Sofía Álvarez-López

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Research Interests

As a member of the MIT Kavli Institute for Astrophysics and Space Research and the LIGO Scientific Collaboration, my main research interest is gravitational-wave (GW) (astro)physics. I'm interested in using Bayesian statistics and data science techniques to understand the populations of black holes and neutron stars in our Universe from their gravitational-wave imprint. Additionally, I have also worked on detector characterization and data calibration efforts to assist in GW searches and discoveries.

Education

Ph.D. in Physics — Aug. 2023 - Today
Massachusetts Institute of Technology, Cambridge, MA
Advisor: Professor Salvatore Vitale

Bachelor of Science in Physics — Aug. 2017 - Jun. 2023
Summa Cum Laude in Physics
Universidad de los Andes, Bogotá, Colombia
GPA: 4.78/5.0

Bachelor of Science in Systems and Computing Engineering — Aug. 2018 - Jun. 2023
Summa Cum Laude in Systems and Computing Engineering
Universidad de los Andes, Bogotá, Colombia
GPA: 4.78/5.0

Minor in Astronomy — Aug. 2022 - Jun. 2023
Universidad de los Andes, Bogotá, Colombia

Experience

MITACS Globaling Research Intern — May 2022 - Aug. 2022
The University of British Columbia, Vancouver, BC
Gravitational wave astrophysics group at UBC
Advisor: Professor Jess McIver

Awards and Honors

Graduate

ACM SIGHPC/Intel Computational and Data Science Fellowship — 2025-

NSF LIGO Laboratory Honorable Mention for Excellence in Detector Characterization and Calibration — 2024, 2025

Mario Santo Domingo Fellowship — 2024-2025
Massachusetts Institute of Technology

MIT Department of Physics Graduate Fellowship — 2023-2024, 2026-2028
Massachusetts Institute of Technology

Undergraduate

Summa Cum Laude in Physics 2023
Universidad de los Andes

Summa Cum Laude in Systems and Computing Engineering 2023
Universidad de los Andes

Ramón de Zubiría Award for Academic Excellence 2023
Universidad de los Andes

Top Performer on the National Higher-Education Exam "Saber Pro" 2023
Colombian Ministry of Education

Mitacs Globalink Summer Research Internship Awardee ($12.000 CAD) 2022
University of British Columbia

Publications

As a member of the LIGO Scientific Collaboration since 2022, I am a co-author on several collaboration papers. Here, I list my first author publications or other publications to which I have contributed significantly.

Álvarez-López, S., Heinzel, J., Mould, M., Vitale, S. "Nowhere left to hide: revealing realistic gravitational-wave populations in high dimensions and high resolution with PixelPop" (2025). ArXiv: https://arxiv.org/abs/2506.20731.

Heinzel, J., Mould, M., **Álvarez-López, S.**, Vitale, S. "High Resolution Nonparameteric Inference of Gravitational-Wave Populations in Multiple Dimensions." *Physical Review D* (2025). DOI: https://doi.org/10.1103/PhysRevD.111.063043.

Soni, S. et al **(incl. Alvarez-Lopez, S.)** "LIGO Detector Characterization in the first half of the fourth Observing run." *Classical and Quantum Gravity* (2025). DOI: https://doi.org/10.1088/1361-6382/adc4b6.

Alvarez-Lopez, S., Liyanage, A., Ding, J., Ng, R., McIver, J. "GSpyNetTree: A signal-vs-glitch classifier for gravitational-wave event candidates." *Classical and Quantum Gravity* (2024). DOI: https://doi.org/10.1088/1361-6382/ad2194.

Raimbaud, P., **Álvarez-López, M.S.**, Figueroa, P., Hernandez, J.T., "Influence of Depth Cues on Eye Tracking Depth Measurement in Augmented Reality Using the MagicLeap Device." *2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)* (2020), pp. 210-214. DOI: 10.1109/VRW50115.2020.00045

Manuscripts in preparation

Álvarez-López, S., Herbst, F., Chan, M., Dhatri, R., Liyanage, A., Ding, J., García-Varela, A., Ng, R., McIver, J. "GSpyNetTree-II: a gravitational-wave signal vs glitch classifier for the fourth LIGO-Virgo-KAGRA observing run" *In prep.*

Invited presentations

1. **Scientific Machine Learning for Gravitational Wave Astronomy**
   NSF Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, RI. June 2025
   Building GSpyNetTree-II: a gravitational-wave signal vs glitch classifier for the fourth LIGO-Virgo-KAGRA observing run (Meeting website, recording).
2. **Universidad de los Andes Astrophysics seminar**
   Bogotá, D.C. April 2022
   Discovering gravitational-wave signals: Analysis and visualization of LIGO data.

Contributed presentations

1. **Gravitational Wave Physics and Astronomy Workshop 2025**
   Atlanta, GA December 2025
   Revealing realistic gravitational-wave populations in high dimensions and high resolution with PixelPop.
2. **24th International Conference on General Relativity and Gravitation and 16th Edoardo Amaldi Conference on Gravitational Waves**
   Glasgow, UK July 2025
   Revealing realistic gravitational-wave populations in high dimensions and high resolution with PixelPop.
3. **American Physical Society Global Physics Summit**
   Anaheim, CA March 2025
   Measuring Multidimensional Correlations in Realistic Astrophysical Populations of Gravitational-Wave Sources Using Nonparametric Inference.
4. **15th Edoardo Amaldi Conference on Gravitational Waves**
   Virtual July 2023
   GSpyNetTree: A signal-vs-glitch classifier for gravitational-wave event candidates (Amaldi15 agenda, session recording).
5. **Gravitational Wave Astronomy Northwest Meeting (GWANW)**
   Hanford, WA June 2023
   GSpyNetTree: A signal-vs-glitch classifier for GW candidates (GWANW 2023 agenda).

Posters

1. **Scientific Machine Learning for Gravitational Wave Astronomy**
   NSF Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, RI. June 2025
   Measuring correlations in astrophysical gravitational-wave populations using PixelPop.
2. **APS Conference for Undergraduate Women in Physics (CUWiP)**
   Virtual February 2023
   GspyNetTree: distinguishing gravitational-wave signals from detector transient noise for the fourth LIGO-Virgo-KAGRA observing run (APS CUWiP Epitome).
3. **LIGO-Virgo-KAGRA collaboration meeting poster session**
   Cardiff University, Cardiff, Wales September 2022
   GSpyNetTree: Improving Gravity Spy classifications toward O4.

Academic Service

Referee *Classical and Quantum Gravity*
Institute of Physics trusted reviewer

Teaching

Teaching Assistant

- Electromagnetism I (2021)
- Quantum Mechanics I (2021)
- Differential Calculus (2018)
- Object Oriented Programming and Algorithmic I (2018)
- Computational Infrastucture (2020)

Grader

- 8.041 Quantum Physics I (2024)
- Transactional Systems (2020)

Grants

Division of Gravitational Physics (DGRAV) Student Travel Grant for APS April Meeting ($600 US) 2025

MIT School of Science Quality of Life grant ($1800 US) Fall 2024

- Awarded $1800 US to host a Latino faculty-graduate student lunch series with the Latinx Graduate Student Association (LGSA) at MIT. Our events encourage open conversations about challenges and successes in academia, while also providing opportunities for mentorship and professional networking in a casual and supportive environment.

MIT Graduate Student Experience Grant ($1600 US) Fall 2024

- Awarded $1600 US to celebrate Hispanic Heritage Month with the Latinx Graduate Student Association (LGSA) at MIT.

Career Mentorship

Mentor, PhysGAAP mentor at MIT Physics 2023, 2024

- PhysGAAP (Physics Graduate Application Advising Program) is an MIT Physics initiative that pairs current graduate students with prospective applicants to the Physics PhD program. It emphasizes on supporting students coming from minorities or underrepresented groups, and that would otherwise feel a barrier to apply to MIT.

Mentor, MIT Women in Physics Mentorship Program 2024

Mentor, Universidad de Los Andes Physics first-year mentorship program 2021

Leadership, Outreach, and Engagement

MIT Summer Research Program application reviewer January 2025 - present

- Member of the admissions committee for an undergraduate MIT Summer program designed to support undergraduate students with limited access to research opportunities. Help expand access to career development and networking resources.

MIT Physics Graduate Ambassador October 2024 - present

- The Graduate Ambassadors are current MIT graduate students who partner with the Office of Graduate Education to create a more diverse, equitable, and inclusive community at MIT.
- Here is my Ambassador profile.

Latinx Graduate Student Association Fall 2024

- I served as the treasurer for the Latinx Graduate Student Association (LGSA), which aims to build a graduate student Latino community and highlight Latino

researchers at MIT.
- I've written and been awarded several grants to highlight our culture, celebrate our traditions, and empower MIT Latino graduate students.

Astrogazers November 2023 - present

- I am part of Astrogazers, a group of MIT graduate students dedicated to sharing our passion for astrophysics with the general public in the Boston area. I've participated in several events, including a stargazing night and an ask-me-anything session.

Graduate Women in Physics (GWiP) November 2023 - present

- At GWiP, I am part of the travel committee, which approves travel grants for women MIT graduate students in Physics to attend conferences or schools. Additionally, I'm part of the GWiP-UWiP (Undergraduate Women in Physics) mentorship program, providing advice to MIT women undergraduates in Physics.

Gravity Spy blog contributor September 2020

- Contributed to the Gravity Spy blog, an initiative of LIGO's Gravity Spy project members to showcase work on detector characterization and interface with both the public and the scientific community.

Girl Up Campus Club Founding Member and President
Universidad de los Andes Jan. 2018 - Dec. 2020

- Willing to advocate for women (especially in STEM), I founded the first Girl Up Campus Club in Colombia. Girl Up is a United Nations Foundation initiative which aims to help adolescent girls in developing countries. We develop activities in favor of Girl Up's objectives (health, education, gender equality and abolition of gender violence) whilst empowering women in our own community, so that every girl and every woman is able to achieve her dreams and her full potential.
- Made part of Girl Up + Disney's global campaign: Dream Big, Princess.
- Organized and held various conferences with recognized University forums (+200 people reached) to empower young women to consider careers in STEM and discuss gender bias in STEM fields with female colombian Physics Faculty.

Volunteer and Panelist, Professional Orientation Forum May 2018 - Nov 2018

- Volunteer and panelist in the Women for Colombia ("*Mujeres por Colombia*") forum for low-income high school female students to motivate them to get into STEM, to increase women's participation in these fields. I have been a panelist in Physics and Systems and Computing Engineering.

Volunteer, Colombian Network of Female Scientists (RCMC) Sep. 2019

- I represented RCMC as a volunteer at the outreach event "*Cacharrear con Ciencia-ExpoCiencia*" in which we introduced to 700+ primary and middle school students the work of the female Physics Nobel Laureates and showcased demonstration experiments.

Extracurricular Activities

Tennis and Piano

- I love playing tennis and playing the piano in my free time