Iago B. Mendes

Computational Physicist

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Education

B.A. in Physics & Computer Science, Oberlin College 2021 – 2025

GPA: 4.01 / 4.00

Awarded the *Highest Honors* distinction for Senior Honors Thesis

Recipient of the Robert Weinstock Prize for *Outstanding Achievement in Physics Coursework*

Research Experience

Parameter Control in Binary Black Hole Initial Data, Caltech 2024 – Present

Caltech's Summer Undergraduate Research Fellowship (SURF)

Mentors: Nils Vu, Mark Scheel, Saul Teukolsky

Worked with the SpECTRE code to enforce physical parameters (masses, spins, etc.) in simulations.
Implemented the computation of total energy, momenta and center of mass as ADM infinite integrals.
Developed a root-finding scheme that controls simulation parameters using Broyden's method.

Isometric Embeddings of Black Hole Horizons, Oberlin College 2021 – Present

Mentor: Robert Owen

Developed a new approach to solve the PDEs needed to embed 2-surfaces into 3-Euclidean space.
Implemented our algorithm in a finite-difference C++ code & in the Spectral Einstein Code (SpEC).
Ran binary black hole merger simulations, gaining insight into the behavior of horizon embeddability.

Determination of Air Viscosity via a Damped Oscillator, IFNMG, Brazil 2019 – 2021

Mentor: Marcos Carvalho

Designed an experimental spring-mass system to determine air viscosity for educational purposes.
Wrote MATLAB scripts that fitted the system's motion based on previously established models.

Publications

1. **Iago B. Mendes**, Nils L. Vu, Harald P. Pfeiffer, Oliver Long, and Robert Owen. "Parameter control for binary black hole initial data" (2025). *In preparation.*
2. **Iago B. Mendes**, Hengrui Zhu, and Robert Owen. "Isometric Embeddings of Numerical Horizons" (2025). *In preparation.*
3. **Iago B. Mendes**, Hengrui Zhu, and Robert Owen. "EuclED: A Code for Isometric Embeddings of 2-Surfaces into 3-Euclidean Space" (2025). *In preparation.*
4. Geoffrey Lovelace, Kyle C. Nelli, and 29 co-authors (including **Iago B. Mendes**). "Simulating binary black hole mergers using discontinuous Galerkin methods" (2024). *Accepted in* Classical and Quantum Gravity. `arxiv:2410.00265`.
5. **Mendes, Iago**. "Isometric Embeddings of Black Holes: Numerical Horizons in Euclidean Space" (2024). Oberlin College Honors Papers, 914. `https://digitalcommons.oberlin.edu/honors/914`
6. **Mendes, I. B.**; Alkimim, H. D. S.; Mota, G. O.; Carvalho, M. A. D. "Exploring the viscosity of air through a damped oscillator" (2021). Annals of Scientific Initiation Seminar of IFNMG, ISSN 2238-085X, p. 1012. `https://ifnmg.edu.br/seminarios-sic`.

Conference Presentations

1. "Parameter Control of Binary Black Hole Initial Data", APS Global Physics Summit 2025
2. "Parameter Control in SpECTRE's BBH Initial Data", SpECTRE Community Workshop (2024)
3. "Black Holes in Euclidean Space", State University of Montes Claros, Brazil (2024)
4. "Isometric Embeddings in Binary Black Hole Merger Simulations", APS April Meeting 2024
5. "Testing a new algorithm for isometric embedding of black hole horizons", APS April Meeting 2023

Teaching & Employment

Instructor of General Relativity, Oberlin College's program of student-taught courses 2024

Teaching Assistant for Physics & Computer Science, Oberlin College 2022 – 2024

Courses: Mechanics & Relativity, Electromagnetism & Thermodynamics, Programming Abstractions

Resident Assistant at the Underrepresented in STEM House, Oberlin College 2022 – 2025

Grader for Physics & Mathematics, Oberlin College 2021 – 2025

Courses: Quantum Mechanics, Statistical Mechanics, Multivariable Calculus

Software Engineer Intern at Google, Wear OS team 2023

Used Java and C++ to develop features on the Android operating system for smartwatches.
Worked on three parts of the codebase, completing two additional projects beyond the initial scope.
Collaborated with my team and others, including managers, input engineers, and UX designers.

Training Software Engineer Intern at Google, Assistant AI team 2022

Used Angular (TypeScript) to create reusable components for Google's issue-tracking platform.
Used Sass and Angular Material to build a modern, intuitive UI with support for themes.
Completed entire development process: design doc, implementation, documentation, and launch.

Honors & Awards

Associate Member of Sigma Xi, The Scientific Research Honor Society 2024

Featured Researcher, Oberlin Undergraduate Research office 2022

International Astronomy & Astrophysics Competition (IAAC)

2x Gold Honor for being in the top 5% of worldwide participants 2021, 2023
Silver Honor for being in the top 10% of worldwide participants 2020
Ambassador Award for recruiting the most students in Brazil 2020

International Youth Math Challenge (IYMC)

Silver Honor for being in the top 10% of worldwide participants 2021
Bronze Honor for being in the top 20% of worldwide participants 2020

International Astronomical Search Collaboration (IASC)

Provisional discovery of an Asteroid in data from Pan-STARRS partnered with NASA 2021

Science Outreach

Stargazing Lecture series, Caltech 2024

Volunteer

Screened questions for the Q&A panel at the 100th edition with Kip Thorne.
Managed a telescope and answered audience questions at the 101st edition.

Astronomical Olympic League, Brazil 2019 – 2022

Content Director, Content Creator

Created free materials and events for students to prepare for Astronomy competitions.
Managed the Content Team, delegating tasks and maintaining a consistent production schedule.

Regional Astronomical Studies Center, Brazil 2019 – 2021

Founder, Event Organizer, Lecturer

Organized many public stargazing sessions, including a lunar eclipse event with over 200 people.
Lectured on Astronomy topics at several public schools and private events.

Coding Projects

Stargazing Conditions Platform 2021 – Present

Developed app & website to see stargazing conditions.
10,000+ installs and 1,000+ active users on Google Play.

Telegram Bot Seller 2021

Built a Telegram bot controlled by a back-end using Node.js and MongoDB.
Won 2nd place in a Brazilian Hackathon organized by VTEX.