Curriculum Vitae

NAME

Wilmar Alberto Cardona Castro

WEBSITE

https://www.wilmarcardona.com/

RESEARCH INTERESTS

Cosmological constraints, data analysis, forecasts, statistical methods, relativistic effects, statistical isotropy, non-Gaussianity, dark energy, modified gravity, Cosmic Microwave Background, large-scale structure, perturbation theory, machine learning and artificial intelligence

PROFESSIONAL EXPERIENCE

01/12/2022 – 31/10/2023
Universidad Antonio Narino (UAN), Bogota, Colombia
Post-doctoral researcher

01/01/2022 – 30/11/2022
ICTP South American Institute for Fundamental Research & Instituto de Física Teórica, Universidade Estadual Paulista (UNESP), São Paulo, Brazil
Post-doctoral researcher

01/07/2019 – 31/12/2021
Universidad del Valle (UNIVALLE), Cali, Colombia
Post-doctoral researcher

01/06/2017 – 31/05/2019
Instituto de Física Teórica UAM-CSIC, Madrid, Spain
Post-doctoral researchers

01/03/2014 – 01/10/2016
Centre d'Appui Scolaire, Geneva, Switzerland
Teacher and website administrator

01/02/2013 – 30/09/2016
Physics department University of Geneva (UNIGE), Geneva, Switzerland
Teaching assistant and cosmology website administrator
Courses: **Lab on semiconductors, Thermodynamics, Computer Laboratory**

Summer 2014

Physics department UNIGE
Co-organiser *Nuit de la Science*

01/02/2010 – 30/06/2010 and 01/08/2009 – 31/12/2009
Physics department UNIVALLE
Teacher
Courses: **Electromagnetism, Kinematics and Dynamics**

EDUCATION

17/10/2016
Université de Genève (UNIGE), Geneva, Switzerland
Ph. D in physics, Advisor: Prof. Martin Kunz
Title: *"Cosmological constraints: anisotropic dark energy, the Hubble constant, and the neutrino mass"*

30/10/2012
Centro Brasileiro de Pesquisas Físicas (CBPF), Rio de Janeiro, Brazil
M.Sc. in physics, Advisor: Prof. Marcelo Reboucas
Title: *"A study of Non-Gaussianity in the Cosmic Microwave Background Radiation"*

05/06/2009
Universidad del Valle (UNIVALLE), Cali, Colombia
B.Sc. i*n physics,* Advisor: Prof. Luis Norberto Granda
Title: "*An approach to the Dark Energy from the Holographic Principle*"

PUBLICATIONS

14 in *International journals* and **1** in *International Conference Proceedings*
Citations (excluding self-citations): **330**, average per paper (published): **20.6,** h-index: **8**

∗ J. B. Orjuela-Quintana, S. Nesseris, and **Wilmar Cardona**, *Using machine learning to compress the matter transfer function T(k)*, *Phys. Rev. D* 107 (2023) 8, 08, arXiv:2211.06393 [astro-ph.CO]

∗ **Wilmar Cardona** and M. A. Sabogal, *Holographic energy density, dark energy sound speed, and tensions in cosmological parameters: H_0 and S_8*, JCAP 02 (2023) 045, arXiv:2210.13335 [astro-ph.CO]

∗ **Wilmar Cardona** and D. Figueruelo, *Momentum transfer in the dark sector and lensing convergence in upcoming galaxy surveys*, JCAP 12 (2022) 010, (arXiv:2209.12583 [astro-ph.CO]).

∗ **Wilmar Cardona**, J. Bayron Orjuela-Quintana, Cesar A. Valenzuela-Toledo, *An effective fluid description of scalar-vector-tensor theories under the sub-horizon and quasi-static approximations*, JCAP 08 (2022) 059, (arXiv:2206.02895 [astro-ph.CO]).

∗ **Wilmar Cardona**, R. Arjona, A. Estrada, and S. Nesseris, *Cosmological constraints with the Effective Fluid approach for Modified Gravity*, JCAP 05 (2021) 064, (arXiv:2012.05282 [astro-ph.CO]).

∗ L. N. Granda, D. F. Jimenez, **Wilmar Cardona**. *Higgs inflation with non-minimal derivative coupling to gravity,* Astropart. Phys. 121 (2020) 102459 (arXiv:1911.02901 [gr-qc]).

∗ Rubén Arjona, **Wilmar Cardona**, Savvas Nesseris. *Analytic expressions for the background evolution of massive neutrinos and dark matter particles,* JCAP 10 (2019) 060 (arXiv:1906.03160 [astro-ph.CO]).

∗ Rubén Arjona, **Wilmar Cardona**, Savvas Nesseris. *Designing Horndeski and the effective fluid approach,* Phys. Rev. D 100 (2019) 6, 063526 (arXiv:1904.06294 [astro-ph.CO]).

∗ Rubén Arjona, **Wilmar Cardona**, Savvas Nesseris. *Unraveling the effective fluid approach for f(R) models in the subhorizon approximation,* Phys. Rev. D 99 (2019) 4, 043516 (arXiv:1811.02469 [astro-ph.CO]).

∗ **Wilmar Cardona**, M. Kunz, and V. Pettorino, *Determining H_0 with Bayesian hyper-parameters*, JCAP 1703 (2017) 03, 056 (arXiv:1611.06088 [astro-ph.CO]).

∗ **Wilmar Cardona**. R. Durrer, M. Kunz., and F. Montanari, *Lensing convergence and the neutrino mass scale in galaxy redshift surveys*, Phys. Rev. D 94 (2016) 043007 (arXiv:1603.06481 [astro-ph.CO]).

∗ **Wilmar Cardona,** L. Hollenstein, and M. Kunz, *The traces of anisotropic dark energy in light of Planck*, JCAP 07, (2014), 032 (arXiv:1402.5993 [astro-ph.CO]).

∗ **Wilmar Cardona**, A. Bernui, and M. Rebouças, *A Comparative Study of Non–Gaussianity* in ILC–7 yr CMB Map, International Journal of Modern Physics: Conference Series Vol. 18 (2012) pp. 156-163.

∗ L. N. Granda, and **Wilmar Cardona,** *General Non-minimal Kinetic Coupling to Gravity*, JCAP 1007, (2010), 021 (arXiv:1005.2716 [hep-th]).

∗ L. N. Granda, A. Oliveros, **Wilmar Cardona,** *Age Problem in Holographic Dark Energy*, Mod. Phys. Lett. A, Vol. 25, No. 19 (2010) pp. 1625-1634. (arXiv:0905.1976v1 [hep-th]).

PRESENTATIONS

Talk titled “Cosmological constraints with the Effective Fluid approach for Modified Gravity” in the third **CoCo 2021: Cosmology in Colombia** (9 September 2021)

Talk titled **"***Designing Horndeski and the effective fluid approach*" in the parallel session "Modified gravity" in the **30th Texas Symposium on Relativistic Astrophysics** hosted by the University of Portsmouth (15-20 December 2019)

Talk titled "*Lensing convergence and anisotropic dark energy in galaxy redshift surveys*" in the **XXVIII Congreso Nacional de Física** hosted by Sociedad Colombiana de Física (9-12 September 2019)

Talk titled "*A determination of the Hubble constant without outlier rejection algorithm*" hosted by **Institute for Theoretical Physics** in Madrid (16 November 2017)

RESEARCH EXPEDITIONS

May 25th – June 25th 2015
Institute of Cosmos Sciences, Barcelona, Spain
I visited Prof. Licia Verde and Prof. Raúl Jimenez

October 1st – October 30th 2015
University of Heidelberg
Institute for Theoretical Physics, Heidelberg, Germany
I visited Prof. Valeria Pettorino.

PRIZES AND AWARDS

Scholarship Francisco José de Caldas from the **Administrative Department of Science, Technology and Innovation (COLCIENCIAS)** for conducting doctoral studies abroad

Scholarship from the **National Council for Scientific and Technological Development (CNPq)** for conducting master studies in the period August 2010 – June 2012

Academic scholarships from **UNIVALLE** for academic achievements 2002 – 2005

COLLABORATION MEMBERSHIP

During my PhD I was a member of the Theory Science Working Group in the **EUCLID** survey: Statistical Methods and Forecasting

LANGUAGES

Spanish (*native*), Portuguese (*written and spoken*), English (*written and spoken*), French (*written and spoken*), Italian (*intermediate*)

PROGRAMMING SKILLS

Healpix, GDL, Fortran, Python, CLASS, MontePython, CAMB, COSMOMC, Docker, GitHub, SPSS, Mathematica

https://github.com/wilmarcardonac

https://hub.docker.com/u/wilmarcardonac

MEMBER OF THE JURY

M.Sc. in physics (February 23rd 2017), **UNIVALLE**
Title: "*Formalismo general de perturbaciones gravitacionales y cálculo del índice espectral escalar en modelos de inflación cósmica tipo slow-roll*".
Student: Juan Restrepo

Ph. D in physics (January 20th 2020), **UNIVALLE**
Title: "*Inflación y energía oscura en un modelo con acoplamiento cinético, no mínimo y de Gauss Bonnet*"
Student: Diego Jimenez

B.Sc. i*n physics (January 28th 2020),* **UNIVALLE**
Title: "*Ajuste de parámetros en modelos de energía oscura usando datos de supernovas Ia*"
Student: Alejandro Estrada

B.Sc. i*n physics (July 17th 2020),* **UNIVALLE**
Title: "Formación de estructuras a gran escala en el universo"
Student: Pedro Ibarbo

SUPERVISING AND MENTORING ACTIVITIES

Jose Palacios
M.Sc. student
February 2021 - February 2023

Bayron Orjuela
Ph. D student
February 2021 - February 2023

REFEREE INTERNATIONAL JOURNALS

Physical Review D, Astronomy & Astrophysics, Monthly Notices of the Royal Astronomical Society, International Journal of Modern Physics D, New Astronomy

GENERAL INTERESTS

Cycling, capoeira, basketball, languages, oil painting, and sociology