Curriculum Vitae

Javier Gómez Serrano

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Personal Data

Department of Mathematics
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Academic Background

5-year degree   February 2009
    Universidad Politécnica de Cataluña, Barcelona.
    Mathematics. Ranked 3rd in class.

5-year degree   October 2009
    Universidad Politécnica de Cataluña, Barcelona.
    Telecommunication. Ranked 1st in class. Ranked 3rd in Spain (36 universities).
    Final Degree Project done in collaboration with EPFL (Lausanne, Switzerland):
    Mean field dynamics of the bounded confidence model
    Grade: 6.0/6.0 (ECTS: A), 10.0/10.0 (Honors)
    Advisor: Prof. Jean-Yves Le Boudec.

Engineering   October 2009
    Centro de Formación Interdisciplinaria Superior (CFIS), Barcelona.
    Multidisciplinar Engineer.

Master   October 2010
    Universidad Autónoma de Madrid, Madrid.
    Mathematics. Ranked 1st in class.
    Master Thesis: *Boundary layer theory and Prandtl's equation*
    Grade: 10.0/10.0. Advisor: Prof. Diego Córdoba.

PhD   July 2013
    Universidad Autónoma de Madrid, Madrid.
    Mathematics. Best dissertation of the year award.
    Analytical and Computer-assisted proofs in incompressible fluids
    Advisor: Prof. Diego Córdoba.

Professional Interests

Partial Differential Equations in Fluid Mechanics, Computer-assisted proofs,
Spectral geometry, Analysis

Appointments

- Assistant Professor, Princeton University, 2016-currently.
- Instructor, Princeton University, 2013-2016.
- ERC Predoc, CSIC, Madrid, 2009-2013.
- Software Engineering Intern, Google Dublin, 2008.
- Becario de Penúltimo Curso, CSIC, Madrid, 2007.
- High School Teacher (Programming in C++), Aula Escola Europea, Barcelona, 2007.

Publications

Research papers

1. "Symmetry in stationary and uniformly-rotating solutions of active scalar equations" (with J. Park, J. Shi and Y. Yao), *arXiv preprint: 1908.01722*. Submitted.
2. "Convexity of cusped Whitham waves" (with A. Enciso and B. Vergara), *arXiv preprint:1810.10935*. Submitted.
3. "Computer-Assisted Proofs in PDE: a survey", *SeMA Journal*, 76, no. 3, 459-484 (2019).
4. "On the existence of stationary patches", *Advances in Mathematics*, 343, 110-140 (2019).
5. "Spectral determination of semi-regular polygons" (with A. Enciso), *arXiv preprint: 1709.05960*. Submitted.
6. "Global solutions for the generalized SQG patch equation" (with D. Córdoba & A. Ionescu), *Arch. Ration. Mech. Anal.*, 233, no. 3, 1211-1251 (2019).
7. "Uniformly rotating smooth solutions for the incompressible 2D Euler equations" (with A. Castro & D. Córdoba), *Arch. Ration. Mech. Anal.*, 231, no. 2, 719-785 (2019).
8. "Global smooth solutions for the inviscid SQG equation" (with A. Castro & D. Córdoba), *Memoirs of the AMS*. To appear. 2017.
9. "A note on stability shifting for the Muskat problem II: stable to unstable and back" (with D. Córdoba & A. Zlatoš), *Analysis & PDE*, 10, no. 2, 367-378 (2017).
10. "Uniformly rotating analytic global patch solutions for active scalars" (with A. Castro and D. Córdoba), *Annals of PDE*, 2, no. 1, 1-34 (2016).
11. "Splash singularities for the free boundary Navier-Stokes equations" (with A. Castro, D. Córdoba, C. Fefferman and F. Gancedo), *Annals of PDE*, 5, no. 1, Art. 12, 1-117 (2019).
12. "A note on stability shifting for the Muskat problem" (with D. Córdoba & A. Zlatoš), *Philosophical Transactions of the Royal Society A*, 373, 20140278 (2015).
13. "Existence and regularity of rotating global solutions for the generalized surface quasi-geostrophic equations" (with A. Castro & D. Córdoba), *Duke Mathematical Journal*, 165, no. 5, 935-984 (2016).
14. "Structural stability for the splash singularities of the water waves problem" (with A. Castro, D. Córdoba, C. Fefferman & F. Gancedo), *Discrete and Continuous Dynamical Systems - A*, 34, no. 12, 4997-5043 (2014).
15. "Remarks on the geometric properties of the SQG sharp fronts and α-patches" (with A. Castro, D. Córdoba & A. Martín Zamora), *Discrete and Continuous Dynamical Systems - A*, 34, no. 12, 5045-5059 (2014).
16. "On turning waves for the inhomogeneous Muskat problem: a computer-assisted proof" (with R. Granero-Belinchón), *Nonlinearity*, vol. 27, n. 6, 1471-1498, (2014). Featured article.
17. "Finite time singularities for water waves with surface tension" (with A. Castro, D. Córdoba, C. Fefferman & F. Gancedo), *Journal of Mathematical Physics*, 53, 115622 (2012). Special issue "Incompressible Fluids, Turbulence and Mixing".

18. "Finite time singularities for the free boundary incompressible Euler equations" (with A. Castro, D. Córdoba, C. Fefferman & F. Gancedo), *Annals of Mathematics*, 178, no. 3, 1061-1134 (2013).

19. "Splash Singularity for Water Waves" (with A. Castro, D. Córdoba, C. Fefferman & F. Gancedo), *Proceedings of the National Academy of Sciences (PNAS)* 109, num. 3, 733-738, (2012).

20. "The Bounded Confidence Model Of Opinion Dynamics" (with J.-Y. Le Boudec & C. Graham), *Mathematical Models and Methods in Applied Sciences (M3AS)* 22, num. 2, 1150007-1–1150007-46, (2012).

21. "Comment on Mixing Beliefs Among Interacting Agents" (with J.-Y. Le Boudec), *Advances in Complex Systems (ACS)* Vol. 15, No. 7, 1250028-1–1250028-7, (2012).

Other publications (educational)

1. "Combinatorial Games: Following John H. Conway (in Spanish)" (with L. Hernández-Corbato), in *Matemáticas para estimular el talento III*, pp. 223-245. Sociedad Andaluza de Educación Matemática THALES, Granada. Pérez, A.; Sánchez, M. (Eds.), ISBN: 978-84-15641-06-03, (2014).

2. "XXVII Olimpiada Iberoamericana de Matemáticas" (with M. Castrillón), *La Gaceta de la RSME.*, Vol. 15 (4), 772-775, (2012).

3. "XXVI Olimpiada Iberoamericana de Matemáticas" (with M. Castrillón), *La Gaceta de la RSME.*, Vol. 14 (4), 798-801, (2011).

Selected Prizes

- Antonio Valle Prize. Best Spanish Applied Mathematician under 33, 2018.
- FBBVA Vicent Caselles Prize. Best Spanish Mathematicians under 32, 2017.
- Junior Faculty Teaching Award, Princeton, 2015.
- Best PhD dissertation award in Mathematics in the year 2012-2013 at UAM, 2013.
- Third best Record Nationwide in Telecommunication Engineering (National Prize - 36 Universities), 2013.
- Certamen Universitario Arquímedes (Introduction to Research for Undergraduates), 2009. Science Category, 2nd Prize for the paper *The bounded confidence model in opinion dynamics*.
- International Mathematics Competition, 2nd Prize (2005), 3rd Prize (2006).
- Iberoamerican Mathematical Olympiad for University Students, Silver Medal (2004), Silver Medal (2007).
- Top 250 Worldwide at Google Code Jam 2005.
- ACM ICPC SouthWestern Europe Regional Contest, 7th Place (2004), 9th Place (2005), 4th Place (2006), 8th Place (2007), 3rd Place (2008).
- Participant at the International Mathematical Olympiad, (Tokio, Japan), 2003.
- Spanish National Olympiads:
    - Mathematics: Silver Medal (2002), Gold Medal (2003).
    - Physics: Bronze Medal (2003).
    - Chemistry: Bronze Medal (2002), Gold Medal (2003).
- Mediterranean Mathematics Competition, Honorable Mention (2002). Bronze Medal (2003).
- Olimpiada de Mayo (Iberoamerican level), Bronze Medal (2000).

Research Grants

- PI: ERC Starting Grant ERC-StG-CAPA-852741 (1,485,000 €), 2020-2025.
- PI: NSF Grant DMS-1763356 ($120,000), 2018-2021.
- PI: Simons Collaboration Grant ($42,000), 2017-2022.
- PI: AMS-Simons Travel Grant, 2014-2016.
- External Member of the grants ERC-StG-203138-CDSIF, MTM2008-03754, MTM2011-26696, MTM2014-59488-P, MTM2017-89976-P, SEV-2015-554 (PI: Diego Córdoba), and SEV-2011-0087 (PI: Manuel de León).

Students

- Joel Dahne, Uppsala. PhD (co-advised with Jordi-Lluis Figueras and Warwick Tucker). 2019-
- Jia Shi, Princeton. PhD (co-advised with Charles Fefferman).   2017-
- Gonzalo Cao. Princeton / UPC. Double degree thesis.   2019-2020
- Gerard Orriols. Princeton / UPC. Double degree thesis.   2018-2019
- Bruno Vergara. Princeton / ICMAT. Visiting Graduate Student.   Spring 2018, Spring 2019
- Joseph Obiajulu, Princeton. Senior thesis.   2016-2017
- Yuan Wang, Princeton. Senior thesis.   2016-2017

Invited Talks at Conferences and Workshops

- 13th AIMS Conference. Special Session
  Computer assisted proofs in nonlinear dynamics, Atlanta   June 2020
- **(Plenary Talk)** V Congress of Young Researchers RSME, Castellón, Spain   January 2020
- PDE's in fluid mechanics, CIEM, Castro Urdiales
  Minicourse 3 hours   September 2019
- Summer school on fluid mechanics at the ICMAT, Madrid
  Minicourse 3 hours   June 2019
- Scientific Computing Across Scales:
  Extreme events and criticality in fluid mechanics, Fields Institute   April 2019
- Workshop: Rigorous Computational Dynamics
  in Infinite Dimensions, CRM Montréal   April 2019
- AMS Spring Sectional Meeting. Special Session
  Stability and Singularity in Fluid Dynamics. University of Hawaii   March 2019
- 12th AIMS Conference. Special Session
  Nonlinear and nonlocal evolution PDEs, Taipei   July 2018
- **(Plenary Talk)** XVIII Spanish-French School
  Jacques-Louis Lions about Numerical Simulation
  in Physics and Engineering. Univ. Las Palmas de Gran Canaria   June 2018
- Workshop "MathFluids", University of Seville   June 2018
- AMS Spring Sectional Meeting. Special Session
  Nonlinear and Stochastic PDE and Applications. Northeastern University   April 2018
- FRG-PDE Meeting, Princeton University   October 2017
- 2017 Fall Program on Analysis of PDE, Fudan University   October 2017

- 2017 Mathematical Congress of the Americas. Special Session
  Incompressible Fluid Dynamics, Montréal   July 2017
- XXV Congreso de Ecuaciones Diferenciales y Aplicaciones (CEDYA).
  Special Session: Computational Dynamical Systems, Cartagena   June 2017
- AMS Spring Eastern Sectional Meeting. Special Session
  Hydrodynamic and Wave Turbulence, Hunter College, CUNY   May 2017
- AMS Spring Western Sectional Meeting. Special Session
  Analysis on the Navier-Stokes and related PDEs, Washington State University April 2017
- Semester Program on "Singularities and Waves In Incompressible Fluids"
  Dynamics of Small Scales in Fluids, ICERM   February 2017
- V Congreso Latinoamericano de Matemáticos. Thematic Session
  Fluid dynamics, non linear and dispersive PDEs, Barranquilla, Colombia   July 2016
- 11th AIMS Conference. Special Session
  Vortex Dynamics and Geometry, Orlando   July 2016
- Analysis of PDEs of Fluid Mechanics, Rice University   May 2016
- Thematic Program on Multiscale Scientific Computing
  Extreme events and criticality in fluid mechanics, Fields Institute   January 2016
- Second International ACCA-JP/UK Workshop, Kyoto   January 2016
- Clay Research Conference and Workshops
  Water Waves and Related Fluid Models, Oxford   October 2015
- ICIAM 2015. Parallel Session
  Extreme Behaviour in Flow Models, Beijing   August 2015
- AMS Spring Western Sectional Meeting
  Special Session on Waves and Fluids, Las Vegas   April 2015
- AMS Fall Western Sectional Meeting. Special Session
  Nonlinear PDE I, San Francisco   October 2014
- 10th AIMS Conference. Special Session
  Rigorous and Numerical Methods, Madrid   July 2014
- AMS Fall Central Sectional Meeting
  Special Session on Fluid Mechanics, St. Louis   October 2013
- Rigorous computation for infinite dimensional nonlinear dynamics
  AIM Workshop, Palo Alto   August 2013
- Congress of Young Researchers RSME, Soria, Spain   September 2011
- Workshop for Young Researchers in Mathematics 2010, Madrid   September 2010
- II Seminario sobre actividades para estimular
  el talento precoz en Matemáticas, Madrid   March 2009

Seminars and Colloquia

- Tulane University   October 2019
- Princeton University   September 2019
- University of Minnesota (2 talks)   February 2019
- Brown University   February 2019
- Georgia Tech   February 2019
- University of Toronto   January 2019
- Duke University   January 2019

- Brown University   November 2018
- Georgia Tech   February 2018
- UPenn   November 2017
- UIC   October 2017
- Uppsala University   June 2017
- Heriot-Watt University   April 2017
- University of Pittsburgh   January 2017
- Ohio State University   April 2016
- Columbia University   March 2016
- Brown University   November 2015
- UW Madison   November 2015
- Universidad de Sevilla   September 2015
- Princeton University   April 2014
- UPenn   February 2014
- Rutgers University   November 2013
- Universidad Autónoma de Madrid (Minicourse 3 hours)   April 2013
- Instituto de Ciencias Matemáticas   March 2013
- Instituto de Ciencias Matemáticas (Minicourse 6 hours)   February 2013
- Uppsala University   October 2012
- Universidad Autónoma de Madrid   April 2011
- CSIC (National Research Council, Madrid)   October 2009

Stays in research centers

- Instituto de Ciencias Matemáticas, 8 Weeks   June-July 2019
- Instituto de Ciencias Matemáticas, 12 Weeks   May-August 2018
- Instituto de Ciencias Matemáticas, 8 Weeks   June-August 2017
- Uppsala University, 1 Week   June 2017
- Instituto de Ciencias Matemáticas, 13 Weeks   June-August 2016
- Instituto de Ciencias Matemáticas, 15 Weeks   June-September 2015
- Instituto de Ciencias Matemáticas, 13 Weeks   June-August 2014
- Uppsala University, 1 Week   October 2012
- International Centre for Theoretical Physics, 3 Weeks   June 2011
- Princeton University, 1 Week   May 2011
- EPFL, 28 Weeks   February-August 2009

Teaching experience (University)

- *At Princeton University*
  - Math 215 (Honors Analysis)   Fall 2019
  - Math 330 (Complex Analysis with Applications)   Spring 2019
  - Math 215 (Honors Analysis)   Fall 2018

- Math 104 (Calculus II) - two sections, course head — Fall 2017
- Math 104 (Calculus II) - two sections, course head — Fall 2016
- Math 104 (Calculus II) - precepts — Spring 2016
- Math 981 (Junior Seminar: Computer-assisted proofs in analysis) — Spring 2016
- Math 202 (Linear Algebra) - precepts — Fall 2015
- Math 321 (Numerical Methods) — Fall 2015
- Math 204 (Advanced Linear Algebra) — Spring 2015
- Math 104 (Calculus II) - two sections — Fall 2014
- Math 202 (Linear Algebra) - two sections — Spring 2014
- Math 103 (Calculus I) — Fall 2013

- *At Universidad Autónoma de Madrid*
  - Mathematics I — Fall 2011

- *At Universitat Politècnica de Catalunya (Barcelona)*
  - Problem Workshop II — Spring 2006, Spring 2007, Spring 2008
  - Problem Workshop I — Fall 2005, Fall 2006, Fall 2007

Activities Organization, Outreach and Service

- Director of Graduate Studies, Princeton — 2016 - currently
- Organizer of the "What's Happening in Fine Hall" Seminar, Princeton — 2016 - currently
- Co-organizer of the Analysis of Fluids Seminar, Princeton — 2015 - currently
- Co-organizer of the Colloquium, Princeton — 2019
- Graduate Admissions Committee, Princeton — 2016/2017, 2017/2018, 2018/2019
- Organizer of a Parallel Session at the
  XII Americas Conference on Differential Equations and Nonlinear Analysis — December 2019
- Lecturer at the Smartick Mathematics and Technology Summer Camp for girls — July 2017
- Lecturer at the BarcelonaTech
  Math Summer Camp (UPC) — July 2015, 2016, 2017, 2018, 2019
- Lecturer at the JAE School of Mathematics (ICMAT, Madrid) — July 2013, 2019
- Selection Committee, interviewer and teacher of the ESTALMAT
  (Stimulus of the Mathematical Talent) Project — 2003 - 2013, 2018
- Deputy Leader of the Spanish delegation at the
  Iberoamerican Mathematical Olympiad — September 2011, 2012
- Evaluator at the Spanish Mathematical Olympiad — March 2010, 2011, 2012, 2013
- Problemsetter and Evaluator at the ACM ICPC -
  Southwestern Europe Regional Contest — October 2009, 2010, 2011
- Co-Organizer of the First Multidisciplinary Week (UAM, Madrid) — July 2010
- Deputy Leader of the Spanish delegation at the
  International Olympiad in Informatics — August 2007, 2009
- Problemsetter and Evaluator at the Spanish Olympiad in Informatics — June 2007
- Problem Selection Committee for the
  Assamblée générale de 'Le Kangourou sans frontières' — June 2006
- Trainer for the Spanish (and International) Math. Olympiad — 2004-2007
- PhD Defense Committee of Matt Hernandez (Princeton, 2017)
- Reader for the PhD Thesis of In-Jee Jeong (Princeton, 2017), Bruno Vergara (UAM, 2019), Joonhyun La (Princeton, 2019).

- Referee for: Advances in Mathematics, Annals of Mathematics, Annals of PDE, Archive for Rational Mechanics and Analysis, Bulletin of the LMS, Communications in Mathematical Physics, Communications in Mathematical Sciences, Communications on Pure and Applied Mathematics, Discrete and Continuous Dynamical Systems, Journal of the American Mathematical Society, Journal of the European Mathematical Society, Monatshefte für Mathematik, Nonlinear Analysis: TMA, Nonlinearity, RACSAM, Rendiconti del Circolo Matematico di Palermo, SIAM Journal on Applied Dynamical Systems, SIAM Journal on Mathematical Analysis.
- External Referee for the "Programme for Postdoctoral Talent Attraction" (UAM).
- NSF Panelist.

Languages

- Spanish: Mother tongue.
- English: Certificate in Advanced English obtained in 2009.
- German: Zentrale Mittelstufenprüfung obtained in 2003. German University Entrance Exams (Abitur) passed with a 1.8 grade in a scale between 1.0 (best) and 6.0 (worst).
- French: Intermediate.
- Catalan: Intermediate.