Also, the results obtained in this nonlinear setting are new even in the case of the local perimeter.

S. Dipierro, A. Karakhanyan, E. Valdinoci, *A class of unstable free boundary problems*, Anal. PDE 10 (2017), no. 6, 1317–1359.

S. Dipierro, A. Karakhanyan, E. Valdinoci, *A nonlinear free boundary problem with a self-driven Bernoulli condition*, J. Funct. Anal. 273 (2017), no. 11, 3549–3615.

Nonlocal minimal surfaces. We consider the behavior of the nonlocal minimal surfaces in the vicinity of the boundary. By a series of detailed examples, we show that nonlocal minimal surfaces may stick at the boundary of the domain, even when the domain is smooth and convex. This is a purely nonlocal phenomenon, and it is in sharp contrast with the boundary properties of the classical minimal surfaces.

In all the examples, we present concrete estimates on the stickiness phenomena. Also, we construct a family of compactly supported barriers which can have independent interest.

Moreover, we show that a nonlocal minimal surface which is a graph outside a cylinder is in fact a graph in the whole of the space. As a consequence, in dimension 3, we show that the graph is smooth.

S. Dipierro, O. Savin, E. Valdinoci, *Boundary behavior of nonlocal minimal surfaces*, J. Funct. Anal. (2017), no. 5, 1791–1851.

S. Dipierro, O. Savin, E. Valdinoci, *Graph properties for nonlocal minimal surfaces*, Calc. Var. Partial Differential Equations 55 (2016), no. 4, 55:86.

Nonlocal Delaunay surfaces. We construct codimension 1 surfaces of any dimension that minimize a periodic nonlocal perimeter functional among surfaces that are periodic, cylindrically symmetric and decreasing. These surfaces may be seen as a nonlocal analogue of the classical Delaunay surfaces (onduloids). For small volume, most of their mass tends to be concentrated in a periodic array and the surfaces are close to a periodic array of balls.

J. Dávila, M. Del Pino, S. Dipierro, E. Valdinoci, *Nonlocal Delaunay surfaces*, Nonlinear Anal. 137 (2016), 357–380.

Chaotic orbits for nonlocal equations. We consider a system of nonlocal equations driven by a perturbed periodic potential, and we construct multibump solutions that connect one integer to another one in a prescribed way. In particular, heteroclinic, homoclinic and chaotic trajectories are constructed.

After the celebrated work of Paul Rabinowitz in 1989, this is the first attempt to consider a nonlocal version of this type of dynamical systems in a variational setting and the first result regarding symbolic dynamics in a fractional framework.

S. Dipierro, S. Patrizi, E. Valdinoci, *Chaotic orbits for systems of nonlocal equations*, Comm. Math. Phys. 349 (2017), no. 2, 583–626.

A notion of divergent fractional Laplacian. We introduce a notion of fractional Laplacian for functions which grow more than linearly at infinity. In such case, the operator is not defined in the classical sense: nevertheless, we can give an ad-hoc definition which can be useful for applications in various fields, such as blowup and free boundary problems. In this setting, when the solution has a polynomial growth at infinity, the right hand side of the equation is not just a function, but an equivalence class of functions modulo polynomials of a fixed order.

S. Dipierro, O. Savin, E. Valdinoci, *Definition of fractional Laplacian for functions with polynomial growth*, Rev. Mat. Iberoam., <https://arxiv.org/abs/1610.04663>)

Language spoken

- Italian (mother tongue),
- English (fluent),
- German (good),
- Spanish (basic).