# Asier López-Gordón


Postdoctoral researcher

*Institute of Mathematics of the Polish Academy of Sciences (IM PAN),*
*ul. Śniadeckich 8, 00-656 Warszawa, Poland*

alopez-gordon@impan.pl | alopezgordon.xyz | 0000-0002-9620-9647


## Education

**Autonomous University of Madrid** — *Madrid, Spain*

PhD Mathematics — *2021 - 2024*

- PhD thesis: The geometry of dissipation (arXiv:2409.11947)
- 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)
- 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

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| 2024- | **Assistant professor (*adiunkt*)**, Institute of Mathematics of the Polish Academy of Sciences (IM PAN), Warsaw, Poland |
| 2021-2024 | **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

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|---|---|
| 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

L. Colombo, M. de León, M. E. Eyrea Irazú and A. López-Gordón, "Hamilton–Jacobi theory for nonholonomic and forced hybrid mechanical systems", *Geom. Mech.* **01**(02) (July 2024), doi: 10.1142/S2972458924500059.

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.* **198**, 105116 (Feb. 2024), doi: 10.1016/j.geomphys.2024.105116 (Open Access).

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 (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**, 104787 (Mar. 2023), doi: 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.

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.

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 (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.

### Conference papers

A. López-Gordón and L. J. Colombo, "On the integrability of hybrid Hamiltonian systems", *8th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control LHMNC 2024*, IFAC-PapersOnLine, vol. 58, pp. 83-88 (Sep. 2024), doi:. 10.1016/j.ifacol.2024.08.261 (Open Access).

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 (Aug. 2023), doi: 10.1007/978-3-031-38299-4_12.

A. Anahory 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.

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.

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.

### Preprints

L. Colombo, M. de León, M. E. Eyrea Irazú and A. López-Gordón, "Homogeneous bi-Hamiltonian structures and integrable contact systems" (Feb. 2025), arXiv:2502.17269 [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 [math.SG].

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 [eess.SY].

## Awards, Fellowships, & Grants

| | | |
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| 2021 | **"FPI" predoctoral contract**, Spanish Ministry of Science and Innovation | |
| | **"JAE Intro" Grant extension**, Institute of Mathematical Sciences (ICMAT) | *3 000 €* |
| 2020 | **"JAE Intro" Grant**, Spanish National Research Council (CSIC) | *3 000 €* |
| 2019 | **"Beca de Colaboración en Departamentos"**, Complutense University of Madrid | *2 000 €* |

## Talks and Posters

### Invited Talks at Conferences

January 13, 2025. **VII Young Researchers Congress of the Royal Spanish Mathematical Society. Parallel session on Geometric Structures in Manifolds.** *On integrable contact systems and bi-Hamiltonian structures.* University of the Basque Country (UPV/EHU), Bilbao, Spain.

August 23, 2024. **Workshop on Geometric aspects in mathematical modelling.** *Hybrid dynamical systems for the modelling of rigid bodies with impacts.* National University of Distance Education (UNED), Madrid, 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.

February 6, 2023. **VI Young Researchers Congress of the Royal Spanish Mathematical Society. Parallel session on Symplectic Geometry and Hamiltonian Dynamics.** *Integrability of contact Hamiltonian systems.* University of León, Spain.

January 6, 2023. **Workshop on Nonlinear Systems III.** *Symmetries, conservation and dissipation in time-dependent contact systems.* Gebze Teknik Üniversitesi, Kocaeli, Turkey.

## Contributed Talks at Conferences

September 5, 2024. **XXXII International Fall Workshop on Geometry and Physics.** *Contact bi-Hamiltonian systems.* University of Coimbra, Portugal.

June 21, 2023. **XVI International ICMAT Summer School on Geometry, Dynamics and Field theory.** *Nijenhuis–Jacobi structures and integrability of contact Hamiltonian systems.* La Cristalera, Miraflores de la Sierra, Madrid, Spain.

June 10, 2024. **8th IFAC Workshop on Lagrangian and Hamiltonian Methods for Non Linear Control.** *On the integrability of hybrid Hamiltonian systems.* Besançon, France.

February 23, 2024. **XXVIII International Young Researchers Workshop in Geometry, Dynamics and Field Theory.** *On the stability of contact Hamiltonian systems.* University of Warsaw, Poland.

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

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, Belgium.

January 19, 2023. **XXIV Encuentro de Invierno en Geometría, Mecánica y Control.** *Symmetries, conservation and dissipation in time-dependent contact systems.* University of Zaragoza, Spain.

September 1, 2022. **XXX International Fall Workshop in Geometry and Physics.** *Hamilton-Jacobi theory for contact systems: autonomous and non-autonomous.* Instititute of Mathematical Sciences (ICMAT), 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, 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.* University of 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.* National University of the South, 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*. Centre of Mathematics and Applications, University of Beira Interior, Covilhã, Portugal (online).

## Seminars and Colloquia

December 4, 2024. **Geometry and Differential Equations Seminar**. *Liouville-Arnol'd theorem for contact Hamiltonian systems .* Institute of Mathematics of the Polish Academy of Sciences (IM PAN), Warsaw, Poland.

May 30, 2024. **Seminario de Doctorandos.** *Un primer contacto con la geometría de contacto.* Faculty of Mathematics, Complutense University of Madrid, Spain.

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.* Instititute of Mathematical Sciences (ICMAT), Madrid, Spain.

May 11, 2023. **Geometry and Applications: Modern Mathematical Approaches (Gamma) Seminar.** *An introduction to integrable systems.* University of Warsaw, Poland (online).

April 1, 2022. **Geometry, Mechanics and Control Seminar.** *Reduction, Hamilton-Jacobi theory and discretization of mechanical systems with external forces.* Instititute of Mathematical Sciences (ICMAT), 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. **Biennal Congress of the Royal Spanish Mathematical Society.** *Systems with external forces. Symmetries, reduction and Hamilton-Jacobi theory.* University of 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.

## Teaching Experience

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| Winter 2023-24 | **Mathematics I**, Teaching Assistant, Degree in Biomedical Engineering, Autonomous University of Madrid | *30 h* |
| Winter 2023-2024 | **Mathematics**, Teaching Assistant, Degree in Biochemistry, Autonomous University of Madrid | *30 h* |
| Winter 2022-23 | **Mathematics**, 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 | **Mathematics**, Teaching Assistant, Degree in Biochemistry, Autonomous University of Madrid | *30 h* |

## Outreach & Professional Development

### 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.

### Organisation of scientific meetings

Organiser of the parallel session on *Differential Geometry, Mathematical Physics and Control Theory*, at the *VII Congreso de Jóvenes Investigadores de la Real Sociedad Matemática Española*, held at the University of the Basque Country (UPV/EHU), in Bilbao (Spain), on January 16-17, 2025.

Organiser of the *Joint Mathematics Junior Colloquium (ICMAT-UAM-UC3M-UCM)*, held alternatively at the Department of Mathematics of the Autonomous University of Madrid and the Institute of Mathematical Sciences, during the academic year 2023-2024.

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

Organiser of the parallel session on *Differential Geometry, Mathematical Physics and Control Theory*, at 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

I am a reviewer of MathSciNet/Mathematical Reviews from the AMS. Besides that, I have peer reviewed for several journals and conference proceedings, including the following:

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

**Spanish.** Mother tongue

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

## Computer skills

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

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