Santiago Casas

Theoretical Cosmologist

Helping the Universe to understand itself

Summary

Theoretical Cosmologist with a profound interest in the nature of Dark Matter and Dark Energy. Specializing in the synergies between radio, optical, and gravitational experiments to explore the Universe's large-scale structure. Proficient Python programmer contributing to and developing more than 5 open source projects widely used in the field. Expert in Bayesian statistics, theories of gravity, the primordial Universe, neutrinos, and cosmological parameter estimation. Active member of the Euclid– builder status –and SKAO collaborations. Known for being a flexible and dynamic team player with a keen curiosity across interdisciplinary fields and strong social skills.

Education

Ph.D. in Theoretical Physics

2013-2017	Institute of Theoretical Physics, Ruprecht-Karls-Universität Heidelberg
title	*Non-linear structure formation in models of Dark Energy and Modified Gravity*
supervisors	Dr. Valeria Pettorino, Prof. Luca Amendola, *Jury*: Prof. Volker Springel
grade	Summa Cum Laude

Masters of Science in Physics

2011 - 2013	Institute of Theoretical Physics, Ruprecht-Karls-Universität Heidelberg
title	*Fitting and forecasting models of coupled Dark Energy from simulations*
supervisors	Prof. Luca Amendola, Prof. Marco Baldi
grade	1.2/1
2006 - 2009	**Bachelor of Science in Physics**, *University of Costa Rica*, San José, CR Student assistant at the Planetarium and at the Department of Theoretical Physics.
1998-2005	**German Abitur**, *Deutsche Humboldt Schule*, San José, CR Emphasis: Natural Sciences. Grade: 1.5

Languages

Spanish	Mother language	German	C2-level, proficiency
English	C2-level professional proficiency	French	B1-level

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Experience

Cosmologist

2024 **Postdoctoral Researcher**, *Institute of Cosmology and Gravitation, University of Portsmouth*, United Kingdom
- Euclid research scientist with Builder status
- Theory Working Group Work Package Likelihood co-lead
- Theory Working Group pre-launch Key Project coordinator
- SKAO Synergies and Cosmology, Science Book chapter coordinator

2021-2024 **Postdoctoral Researcher**, *Theoretische Teilchenphysik und Kosmologie (TTK), RWTH Aachen University*, Aachen, DE
Theoretical, phenomenological and numerical cosmology.
Detailed achievements:
- Supervised 5 master (1-year each) and 2 bachelor students (3-months each);
- Topics: Neutrinos in Cosmology, Bayesian Statistics, Likelihoods, Galaxy Clustering and Weak Lensing, Effective Field Theory for Large Scale Structure, Modified Gravity, Gravitational Waves, Machine Learning Emulators.
- Published 7 independent papers, 8 Euclid collaboration papers as lead author and co-signed more than 50 Euclid collaboration papers.
- Development in cosmological software packages: CLOE, MontePython, CosmicFish, CLASS-1loop, JaxCosmo.

2018-2021 **Postdoctoral Researcher**, *CosmoStat, DAp, CEA*, Paris-Saclay, FR
Theoretical, phenomenological and numerical cosmology for Euclid.
Detailed achievements:
- Supervised 2 Masters 1/2 interns (6-months each);
- Topics: Bayesian Statistics, Likelihoods, Forecasts, Galaxy Clustering and Weak Lensing, 21cm Radio Cosmology, Modified Gravity, Machine Learning Emulators.
- Published 12 independent papers, 4 Euclid collaboration papers as lead author and co-signed more than 15 Euclid collaboration papers.
- Development in cosmological software packages: CLOE, CosmicFish, JaxCosmo.

Teaching Experience

2021-2023 **RWTH Aachen University**; Teaching assistant of Theoretical Mechanics (B.Sc. in German), General Relativity and Advanced Cosmology (M.Sc. in English).

2019-2021 **CosmoStat, CEA**; Tutorials on Numpy/Scipy/Boltzmann codes/Programming techniques for Scientific Developers.

2020 **Alpha-Cen founding member;** Tutorials, Remote webinars and Introduction to Cosmology for Students of Central America.

2013-2017 **University of Heidelberg**; General Relativity, Electromagnetism (in German), Theoretical Mechanics (in German), Advanced Cosmology.

2010 **Universidad de Costa Rica**; Lecturer for General Physics II, Laboratory of Physics I and II and Physics for Life Sciences.

Research Visits

10/2015 **University of Geneva;** Funded by HGSFP, in collaboration with Prof. Martin Kunz

05/2016 **University of Lisbon;** DAAD, in collab. with Prof. Nelson Nunes.

02/2018 **Universidad Antonio Nariño;** DAAD, in collab. with Prof. Nicolás Bernal.

Community impact

2015 - present **Referee** of High impact journals in Cosmology; JCAP, Physical Review D, Physics of the Dark Universe, Monthly Notices of the Royal Astronomical Society, Astronomy & Astrophysics

2016-2021 **Winter School Organizer;** Tonale winter school in Cosmology, for Master and PhD students. 4 times in the local organization team. Arranging of speakers, student support, website, design of program, on-site management.

2019-present **Alpha-Cen founding member;** Mentoring for Students of Central America.

Industry

2009-2010 **Physicist and Software Developer**, *Engineering Scientific Services, S.A.*, San José, Costa Rica
Developing Finite element methods in Objective-C for engineering applications

2009-2010 **Data Scientist**, *DeFi Pulse*, Remote, USA
Creating graph-databases to analyze decentralized finance portfolios on-chain in Ethereum.

Computer skills

Programming languages	Wolfram Mathematica, Bash, C++, Python, Fortran, JAX	**Libraries**	Numpy, Scipy, ScikitLearn, Numba, Pytest, Pystyle
Tools	Docker, SLURM, Git, HPC, Jekyll, Markdown	**Methods**	Neural Networks, Gaussian Processes, Markov Chain Monte Carlo, Profiling, Principal Component Analysis, N-body simulations, Finite Differences
Cosmological software	(Hi-)CLASS, (MG-)CAMB, MontePython, CosmicFish, CLOE, Cobaya, PyCCL, JaxCosmo, Fishermathica, Gadget2, CONCEPT, Polychord		

Invited Talks / Conferences / Workshops / Schools

- **International Summer School in Communicating Science;** Alexander von Humboldt Foundation, Berlin, 2021.
- **SKAO collaboration meetings;** Invited speaker: SKA France (2019), Remote Science Conference (2021), Manchester SWG meeting (2023).
- **Notable seminars in past 5 years;** COSPAR-Pasadena, Prague, Porto, Leiden, Pascal Institute, Poincaré Institute, Oslo, Portsmouth, Ringberg. First Central American Aerospace Symposium.
- **MIAPbP Workshop, Garching;** Differentiable Methods in Physics, 3 Weeks. By invitation only.
- **Euclid Collaboration meetings;** Lausanne, Lisbon, London, Bonn, Helsinki (plenary prize talk), Oslo, Copenhagen, Rome.
- **Invited talks 2023;** a) Brussels Workshop. b) Saclay Astroparticle Symposium c) Institute Seminar at the Bethe Center, Bonn. d) Cosmology Seminar, CEICO, Prague. e) Cosmology Seminar, Oslo. f) TTK Seminar

- **Invited talks 2024;** a) Lorentz Insitute, University of Leiden. b) Euclid Consortium Rome meeting 2024, Invited Plenary Speaker on behalf of the Theory Working Group.
- c) 35th Rencontres de Blois 2024, Invited speaker on behalf of the Euclid Consortium. d) Group seminar at University Ghent

Awards

- Euclid STAR prize for the IST:Forecasting team, (presented plenary STAR prize talk) Helsinki 2019.
- Euclid STAR prize IDEA for the ECICOM effort, Rome 2024.
- Laboratorio Nacional de Luz Sincrotron, Campinas, Brazil; 3 month paid internship.
- Ministerio de Ciencia y Tecnologia, Costa Rica; 2-year fellowship for postgraduate studies abroad.

Soft Skills

- **Podcasts:** My Cosmic-Sloth Podcast for researchers about the academic world. Invited Guest at Podcasts: Astroblog Chile, Starts with a Bang. **Blogs:** Contributor to Astrobitos, Blog in Medium.
- **Outreach:** Telemedellín Colombia, Delfino Noticias Costa Rica, El Espectador, Colombia. El Colombiano, Colombia. Public talks at libraries and outreach events. Blog. CNRS 80-years anniversary.**Euclid Consortium** instagram ⓞ social media manager.

References

Supervisors
- Prof. Valeria Pettorino
- Prof. Luca Amendola
- Prof. Christof Wetterich

PhD mentors
- Prof. Martin Kunz
- Prof. Marco Baldi
- Prof. Massimo Pietroni
- Prof. Matthias Bartelmann

Collaborators / Employers
- Prof. Julien Lesgourgues
- Prof. Alkistis Pourtsidou
- Prof. Kazuya Koyama
- Dr. Vincenzo Cardone