

Gabriela Alejandra Valencia Zuñiga

CONTACT INFORMATION

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[in](#) 

EDUCATION

Universidad del Valle, Cali, Colombia February 2017 - November 2024
Bachelor's in Physics, *Focus on Cosmology*
Thesis: *Structure Formation in an Anisotropic Universe*
Advisors: Cesar Valenzuela

PUBLICATIONS

2. **Valencia-Zuñiga, G. A.**, "[Structure Formation in an Anisotropic Universe](#)", 2024, *Universidad del Valle Repository. Undergraduate Thesis Manuscript.*
1. **Valencia-Zuñiga, G.A.**, Asorey, J. [Testing the Standard Cosmological Model \$\Lambda\$ CDM.](#), *Astrophysical literature journal Astrobites en Español.*

In preparation

1. Palacios, J., **Valencia-Zuñiga, G.A.**, Orjuela, J.B., Valenzuela, C.A., "Study of Anisotropic Expansion through Cosmological Observations".

AWARDS & HONORS

Academic Stimulus and Scholarship 2020-II - 2022-I
Academic Stimulus and Scholarship awarded in the 2020-II, 2021-I, 2021-II, and 2022-I academic terms, granted semiannually to the top 5 students with the highest GPAs in their cohort of the Physics program.

SPIE and OPTICA Contest Winner 2024
First place among 20 STEM students selected university-wide to present an optics research project in 5 minutes. Topic: "Study of Anisotropic Expansion through Cosmological Observations".

RECA Research Internship 2024
Awarded nationwide to the top 8% of students from Colombian institutions for a scientific training program in Cosmology.

Mitacs Globalink Research Internship 2023
Awarded internationally to students with strong academic for a fully funded research internship at a Canadian university.

RESEARCH EXPERIENCE

Research Collaborator Sept 2024 - Present
LSST Dark Energy Science Collaboration
Supervisor: Agnès Ferté and Andrés A. Plazas Malagón
⇒ Reviewed literature and implemented the CosmoSIS framework for cosmological analysis.
⇒ Currently determining CAMB parameters to compute the matter power spectrum with high precision for the LSST 3x2pt likelihood evaluation.
⇒ Presented results at the 2024 Sprint Week, highlighting the project's progress and key findings.

Research Intern May 2024 - Aug 2024
RECA INTERNSHIP PROGRAM 2024
Supervisor: Jacobo Asorey-Barreiro and Andrés A. Plazas Malagón
⇒ Explored cosmological models beyond the standard Λ CDM.
⇒ Reviewed the implementation of Cobaya.
⇒ Conducted MCMC analyses using Cobaya to explore the parameter spaces in different models beyond the standard Λ CDM.
⇒ Summarized findings in the astrophysical literature journal [Astrobites](#), currently under review for publication.

- ⇒ Utilized the Perlmutter supercomputer at NERSC to run large MCMC chains with Cobaya for cosmological analyses.
- ⇒ Conducted remote observations using the IAC80 telescope at the Teide Observatory.
- ⇒ Presented key results in an invited talk at the [IV RECA Internship Symposium 2024](#).

Research Collaborator

January 2024 - Present

Universidad del Valle

Advisor: Cesar A. Valenzuela

Collaborators: J. Bayron Orjuela-Quintana, Jose L. Palacios-Córdoba

⇒ Conducted extensive literature review on Markov Chain Monte Carlo (MCMC) techniques and their application in cosmology.

⇒ Reviewed the implementation of CLASS and Montepython.

⇒ Implemented several anisotropic dark energy models within the CLASS code.

⇒ Conducted MCMC analyses using MontePython to explore the parameter spaces in different anisotropic dark energy models.

⇒ Summarized findings in a manuscript, currently preparing for submission. This manuscript will be my first paper.

Research Intern

May 2023 - Aug 2023

Mitacs Globalink Research Internship| Brock University

Advisor: Barak Shoshany

⇒ Conducted a theoretical study in general relativity and quantum mechanics.

⇒ Extended the [entangled timeline model](#), previously developed by my supervisor, to incorporate more general and sophisticated scenarios.

⇒ Compiled the results into the manuscript “[Expansion of the Entangled Timelines Model: Accounting for General and Sophisticated Paradox Scenarios](#)” to guide future interns and collaborators on the next steps of the research.

⇒ Presented first-author posters at the 2023 Brock Undergraduate Research Symposium and delivered an invited talk at [CoCo 2023: Cosmology in Colombia](#).

Undergraduate Research Thesis

Jul 2022 - Jul 2024

Universidad del Valle

Advisor: Cesar A. Valenzuela Toledo

⇒ Reviewed relevant cosmology literature, focusing on perturbation theory in the context of structure formation.

⇒ Developed code using the Mathematica package XPand to derive first-order perturbed field equations.

⇒ Constructed contrast density plots for different scenarios using Mathematica to study the growth of structures in the universe.

⇒ Wrote a [49-page dissertation](#) introducing the field, research questions, and key findings.

⇒ Presented a first-author invited talk at the [Third Workshop on Current Challenges in Cosmology](#).

TEACHING & MENTORING EXPERIENCE

Independent teacher

2018 - 2023

Student tutor in areas of mathematics and physics.

Monitor

Universidad del Valle - Carpa Melquiades

I conducted science outreach activities for people of all ages at 'La Casa Melquíades' event in December 2021, October 2022, and December 2022

Mentor

Oct 2021 - December 2021

Universidad del Valle - ASES STRATEGY

Offer social-academic mentorship to physics students belonging to social government programs focused on vulnerable populations in order to assist and decrease academic drop out.

SELECTED SCIENCE TALKS & POSTERS

Science Talks

IV RECA Internship Symposium 2024 (Remote)

August 2024

| | | |
|---------------------------------------|---|---------------------|
| | Thesis Dissertation (<i>Universidad del Valle</i>) | Jul 2024 |
| | Seminar of the cosmology group of the Universidad del Valle (Cali, Colombia) | May 2024 |
| | Seminar of the cosmology group of the Universidad del Valle (Cali, Colombia) | Feb 2024 |
| | Third Workshop on Current Challenges in Cosmology (Bucaramanga, Colombia) | Oct 2023 |
| | CoCo 2023: Cosmology in Colombia (<i>Cali, Colombia</i>) | Sep 2023 |
| | Posters | |
| | 2023 Brock Undergraduate Research Symposium (St. Catharines, Canada) | Aug 2023 |
| SELECTED OUTREACH | First Student Meeting of Sciences: A Look to the Future | |
| | Special Invited Seminar (<i>Spanish</i>) (<i>Cali, Colombia</i>) | Sept 2024 |
| | Delivered an inspirational talk to approximately 50 undergraduates at Universidad del Valle, sharing my personal and research journey. I provided practical tips and motivation for pursuing a career in STEM. | |
| | High School Monseñor Jose Manuel Salcedo | |
| | Special Invited Speaker (<i>Spanish</i>) (<i>Palmira, Colombia</i>) | Feb 2023 |
| | Engaged dialogue and Q&A sessions with hundreds of curious high school students from a rural town in Colombia, fostering scientific curiosity and knowledge sharing. | |
| LEADERSHIP & SERVICE | College Leadership & Service | |
| | Optica and SPIE Student Chapter (CUVO) – Member | Jan 2021 - Jan 2023 |
| | Organize events and projects that focus on science outreach in optics and photonics for science students and the community in general such as school visits, seminars, contests and workshops; as well as professional events along with other OPTICA and SPIE student chapters across the country. | |
| | Physics Student Group (GEF) – Member | Feb 2021 - Jun 2024 |
| | Organize activities for the physics undergraduate students in order to promote different academic opportunities, offer mentorship and create a strong student support network to avoid academic drop out. | |
| | Other Service | |
| | Network of Colombian Astronomy Students (RECA) – Member | Sep 2024 - Present |
| | Participating in inspirational talks and activities about the universe and science in general for students of all levels in remote regions of Colombia, fostering curiosity and encouraging them to explore educational opportunities in STEM fields. | |
| PROFESSIONAL SOCIETIES & GROUPS | LSST DESC | Sep 2024 - Present |
| | OPTICA (FORMERLY OSA) | Jan 2022 - Jan 2023 |
| | SPIE | Jan 2022 - Jan 2023 |
| WORKSHOPS & COURSES | Professional Electives (<i>Universidad del Valle</i>) | Feb 2020 - Nov 2022 |
| | Attend to professional courses: Geometric methods of physics, quantum optics, nuclear physics and Relativity. | |
| | 1st Gaia Latin American School (<i>Remote</i>) | Feb 2022 |
| | Attendance to course offered by the collaboration of several entities such as ESO and the Universidad de Antioquia about of the necessary tools to make scientific use of the data from the Gaia mission. | |
| OTHER SKILLS & TRAINING | <i>Software Tools & Packages</i> | |
| | • Mathematica, CLASS, CAMB, MontePython, Cobaya, CosmoSIS, \LaTeX , Microsoft office. | |
| | <i>Programming Languages</i> | |
| | • Python, C++. | |
| | <i>OS Proficiency</i> | |
| | • Linux (<i>Ubuntu</i>), Windows. | |
| | <i>Languages</i> | |

- Spanish (Native Proficiency), English (Proficient reading, writing and speaking).