

Ángel D. Martínez

13 de marzo de 2024

0.1. Employment

Maria Zambrano Postdoctoral Fellow (Sept 2022-Aug 2024) , Universidad Autónoma de Madrid. Mentor: Fernando Chamizo.

Fields Ontario Postdoctoral Fellow (Feb 2021-Aug 2022), University of Toronto Mississauga. Mentor: Almut Buchard, Fabio Pusateri, Kostya Khanin.

Member of the Institute for Advanced Study (2018-2020) Mentor: Camillo de Lellis, second mentors: Eugenia Malinnikova (2019), Daniel Cristofaro-Gardiner (2020).

0.2. Mathematical interests

Harmonic Analysis and its applications.

Partial Differential equations: elliptic, fluid dynamics (Euler equation, Navier-Stokes, SQG, Córdoba-Córdoba-Fontelos, etc.), nonlocal, Laplace-Beltrami eigenfunctions.

Riemannian Geometry: isometric embeddings (Nash-Kuiper theorem).

Number theory in connection with the above.

0.3. Education

PhD student (late 2012-2018) at the Autonomous University of Madrid.

- *Thesis advisor:* Antonio Córdoba Barba.
- *Estancia breve* visiting Charles L. Fefferman at Princeton University from January-May 2016.

- *PhD dissertation: An integral representation and pointwise inequality for the fractional Laplace-Beltrami operator.* Defended 22 June 2018.
- At the beginning as a becario FPI and later holding a teaching assistant position at UAM. Member of the ICMAT-CSIC.

Advanced and profesional Mathematics Master (2011-2012) at the University of Barcelona. Master advisor: Ignasi Mundet. Thesis title: *An approach to Galois representation.* Master thesis supervisor: Luis V. Dieulefait.

Undergraduate Mathematics studies (2006-2011) at the University of Valencia (UVEG). In the following we detail movility to other universities enjoyed during this period.

- *SICUE (10/11)* to the University of Barcelona. There an Academically Directed Thesis (9ECTS) about Differential Galois Theory was done (Supervisor: Teresa Crespo).
- *Erasmus (09/10)* to the National Kapodistrian University of Athens (Greece).
- *Special International Scholarship from UVEG (08/09):* to Rutgers (the State University of New Jersey, USA). There under the supervision of Brandon Bate a Directed Reading Program on J-P. Serre's *A course in arithmetic* was enjoyed.
- *Accomodation scholarship (2006-2009):* at Colegio Mayor San Juan de Ribera (Burjassot, Valencia). Excellence scholarship by entrance examination.

Baccalaureate both Spanish National (LOGSE) and International (IB) at IES Bachiller Sabuco (Albacete, 2004-2006) achieving Honors. Matrícula de Honor de Bachillerato.

Educación Primaria y Secundaria en el Colegio Nuestra Señora del Rosario (Albacete, -2004).

0.3.1. Formación docente

- Detección y manejo de problemas psicológicos entre el alumnado. (1 ECTS, UAM Abril 2023, curso impartido por Ana Calero Elvira).
- La mejor clase. Claves para el diseño de actividades de enseñanza aprendizaje (active learning).(1 ECTS, UAM Mayo 2023, curso impartido por Ernesto de los Reyes López).

- Curso de Aprendizaje activo en grupos numerosos (0.5 ECTS, UAM Octubre 2023, curso impartido por Miguel Valero García).
- Curso Aprendizaje Basado en Proyectos: Instrucciones concretas para empezar YA. (0.5 ECTS, UAM Octubre 2023, curso impartido por Miguel Valero García).
- Curso Dar la vuelta a la clase: introducción al Flipped Classroom (1 ECTS, UAM Noviembre 2023, curso impartido por José Manuel Sánchez Galán).
- Curso Feedback eficaz al estudiantado en la competencia de comunicación en público, presencial y en videollamadas (6h, UAM Enero 2024, curso impartido Pedro Pablo Sigüenza Pizarro).
- El estudio de casos como método de aprendizaje (active learning).(1 ECTS, UAM Febrero 2024, curso impartido por Ernesto de los Reyes López).

0.4. Academic visits

- Princeton University (Charles Fefferman, 4 months, Jan-May 2016)
- Instituto de Matematicas Universidad de Sevilla (F. Torres de Lizaur, 1 week, Nov 2022).
- Instituto de Matematicas Universidad de Sevilla (F. Torres de Lizaur, 1 week, Nov 2023).

0.5. Habilitation/Acreditation

Profesor Contratado Doctor 2023: ANECA.

Profesor Universidad Privada 2023: ANECA.

Profesor Ayudante Doctor 2020: ANECA.

Professor Lector 2020: AQU (Agencia per a la Qualitat del Sistema Universitari de Catalunya).

0.6. Participation in research projects

Proyectos con otro Investigador Principal

Antonio Córdoba Barba tres proyectos consecutivos:

- MTM2011-2281,
- MTM2014-56350p
- MTM2017-83496p.

Jean Bourgain, Helmut Hofer y Peter Sarnak National Science Foundation under Grant No. DMS-1638352.

Fields Ontario Postdoctoral Fellowship financed by NSERC Discovery Grant 311685 and NSERC Grant RGPIN-2018-06487. (Almut Burchard, Fabio Pusateri, Kostya Khanin).

Pablo Candela (Fernando Chamizo) PID2020-113350GB-I00 (Análisis armonico, combinatoria y aritmetica).

Eduardo García-Juárez y Francisco Torres de Lizaur

0.7. Scholarships and contracts

- Maria Zambrano scholarship (2 years postdoc).
- Fields Ontario Postdoctoral Fellow, University of Toronto Mississauga (Toronto, 2021-2023).
- Member of the Institute for Advanced Study (Princeton, 2018-2020).
- Teaching assistant at the Universidad Autónoma de Madrid (September 2016-September 2018)
- Estancia Breve EEBB-I-16-10718 of the MCINN (Spain).
- *Formación de Personal Investigador (FPI-2011)*. MTM2011-2281 project of MCINN (Spain). (January 2013 to September 2016, declined).
- Beca de inicio de doctorado del Departamento de Matemáticas de la UAM (September to December 2012, declined).
- A maintenance "*la Caixa*" *Foundation scholarship (2011-2012)* to perform Master studies.

- *Séneca*. Little economic aid for university exchange students under SI-CUE program.
- *JAE-Intro 2010*. Introduction to research scholarship at CSIC. It was enjoyed under the direction of Javier Parcet. The topic covered was *Fourier analysis on topological groups*.
- *Erasmus scholarships*. Diverse little economic aids for university exchange students under Erasmus program.
- *JAE-Intro 2009*. Introduction to research scholarship at CSIC. It was enjoyed under the direction of Juan José Velázquez. The topic was *Partial differential equations*.
- *Bancaja International Scholarship*. Economic aid.

0.8. Articles

Research papers: most of them are published (there are **three exceptions with *** which are available preprints not intended for publication or published as appendices to other papers)

- 1 (with Córdoba, A.) *A pointwise inequality for fractional laplacians*, Advances in Mathematics Volume 280, 6 August 2015, Pages 79-85, arXiv: 1502.01635.
- 2* (Chapter 5 of my PhD thesis) *Eigenfunction maxima and spherical means*.
- 3 (with D. Alonso-Orán and A. Córdoba) *Continuity of weak solutions of the critical quasigeostrophic equation on the sphere*, arXiv:1704.06129, Advances in Mathematics Volume 328, 13 April 2018, pp. 264-299.
- 4 (with A. Córdoba and D. Alonso-Orán) *Integral representation for fractional Laplace-Beltrami operators*, arXiv:1704.06126, Advances in Mathematics Volume 328, 13 April 2018, pp. 436-445.
- 5 (with A. Córdoba and D. Alonso-Orán) *Global well-posedness of critical surface quasigeostrophic equation on the sphere*, arXiv:1704.06132, Advances in Mathematics Volume 328, 13 April 2018, pp. 248-263.
- 6 (with P-Y. Bienvenu, D. González-Sánchez) *A note on the Bilinear Bogolyubov Theorem: Transverse and bilinear sets*, arXiv:1811.09853, Proc. Amer. Math. Soc. 148 (2020), pp. 23-31 1.

- 7 (with D. Spector) *An improvement to the John-Nirenberg inequality for functions in Critical Lorentz spaces*, arXiv:2007.04576, Advances in Nonlinear Analysis 10 (2021), pp. 877-894.
- 8 (with F. Torres de Lizaur) *Distribution symmetry of toral eigenfunctions*, arXiv:2205.14491, Revista Matemática Iberoamericana 38 (2022), no. 4, pp. 1371-1382.
- 9 *Córdoba's differentiation theorem: revisited*, arXiv:2205.15309, Annales de l'Institut Fourier, Volume 73 (2023) no. 2, pp. 559-565.
- 10 (with D. Alonso-Orán, F. Chamizo, A. Mas) *Pointwise monotonicity of heat kernels*, arXiv:1807.11072, Revista Matemática Complutense 36 (2023), pp. 207-220.
- 11 (with F. Torres de Lizaur) *Sign equidistribution of Legendre polynomials*, arXiv:2205.14493, accepted in Analysis and Mathematical Physics.
- 12 (with D. Alonso-Orán) *On the blow up of a nonlocal transport equation in compact manifolds*, arXiv:2205.15310, Proc. Amer. Math. Soc. 151 (2023), pp. 723-735.
- 13* $C^{1,1/3-\epsilon}$ surface isometric embeddings in \mathbb{R}^4 , draft not intended for publication at the moment.
- 14 $C^{1,1-\epsilon}$ isometric embeddings, to appear in Trans. Amer. Math. Soc.
- 15* *An abstract generalization of Källen-Kröner's iteration*. Originally an independent paper now merged to be the Appendix to 14.

Submitted at the moment

- 16 *Quasisymmetry and blow ups of eigenfunctions*, submitted.
- 17 (with A. Burchard) *On monotonicity of heat kernels: a new example and counterexamples*, submitted.
- 18 *On divisors in certain congruence classes*, submitted.

In preparation at the moment

- 20 (with F. Torres de Lizaur) *Distributional gaussianity of most monochromatic random waves*, work in progress.
- 21 $C^{1,1-\epsilon}$ isometric embeddings II, work in progress.
- 22 (with F. Torres de Lizaur) *Shadow rigidity of ellipsoids*, first draft, in progress.

23 (with A. Burchard) *On the theorems of Hersch and Cheng in low regularity*, work in progress.

24 (with A. Burchard) *Symmetry breaking for the isodiametric problem of Riesz energies*, work in progress.

Outreach articles: book or article reviews

1 Biblioteca: la paja en el pajar, Matgazine 2, 4 pp.

2 La Biblioteca, de luto, Matgazine 3, 10 pp.

3 Biblioteca, Matgazine 4, 7 pp.

4 Biblioteca, Matgazine 5, 6 pp.

5 (with A. Córdoba) Scientific Review: *A pointwise inequality for fractional Laplacians*, 13th ICMAT Newsletter, 1 p.

0.8.1. Impact factor (clarivate analytics)

Adv. in Math. 2015 factor 1.405 ranked 23/312.

Adv. in Math. 2018 factor 1.435 ranked 27/311.

Proc. of the Amer. Math. Soc 2020 factor 1.016 ranked 152/330.

Adv. in Nonlinear Analysis 2021 factor 4.544 ranked 3/333.

Rev. Mat. Complu. 2021 factor 1.009 ranked 151/333.

Rev. Mat. Ibero. 2022 factor 1.2 ranked 91/329.

0.9. Seminars, courses and other events

Actively: as lecturer, organizer, etc.

- *On the symmetry conjecture for eigenfunctions*, seminario en CU-NEF (28 Febrero 2024, organized by André Alvez Portela).
- *A walk through eigenfunctions' realm*, Geometry and statistics of eigenfunctions (28 Noviembre 2023, IMUS Universidad de Sevilla, invitado por F. Torres de Lizaur).
- *A walk through eigenfunctions' realm*, Workshop de Jóvenes investigadores (25-27, Septiembre 2023, Universidad Complutense de Madrid, organizado por Carlos Mora Corral et al.)

- *On the symmetry conjecture for eigenfunctions*, VI Congreso de Jóvenes investigadores de la RSME (León 6-10 Febrero 2023, Sesión de Análisis Matemático Aplicado y Ecuaciones Diferenciales, organizada por D. Alonso-Orán, Rafael Granero y Martina Magliocca).
- *On the symmetry conjecture for eigenfunctions*, Analysis and Fluid flows (16-17 November 2022, IMUS-Universidad de Sevilla, organized by F. Torres de Lizaur and F. Gancedo).
- *On the symmetry conjecture for eigenfunctions*, Canadian Mathematical Society Summer meeting (3-6 June 2022, Memorial University, session Geometry of eigenfunctions and random fields organized by Graham Cox, Suresh Eswarathasan and Dmitry Jakobson).
- *On the symmetry conjecture for eigenfunctions*, Spring 2022 Nonlinear Analysis Seminar Series (8 March 2022, National Taiwan Normal University, organized by D. Spector, online).
- *On the symmetry conjecture for eigenfunctions*, Analysis and Applied Math Seminar (12 Oct 2021, University of Toronto, organized by Kirill Serkh and William Yu)
- *C^1 isometric embeddings*, Geometric Analysis Seminar (25 Oct 2021, University of Toronto, organized by Bruno Staffa).
- *The isometric embedding problem*, Okinawa Institute of Science and Technology (February 2020)
- *The Surface Quasigeostrophic equation on the sphere*, Analysis Seminar (28 October 2019, Institute for Advanced Study).
- *Pointwise inequalities for certain nonlocal operators* in the Short Talks by Postdoctoral Members (27 September 2019, Institute for Advanced Study).
- Talk *SQG equation on the sphere* in Seminar Analysis of fluids and related topics (19 Septiembre 2019, Princeton University).
- Talk *SQG equation on the sphere* in Analysis Seminar (4 April 2019, University of Pennsylvania).
- Talk *Pointwise monotonicity of heat kernel* in the Short Talks by Postdoctoral Members (1 October 2018, Institute for Advanced Study).
- Talk *Fractional operators related to the SQG equation on the two dimensional sphere* in the research program Geometric Function Theory in fluid mechanics (7 July 2018, Centre de Recerca Matemàtica, UAB).

- Talk *Fractional operators and SQG equation on the two dimensional sphere*, Seminari d'Anàlisi de Barcelona (25 June 2018).
- Talk *Fractional operators and SQG equation on the two dimensional sphere*, Tianyuan Advanced Seminar on Harmonic analysis, Geometry and Partial Differential Equations (28 May - 8 June 2018, Beijing International Center for Mathematical Research).
- Talk *An integral representation and pointwise inequality for the fractional Laplace-Beltrami operator*, in the Seminario de Análisis y Aplicaciones en el Departamento de Matemáticas de la Universidad Autónoma de Madrid (18 Mayo 2018).
- Talk *Operadores fraccionarios y ecuación SQG en la esfera dos dimensional*, in IMUS - Sevilla (27 April 2018).
- Talk *La conjetura de Zygmund*, in ICMAT (1 Dec 2017).
- Talk with D. Alonso-Orán entitled *The surface quasi-geostrophic equation on the sphere*, in the Fluid mechanics seminar (31 October 2017, ICMAT) organized by A. Castro.
- Organizer of the working group of discrete analysis UAM-ICMAT 2017-2018.
- Talk title: *El Laplaciano Fraccionario espectral en variedades riemannianas* en la sesión de Análisis Armónico y Aplicaciones del IV Congreso de Jóvenes Investigadores de la RSME (3-8 Sept. 2017, Valencia).
- *Seminario Zygmund: back to the roots*, ponente y organizador junto a E. Latorre y Jesús Ocáriz (ICMAT), 2015.
- *Seminario de teoría de números*, ponente y organizador junto con C. Alcoceba (ICMAT), 2014.
- *Matemáticas de competición: olimpiadas matemáticas*, contertulio en mesa redonda (ICMAT), 9 Abril 2014.
- *Seminario de integrales singulares*, ponente y organizador junto con E. Latorre (ICMAT), 2013/2014.
- Delivered a lecture entitled *Un cuento recurrente* in the Junior Seminar (UAM-ICMAT, March 2015).
- Lecturer at *Seminario L* (UAB, 2nd, 16th and 23rd of March 2012) about *construction and applications of Stiefel-Whitney classes*. The seminar is directed by Wolfgang Pitsch (UAB).
- Lecturer at *The threefold seminars* (ICMAT, 18-22 de July 2011) about *p-adic numbers*.

Pasively: attending a summer school, congress, etc.

- Harmonic Analysis, Partial Differential Equations and Geometric Measure Theory (Bilbao, 2023)
- Summer meeting of the Canadian Mathematical Society (online, 2021).
- *Fluids and Variational methods* (June 10-14, 2019, Renyi Institute, Budapest).
- *Topics in Differential Equations - Nonlinear iterations for partial differential equations*, Math 538, (Fall 2018/2019, Camillo de Lellis, Princeton University).
- *Mathfluids: mathematical analysis of incompressible fluids* congress (Seville 12-15 June 2018).
- *Lectures on PDEs and Geometry*, delivered by Xavier Cabré at UAM (23-25 January 2018).
- *Harmonic Analysis in Winter*, (ICMAT, 8-12 January 2018).
- *The music of numbers. Conference in honor of Javier Cilleruelo*, (UAM-ICMAT, 20-22 September 2017).
- *Nonlinear Diffusion and Free Boundary Problems. A conference on the occasion of the 70th anniversary of Juan Luis Vázquez* (UAM 17-19 May 2017).
- *ERC and Mathematics in Spain* (ICMAT, 13-14 March 2017).
- *Algunos problemas elípticos y parabólicos con difusión local y no local*, curso de doctorado impartido por Irene Peral y Fernando Soria (10 semanas, 30h. UAM 2017).
- *EPSCR Symposium: PDEs in Fluid Mechanics* at Warwick University (25-30 September 2016).
- *Spanish-French workshop on analysis of PDEs from fluid mechanics* at ICMAT (19-21 September 2016).
- *10th international conference on harmonic analysis and partial differential equations* at el Escorial (Madrid, 12-17 July 2016).
- *Analysis and Beyond, celebrating J. Bourgain's work and impact*, (IAS 21-24 May, 2016).
- *Topics in number theory and related analysis: integer points on affine varieties* by P. Sarnak (Mat515 Princeton University, Spring term 2016).

- *Topics in Differential equations local and global regularity of non linear evolution equations* by A. Ionescu (Mat520 Princeton University, Spring term 2016).
- Summer School Trento 2015 ???
- *Non-local problems in analysis and geometry* course delivered by Enrico Valdinoci (1-5 December 2014).
- *Sum-product set estimates and trigonometrical sums* course delivered by Moubariz Garaev (7,8,14 and 16 October 2014).
- *Calderón-Zygmund theory and beyond: Fourier analysis, uncertainty and modeling* by A. Córdoba (UAM-ICMAT), 21 Octubre 2014.
- Three days on analysis and PDE (ICMAT-UAM), 3-5 Junio 2014.
- *Summer School on Analytic number theory* (IHES, 9-23th July 2014).
- Attended the *28th Journées arithmétiques* (Grenoble, July 2013).
- Summer school *Number theory and dynamics* at the Institut Fourier (17th June to 5th July 2013).
- *Sharp weighted bound – The A_2 theorem and beyond* course delivered at ICMAT by Thomas Hytönen (25-30 April 2013).
- *Modelling in fluid dynamics* course delivered at Universidad Complutense of Madrid (UCM) by Amable Liñán from (14-18 January 2013).
- *Problems in quasilinear equations* course delivered at UCM by F. Murat (14-18 January 2013).
- *Introduction to Stochastic PDE* course delivered at UCM by Gregorio Díaz Díaz (14-18 January 2013).
- *Nonlinear diffusion in image analysis. Applications to medical image processing.* Course delivered at UCM by Emmanuelle Schiavi (14-18 January 2013).
- *Galois theory for rings, algebraic varieties and topological spaces* delivered at the University of the Basque Country (UBC) by Lenny Taelman (17-21 December 2012).
- *IBG Advanced International School on Galois groups* organised at UBC by the Iberian Network of group theory (from 9-27 July 2012).

- *Topics in Geometric analysis and applications to PDE* delivered at ICMAT by Dorina Mitrea (from 22-25 October 2012).
- *Göttingen-Penn State International school in mathematics on Number theory* organized by the Georg-August-Universität Göttingen (from July 29th to August 18th, 2012).
- *Jornadas «los problemas del milenio»* (Barcelona, 1-3 June 2011), tax exemption scholarship by IMUB-RSME.
- School and Meeting of the Spanish Functional Analysis network (Jaca, 4-9 de April 2011).
- Attended complementary courses to JAE-Intro scholarships (2009, 2010, 2011) offered by ICMAT-CSIC.
- Young singularists seminar (2008) at the Topology and Geometry Department at the University of Valencia.

1. Teaching experience

Teaching at the University of Toronto

- Course Instructor of MAT136H5S - Integral Calculus (LEC9105). 470 hours. (Coordinator: Maria Wesslén)
- Course Instructor of MAT102H5F - Intro to Mathematical Proofs (LEC9107, Fall 2021). 470 hours. (Coordinator: Marina Tvalavadze)
- Instructor of MAT102H5Y (LEC9102) - Introduction to Mathematical Proofs (Summer 2021). 460 hours. (Coordinator: Nadya Askaripour)

Teaching as a PhD student and Ayudante no doctor at UAM:

- Algebra I, practice lessons, physics degree (Fall 2014). Responsible professor: J. Munárriz Aldaz.
- Sets and numbers, practice lessons, mathematics degree (Fall 2015). Responsible professor: A. Córdoba Barba.
- Sets and numbers, practice lessons, double degree: mathematics and informatics (Fall 2016). Responsible professor: Alberto Ruiz.
- Real analysis I, practice lessons, mathematics degree and double degree: mathematics and informatics (Fall 2017). Responsible professor: Kazaros Kazarian.

1.1. Mentorship

- Jesús Ocariz (visiting student at IAS, PhD candidate at UAM, visiting June-July 2019).
- Supervisor of the Project 4 (Summer 2021): Eigenfunctions and the Symmetry Conjecture (cosupervised with Dr. Francisco Torres de Lizaur, University of Toronto) Fields Undergraduate Summer Research Programme.

Students involved:

- William Verreault - william.verreault.2@ulaval.ca
- Runyue Wang - wangr109@mcmaster.ca
- Nancy Mae Eagles - s1708813@ed.ac.uk
- Gabriel Beiner - gabriel.beiner@gmail.com

This project had as a by-product two papers, namely <https://arxiv.org/abs/2208.14880> and <https://arxiv.org/abs/2209.00212> where the students extended our results to disprove several conjectures in the field that had been open for decades.

1.2. Synergetic activities

Refereed for American Journal of Mathematics, Revista Iberoamericana Matemática, Journal of Functional Analysis, Proceedings of the American Mathematical Society.

Also collaborate with Mathematical Reviews AMS. Former editor of the section *Biblioteca* (i.e. *Library*) at Matgazine, which is a mathematical magazine oriented to an university audience. Synergetic activities related to mathematical competitions (lecturer at some preparatory classes, logistic, volunteer, etc.) También como representante del sector Personal Docente e investigador en formación en la junta de Facultad de Ciencias (2013-2015) y en el consejo de departamento de matemáticas de la UAM (2013-2015, 2015-2018).

2. Other merits

Here there is highlight of some awards.

Mathematics

- **THIRD** prize at the International Mathematical Competition (2009).
- **SECOND** prize at X premio Jorge Juan from Universidad de Alicante (2007).
- **SILVER** medal at the Iberoamerican Mathematical Olympiad for undergraduates (OIMU).
- Represented Spain at the International Mathematical Olympiad IMO-2006.
- **GOLD** medal (fourth position) at the Spanish Mathematics Olympiad (2006).

Physics

- **BRONZE** medal (unknown position) at the Spanish Physics Olympiad (2006).

2.1. Languages

- **English.** 86 TOEFL Internet based. Fluent.
- **Modern greek.** Maximum mark in the course *Elementary Modern Greek* attended at RUTGERS.
- **French.** Mathematical written comprehension.
- **Catalan.** Written comprehension.
- **Spanish.** Native.
- **Lengua de signos española.** (Spanish sign language) Basics, enough to start to communicate.
- **C++.** Basics. I have used it in my research to provide computer assisted proofs.

3. References

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