







# Níckolas de Aguiar Alves

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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].


### Other Works

- 1 **N. Aguiar Alves** and B. A. Costa. *The Measure of a Mass*. Essay written for the Gravity Research Foundation 2025 Awards for Essays on Gravitation. 2025. arXiv: 2503.18963 [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 de 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 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






## 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)

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### 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)