

Fabricio MACIÀ

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Personal

Place and date of birth: *Madrid, 11 August 1974*.

Personal address: *Madrid, Spain*.

Gender: *Male*.

Citizenship: *Spain*.

Education

Ph.D. Mathematics, Universidad Complutense Madrid, April 2002. Thesis Title: *Propagation and control of vibrations in discrete and continuous media*. Thesis Advisor: *Enrique Zuazua*.

M.Sc. Mathematics, Universidad Complutense Madrid, November 1999. Thesis Title: *Gaussian Beams and the stabilization, observation and control of waves*. Thesis Advisor: *Enrique Zuazua*.

B.Sc. Mathematics, Universidad Complutense Madrid, 1997.

Positions

2012-. Prof. Titular de Universidad at **Universidad Politécnica de Madrid**. Higher School of Naval Engineering.

2008-2012 . Prof. Ayudante Doctor at **Universidad Politécnica de Madrid**. Higher School of Naval Engineering.

2005-2008. *Juan de la Cierva* research fellow at **Universidad Complutense de Madrid**. Faculty of Mathematics.

2003-2005. Assistant Professor at **Universidad Complutense de Madrid**. Faculty of Mathematics.

2002-2003. Postdoctoral fellow at **École Normale Supérieure**. Département de Mathématiques et Applications.

2002. Postdoctoral fellow at **Università di Pisa**. Dipartimento di Matematica.

1998-2001. Predoctoral fellow at **Universidad Complutense de Madrid**. Faculty of Mathematics.

Other appointments

University of Tokyo, Tokyo. January-April 2017. Invited professor.

Northwestern University, Evanston. February-July 2016. Visiting Scholar.

Université Paris-Diderot, Paris. May 2015. Invited professor.

École Normale Supérieure, Paris. January 2015. Invited professor.

Université de Lille 1, Lille. October 2013. Invited professor.

Université de Paris-Est Creteil, Creteil. December 2012. Invited professor.

Université de Paris-Est Creteil, Creteil. September-December 2011. Invited professor.

PhD. Students

Current

Pablo Eleazar Merino-Alonso (2018-).

Former

Víctor Arnaiz (2015-2018).

Current research interests

Partial Differential Equations and Mathematical Physics; Semiclassical and Microlocal Analysis; Spectral Theory.

High-frequency dynamics of Schrödinger flows on Riemannian manifolds, Quantum Limits and Quantum Ergodicity.

Collective Responsibilities & Grants

I am currently the head of the research group *Mathematical Modeling, Analysis, Simulation In Engineering (M2ASAI)* and of the U.P.M. node of the Spanish Research group *Analysis, Geometry and applications to Inverse Problems (AGAPI)*.

I am the PI of the collaborative research project *Semiclassical Analysis, Control and Inverse Problems (MTM2017-41780)* from Ministerio de Economía y Competitividad (Spain).

Co-organization of Conferences, Seminars

Since 2017. AGAPI Days.

2018. Microlocal and Numerical Analysis, Kinetic Equations and Control Conference. Real Academia de Ciencias, Madrid, Feb. 28 - Mar. 2.

2014. Harmonic Analysis. Segovia, Jul. 1-5.

2006. Recent advances in nonlinear partial differential equations and applications. Toledo, Jun. 7-10.

Invited Lectures

1. Minicourses

September 2018 Max Planck Institute for Applied Mathematics, Leipzig. 6 hour at the Summer School *Inverse and Spectral Problems for (Non)-Local Operators*.

August 2018 Universidad Nacional Autónoma de Mexico. 10 hour course at the Mathematics Institute on *High-Frequency Analysis of Schrödinger equations*.

January 2017 University of Tokyo. 12 hour course at the Graduate School of Mathematical Sciences on *Semiclassical Measures and applications to Partial Differential Equations*.

May 2014. ICMAT and Universidad Autónoma de Madrid. 10 hour at the Doctoral School in Mathematical Research on *Microlocal Defect Measures*.

December 2013. University of Tokyo. 6 hour course at the Graduate School of Mathematics on *Schrödinger Equations on Tori: a two-microlocal approach*.

November 2011. Università di Roma *La Sapienza*. 20 hour course at the Doctoral School of the Mathematics Department on *Semiclassical Analysis*.

October 2010. Universidad Complutense de Madrid. 8 hour course at the thematic period *Sistemas Dinámicos y Geometría: tres aproximaciones* on *Classical KAM Theory*.

June 2009. Universidad Complutense de Madrid. 8 hour course at the thematic period *Sistemas Dinámicos y Geometría: tres aproximaciones* on *Semiclassical Analysis*.

2. Addresses in conferences (since 2008)

- June 2019. Journées équations aux dérivées partielles, Obernai, France.
- April 2019. Trends in PDE's and Related Fields, Sidi Bel Abbes, Algeria.
- June 2018. Analytic Study of Flows. Peyresq, France.
- September 2017. Mathematical Methods in Inverse Scattering and Spectral Theory, U. of Leeds, U.K.
- July 2017. Asymptotic Analysis of Evolution Equations, CIRM Luminy, France.
- May 2017. 2nd Bilbao Meeting on Analysis and PDEs, BCAM Bilbao, Spain.
- January 2017. Tokyo–Berkeley Mathematics Workshop Partial Differential Equations and Mathematical Physics, Tokyo, Japan.
- December 2016. Marrakesh Workshop On Control, Inverse Problems and Stabilization of Infinite dimensional Systems, Marrakesh, Morocco.
- December 2016. New trends in semiclassical analysis, Chalès, France.
- August 2016. XIIIème Colloque Franco-Roumain de Mathématiques Appliquées, Iasi, Romania.
- April 2016. 1120th American Mathematical Society Spring Central Sectional Meeting. Fargo, USA.
- August 2015. Semi-classical Analysis: Spectral Theory and Resonances. Vienna, Austria.
- October 2014. Spectral Theory and Its Applications. Bordeaux, France.
- July 2014. Arts in Mathematics, Mathematics in Arts. El Escorial, Spain.
- May 2014. Journées du groupe ANR GERASIC. Orléans, France.
- December 2013. Spectral and Scattering theory and related topics. Kyoto, Japan.
- September 2013. II Congreso de Jóvenes Investigadores de la Real Sociedad Matemática Española. Sevilla, Spain.
- September 2013. Spectral Geometry, Chaos and Dynamics. Loughborough, U.K..
- June 2013. Quantum chaos, resonances and semi-classical measures. Roscoff, France.
- January 2013. 4th Itinearnt Workshop on PDE's. Rome, Italy.
- November 2012. Geometric structures in P.D.E.. Madrid, Spain.

- June 2012. Ondes Chaotiques. Chaos and Waves. Peyresq, France.
- February 2012. 4th Meeting of the GDR Quantum Dynamics. Toulouse, France.
- October 2011. Microlocal Methods in Spectral and Scattering Theory. Evanston, IL, U.S.A.
- August 2011. Equadiff 2011. Loughborough, U.K.
- September 2010. 4th Workshop on Quantum Chaos and Applications. Castro Urdiales, Spain.
- December 2009. Méthodes Spectrales en chaos quantique et classique. Paris, France.
- July 2009. 7th ISAAC Congress. London, U.K.
- October 2008. Dynamic Days 2008. El Escorial, Spain.

3. Department seminars (since 2008)

- February 2018. Geometric Analysis and PDE seminar. Cambridge University. Cambridge, U.K..
- March 2017. Analysis Seminar. Osaka University, Osaka, Japan.
- February 2017. Analysis Seminar. Saitama University, Saitama, Japan.
- Abril 2016. Probability Seminar. Northwestern University, Chicago, USA.
- February 2016. Analysis Seminar. Northwestern University, Chicago, USA.
- May 2015. Trimestre Problèmes Inverses. Institut Henri Poincaré, France.
- May 2015. Séminaire Analyse non-linéaire et EDP. Institut Henri Poincaré, France.
- March 2015. Departamento de Matemáticas. Universidad Autónoma de Madrid, Spain.
- January 2015. Séminaire EDP. Institut de Mathématiques et de Modélisation de Montpellier, Universidad de Montpellier, Francia.
- February 2014. London Analysis Seminar, Imperial College, U.K.
- December 2013. Graduate School of Mathematics, University of Tokyo, Japan.
- November 2013. Pizza Seminar on PDE and Fluid Mechanics, ICMAT, Spain.
- November 2013. Analysis/PDE Seminar, University of North Carolina, U.S.A.
- October 2013. Physique Mathématique, Université de Lille, France.

February 2013. Partial Differential Equations Seminar, Oxford University.

January 2013. Seminario de Análisis y Aplicaciones, Universidad del País Vasco.

November 2012. Problèmes Spectraux en Physique Mathématique, Institut Henri Poincaré, Paris, France.

December 2011. Physique Mathématique, Université de Lille, France.

December 2011. Analyse, Laboratoire de Mathématiques Jean Leray, Nantes, France.

November 2011. Analisi Matematica, Università di Roma 1 *La Sapienza*.

November 2011. Mathematical Physics, University of Bristol.

September 2011. Analyse non Lineaire et E.D.P., École Normale Supérieure, U. Paris 6-7.

April 2011. Geometría y Física. ICMAT, Madrid.

March 2011. Groupe de travail E.D.P., Institut Mathématique de Bordeaux.

January 2011. Analysis Seminar, McGill University, Montreal.

January 2011. Colegio de España, Paris.

December 2010. Equations aux Derivees Partielles, Université de Paris-Est Creteil.

November 2010. Analyse et Applications, Université d'Evry, France.

October 2010. Physique Mathématique et E.D.P., Université Paris XIII.

June 2010. Seminario de Análisis y Aplicaciones, Universidad del País Vasco.

November 2009. Séminaire EDP et AN, Université de Paris-Sud.

October 2009. Seminario de análisis, UAM, Madrid.

October 2009. Séminaire Problèmes Spectraux en Physique Mathématique, IHP, Paris.

April 2009. Analysis seminar, University of Texas at Austin.

April 2009. Working Dynamical Systems seminar, University of Texas at Austin.

March 2009. Seminario de Analisis Infinito-dimensional, UCM, Madrid.

May 2008. Seminario de análisis matemático y aplicaciones, Universidad del País Vasco.

May 2008. Geometría y Física, UCM, Madrid.

March 2008. Seminario de matemática aplicada, CSIC, Madrid.

January 2008. Seminario di Fisica Matematica, Università di Roma, La Sapienza.

Publications

1. Dynamics of Schrödinger flows and Quantum limits

1. V. Arnaiz, F. Macià. Concentration of quasimodes for perturbed harmonic oscillators. Preprint (2018).
2. V. Chabu, C. Fermanian-Kammerer, and F. Macià. Wigner measures and effective mass theorems. arXiv:1803.07319, 49 pp. (2018).
3. F. Macià and G. Rivière. Observability and quantum limits for the Schrödinger equation on the sphere. arXiv:1702.02066, 15 pp. (2017).
4. V. Chabu, C. Fermanian-Kammerer, and F. Macià. Semiclassical analysis of dispersion phenomena. *Analysis and Partial Differential Equations: Perspectives from Developing Countries*, Springer Proceedings in Mathematics & Statistics **275**, (2018).
5. F. Macià, G. Rivière. Two-microlocal regularity of quasimodes on the torus, *Analysis & PDE* **11**(8) (2018), 2111–2136.
6. N. Anantharaman, M. Léautaud and F. Macià. Wigner measures and observability for the Schrödinger equation on the disk, *Inventiones Mathematicae* **206**(2) (2016), 485–599.
7. N. Anantharaman, M. Léautaud and F. Macià. Delocalization of quasimodes on the disk, *Comptes Rendus Mathématique*, **354**(3) (2016), 257–263.
8. F. Macià, G. Rivière. Concentration and non-concentration for the Schrödinger evolution on Zoll manifolds, *Communications in Mathematical Physics*, **345**(3) (2016), 1019–1054.
9. F. Macià. High-frequency dynamics for the Schrödinger equation, with applications to dispersion and observability. *Nonlinear Optical and Atomic Systems*. Lecture Notes in Mathematics, **2146** (2015), 275–335.
10. N. Anantharaman, C. Fermanian-Kammerer, and F. Macià. Semiclassical Completely Integrable Systems : Long-Time Dynamics And Observability Via Two-Microlocal Wigner Measures, *American Journal of Mathematics*. **137**(3) (2015), 577–638.

11. F. Macià. A semiclassical measure approach to the Aharonov-Bohm effect. *RIMS Kôkyûroku* **1902** (2014), 53–60.
12. N. Anantharaman and F. Macià. Semiclassical measures for the Schrödinger equation on the torus. *Journal of the European Mathematical Society*, **16**(6) (2014), 1253–1288.
13. T. Aïssiou, D. Jakobson and F. Macià. Uniform estimates for the Schrödinger equation on the torus and regularity of semiclassical measures, *Mathematical Research Letters* **19**(3) (2012), 589–599.
14. N. Anantharaman and F. Macià. The dynamics of the Schrödinger flow from the point of view of semiclassical measures. *Spectral Geometry*, Proc. Sympos. Pure Math. Vol. **84**, Amer. Math. Soc., Providence, RI, 2012, 93–116.
15. F. Macià. The Schrödinger flow in a compact manifold: High-frequency dynamics and dispersion, *Modern Aspects of the Theory of Partial Differential Equations*, Operator Theory: Advances and Applications, Vol. **216**, Springer, Basel, 2011, 275–289.
16. D. Azagra and F. Macià. Concentration of symmetric eigenfunctions, *Nonlinear Analysis*, **73**(3) (2010), 683–688.
17. F. Macià. High frequency analysis for the Schrödinger equation on the torus, *Journal of Functional Analysis* **258** (2010), 933–955.
18. F. Macià. Semiclassical measures and the Schrödinger flow on Riemannian manifolds, *Nonlinearity* **22** (2009), 1003–1020.
19. F. Macià. Some remarks on quantum limits on Zoll manifolds, *Communications in Partial Differential Equations*, **33**(6) (2008), 1137–1146.

2. Miscellaneous P.D.E.

1. C. Escudero, F. Macià, R. Toral and J.J.L. Velázquez. Kinetic theory and numerical simulations of two-species coagulation, *Kinetic Theory and Related Models* **7**(2) (2014), 253–290.
2. C. Escudero, F. Macià and J.L.L. Velázquez. Two-species-coagulation approach to consensus by group level interactions, *Physical Review E (3)* **82** (2010), no. 1, 016113, 6 pp

3. D. Azagra, M. Jiménez-Sevilla and F. Macià. Generalized motion of level sets by functions of their curvatures on Riemannian manifolds, *Calculus of Variations and Partial Differential Equations* **33**(2) (2008), 133–167.
4. F. Macià. Wigner measures in the discrete setting: high-frequency analysis of sampling and reconstruction operators, *SIAM Journal on Mathematical Analysis*, **36**(2) (2004), 347–383.
5. G. Buttazzo, A. Davini, I. Fragalà and F. Macià. Optimal Riemannian distances preventing mass transfer, *Journal für die reine und angewandte Mathematik*, **575** (2004), 157–171.
6. F. Macià. The effect of group velocity in the numerical analysis of control problems for the wave equation, *Mathematical and numerical aspects of wave propagation WAVES 2003* (Jyväskylä, 2003). Springer-Verlag, Berlin, 2003, 195–200.
7. F. Macià. High frequency wave propagation in discrete media, *Homogenization 2001*. (Naples, 2001), GAKUTO International Series. Mathematical Sciences and Applications **18**, Gakkōtoshō, Tokyo, 2003, 263–268.
8. F. Macià and E. Zuazua. On the lack of observability for wave equations: a gaussian beam approach, *Asymptotic Analysis* **32**(1) (2002), 1–26.
9. F. Macià and E. Zuazua. Some applications of Gaussian beams to the controllability of waves, *Mathematical and numerical aspects of wave propagation* (Santiago de Compostela, 2000), SIAM, Philadelphia, 2000, 1011–1015.

3. Computational Fluid Mechanics

1. A. Souto-Iglesias, F. Macià, L.M. González, and J.L. Cercós. Addendum to “On the consistency of MPS”, *Computer Physics Communications*, **185**(2) (2014), 595–598.
2. A. Souto-Iglesias, F. Macià, L.M. González, and J.L. Cercós. On the consistency of MPS. *Computer Physics Communications*, **184**(3) 732–745 (2013).
3. F. Macià, L.M. González, J.L. Cercós, and A. Souto-Iglesias. A boundary integral SPH formulation: consistency and applications to ISPH and WCSPH. *Progress in Theoretical Physics*, **128**(3) 439–462 (2012).
4. F. Macià, J.M. Sánchez, A. Souto-Iglesias and L.M. González. WCSPH viscosity diffusion processes in vortex flows. *International Journal for Numerical Methods in Fluids*, **69**(3) 531–543 (2012).

5. F. Macià, M. Antuono, A.Colagrossi, and L.M. González. Theoretical analysis of the no-slip boundary condition enforcement in SPH methods. *Progress in Theoretical Physics*, **125**(6), 1091–1121 (2011).

Teaching Activity

I started my teaching activity on the academic year 2003-4. Since then, I have taught courses on Numerical Methods (undergraduate), Differential Equations (graduate) and Stochastic Processes (Doctoral school), Semiclassical analysis (Doctoral school), and Dynamical Systems (Doctoral school) at the Faculty of Mathematics at Universidad Complutense de Madrid, as well as several undergraduate and graduate courses on Linear Algebra, Calculus, Advanced Numerical Methods, Signal Theory at the Higher School of Naval Engineering at Universidad Politécnica de Madrid.

During the academic year 2010-11 I have hold a visiting professor position at Université Paris XII with teaching duties. I have also taught Ph.D. courses on Semiclassical Methods at Universita Roma I *La Sapienza*, at Tokyo University and at the Mathematical Sciences Institute of Madrid (ICMAT).