

# Asier López-Gordón

PREDOCTORAL RESEARCHER

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## Education

### Autonomous University of Madrid

*Madrid, Spain*

#### PHD MATHEMATICS

*2021 -*

- PhD thesis: The geometry of dissipation
- Advisor: Manuel de León

### Autonomous University of Madrid

*Madrid, Spain*

#### MSc THEORETICAL PHYSICS

*2020 - 2021*

- MSc thesis: The geometry of Rayleigh dissipation (arXiv:[2107.03780](https://arxiv.org/abs/2107.03780))
- Advisor: Manuel de León

### Complutense University of Madrid

*Madrid, Spain*

#### BSc PHYSICS

*2016 - 2020*

- BSc thesis: Integrability, chaos and entanglement in quantum systems
- Advisors: Federico Finkel and Artemio González-López

## Professional Experience

2021-

**Predoctoral researcher**, Institute of Mathematical Sciences (ICMAT), Spanish National Research Council (CSIC), Madrid, Spain

2020-2021

**“JAE Intro” research grantee**, Institute of Mathematical Sciences (ICMAT), Spanish National Research Council (CSIC), Madrid, Spain

## Research stays

February-  
May 2023

**Department of Mathematical Methods in Physics (KMMF), University of Warsaw, Poland**, collaborated with Professor Javier de Lucas and Bartosz M. Zawora

## Research Publications

### JOURNAL ARTICLES

M. de León, M. Lainz, A. López-Gordón and J. C. Marrero, “A new perspective on nonholonomic brackets and Hamilton-Jacobi theory”, *J. Geom. Phys.* (Jan. 2024), doi: [10.1016/j.geomphys.2024.105116](https://doi.org/10.1016/j.geomphys.2024.105116).

J. Gaset, A. López-Gordón and X. Rivas, “Symmetries, conservation and dissipation in time-dependent contact systems”, *Fortschr. Phys.* **71** (8-9), 2300048 (May 2023), doi: [10.1002/prop.202300048](https://doi.org/10.1002/prop.202300048) (Open Access).

M. de León, M. Lainz, A. López-Gordón and X. Rivas, “Hamilton-Jacobi theory and integrability for autonomous and non-autonomous contact systems”, *J. Geom. Phys.* **187** (Feb. 2023), doi: [10.1016/j.geomphys.2023.104787](https://doi.org/10.1016/j.geomphys.2023.104787) (Open Access).

L. Colombo, M. de León and A. López-Gordón, “Contact Lagrangian systems subject to impulsive constraints”, *J. Phys. A: Math. Theor.* **55**(42) (Oct. 2022), doi: [10.1088/1751-8121/ac96de](https://doi.org/10.1088/1751-8121/ac96de).

M. de León, M. Lainz and A. López-Gordón, “Discrete Hamilton–Jacobi theory for systems with external forces”, *J. Phys. A: Math. Theor.* **55**(20) (Mar. 2022), doi: [10.1088/1751-8121/ac6240](https://doi.org/10.1088/1751-8121/ac6240).

M. de León, M. Lainz and A. López-Gordón, “Geometric Hamilton–Jacobi theory for systems with external forces”, *J. Math. Phys.* **63**(2): 022901 (Feb. 2022), doi: [10.1063/5.0073214](https://doi.org/10.1063/5.0073214) (Open Access).

M. de León, M. Lainz and A. López-Gordón, “Symmetries, constants of the motion, and reduction of mechanical systems with external forces”, *J. Math. Phys.* **62**(4): 042901 (Apr. 2021), doi: [10.1063/5.0045073](https://doi.org/10.1063/5.0045073).

## CONFERENCE PAPERS

M. de León, M. Lainz, A. López-Gordón and J. C. Marrero, “Nonholonomic brackets: Eden revisited”, *Geometric Science of Information. GSI 2023. Lecture Notes in Computer Science*, vol. 14072. Springer, Cham, doi: [10.1007/978-3-031-38299-4\\_12](https://doi.org/10.1007/978-3-031-38299-4_12).

A. A. Simoes, A. López-Gordón, A. Bloch and L. Colombo, “Discrete Mechanics and Optimal Control for a Passive Walker Experiencing Foot Slip”, 2023 American Control Conference (ACC), pp. 4587-4592 (July 2023), doi: [10.23919/ACC55779.2023.10156020](https://doi.org/10.23919/ACC55779.2023.10156020).

A. López-Gordón, L. Colombo and M. de León, “Nonsmooth Herglotz principle”, 2023 American Control Conference (ACC), pp. 3376-3381 (July 2023), doi: [10.23919/ACC55779.2023.10156228](https://doi.org/10.23919/ACC55779.2023.10156228).

M. E. E. Irazú, A. López-Gordón, L. J. Colombo and M. de León, “Hybrid Routhian reduction for simple hybrid forced Lagrangian systems”, 2022 European Control Conference (ECC), pp. 345-350 (July 2022), doi: [10.23919/ECC55457.2022.9838077](https://doi.org/10.23919/ECC55457.2022.9838077).

## PREPRINTS

A. López-Gordón and L. J. Colombo, “On the integrability of hybrid Hamiltonian systems” (December 2023), [arXiv:2312.12152](https://arxiv.org/abs/2312.12152) [math-ph].

L. Colombo, M. de León, M. Lainz and A. López-Gordón, “Liouville-Arnold theorem for contact Hamiltonian systems” (Feb. 2023), [arXiv:2302.12061](https://arxiv.org/abs/2302.12061) [math.SG].

L. Colombo, M. de León, M. E. Eyrea Irazú and A. López-Gordón, “Geometric Hamilton-Jacobi theory and integrability for nonholonomic and forced hybrid systems” (Nov. 2022), [arXiv:2211.06252](https://arxiv.org/abs/2211.06252) [math-ph].

L. J. Colombo, M. de León, M. E. Eyrea Irazú and A. López-Gordón, “Generalized hybrid momentum maps and reduction by symmetries of forced mechanical systems with inelastic collisions” (June 2022), [arXiv:2112.02573](https://arxiv.org/abs/2112.02573) [eess.SY].

## IN PREPARATION

J. de Lucas, A. López-Gordón and B. M. Zawora, “Dissipation, stability, and contact Hamiltonian systems”.

## Awards, Fellowships, & Grants

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2021	“FPI” predoctoral contract, Ministerio de Ciencia e Innovación	
	“JAE Intro” Grant extension, Instituto de Ciencias Matemáticas (ICMAT)	3 000 €
2020	“JAE Intro” Grant, Consejo Superior de Investigaciones Científicas (CSIC)	3 000 €
2019	“Beca de Colaboración en Departamentos”, Universidad Complutense de Madrid	2 000 €

## Talks and Posters

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### CONTRIBUTED TALKS

January 19, 2024. **XXV Winter Meeting on Geometry, Dynamics and Field Theory.** *On the stability of contact Hamiltonian systems.* Universidad de Zaragoza, Zaragoza, Spain.

December 11, 2023. **deLeonfest 2023. An interdisciplinary conference on geometric mechanics and related fields.** *Integrability of contact Hamiltonian systems.* Institute of Mathematical Sciences (ICMAT), Madrid, Spain. Co-presented with Manuel Lainz.

June 2, 2023. **2023 American Control Conference.** *Nonsmooth Herglotz variational principle.* San Diego, California, USA.

March 29, 2023. **17th International Young Researchers Workshop on Geometry, Mechanics and Control.** *Liouville-Arnold theorem for contact Hamiltonian systems.* KU Leuven, Leuven, Belgium.

February 6, 2023. **VI Congreso de Jóvenes Investigadores de la Real Sociedad Matemática Española.** *Integrability of contact Hamiltonian systems.* Universidad de León, León, Spain.

- January 19, 2023. **XXIV Encuentro de Invierno en Geometría, Mecánica y Control.** *Symmetries, conservation and dissipation in time-dependent contact systems.* Universidad de Zaragoza, Zaragoza, Spain.
- January 6, 2023. **Workshop on Nonlinear Systems III.** *Symmetries, conservation and dissipation in time-dependent contact systems.* Gebze Teknik Üniversitesi, Kocaeli, Turkey.
- September 1, 2022. **XXX International Fall Workshop in Geometry and Physics.** *Hamilton-Jacobi theory for contact systems: autonomous and non-autonomous.* Instituto de Ciencias Matemáticas (ICMAT-CSIC), Madrid, Spain.
- July 20, 2022. **34th International Colloquium on Group Theoretical Methods in Physics.** *Non-conservative systems can have conserved quantities! Symmetries, reduction and Hamilton-Jacobi theory for forced mechanical systems.* Strasbourg University, Strasbourg, France.
- July 13, 2022. **2022 European Control Conference.** *Hybrid Forced Lagrangian Systems.* Imperial College and University College, London, UK (online).
- July 5, 2022. **14th International Summer School on Geometry, Mechanics and Control.** *Reduction of forced mechanical systems with inelastic collisions.* Universidad de Burgos, Burgos, Spain.
- March 7-11, 2022. **VII Iberoamerican Meeting on Geometry, Mechanics and Control.** *Forced Hamiltonian and Lagrangian systems. Symmetries, reduction and Hamilton-Jacobi theory.* Departamento de Matemática, Universidad Nacional del Sur, Bahía Blanca, Argentina (online).
- September 8, 2021. **XXIX International Fall Workshop in Geometry and Physics.** *Mechanical systems with external forces. Symmetries, reduction and Hamilton-Jacobi theory.* Centro de Matemática e Aplicações, Universidade da Beira Interior, Covilhã, Portugal (online).

#### SEMINARS AND COLLOQUIA

- May 24, 2023. **Joint Mathematics Junior Colloquium (ICMAT-UAM-UC3M-UCM).** *Cómo la geometría nos permite entender la dinámica: una introducción a los sistemas integrables.* Instituto de Ciencias Matemáticas, Madrid, Spain.
- May 11, 2023. **Geometry and Applications: Modern Mathematical Approaches (Gamma) Seminar.** *An introduction to integrable systems.* University of Warsaw, Warsaw, Poland (online).
- April 1, 2022. **Geometry, Mechanics and Control Seminar.** *Reduction, Hamilton-Jacobi theory and discretization of mechanical systems with external forces.* Instituto de Ciencias Matemáticas, Madrid, Spain (online).

#### POSTERS

- July 10, 2023. **XV International ICMAT Summer School on Geometry, Dynamics and Field theory.** *Liouville–Arnold theorem for contact Hamiltonian systems.* La Cristalera, Miraflores de la Sierra, Madrid, Spain.
- January 17-21, 2022. **Congreso Bienal de la Real Sociedad Matemática Española** (Biennial Congress of the Royal Spanish Mathematical Society). *Systems with external forces. Symmetries, reduction and Hamilton-Jacobi theory.* Universidad de Castilla – La Mancha, Ciudad Real, Spain.
- December 1-3, 2021. **Young Researchers Workshop in Geometry, Mechanics and Control.** *Symmetries, reduction, Hamilton-Jacobi theory and discretization for systems with external forces.* Centre de Recerca Matemàtica, Campus de Bellaterra, Barcelona, Spain.

#### Assistance to scientific meetings \_\_\_\_\_

#### WORKSHOPS

- January 18-19, 2024. **XXV Winter Meeting on Geometry, Dynamics and Field Theory.** Universidad de Zaragoza, Zaragoza, Spain
- December 11-13, 2023. **deLeonfest 2023. An interdisciplinary conference on geometric mechanics and related fields.** Institute of Mathematical Sciences (ICMAT), Madrid, Spain.
- July 12-14, 2023. **Dynamical Systems, Mechanics and Control. A workshop in honor to Anthony Bloch.** La Cristalera, Miraflores de la Sierra, Madrid, Spain.
- July 5-7, 2023. **Environmental Monitoring: An Exploratory Workshop.** Spanish Royal Academy of Sciences, Madrid, Spain.
- May 31-June 2, 2023. **2023 American Control Conference.** San Diego, California, USA.

March 29-31, 2023. **17th International Young Researchers Workshop on Geometry, Mechanics and Control.** KU Leuven, Leuven, Belgium.

February 6-10, 2023. **VI Congreso de Jóvenes Investigadores de la Real Sociedad Matemática Española.** Universidad de León, León, Spain.

January 19-20, 2023. **XXIV Encuentro de Invierno en Geometría, Mecánica y Control.** Universidad de Zaragoza, Zaragoza, Spain.

January 3-9, 2023. **Workshop on Nonlinear Systems III.** Gebze Teknik Üniversitesi, Kocaeli, Turkey.

December 12-16, 2022. **II Encuentro RSME-UMA.** Ronda, Spain.

August 29-September 2, 2022. **XXX International Fall Workshop in Geometry and Physics.** Instituto de Ciencias Matemáticas (ICMAT-CSIC), Madrid, Spain.

July 18-22, 2022. **34th International Colloquium on Group Theoretical Methods in Physics.** Strasbourg University, Strasbourg, France.

July 12-15, 2022. **2022 European Control Conference.** Imperial College and University College, London, UK (online).

May 23-26, 2022. **Geometric Aspects of the Swampland.** Centro de Física Teórica y Matemáticas, Madrid, Spain.

March 7-11, 2022. **VII Iberoamerican Meeting on Geometry, Mechanics and Control.** Departamento de Matemática, Universidad Nacional del Sur, Bahía Blanca, Argentina (online).

January 24-25, 2022. **XXIII Winter Meeting on Geometry, Mechanics and Control.** Universidad de Zaragoza, Zaragoza, Spain.

January 17-21, 2022. **Congreso Bienal de la Real Sociedad Matemática Española** (Biennial Congress of the Royal Spanish Mathematical Society). Universidad de Castilla – La Mancha, Ciudad Real, Spain.

December 1-3, 2021. **Young Researchers Workshop in Geometry, Mechanics and Control.** Centre de Recerca Matemàtica, Campus de Bellaterra, Barcelona, Spain.

September 7-10, 2021. **XXIX International Fall Workshop in Geometry and Physics.** Centro de Matemática e Aplicações, Universidade da Beira Interior, Covilhã, Portugal (online).

July 26-30, 2021. **Symposium on New Developments in Momentum Polytope Theory.** Instituto de Ciencias Matemáticas (ICMAT), Madrid, Spain (online).

February 18-19 2021. **XXII Winter Meeting on Geometry, Mechanics and Control.** Universidade de Santiago de Compostela, Santiago de Compostela, Spain (online).

December 1-3, 2020. **BYMAT Conference-Bringing Young Mathematicians Together.** Universitat de València and Universitat Politècnica de València, Valencia, Spain (online).

## SCHOOLS

July 10-11, 2023. **XV International ICMAT Summer School on Geometry, Dynamics and Field theory.** La Cristalera, Miraflores de la Sierra, Madrid, Spain.

July 4-8, 2022. **14th International Summer School on Geometry, Mechanics and Control.** Universidad de Burgos, Burgos, Spain.

August 2-5, 2021. **Summer School on New Developments in Momentum Polytope Theory.** Instituto de Ciencias Matemáticas (ICMAT), Madrid, Spain (online).

June 21-July 9, 2021. **JAE School of Mathematics.** Instituto de Ciencias Matemáticas (ICMAT), Madrid, Spain.

January 25-February 5, 2021. **Master School on Geometry, Analysis and Applications.** Universidad de Cantabria, Santander, Spain (online).

September 7-9, 2020. **JAE School of Mathematics.** Instituto de Ciencias Matemáticas (ICMAT), Madrid, Spain (online).

July 1-5 2019. **I International School on Particle Physics and Cosmology.** Universidad Internacional Menéndez Pelayo, Santander, Spain.

## OTHERS

June 1, 2022. **Conferencia Final Net4impact. Impacto Social De La Investigación Científica.** Instituto de Ciencias Matemáticas, Madrid, Spain.

## Teaching Experience

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Winter 2023-24	<b>Mathematics I</b> , Teaching Assistant, Degree in Biomedical Engineering, Autonomous University of Madrid	30 h
Winter 2023-2024	<b>Mathematics</b> , Teaching Assistant, Degree in Biochemistry, Autonomous University of Madrid	30 h
Winter 2022-23	<b>Mathematics</b> , Teaching Assistant, Degree in Food Science and Technology and Double Degree in Human Nutrition and Dietetics and FST, Autonomous University of Madrid	30 h
Winter 2022-2023	<b>Mathematics</b> , Teaching Assistant, Degree in Biochemistry, Autonomous University of Madrid	30 h

## Outreach & Professional Development

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### POPULAR SCIENCE ARTICLES

A. López-Gordón and A. Timón García-Longoria, “Los misterios de la cicloide, una de las curvas más presentes en la naturaleza”, *El País*, June 19, 2023, <https://elpais.com/ciencia/cafe-y-teoremas/2023-06-19/los-misterios-de-la-cicloide-una-de-las-curvas-mas-presentes-en-la-naturaleza.html>. Accessed October 31, 2023.

### ORGANIZATION OF SCIENTIFIC MEETINGS

Member of the Scientific Committee of the *5th BYMAT Conference*, held at the Institute of Mathematical Sciences in Madrid (Spain) from November 13 to November 16, 2023.

Member of the Organizing Committee of *Environmental Monitoring: An Exploratory Workshop*, held at the Spanish Royal Academy of Sciences from July 5 to July 7, 2023.

Organizer of the parallel session on *Differential Geometry, Mathematical Physics and Control Theory*, during the *VI Congreso de Jóvenes Investigadores de la Real Sociedad Matemática Española*, held at the University of León (Spain) on February 9, 2023.

### PEER REVIEW

Advances in Mathematical Physics

International Journal of Geometric Methods in Modern Physics

Journal of Geometric Mechanics

Journal of Physics A: Mathematical and Theoretical

Mediterranean Journal of Mathematics

Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matemáticas

6th International Conference on Geometric Science of Information

61st IEEE Conference on Decision and Control

### PROFESSIONAL MEMBERSHIPS

Real Sociedad Matemática Española (Royal Spanish Mathematical Society)

Real Sociedad Española de Física (Spanish Royal Physics Society)

## Languages

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**Spanish.** Mother tongue

**English.** Advanced, C1 in the CEFR, 7.5 band score in IELTS Academic

## Computer skills

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**Advanced.**  $\LaTeX$ , GNU/Linux, macOS, Mathematica, Python, Windows

**Basic.** bash/shell, Excel, git, gnuplot, html, Julia, matlab, nginx, OriginLab, SciDAVis