







# Níckolas de Aguiar Alves

PhD student in theoretical physics  
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## Education

- 2023 – Ongoing  **Doctor in Physics**  
**Federal University of ABC** (UFABC), SP, Brazil  
Advisor: Prof. André G. S. Landulfo 
- 2021 – 2023  **Master in Physics**  
**Federal University of ABC** (UFABC), SP, 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), SP, Brazil  
Advisor: Prof. João C. A. Barata 

## Academic Publications

### Journal Articles

- 1 **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].




### 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 [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 B. A. Costa. *The Measure of a Mass*. In preparation.
- 4 **N. Aguiar Alves** and A. G. S. Landulfo. *The Sky as a Killing Horizon*. In preparation.
- 5 **N. Aguiar Alves**, A. G. S. Landulfo, and A. D. Pereira. *Nonperturbative Renormalization Group Flow for a Particle Detector*. In preparation.

## Funding

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

## Funding (continued)



- 2021  MSc Scholarship  
[Coordenação de Aperfeiçoamento de 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
- 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 Experience (continued)

### 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 once 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  **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)

### 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)

## Research Presentations (continued)

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- 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)