

Níckolas de Aguiar Alves

PhD candidate in physics







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Education

- 2023–  **Doctor in Physics**
Federal University of ABC (UFABC), Santo André, São Paulo, Brazil
Advisor: André G. S. Landulfo 
- 2021–2023  **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*
- 2017–2021  **Bachelor in Physics**
Institute of Physics, University of São Paulo (IFUSP), São Paulo, São Paulo, Brazil
Advisor: João C. A. Barata 



Academic Publications

- 1 N. Aguiar Alves. “Lectures on the Bondi–Metzner–Sachs group and related topics in infrared physics”. *Eur. Phys. J. C* (2026). arXiv: [2504.12521 \[gr-qc\]](#). In press.
- 2 C. C. Rodrigues Evangelista and N. Aguiar Alves. “Using thermodynamics to learn gravitational wave physics”. *Eur. J. Phys.* (2026). arXiv: [2602.21261 \[gr-qc\]](#). Forthcoming.
- 3 N. Aguiar Alves and A. G. S. Landulfo. *Sound as a gauge theory and its infrared triangle*. 2025. arXiv: [2512.15796 \[hep-th\]](#). Pre-published.
- 4 N. Aguiar Alves and A. G. S. Landulfo. “Null infinity as a Killing horizon”. *Phys. Rev. D* **112.6**, 065017 (2025). arXiv: [2504.12514 \[gr-qc\]](#).
- 5 N. Aguiar Alves and B. A. Costa. *The Measure of a Mass*. 2025. arXiv: [2503.18963 \[gr-qc\]](#). Pre-published.
- 6 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 \[gr-qc\]](#).
- 7 N. Aguiar Alves. “*Quantum Field Theory in Curved Spacetime. An Introduction*”. Unpublished lecture notes. 2023.
- 8 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 \[gr-qc\]](#).







To Appear

- 1 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



- 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 

Funding (continued)



- 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
Supported 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)
- 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


Teaching Experience (continued)

- 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

Outreach and Miscellanea

-  [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
-  [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




Research Presentations

Invited Talks






- 2026 (scheduled)  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)

Research Presentations (continued)


Contributed Talks

- 2025  Quantum Gravity and the Night Sky
 - [UFABC Physics Week](#) (Federal University of ABC, 14–17 Oct. 2025)
 - “Outstanding Recognition” award (awarded to 12 out of 45 participants)
- 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

- 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)