

# Juan Margalef Bentabol

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## Current position

2014–2018 **La Caixa Fellowship for Ph.D. students 2014–2018 at UC3M-CSIC.**  
**1st candidate among more than 600 applications for the most prestigious fellowship.**

*Supervisors: J.F. Barbero (IEM-CSIC) and E.J.S. Villaseñor (UC3M)*

*Thesis: Towards general relativity through parametrized theories*

## Education

Second national prize of Spain in Mathematics 2010/2011.

Accomplishment in 7 years of a 5-years-B.A. in Mathematics, a 5-years-B.A. in Physics and a M.A. in Mathematical research.

2017 **Research stay**

*Institute for quantum gravity (FAU Erlangen) - 3 months with Dr. Hanno Sahlmann.*

2016 **Research stay**

*TU Wien - 3 months with Dr. Martin Bauer.*

2011–2012 **M.A. in Mathematical research**

*UCM - Specialization in geometry and topology. Overall mark 9.61/10.*

2006–2011 **Degree in Mathematics**

*UCM - Specialization in fundamental Mathematics. Overall mark 9.38/10 (second best of Spain).*

2008–2013 **Degree in Physics**

*UCM - Specialization in fundamental Physics. Overall mark 8.82/10 (top 5%).*

2012–2013 **Erasmus program**

*ULB. Overall Mark: A rate (top 5%) with 16.94/20.*

2009–2010 **Sicue program (with a Séneca grant)**

*UB. Overall Mark 9.74/10 (best of Barcelona).*

## Published papers

- [1] **On the distribution of the eigenvalues of the area operator in loop quantum gravity**  
*J. Fernando Barbero, Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*Classical and Quantum Gravity* 35 (2018) 065008 [[arXiv:1712.06918](https://arxiv.org/abs/1712.06918)]

- [2] **Boundary Hilbert spaces and trace operators**  
*J. Fernando G. Barbero, Benito A. Juárez-Aubry, Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*Classical and Quantum Gravity* 34 (2017) 095005 [[arXiv:1701.00735](#)]
- [3] **Functional evolution of scalar fields in bounded one-dimensional regions**  
*J. Fernando G. Barbero, Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*Classical and Quantum Gravity* 34 (2017) 065004 [[arXiv:1611.09603](#)]
- [4] **Hamiltonian dynamics of the parametrized electromagnetic field**  
*J. Fernando Barbero, Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*Classical and Quantum Gravity* 33 (2016) 125030 [[arXiv:1511.00826](#)]
- [5] **Hamiltonian description of the parametrized scalar field in bounded spatial regions**  
*J. Fernando Barbero, Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*Classical and Quantum Gravity* 33 (2016) 105002 [[arXiv:1507.05438](#)]
- [6] **Realization problems for limit cycles of planar polynomial vector fields**  
*Juan Margalef-Bentabol, Daniel Peralta-Salas,*  
*Journal of Differential Equations* 260 (2015) 4 [[arXiv:1507.00698](#)]
- [7] **Quantization of scalar fields coupled to point-masses**  
*J. Fernando Barbero, Benito A. Juárez-Aubry, Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*Classical and Quantum Gravity* 32 (2015) 245009 [[arXiv:1501.05114](#)]
- [8] **Topology of the Misner Space and its g-boundary**  
*Juan Margalef-Bentabol, Eduardo J.S. Villaseñor,*  
*General Relativity and Gravitation* 46 (2014) 1755 [[arXiv:1406.4552](#)]
- [9] **Evolution of the Cosmological Horizons in a Universe with Countably Infinitely Many State Equations**  
*Berta Margalef-Bentabol, Juan Margalef-Bentabol, Jordi Cepa,*  
*Journal of Cosmology and Astroparticle Physics* 02 (2013) 015 [[arXiv:1302.2186](#)]
- [10] **Evolution of the Cosmological Horizons in a Concordance Universe**  
*Berta Margalef-Bentabol, Juan Margalef-Bentabol, Jordi Cepa,*  
*Journal of Cosmology and Astroparticle Physics* 12 (2012) 035 [[arXiv:1302.1609](#)]
- [11] **Contractions of low-dimensional nilpotent Jordan algebras**  
*J. M. Ancochea Bermudez, J. Fresan, Juan Margalef-Bentabol,*  
*Communications in Algebra* 39 (2011) 1139-1151 [[arXiv:0805.3758](#)]
- [12] **Sur la réductibilité des variétés des lois d'algèbres de Leibniz complexes**  
*J.M. Ancochea-Bermúdez, J. Margalef-Bentabol,*  
*Journal of Lie Theory*, 17 (2007) 617–624 [[arXiv: 1508.00253](#)]

## Honors and awards

Total amount awarded in prizes, awards and grants: **190 650€**.

2018 Second prize at the Thesis Talk contest of the UC3M (600€)

2016-2018 Full fellowship to live at the *Residencia de Estudiantes* (worth 33600€) among hundreds of candidates.

2017 Travel grant from UC3M (3000€).

2016 Travel grant from the TU Wien (3000€).

- 2014 First position in the area of science at the prestigious Ph.D. fellowship of “La Caixa” foundation (duration of 4 years, 113500€) among more than 600 candidates.
- 2014 Second national prize of Spain of the 2010/2011 class. Awarded by the Spanish ministry of education (2650€) to the best three students of mathematics in the Spain.
- 2012 Best scientific report of the CSIC (Spanish Research Council) in 2012 for the work *Horizons and null submanifolds in General Relativity* under the supervision of Dr. Fernando Barbero (3000€).
- 2011 First prize at the *X Certamen universitario Arquímedes* (most important research contest for undergraduate students organized by the Spanish ministry of education) with the work *Inverse Problems of limit cycles in planar polynomial systems* (9000€).
- 2011 Awarded at the *X Certamen Universitario Arquímedes* with a stay of two weeks in a center of CSIC.
- 2010 Awarded with a *JAE Intro* grant at the CSIC for the introduction to the scientific research under the supervision of Dr. Daniel Peralta Salas, of the ICMAT-CSIC (1500€).
- 2010 Grant of excellence awarded by the government of Madrid (5000€).
- 2007 First prize at the *XX Certamen Jóvenes Investigadores* (most important research contest for bachelor students organized by the Spanish Ministry of Education) with the work *Reducibility of the complex Leibniz algebras* (4500€).
- 2006 Grant of excellence awarded by the government of Madrid (5000€).
- 2006 Honorary Mention at the 38th International Chemistry Olympiad (Gyeongsan - South Korea).
- 2006 Bronze medal at the 11th Ibero-american Chemistry Olympiad (Aveiro - Portugal).
- 2006 Gold medal at the 19th National Chemistry Olympiad (Vigo - Spain, 750€).
- 2006 Silver Medal at the 17th National Physics Olympiad (Teruel - Spain).
- 2006 Gold Medal at the Local Chemistry Olympiad (Madrid - Spain, 330€).
- 2006 Gold Medal at the Local Physics Olympiad (Madrid - Spain, 220€).

## Teaching experience

- Supervisor of the final degree project of Carlos Blasco Navarro entitled *Can we hear the shape of a drum?*
- Assistant professor of Linear Algebra at the computer science grade of UC3M (2017). Overall mark given by the students on the quality surveys: 4.05/5 (university award).
- Assistant professor of calculus problems at the computer science grade of UC3M (2016). Overall mark given by the students on the quality surveys: 4.67/5 (university award).
- Assistant professor of calculus problems at the computer science grade of UC3M (2016). Overall mark given by the students on the quality surveys: 3.15/5.
- Assistant professor of linear algebra problems at the computer science grade of UC3M (2015). Overall mark given by the students on the quality surveys: 4.81/5 (university award).
- Granted with a complete fellowship to attend the course “The use of ICT on 21st century Higher Education” at UIMP (2016).
- Course for developing teaching skills at UC3M (2015 and 2016).

- Teacher of the students participating in the local, national and international chemistry Olympiads of 2007 and 2008.

## Contributions to conferences

- 2018 **Let's play with partitions! The distribution of the eigenvalues of the area operator**  
15th Marcel Grossmann Meeting, (Università degli Studi di Roma, La Sapienza).
- 2018 **Geometry, constraints, and boundaries. It takes three to tango.**  
First BYMAT Conference, (ICMAT).
- 2018 **Understanding the geometry of the Misner spacetime through topology**  
12th International young researchers workshop on GMC, (UNIPD).
- 2017 **Topology and general relativity, it takes two to tango**  
VI Postgraduate meeting on theoretical physics, (UV).
- 2017 **Why parametrize field theories?**  
IX Jornadas CPAN, (CPAN).
- 2017 **On the realization of limit cycles in planar polynomial systems**  
XXV CEDYA, (UPCT).
- 2017 **Geometry, constraints, and boundaries. It takes three to tango.**  
Quantum gravity seminar, (FAU Erlangen-Nürnberg).
- 2017 **About non standard boundary conditions**  
Quantum gravity seminar, (FAU Erlangen-Nürnberg).
- 2017 **When continuous meets discrete: quantization of field systems with point-masses**  
V Iberoamerican meeting on GMC, (ULL).
- 2016 **Playing with the Misner space and the topology**  
De Madrid al Cosmos, (IEM-CSIC).
- 2016 **On the realization of limit cycles in planar polynomial systems**  
Nonlinear integrable systems, (UBU).
- 2016 **Parametrized theories, making EM even "gaugier"**  
21st Int. conference on general relativity and gravitation, (University of Columbia).
- 2016 **Parametrized theories, making EM even "gaugier"**  
Vienna relativity seminar, (UWien).
- 2016 **Misner space as a (toy) counterexample to almost anything**  
GAP seminar, (UWien).
- 2016 **Parametrized theories, making EM even "gaugier"**  
Geometry TUWien seminar, (TU Wien).
- 2016 **The space of embeddings within the Hamiltonian formulation of the electromagnetism**  
XVIII Winter meeting on GMC, (UZ).
- 2016 **Hamiltonian dynamics of the parametrized electromagnetic field**  
10th International young researcher workshop on GMC, (HIP-Paris).
- 2015 **Embeddings as variables in the Hamiltonian formulation of a field theory**  
ULL mathematical seminar, (ULL).
- 2015 **Parametrized field theories in bounded regions**  
Spanish relativity meeting, (UIB).
- 2015 **Hamiltonian dynamics of the parametrized scalar field with boundaries**  
XXIV International fall workshop in geometry and physics, (CUD-UZ).

- 2014 **Quantization of field theories coupled to point-masses**  
IFF-CSIC seminar, (CSIC).
- 2014 **From classical mechanics to quantum mechanics**  
PhD student seminar UCM, (UCM).
- 2014 **Understanding some pathologies in general relativity through topology**  
III Spanish young topologists meeting, (USC).
- 2014 **Quantization of field theories coupled to point-masses**  
Mathematical-Physics seminar, (University of Nottingham).
- 2014 **Topology of the Misner space and its g-boundary**  
Spanish relativity meeting, (UV).
- 2013 **Introduction to catastrophe theory**  
II Spanish young topologists meeting, (UB).
- 2013 **Are there really 17 ways of making a tessellation of the plane?**  
Seminar of algebra, (US).
- 2013 **Sur la classification topologique des pavages**  
Mathématiques à table, (ULB).
- 2012 **Inverse problems of limit cycles in planar polynomial systems**  
I Spanish meeting of young topologists, (US).
- 2012 **Rational homotopy theory and minimal models**  
Workshop of young researchers in mathematics, (UCM).

## Outreach activities

- 2018 **Las fronteras de la física**  
Thesis talk 2017-2018, (UC3M).
- 2018 **Questions and catastrophes**  
International final FameLab 2018, (FameLab).
- 2018 **Are numbers so natural?**  
International semifinal FameLab 2018, (FameLab).
- 2018 **Preguntas y catástrofes**  
Final FameLab-Spain, (FECYT).
- 2018 **¿Son los números tan naturales?**  
Semifinal FameLab-Spain, (FECYT).
- 2018 **Grafos, ¡hasta en la pizza!**  
T3chFest, (UC3M).
- 2018 **¿Qué pinta la topología en la Alhambra?**  
Seminario Junior IGM, (UC3M).
- 2017 **Contando con clips llegamos a... ¡los grafos!**  
XVI Semana de la ciencia, (UC3M).
- 2017 **Contando con clips llegamos a... ¡los grafos!**  
XVI Semana de la ciencia, (IEM-CSIC).
- 2017 **Can boundaries and Hamiltonians get along?**  
Classical and quantum gravity blog, (CQG+).
- 2017 **Clips y números naturales**  
La Aventura del Saber, (RTVE).

- 2016 **¿Sabía Escher Topología?**  
Un fisquito de matemáticas, (ULL).
- 2016 **La Alhambra, Escher y 17, el número mágico**  
XVI Semana de la ciencia, (UC3M).
- 2016 **La Alhambra, Escher y 17, el número mágico**  
XVI Semana de la ciencia, (IEM-CSIC).
- 2016 **Poquito a poco me voy cuantizando**  
Seminario Junior IGM, (UC3M).
- 2016 **¡Se oyen, se sienten, las ondas gravitatorias están presentes!**  
Seminario Junior IGM, (UC3M).
- 2015 **¡Menuda catástrofe!**  
Seminario Junior IGM, (UC3M).
- 2015 **La Alhambra, Escher y 17 ¡el número mágico!**  
XV Semana de la ciencia, (IEM-CSIC).
- 2015 **Classical vs Quantum: Two views of the world**  
International Loop Quantum Gravity Seminar, (LSU).

## Conference organization

- 2018 Trivulgando: investigación, sociedad y divulgación (Residencia de Estudiantes).
- 2017 Challenges in nonlinear systems: a meeting to celebrate the 60th birthday of prof. L.L. Bonilla (UC3M).
- 2016 Organizer of the 25th international fall workshop on geometry and physics (IEM-CSIC).
- 2015-2017 Organizer of the junior seminar of the Gregorio Millán Barbany (UC3M).
- 2015 Organizer of the 4th Spanish Young Topologist Meeting (UCM).
- 2015 Organizer of the 1st encounter of *The Invisible Faculty* (Madrid).
- 2013 Volunteer of the 10th *AIMS conference on dynamical systems differential equations and applications* (ICMAT).
- 2008 Volunteer of the 49th International Mathematical Olympiad (Madrid).
- 2008 Collaborator in the organization of the 21st National Chemistry Olympiad (Castellón).
- 2007 Coorganizer of the 20th National Chemistry Olympiad (Córdoba).

## Professional activities

Referee/Reviewer: AMS, General relativity and gravitation.

## Courses attended

- 2018 Summer school on current topics in mathematical physics (one week long).
- 2014 Summer doctoral school held at the IMPA in Río de Janeiro (two months long).
- 2014 8th ICMAT International Summer School on Geometry, Mechanics and Control hold in Madrid (two weeks long).

2010 Summer school JAE Intro of introduction to research in Madrid at the ICMAT-CSIC (two months long).

## Languages

Spanish	Native	
Catalonian	Native	
English	C2	<i>Nivel C1.2 by the Escola d'Idiomes Moderns of the UB (2013).</i>
Portuguese	C2	<i>2 stays of four months in Brazil.</i>
French	C2	<i>Certificate of the section de langues et littératures of the ULB. Stay for a year at Brussels (Belgium) with the Erasmus program.</i>
Italian	B1	
German	A2	<i>1 stay of three months in Vienna (Austria). 1 stay of three months in Erlangen (Germany).</i>

## Programming languages

Imperative	Pascal	<i>High</i>
	C++	<i>Intermediate</i>
	Python	<i>Intermediate-Low</i>
Functional	Haskell	<i>Intermediate</i>
Logical	Prolog	<i>Intermediate-Low</i>
Symbolic calculus	Mathematica	<i>High</i>
	Maple	<i>Intermediate-Low</i>
Numerical Calculus	Matlab/Octave	<i>Very high</i>
Edition	L <sup>A</sup> T <sub>E</sub> X <sub>2</sub> $\epsilon$	<i>High</i>
	T <sub>E</sub> X	<i>Intermediate</i>
Web	HTML/CSS/JS/PHP	<i>Intermediate-high</i>

Webs I have hacked from templates:

- <http://juanmargalef.com>
- <http://trivulgando.es>
- <http://scala.uc3m.es/ftsm>
- <http://scala.uc3m.es/seminariojunior>
- <http://lafacultadinvisible.com>