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 PhD candidate in physics

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 Portuguese (native), English (fluent), Italian (basic)

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Education

2023–
Sep.

Doctor in Physics

Federal University of ABC (UFABC), Santo André, São Paulo, Brazil

Advisor: André G. S. Landulfo 

2021–2023
Feb. Apr.

Master in Physics

Federal University of ABC (UFABC), Santo André, São Paulo, Brazil


Advisor: André G. S. Landulfo 

Thesis: *Nonperturbative Aspects of Quantum Field Theory in Curved Spacetime*

2017–2020
Feb. Dec.

Bachelor in Physics

Institute of Physics, University of São Paulo (IFUSP), São Paulo, São Paulo, Brazil

Advisor: João C. A. Barata 

Academic Publications

Research Articles

- 1** N. Aguiar Alves and A. G. S. Landulfo. *Sound as a gauge theory and its infrared triangle*. 2025. arXiv: [2512.15796](https://arxiv.org/abs/2512.15796) [hep-th]. Pre-published.
- 2** N. Aguiar Alves and A. G. S. Landulfo. “Null infinity as a Killing horizon”. *Phys. Rev. D* **112.6**, 065017 (2025). arXiv: [2504.12514](https://arxiv.org/abs/2504.12514) [gr-qc].
- 3** N. Aguiar Alves, A. G. S. Landulfo, and B. A. Costa. “Positive mass in general relativity without energy conditions”. *Phys. Rev. D* **111.4**, 044027 (2025). arXiv: [2408.00154](https://arxiv.org/abs/2408.00154) [gr-qc].

Review Articles

- 1** N. Aguiar Alves. “Lectures on the Bondi–Metzner–Sachs group and related topics in infrared physics”. *Eur. Phys. J. C* **86.5**, 507 (2026). arXiv: [2504.12521](https://arxiv.org/abs/2504.12521) [gr-qc].

Pedagogical Articles

- 1** C. C. Rodrigues Evangelista and N. Aguiar Alves. “Using thermodynamics to learn gravitational wave physics”. *Eur. J. Phys.* **47.2**, 025604 (2026). arXiv: [2602.21261](https://arxiv.org/abs/2602.21261) [gr-qc].

Essays and Short Contributions

- 1** N. Aguiar Alves. “Physics as a branch of poetry”. *Am. J. Phys.* In press.
- 2** N. Aguiar Alves and B. A. Costa. *The Measure of a Mass*. 2025. arXiv: [2503.18963](https://arxiv.org/abs/2503.18963) [gr-qc]. Pre-published.

Theses

- 1** N. Aguiar Alves. “*Nonperturbative Aspects of Quantum Field Theory in Curved Spacetime*”. MSc thesis. Santo André, Brazil: Federal University of ABC, 2023. xxiv, 152 pp. arXiv: [2305.17453](https://arxiv.org/abs/2305.17453) [gr-qc].

Other Works

- 1 N. Aguiar Alves. “Quantum Field Theory in Curved Spacetime. An Introduction”. Unpublished lecture notes. 2023.

In Preparation

- 1 N. Aguiar Alves, A. G. S. Landulfo, and A. D. Pereira. *Nonperturbative renormalization group flow for a particle detector*. In preparation.
- 2 N. Aguiar Alves, C. C. Rodrigues Evangelista, G. J. Olmo, and D. Rubiera-Garcia. *Platypus stars: Exotic compact objects supported by vacuum pressure*. In preparation.

Funding

- | | | |
|-----------|---|---|
| 2026– | 📖 | PhD Scholarship – Research Internship Abroad
Explorations with Twistors and Cosmological Correlators
São Paulo Research Foundation (FAPESP) Grant No. 2026/02509-8
Advisor in Brazil: André G. S. Landulfo 
Supervisor abroad: Guilherme L. Pimentel  |
| 2025– | 📖 | PhD Scholarship
The Sky as a Killing Horizon and Other Topics on the Infrared Structure of Gravity
São Paulo Research Foundation (FAPESP) Grant No. 2025/05161-0
Advisor: André G. S. Landulfo  |
| 2023–2025 | 📖 | PhD Scholarship
Coordenação de Aperfeiçoamento do Pessoal de Ensino Superior (CAPES)
Granted to pursue my PhD after placing first in UFABC’s admission ranking |
| 2021–2023 | 📖 | MSc Scholarship
The Functional Renormalization Group in Quantum Field Theory in Curved Spacetimes
São Paulo Research Foundation (FAPESP) Grant No. 2021/07372-7
Advisor: André G. S. Landulfo  |
| 2021 | 📖 | MSc Scholarship
Coordenação de Aperfeiçoamento do Pessoal de Ensino Superior (CAPES)
Granted to pursue my MSc after placing first in UFABC’s admission ranking |
| 2019–2020 | 📖 | BSc Scholarship
Hyperbolic Equations
São Paulo Research Foundation (FAPESP) Grant No. 2019/12158-4
Advisor: João C. A. Barata  |

Academic Service

Conferences Organized

- | | | |
|------------------|---|---|
| 2026 (scheduled) | 📖 | Thermality in Quantum Field Theory in Curved Spacetimes
Main organizer
Promoted by the ICTP South American Institute for Fundamental Research |
| 2023 | 📖 | Golden Wedding of Black Holes and Thermodynamics
Main organizer |

Schools Organized

- | | | |
|-------|---|---|
| 2024– | 📖 | São Paulo School in Gravitational Physics
Main organizer
Part of ICTP Physics Without Frontiers (second edition onward) |
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Academic Service (continued)







- 2018–2021  [Jayme Tiomno School in Theoretical Physics](#)
Founder and organizer of the first three editions

Scientific Societies






- 2025–  [Brazilian Physical Society](#)
2024–  [International Society for Quantum Gravity](#)

Teaching Experience


Minicourses and Workshops

- 2025  [Introduction to Black Hole Physics](#)
[II São Paulo School in Gravitational Physics](#)
Minicourse for early undergraduate students
- 2024  [Infrared Symmetries of General Relativity](#)
[I São Paulo School in Gravitational Physics](#)
Minicourse for advanced undergraduate and early graduate students
- 2023  [Quantum Field Theory in Curved Spacetime](#)
[Golden Wedding of Black Holes and Thermodynamics](#)
Minicourse for early graduate students
- 2021  [Algebraic Methods of Theoretical Physics](#)
[III Jayme Tiomno School in Theoretical Physics](#)
Minicourse on group theory in physics for first-year undergraduate students
- 2020  [An Introduction to \$\LaTeX\$](#)
[XV Oceanography Thematic Week](#)
Oceanographic Institute, University of São Paulo
- 2018  [An Introduction to \$\LaTeX\$](#)
[I Jayme Tiomno School in Theoretical Physics](#)

Teaching Assistant





- 2025  [Topics in Celestial Holography](#)
Institute of Physics, University of São Paulo
Graduate-level course
-  [Advanced Topics in General Relativity](#)
Institute of Physics, University of São Paulo
Graduate-level course
- 2024  [Electromagnetic Phenomena](#)
Federal University of ABC
Undergraduate-level course covering introductory electrodynamics
- 2021  [Classical Mechanics II](#)
Federal University of ABC
Undergraduate-level course covering analytical mechanics
- 2019  [Mathematical Physics I](#)
Institute of Physics, University of São Paulo
Undergraduate-level course covering introductory Fourier analysis

Participation in Panels


- 2026  [VI ICTP-SAIFR Summer School for Young Physicists](#)
Panel with graduate students in physics

Teaching Experience (continued)

Outreach and Miscellanea



- 2025  [VI ICTP-SAIFR Summer School for Young Physicists](#)
Tutored a course on black hole physics for high school students
- 2025  [International Young Physicists Tournament \(Brazil\)](#)
Juror for the final stage of the 2025 edition of the IYPT Brazil
- 2018–  [V ICTP-SAIFR Summer School for Young Physicists](#)
Tutored a course on black hole physics for high school students
- 2018–  [Physics Stack Exchange](#)
Active contributor to the Physics Stack Exchange Q&A website
Most prolific contributor to the [qft-in-curved-spacetime](#) tag

Awards





- 2025  “Outstanding Recognition” award at the [UFABC Physics Week](#)
 - awarded to 12 out of 45 participants based on talks about their research progress

Research Presentations


Invited Talks

- 2026  Sound as a gauge theory and its infrared triangle
 - [Simon’s Collaboration on Celestial Holography Zoom Seminars](#) (10 Mar. 2026)
- 2025  The sky as a Killing horizon
 - [Siembra-HoLAGrav Future of Physics](#) (08 May 2025)

Contributed Talks

- 2026  Sound as a gauge theory and its infrared triangle
 - [Simons–Balseiro School and Workshop on Advanced Aspects of QFT](#) (Instituto Balseiro, 18–27 May 2026)
- 2025  Quantum Gravity and the Night Sky
 - [UFABC Physics Week](#) (Federal University of ABC, 14–17 Oct. 2025)
- 2024  Positive mass in general relativity without energy conditions
 - [XLVII Paulo Leal Ferreira Congress](#) (Institute of Theoretical Physics, São Paulo State University, 29 Oct.–01 Nov. 2024)
- 2023  Nonperturbative renormalization group flow for a particle detector
 - [Golden Wedding of Black Holes and Thermodynamics](#) (online conference, 04–08 Dec. 2023)

Poster Presentations

- 2026  We can use the renormalization group to study the nonperturbative behavior of particle detectors
 - [Simons–Balseiro School and Workshop on Advanced Aspects of QFT](#) (Instituto Balseiro, 18–27 May 2026)

Research Presentations (continued)

- 2025
- Linear sound has asymptotic symmetries
 - [XI QCD Meets Gravity Conference](#) (Principia Institute, 15–19 Dec. 2025)
 - [XI QCD Meets Gravity School](#) (Institute of Theoretical Physics, São Paulo State University, 08–12 Dec. 2025)
 - Stars with extreme pressures can mimic black holes
 - [XLVIII Paulo Leal Ferreira Congress](#) (Institute of Theoretical Physics, São Paulo State University, 14–17 Oct. 2025)
 - Killing horizons naturally define asymptotic symmetries
 - [First International Latin American Conference on Gravitational Waves](#) (National Institute for Space Research, 15–19 Sep. 2025)
 - [VI Siembra-HoLAGrav Young Frontiers Meeting at ICTP-SAIFR](#) (Institute of Theoretical Physics, São Paulo State University, 30 June–11 July 2025)
 - [Program on Anomalies, Topology and Quantum Information in Field Theory and Condensed Matter Physics](#) (Principia Institute, 16–27 June 2025)
- 2024
- Negative masses are unstable and we don't need energy conditions to prove it
 - [Witnessing Quantum Aspects of Gravity in a Lab](#) (Principia Institute, 23–27 Sep. 2024)
- 2023
- Nonperturbative aspects of quantum field theory in curved spacetime
 - [XLVI Paulo Leal Ferreira Congress](#) (Institute of Theoretical Physics, São Paulo State University, 24–27 Oct. 2023)
 - [V Jayme Tiomno Physics School](#) (Institute of Physics, University of São Paulo, 4–8 Sep. 2023)
 - [Interfaces Between Quantum and Classical Statistical Mechanics](#) (Institute of Mathematics and Statistics, University of São Paulo, 24–28 July 2023)

Flash Talks

- 2023–2024
- Nonperturbative renormalization group flow for a particle detector
 - [School on Phase Transitions and Gravitational Waves](#) (International Institute of Physics, Federal University of Rio Grande do Norte, 4–8 Mar. 2024)
 - [Quantum Spacetime and the Renormalization Group 2023](#) (Sant'Elmo Beach Hotel, 2–6 Oct. 2023)