

# ALBERTO CASTELLANO

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## RESEARCH INTERESTS

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I am currently a Kadanoff Fellow at the Enrico Fermi Institute doing cutting-edge research on theoretical High Energy and Particle Physics. My work so far has focused mostly on broad topics such as **String Theory**, **String Phenomenology** and **Quantum Gravity** (QG). Lately, I am also very interested in Black Hole physics, (supersymmetric) Quantum Field Theories, in particular in the infinite distance singularities that arise in their moduli spaces—and how String Theory as a *UV complete* theory of QG resolves them, as well as in the interplay between the Swampland Program, Holography and Mathematics.

## EDUCATION

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**Instituto de Física Teórica** | *Madrid, Spain* Sept. 2020 - Sept. 2024

PhD in Theoretical Physics

Advisor: Prof. Luis E. Ibáñez

**University of Cambridge** | *Cambridge, United Kingdom* Oct. 2019 - Jul. 2020

MAST in Applied Mathematics and Theoretical Physics

Centre for Mathematical Sciences (CMS)

**Universidad Autónoma de Madrid** | *Madrid, Spain* Sept. 2015 - Jul. 2019

Bachelor of Science, Physics

1st in class of 170 students

**IES Arquitecto Ventura Rodríguez** | *Boadilla del Monte, Madrid* Sept. 2013 - Jun. 2015

High School Excellence Program

## RESEARCH POSITIONS AND EMPLOYMENTS

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**University of Chicago** | *Chicago, United States of America* Oct. 2024 - (Oct. 2027)

Postdoctoral position (Kadanoff Fellowship & KICP Associate Fellowship)

Kadanoff Centre for Theoretical Physics, Enrico Fermi Institute and Kvali Institute for Cosmological Physics (KICP)

## PUBLICATIONS

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*Jul. 2025* | “On Supersymmetric D-brane Probes in 4d  $\mathcal{N} = 2$   $\text{AdS}_2 \times \text{S}^2$  Attractors”,  
A. Castellano, C. Montella, M. Zatti, [[2507.17857](#)].

*Jun. 2025* | “Laplacians in Various Dimensions and the Swampland”, C. Aoufia, A. Castellano,  
L. Ibáñez, [[2505.15920](#)].

*May 2025* | “Quantum Calabi-Yau Black Holes and Non-Perturbative D0-brane Effects”,  
A. Castellano, D. Lüst, C. Montella, M. Zatti, [[2505.15920](#)].

*Feb. 2025* | “Black Hole Entropy, Quantum Corrections and EFT Transitions”, A. Castellano,  
M. Zatti, JHEP 08 (2025) 112, [[arXiv:2502.02655](#)].

*Jan. 2025* | “The Double EFT Expansion in Quantum Gravity”, J. Calderón-Infante,  
A. Castellano, A. Herráez, [[arXiv:2501.14880](#)].

- Oct. 2024* | “The Moduli Space Curvature and the Weak Gravity Conjecture”, *A. Castellano*, F. Marchesano, L. Melotti, L. Paoloni, [[arXiv:2410.10966](#)].
- Sep. 2024* | “The Quantum Gravity Scale and the Swampland”, *A. Castellano*, [[arXiv:2409.10003](#)].
- Oct. 2023* | “A Universal Pattern in Quantum Gravity at Infinite Distance”, *A. Castellano*, I. Ruiz, I. Valenzuela, Phys.Rev.Lett. 132 (2024) 18, 181601 [[arXiv:2311.01501](#)].
- Oct. 2023* | “Stringy Evidence for a Universal Pattern at Infinite Distance”, *A. Castellano*, I. Ruiz, I. Valenzuela, JHEP 06 (2024) 037, [[arXiv:2311.01536](#)].
- Oct. 2023* | “On the Species Scale, Modular Invariance and the Gravitational EFT expansion”, *A. Castellano*, A. Herráez, L. Ibáñez, JHEP 12 (2024) 019, [[arXiv:2310.07708](#)].
- Jun. 2023* | “Entropy Bounds and the Species Scale Distance Conjecture”, J. Calderón-Infante, *A. Castellano*, A. Herráez, L. Ibáñez, JHEP 01 (2024) 039, [[arXiv:2306.16450](#)].
- Jan. 2023* | “Towers and Hierarchies in the Standard Model from Emergence in Quantum Gravity”, *A. Castellano*, A. Herráez, L. Ibáñez, JHEP 10 (2023) 172, [[arXiv:2302.00017](#)].
- Dec. 2022* | “The Emergence Proposal in Quantum Gravity and the Species Scale”, *A. Castellano*, A. Herráez, L. Ibáñez, JHEP 06 (2023) 047, [[arXiv:2212.03908](#)].
- Dec. 2021* | “IR/UV Mixing, Towers of Species and Swampland Conjectures”, *A. Castellano*, A. Herráez, L. Ibáñez, JHEP 08 (2022) 217, [[arXiv:2112.10796](#)].
- Apr. 2021* | “A Gravitino Distance Conjecture”, *A. Castellano*, A. Font, A. Herráez, L. Ibáñez, JHEP 08 (2021) 092, [[arXiv:2104.10181](#)].

## RESEARCH TALKS AT INTERNATIONAL CONFERENCES AND WORKSHOPS

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- Jul. 2025* | “Gluing Black Hole Entropies Across Dimensions”, *Parallel Talk*, String Phenomenology 2025, Boston, USA.
- Jan. 2025* | “Quantum Corrected Black Hole Entropy & EFT Transitions”, *Plenary Talk*, Iberian Strings 2025, Bilbao, Spain.
- Jun. 2024* | “Supersymmetric gravitational EFTs and the Swampland”, *Parallel Talk*, SUSY 2024, Madrid, Spain.
- Nov. 2023* | “A Universal Pattern in Quantum Gravity”, *Invited Talk*, (Online) Seminar Series on String Phenomenology.
- Jul. 2023* | “The Quantum Gravity cut-off in a (convex) Nutshell”, *Parallel Talk*, String Phenomenology 2023, Daejeon, South Korea.
- Feb. 2023* | “How can Gravity Emerge?”, *Invited Talk*, (Online) Seminar Series on String Phenomenology.
- Dec. 2022* | “The Emergence Proposal in Quantum Gravity”, *Plenary Talk*, Madrid Winter Workshop 2022, Madrid, Spain.
- Jul. 2022* | “The Gravitino in the corners of Moduli Space”, *Parallel Talk*, String Phenomenology 2022, Liverpool, UK.
- Feb. 2022* | “IR/UV Mixing and the Swampland”, *Invited Talk*, (Online) Seminar Series on String Phenomenology.
- Sep. 2021* | “The Gravitino and the Swampland”, *Parallel Talk*, DESY Theory Workshop 2021, Bright Ideas for a dark Universe, Hamburg, Germany.

*Aug. 2021* | “**The Gravitino Distance Conjecture**”, *Parallel Talk*, YITP Strings and Fields 2021, Kyoto, Japan.

## INVITED SEMINARS AT OTHER INSTITUTIONS

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*Apr. 2025* | “**Quantum Calabi–Yau Black Holes and Non-perturbative D0-brane Effects**”, Harvard (Online) Swampland Seminar.

*Apr. 2025* | “**Quantum Corrected Black Hole Entropy & EFT Transitions**”, Particle Theory Seminar at U. of Chicago, United States.

*Mar. 2025* | “**On Quantum Corrections to the Black Hole Entropy**”, String Theory Seminar at Harvard University, United States.

*Mar. 2025* | “**Quantum Corrected Black Hole Entropy & EFT Transitions**”, Theory Seminar (High Energy/Cosmology) at UW Madison, United States.

*Apr. 2024* | “**A Geometric Characterization of the Species Scale**”, Swampland Seminar at Harvard University, United States.

*Apr. 2024* | “**The Species Scale and the Swampland**”, String Theory Seminar at Kadanoff Centre for Theoretical Physics, U. of Chicago, United States.

*Apr. 2024* | “**Recent Developments regarding the Species Cutoff**”, Harvard (Online) Open Mic Discussion.

*Mar. 2024* | “**Universal Patterns at Infinite Distance**”, String Theory Seminar at Utrecht, Netherlands.

*Nov. 2023* | “**The role of the Species Scale in Quantum Gravity**”, String Theory Seminar at DESY, Hamburg, Germany.

*Jun. 2023* | “**What is the scale of quantum gravity?**”, CERN Journal Club of Strings & QFT, Geneva, Switzerland.

## ACADEMIC AWARDS AND GRANTS

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- Awarded the **Kadanoff Fellowship** (highly competitive postdoctoral position at international level, granted by a committee of experts) supported by the Enrico Fermi Institute and the Kadanoff Center for Theoretical Physics for a 3-year research position at the University of Chicago.
- Awarded the **Residencia de Estudiantes del CSIC** grant (highly competitive scholarship at national level) supported by the Ministerio de Ciencia e Innovación for a 1-year stay at the prestigious and historic CSIC Students Residence in Madrid. Financial envelope: 16.000 €.
- Awarded the **FPI grant** by the Ministerio de Educación for a 4-year training in research, in association with the Consejo Superior de Investigaciones Científicas (CSIC). Financial envelope: 74.140 €.
- Awarded the **Premio Extraordinario de Grado** by the Universidad Autónoma de Madrid for attaining the highest overall graduation grade in September 2019.
- Awarded the **Student Collaboration Scholarship** (competitive scholarship at national graduate level) by the Ministerio de Educación for a 1-year training in research. Financial envelope: 2.000 €.
- Awarded the **Excellence Scholarship** by the Comunidad de Madrid, in recognition of my academic achievements over the four courses (2015-2019) of the programme. Financial envelope: 12.000 €.
- Awarded the **Matrícula de Honor de Bachillerato** by the Comunidad de Madrid, in recognition of my excellent results during the two academic courses of preparation before entering the university, in May 2015.

- Awarded the **Mención Honorífica** with the maximum grade (10/10) in the High School Final Project ‘Flux and Speed Determination of Cosmic Ray Muons’ by IES Arquitecto Ventura Rodríguez, in January 2015.

## SCIENTIFIC STAYS AND VISITS

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### **Short-term visit** | *Aspen Center for Physics*

*May 2025–Jun. 2025*

3-week stay in Aspen during the program ‘Bootstrap, Holography & Swampland: Imprint of UV Principles on IR Physics’ organized by Miguel Montero, Julio Parra-Martínez, Leonardo Rastelli and Irene Valenzuela.

### **Short-term visit** | *Harvard University*

*Apr. 2024*

Person in charge: Prof. Cumrun Vafa, Duration: 2 weeks, in the context of the Harvard Swampland Initiative and supported by the DellaPietra Foundation, the Simons Foundation, the National Science Foundation, the Harvard Physics Department and the Center of Mathematical Sciences and Applications.

### **Long-term visit** | *CERN*

*Mar. 2023 - Jun. 2023*

Person in charge: Dr. Irene Valenzuela. Supported by FPI grant from Spanish Ministry of Education. It led to two scientific papers.

### **Short-term visit** | *Institut de Physique Théorique, Université Paris Saclay CEA, CNRS*

*Nov. 2022*

Person in charge: Prof. Mariana Graña, Duration: 2 weeks. Supported by ERC Consolidator Grant 772408-Stringlandscape. It led me finish the paper ‘The Emergence Porposal in QG and the Species Scale’.

## CONFERENCES AND WORKSHOPS (ATTENDED ON-SITE)

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*Jul. 2025* | **String Phenomenology 2025**, Boston (USA).

*May 2025* | **Iberian Strings 2025**, Bilbao (Spain).

*Jan. 2025* | **Iberian Strings 2025**, Bilbao (Spain).

*Sep. 2024* | **Accelerated Expansion, dS & Strings**, IFT-Madrid (Spain).

*Jun. 2024* | **Strings 2024**, CERN (Switzerland).

*May 2024* | **Swamplandia 2024**, Abbey Seeon (Germany).

*Apr. 2024* | **Surveying the Landscape**, University of Massachusetts Amherst (USA).

*Oct. 2023* | **ASC School 2023**, LMU Munich (Germany).

*Sep. 2023* | **Swamplandia**, IFT-Madrid (Spain).

*Jul. 2023* | **String Phenomenology 2023**, IBS (Korea).

*Jun. 2023* | **Recent Trends in and out of the Swampland**, IBS (Korea).

*Sep. 2022* | **Back to the Swamp**, IFT-Madrid (Spain).

*Aug. 2022* | **2022 Simons Summer Workshop**, Simons Centre for Geometry and Physics (USA).

*Jul. 2022* | **String Phenomenology 2022**, University of Liverpool (UK).

*Jun. 2022* | **Geometric Aspects of the Swampland, Part II**, IFT-Madrid (Spain).

*May 2022* | **Geometric Aspects of the Swampland, Part I**, IFT-Madrid (Spain).

*May 2022* | **Strings and Geometry 2022**, Utrecht University (Netherlands).

*Mar. 2022* | **Iberian Strings 2022**, Gijón (Spain).

## REVIEWING ACTIVITIES

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*Since 2023* | **Reviewer of scientific journal “Journal of High Energy Physics (JHEP)”**.

*Since 2025* | **Reviewer of scientific journal “SciPost”**.

## PARTICIPATION IN RESEARCH PROJECTS

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*2023-2026* | **Abriendo ventanas a nueva física**, Spanish MCIN. Ref: PID2022-137127NB-I00.

*2021-2025* | **Centro de Excelencia Severo Ochoa Program**, Spanish MINECO. Ref: CEX2020-001007-S.

*2022-2025* | **Aspectos clave de la teoría de cuerdas: La ciénaga, agujeros negros y holografía**, Spanish MCIN. Ref: PID2021-123017NB-I00.

*2020-2023* | **Física de Partículas Inexplorada**, Spanish MCIN. Ref: PID2019-108892RB-I00.

*2019-2022* | **Gravedad, Supergravedad y Supercuerdas**, Spanish MCIN, AEI, FEDER. Ref: PGC2018-095205-B-I00.

*2017-2021* | **Centro de Excelencia Severo Ochoa Program**, Spanish MINECO. Ref: SEV-2016-0597.

## ORGANIZING EXPERIENCE

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*Sept. 2023* | Assisted the Local Org. committee of **Swamplandia**.

*Sept. 2022* | Assisted the Local Org. committee of **Back to the Swamp**.

*Jun. 2022* | Assisted the Local Org. committee of **Geometric Aspects of the Swampland II**.

*May 2022* | Assisted the Local Org. committee of **Geometric Aspects of the Swampland I**.

## TEACHING EXPERIENCE

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*2022* | **Teaching Assistant in Quantum Mechanics II**, 3<sup>rd</sup> course of Physics degree, UAM.

*2021* | **Teaching Assistant in Fundamentals of Physics III**, 1<sup>st</sup> course of Physics degree, UAM.

## SUPERVISION AND MENTORING

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*2022-2023* | **Co-director of undergraduate student: Carlos Barahona**, Universidad Autónoma de Madrid, Spain. BSc Thesis: ‘Supersymmetric Quantum Mechanics’.

*2020-2021* | **Co-director of undergraduate student: David García**, Universidad Autónoma de Madrid, Spain. BSc Thesis: ‘Spatial Extra Dimensions’.

## PREVIOUS RESEARCH EXPERIENCE

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*2018-2019* | **Student Collaboration Scholarship**, *Instituto de Física Teórica (IFT UAM-CSIC), Madrid*. Person in charge: Prof. Luis E. Ibáñez. It led to the realisation of my undergraduate thesis: ‘Extra Spatial Dimensions’. Financial envelope: 2000 euros.

*2018* | **Undergraduate Extra-curricular Internship**, *Instituto de Física Teórica (IFT UAM-CSIC), Madrid*. Person in charge: Prof. Luis E. Ibáñez.

*2013-2015* | **Research Intern Student**, *Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Madrid*. Person in charge: Dr. Pablo García Abia. It led to the realisation of my high-school research project: ‘Determination of flux and velocity of cosmic ray muons’.

## OUTREACH

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*Jun. 2023* | **“Trivulgando 2023”**, *Outreach Activity*, Organization and collaboration in this annual outreach activity at the Residencia de Estudiantes del CSIC.

*Sept. 2022* | **“Noche Europea de los Investigadores”**, *Outreach Activity*, Organization and collaboration with the IFT in this annual outreach activity at the Campus of the Universidad Autónoma de Madrid.

*Nov. 2021* | **“Los Diagramas de Feynman, desde CERO”**, *Outreach video*, IFT Youtube channel, 40K views.

*Nov. 2021* | **“Animales Cuánticos y Dónde Encontrarlos”**, *Outreach talk*, High school IES Arquitecto Ventura Rodríguez, Boadilla del Monte, Madrid.

*Nov. 2021* | **“Ciclo de Conferencias: El paisaje de la Física Fundamental”**, *IFT Youtube Channel moderator* helping during the PhD students debate, Residencia de Estudiantes del CSIC, Madrid.

## TECHNICAL STRENGTHS AND SKILLS

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<b>Programming</b>	MATLAB, R, C++, ROOT
<b>Software &amp; Tools</b>	LaTeX, Mathematica, SciDavis, Origin
<b>Theoretical Modeling</b>	
<b>Oratory</b>	
<b>Languages</b>	Spanish (native), English (Fluent, Advanced Level), French (Basic)

## EXTRA-CURRICULAR

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- International Volunteering, as a teacher assistant in Accra (Ghana) in collaboration with Dream Africa Care Foundation (DAF) NGO, during the summer (June-July) of 2017.
- Participation in the Congress ‘Après CERN’ aimed at secondary physics teachers who visited the CERN facilities during the Summer of 2018, and held at CTIF Madrid-Sur. Title of the talk: ‘My little research project’.
- Participation in the ‘2013-2014 Particle Physics Masterclass’ held at CIEMAT, Madrid, in November 2013.
- Work experience as a maths and physics (private) tutor for five years.
- Best Orator Award in First Debating Tournament by Universidad Francisco de Vitoria (UFV) in May 2013.