Nícholas de Aguiar Alves

PhD student in physics
Federal University of ABC
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Education

2023 – Ongoing
Doctor in Physics
Federal University of ABC (UFABC), Santo André, São Paulo, Brazil
Advisor: Prof. André G. S. Landulfo

2021 – 2023
Master in Physics
Federal University of ABC (UFABC), Santo André, São Paulo, Brazil
Advisor: Prof. 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: Prof. João C. A. Barata

Academic Publications

Papers and Preprints

1. **N. Aguiar Alves** and B. A. Costa. "The Measure of a Mass". (2025). Essay written for the Gravity Research Foundation 2025 Awards for Essays on Gravitation. arXiv: 2503.18963 [gr-qc]. Pre-published.
2. **N. Aguiar Alves**, A. G. S. Landulfo, and B. A. Costa. "Positive Mass in General Relativity Without Energy Conditions". *Physical Review D* **111**, 044027 (2025). arXiv: 2408.00154 [gr-qc].

Other Works

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 [gr-qc].

To Appear

1. **N. Aguiar Alves**. *Lectures on the Bondi–Metzner–Sachs Group and related topics in infrared physics*. In preparation.
2. **N. Aguiar Alves**. *Measurements Are Never Relative*. In preparation.
3. **N. Aguiar Alves** and A. G. S. Landulfo. *The Sky as a Killing Horizon*. In preparation.
4. **N. Aguiar Alves**, A. G. S. Landulfo, and A. D. Pereira. *Nonperturbative Renormalization Group Flow for a Particle Detector*. In preparation.
5. **N. Aguiar Alves** and C. C. Rodrigues. *The Platypus Spacetime: An Example of Gravity Without Mass in General Relativity*. In preparation.

Funding

2023 – Ongoing
PhD Scholarship
Coordenação de Aperfeiçoamento do Pessoal de Ensino Superior (CAPES)
Granted to pursue my PhD after placing first in UFABC's admission ranking

Funding (continued)

2021 – 2023 — MSc Scholarship
São Paulo Research Foundation (FAPESP) Grant No. 2021/07372-7
Project: The Functional Renormalization Group in Quantum Field Theory in Curved Spacetimes
Advisor: Prof. 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
São Paulo Research Foundation (FAPESP) Grant No. 2019/12158-4
Project: Hyperbolic Equations
Advisor: Prof. João C. A. Barata

Academic Service

Conferences Organized

2023 — Golden Wedding of Black Holes and Thermodynamics
Main organizer

Schools Organized

2024 — I São Paulo School in Gravitational Physics
Main organizer

2018 – 2021 — Jayme Tiomno School in Theoretical Physics
Founder and organizer of the first three editions

Miscellaneous

2018 — Dead Physicists Society
Founded a student-driven organization still responsible for the organization of schools and seminars at IFUSP

2017 – Ongoing — Organized several other events, seminars, and colloquia

Scientific Societies

2025 – Ongoing — Brazilian Physical Society

2024 – Ongoing — International Society for Quantum Gravity

Teaching Experience

Minicourses and Workshops

2024 — Infrared Symmetries of General Relativity
I São Paulo School in Gravitational Physics
10-hour-long minicourse for advanced undergraduate and early graduate students

2023 — Quantum Field Theory in Curved Spacetime
Golden Wedding of Black Holes and Thermodynamics
12-hour-long minicourse for early graduate students

2021 — Algebraic Methods of Theoretical Physics
III Jayme Tiomno School in Theoretical Physics
10-hour-long minicourse for first-year undergraduate students on the basics of group theory and its applications to physics

Teaching Experience (continued)

2020 — An Introduction to LaTeX
XV Oceanography Thematic Week
Oceanographic Institute, University of São Paulo

2019 — An Introduction to LaTeX
I Jayme Tiomno School in Theoretical Physics

Teaching Assistant

2025 — Advanced Topics in General Relativity
Institute of Physics, University of São Paulo, SP, Brazil
Graduate-level course covering advanced topics in general relativity
Office hours twice a week (voluntary)

2024 — Electromagnetic Phenomena
Federal University of ABC, SP, Brazil
Undergraduate-level course covering introductory electrodynamics
Office hours twice a week

2021 — Classical Mechanics II
Federal University of ABC, SP, Brazil
Undergraduate-level course covering analytical mechanics
Office hours twice a week

2019 — Mathematical Physics I
Institute of Physics, University of São Paulo, SP, Brazil
Undergraduate-level course covering introductory Fourier analysis
Office hours twice a week

Outreach and Miscellanea

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

2023 – Ongoing — gravitonick
`https://www.youtube.com/@gravitonick`
YouTube channel discussing advanced physics topics aimed at undergraduate students

2018 – Ongoing — Physics Stack Exchange
Active contributor to the Physics Stack Exchange Q&A website
Most prolific contributor to the `qft-in-curved-spacetime` tag

2018 – 2020 — Informal office hours
Hosted "informal office hours" twice a week for first-year students at IFUSP

Research Presentations

Contributed Talks

2024 — Positive mass in general relativity without energy conditions

- XLVII Paulo Leal Ferreira Congress (São Paulo State University, São Paulo, Brazil)

2023 — Nonperturbative renormalization group flow for a particle detector

- Golden Wedding of Black Holes and Thermodynamics (online conference)

Research Presentations (continued)

Poster Presentations

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, São Paulo, Sep. 23–27, 2024)

2023 — Nonperturbative aspects of quantum field theory in curved spacetime

- Interfaces Between Quantum and Classical Statistical Mechanics (University of São Paulo's Institute of Mathematics and Statistics, Jul. 24–28 2023)
- V Jayme Tiomno Physics School (University of São Paulo's Institute of Physics, Sep. 4–8, 2023)
- XLVI Paulo Leal Ferreira Congress (São Paulo State University's Institute of Theoretical Physics, Oct. 24–27, 2023)

Flash Talks

2023 – 2024 — Nonperturbative renormalization group flow for a particle detector

- School on Phase Transitions and Gravitational Waves (Federal University of Rio Grande do Norte's International Institute of Physics, Mar. 4–8, 2024)
- Quantum Spacetime and the Renormalization Group 2023 (Sant'Elmo Beach Hotel, Oct. 2–6, 2023)