

# Guillermo Franco Abellán

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## Personal details

**Birth date:** December 3, 1995  
**Birthplace:** Murcia, Spain  
**Nationality:** Spanish

## Research interests

I'm a theoretical cosmologist, with a special interest in the phenomenology of beyond- $\Lambda$ CDM models in CMB and LSS observations. During my PhD, I derived state-of-the-art cosmological constraints on a large number of  $\Lambda$ CDM extensions, mostly motivated by the  $H_0/S_8$  tensions, the neutrino mass problem, and inflation. As a postdoc, I focus on developing new deep learning tools in simulation-based inference (SBI) in order to accelerate and refine parameter inference for cosmology.

## Academic positions

Nov. 2022 – current **Postdoctoral Research Fellow** at GRAPPA Institute, University of Amsterdam, The Netherlands

## Education

Oct. 2019 – Oct. 2022 **Ph.D. in Physics, specialising in Cosmology**, Université de Montpellier, France  
Supervisors: Vivian Poulin and Julien Lavalle  
Thesis title: *Searching for new physics with CMB precision cosmology*, [available online](#)  
Date of defense: July 18, 2022

Sep. 2018 – June 2019 **M.Sc. in Astroparticle Physics and Cosmology**, Université de Montpellier, France  
Highest promotion grade (17.7/20)  
Master internship: *Signatures of dark matter in the CMB*

Sep. 2013 – June 2018 **B.Sc. in Physics**, Universidad de Murcia, Spain and Universität Ulm, Germany (Exchange). Highest promotion grade (8.1/10)  
Bachelor's thesis: *An introduction to supersymmetry*

## Mentoring and supervision

Since 2024 **Supervision of Master student**, University of Amsterdam, The Netherlands  
Master's Degree Candidate: Nicola Terzaghi

Since 2023 **Co-supervision of PhD student**, University of Amsterdam, The Netherlands  
PhD candidate: Fabian Zimmer

Since 2023 **Co-supervision of PhD student**, University of Amsterdam, The Netherlands  
PhD candidate: Oleg Savchenko

## Teaching experience

2023 - 2024 Teaching assistant for *Student Seminar Theoretical Physics*, Master's Course (24h)  
University of Amsterdam, The Netherlands

2023 Teaching assistant for *Academic Skills for Research*, Master's Course (40h)  
University of Amsterdam, The Netherlands

2020 Tutored for *Fundamentals of Physics for Biologists*, Undergrad Course (64h)  
Université de Montpellier, France

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## General Skills

<b>Languages</b>	Spanish ( <i>native</i> ), English ( <i>fluent</i> ), French ( <i>fluent</i> )
<b>Coding</b>	PYTHON/PYTORCH ( <i>advanced</i> ), C/C++ ( <i>advanced</i> ), MATHEMATICA ( <i>basic</i> )
<b>Scientific Software</b>	CLASS ( <i>developer</i> ), SWYFT ( <i>developer</i> ), MONTEPYTHON, COBAYA, GETDIST, PYBIRD ( <i>basic</i> ), PYLIANS, PINOCCHIO ( <i>basic</i> )
<b>Misc.</b>	L <sup>A</sup> T <sub>E</sub> X, Bash scripting, HTML ( <i>basic</i> ), git, Slurm

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## Scientific contributions

Since 2023	Referee for journals (Astronomy & Astrophysics, JCAP)
Since 2023	Member of Euclid collaboration (Theory Work Package: Likelihood and forecasts)
Since 2022	Handler of official Twitter/X account for GRAPPA
March 2023	Crash course on the CLASS code (2h), University of Amsterdam, The Netherlands

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## Organizational skills

May 2024	Member of Local Organizing Committee for <i>European AI for Fundamental Physics Conference (EuCAIFCon, 30 Apr.-3 May 2024)</i> . Amsterdam, The Netherlands
2023 - 2024	Organizer of bi-weekly <i>Amsterdark</i> Seminar Series
Nov. 2023	Co-organizer of ISAPP PhD school <i>Exploring the dark universe (13-19 Nov. 2023)</i> . Texel island, The Netherlands

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## Outreach

July 2022	<i>Anomalies en cosmologie: faire la lumière sur le secteur sombre de l'univers</i> , Journée des chercheurs non-permanents du LUPM, U. de Montpellier (France)
Apr. 2021	<i>Anomalías en cosmología: arrojando luz sobre el universo oscuro</i> , Invited talk for physics bachelor students, U. de Murcia (Spain)
Nov. 2019	<i>Dark Matter: the invisible structure of the Universe</i> , Public talk at Phd Pub, Montpellier (France)

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## References

Vivian Poulin  
LUPM, University of Montpellier  
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## Selected list of talks/seminars

As of November 24, 2024

- Oct. 2024 **Contributed Talk**, *International Conference on Particle Physics and Cosmology, COSMO'24*, Kyoto (Japan)
- June 2024 **Invited Talk**, *Exploring the Dark Side of the Universe, EDSU-Tools 2024*, Île de Noirmoutier (France)
- May 2024 **Contributed Talk**, *European AI for Fundamental Physics, EuCAIFCon 2024*, Amsterdam (The Netherlands)
- Jan. 2024 **Seminar**, *Centre de Physique Théorique, CPT*, Marseille (France)
- Oct. 2023 **Contributed Talk**, *Atelier Théorie, Univers et Gravitation, TUG 2023*, Paris (France)
- June 2023 **Seminar**, *Université Libre de Bruxelles, ULB*, Brussels (Belgium)
- June 2023 **Contributed Talk**, *Third EuCAPT Annual Symposium*, Geneva @CERN (Switzerland)
- May 2023 **Contributed Talk**, *Progress on Old and New Themes in cosmology, PONT 2023*, Avignon (France)
- Mar. 2023 **Seminar**, *Instituto de Astrofísica de Canarias, IAC*, Tenerife (Spain) [remote]
- Nov. 2022 **Seminar**, *Physics Reports Seminar Series* [remote]
- Sep. 2022 **Seminar**, *University of the Western Cape, UWC*, Cape Town (South Africa) [remote]
- July 2022 **Invited Talk**, *Intriguing inconsistencies in the growth of structure over cosmic time*, Sesto (Italy)
- June 2022 **Seminar**, *Laboratoire de Physique des 2 Infinis Irène Joliot-Curie, IJCLab*, Orsay (France)
- June 2022 **Contributed Talk**, *News from the dark (Episode 7: On Dark Matter Subhalos)*, Montpellier (France)
- Jan. 2022 **Contributed Talk**, *56<sup>th</sup> Rencontres de Moriond (Cosmology session)*, La Thuile (Italy)
- Dec. 2021 **Seminar**, *Max Planck Institute for Astrophysics*, Garching (Germany) [remote]
- Nov. 2021 **Seminar**, *Stony Brook University, SBU*, Long Island (US)
- Nov. 2021 **Seminar**, *Center for Cosmology and Particle Physics, CCPP*, New York (US) [remote]
- Nov. 2021 **Seminar**, *University of Maryland, UMD*, Washington D.C. (US)
- Nov. 2021 **Seminar**, *John Hopkins University, JHU*, Baltimore (US)
- Nov. 2021 **Seminar**, *Scuola Internazionale Superiore di Studi Avanzati, SISSA*, Trieste (Italy)
- Oct. 2021 **Seminar**, *Institut de Ciències del Cosmos, ICC*, Barcelona (Spain) [remote]
- Oct. 2021 **Seminar**, *Instituto de Física Corpuscular, IFIC*, Valencia (Spain)
- Oct. 2021 **Seminar**, *Instituto de Física Teórica, IFT*, Madrid (Spain)
- May. 2021 **Contributed Talk**, *XIV International Workshop on Interconnections between Particle Physics and Cosmology, PPC 2021*, Oklahoma (US) [remote]
- Apr. 2021 **Contributed Talk**, *Rencontres de Physique des Particules, RPP 2021*, Tours (France) [remote]

As of November 24, 2024

[\[Inspire HEP profile\]](#)

I am the author of 13 papers and 2 pre-prints (with  $\leq 10$  authors). These works have been cited 963 times and I have an h-index of 11. I have published in high-impact journals such as JCAP, JHEP, PRD and Physics Reports. One paper has now accrued over 400 citations (Ref. (A12)).

- (A1) O. Savchenko\*, F. List, **G.F. Abellán**, N. Anau Montel and C. Weniger, *Mean-Field Simulation-Based Inference for Cosmological Initial Conditions*, in *38th conference on Neural Information Processing Systems*, 10, 2024, [2410.15808](#)
- (A2) F. Zimmer\*, **G.F. Abellán** and S. Ando, *Effects of primordial fluctuations on relic neutrino simulations*, *JCAP* **10** (2024) 098 [[2407.14582](#)]
- (A3) **G.F. Abellán**, G. C. Herrera, M. Martinelli, O. Savchenko, D. Sciotti and C. Weniger, *Fast likelihood-free inference in the LSS Stage IV era*, *JCAP* in press [[2403.14750](#)]
- (A4) **G.F. Abellán**, M. Braglia, M. Ballardini, F. Finelli and V. Poulin, *Probing Early Modification of Gravity with Planck, ACT and SPT*, *JCAP* **12** (2023) 017 [[2308.12345](#)]
- (A5) N. Schöneberg, **G.F. Abellán**, T. Simon, A. Bartlett, Y. Patel and T. L. Smith, *Comparative analysis of interacting stepped dark radiation*, *Phys. Rev. D* **108** (2023) 123513 [[2306.12469](#)]
- (A6) **G.F. Abellán** and G. Facchinetti, *Minihalos as probes of the inflationary spectrum: accurate boost factor calculation and new CMB constraints*, *JCAP* **06** (2023) 032 [[2304.02996](#)]
- (A7) N. Schöneberg and **G.F. Abellán**, *A step in the right direction? Analyzing the Wess Zumino Dark Radiation solution to the Hubble tension*, *JCAP* **12** (2022) 001 [[2206.11276](#)]
- (A8) J. I. Juan, P. D. Serpico and **G.F. Abellán**, *The QCD phase transition behind a PBH origin of LIGO/Virgo events?*, *JCAP* **07** (2022) 009 [[2204.07027](#)]
- (A9) T. Simon, **G.F. Abellán**, P. Du, V. Poulin and Y. Tsai, *Constraining decaying dark matter with BOSS data and the effective field theory of large-scale structures*, *Phys. Rev. D* **106** (2022) 023516 [[2203.07440](#)]
- (A10) T. L. Smith, M. Lucca, V. Poulin, **G.F. Abellán**, L. Balkenhol, K. Benabed et al., *Hints of early dark energy in Planck, SPT, and ACT data: New physics or systematics?*, *Phys. Rev. D* **106** (2022) 043526 [[2202.09379](#)]
- (A11) **G.F. Abellán**, Z. Chacko, A. Dev, P. Du, V. Poulin and Y. Tsai, *Improved cosmological constraints on the neutrino mass and lifetime*, *JHEP* **08** (2022) 076 [[2112.13862](#)]
- (A12) N. Schöneberg, **G.F. Abellán**, A. Pérez Sánchez, S. J. Witte, V. Poulin and J. Lesgourgues, *The  $H_0$  Olympics: A fair ranking of proposed models*, *Phys. Rept.* **984** (2022) 1 [[2107.10291](#)]
- (A13) **G.F. Abellán**, R. Murgia and V. Poulin, *Linear cosmological constraints on 2-body decaying dark matter scenarios and the  $S_8$  tension*, *Phys. Rev. D* **104** (2021) 123533 [[2102.12498](#)]
- (A14) R. Murgia, **G.F. Abellán** and V. Poulin, *Early dark energy resolution to the Hubble tension in light of weak lensing surveys and lensing anomalies*, *Phys. Rev. D* **103** (2021) 063502 [[2009.10733](#)]
- (A15) **G.F. Abellán**, R. Murgia, V. Poulin and J. Lavalley, *Implications of the  $S_8$  tension for decaying dark matter with warm decay products*, *Phys. Rev. D* **105** (2022) 063525 [[2008.09615](#)]

\* = Student supervised for the project

## White papers

- E. Abdalla et al., *Cosmology intertwined: A review of the particle physics, astrophysics, and cosmology associated with the cosmological tensions and anomalies*, *JHEAp* **34** (2022) 49 [[2203.06142](#)]