

Research interests

My current research focuses on the effect of extra scalar degrees of freedom on our universe. On large scales, I have studied their impact on the Hubble tension and on the CMB visibility function through their collapse into compact objects. On short scales, I have explored fifth forces and screening mechanisms originating from non-minimal couplings to gravity.

Academic History

- 2023- **Post-doctoral position** at IPPP, **Durham University**, UK.
Collaborators: Dr. Djuna Croon and Dr. Francesca Chadha-Day.
- 2020-2023 **PhD in Particle Cosmology** at School of Physics and Astronomy, **University of Nottingham**.
Title: *FeynMG: Automating particle physics calculations in scalar-tensor theories*
Supervisor: Prof. Edmund J. Copeland and Dr. Pete Millington
- 2019-2020 **Part III** in Applied Mathematics and Theoretical Physics at **University of Cambridge**, UK.
Essay: ‘*Tunneling Transitions in Quantum Mechanics, Field Theory and Gravity*’
Supervisor: Prof. Fernando Quevedo.
- 2016-2019 **B.Sc** in Physics and Theoretical Physics at **University of Nottingham**, UK.
Third-year project: ‘*Scalar Fields in Cosmology and the Swampland Conjecture*’
Supervisor: Prof. Edmund J. Copeland.

Selected Talks

Title: **Scaling solutions as a possible resolution for the Hubble tension:**

- UNAM, Mexico (Apr 2024)
- University of Nottingham (Dec 2022)

Title: **How to work with modified gravity and not collapse in the process**

- Perimeter Institute, Canada (Jul 2024)
- IPPP, Durham (Dec 2023)
- COSMOS’23, IFT, Madrid (Sep 2023)
- UKCosmo, Cambridge (May 2023)
- Cosmology from home (Jun 2024)
- Newcastle University (Dec 2023)
- PASCOS’23, California (Jul 2023)
- BritGrav’23, Southampton (Apr 2023)

Title: **Extended dark matter objects on the CMB**

- Cosmology from home (Jun 2024)
- Beyond WIMPS, Durham (Mar 2024)
- University of Nottingham (Jun 2024)

Computational skills and projects

- MATHEMATICA:** **FeynMG:** A Feynrules subpackage for studying scalar-tensor theories within particle theory pipelines.
CMB accretion: A numerical code to predict and constrain the influence of Extended Dark Matter objects on the CMB visibility function.
- PYTHON:** **EDOBounds:** Repository for constraints on Extended Dark Matter Objects, allowing the plotting of various bounds combinations for any given shape or radius.

Teaching Experience

- 2023-2024 Tutor for first year physics course '*Foundations of physics*' at Durham University.
- 2020-2023 Demonstrated '*Quantitative physics*', '*Quantum dynamics*', '*Computing*', '*Symmetries and action principles*', '*Fourier analysis*' and '*Atoms, photons and fundamental particles*' at University of Nottingham, UK.
- 2017-2022 Physics and Mathematics private tutor for A-level students.

Official visits and Internships

- Jun 2024 2-week visit to the Perimeter Institute, Waterloo, Canada.
Collaborator: Prof. Cliff Burgess.
- Mar 2024 1-week visit to the Physics department of the University of Manchester, UK.
Collaborator: Dr. Peter Millington.
- Jun 2022 1-week visit to the Physics department of the University of Glasgow, UK.
Collaborator: Prof. Christoph Englert.
- Feb 2022 1-week visit to the Physics department of Durham University, UK.
Collaborator: Prof. Michael Spannowsky.

Academic activities

- 2024 - Interviewer for EUCAPT series of videos (starting in September 2024).
- 2023 - IPPP Postdoctoral Representative at RSCC Meetings in the Physics Department.
- 2022 - 2023 Web page editor for UK Cosmo.
- 2021 - 2023 Web page editor for the Particle Cosmology group at University of Nottingham, UK.
- 2021 - 2022 Coordinator of the '*Particle Cosmology Student Journal Clubs*', University of Nottingham, UK.

Awards and Scholarships

- Jun 2023 Paul Dirac price at Erice summer school for my contributions and special talent talk.
- May 2023 Andrew Hendry Scholarship Endowed Award 2023 for my PhD trajectory.
- Mar 2022 1st Prize in the 2022 Physics and Astronomy Poster competition at University of Nottingham, UK.
- Sep 2020 STFC funding for 3.5 years to do a PhD at University of Nottingham, UK.
- Jan 2017 Sir Peter Mansfield Award for excellent academic results at University of Nottingham, UK.

Outreach Activities

- May 2024 20-min talk titled: "The expansion of the universe and the Hubble tension" Pint of Science, Durham
- Mar 2024 40-min talk titled: "The expansion of the universe and the Hubble tension", Café Scientifique, Durham
- Oct 2022 DigitalizArte: Undertook a +20 hours online course on using YouTube for communicating science.
- 2021- Multiple outreach talks on "*Quantum mechanics and philosophy of science*" at School CEU San Pablo, Spain.
- 2018- Uploaded multiple outreach videos to YouTube and Instagram talking about topics enclosing from Classical dynamics to Early Universe topics.