

# Rodolfo Reis Soldati

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## Education

- 2019 – present **Ph.D. (CNPq/DAAD fellow) – Advisors: Prof. Gabriel Landi, Prof. Eric Lutz**, IFUSP, Universidade de São Paulo, ITP1, Universität Stuttgart.  
Thesis: Autonomous quantum absorption refrigerators using ultracold atoms in an optical cavity.
- 2017 – 2018 **M.Sc. Physics – Advisor: Prof. Nelson Yokomizo**, *Dep. of Physics, ICEx*, UFMG, Belo Horizonte, Brazil.  
Dissertation: Entanglement entropy in quantum field theory.
- 2014 – 2015 **Visiting student – Theoretical Physics**, Durham University, Durham, UK.  
Awarded with the Science Without Borders scholarship.
- 2013 – 2016 **B.Sc. Physics**, *Dep. of Physics, ICEx*, UFMG.

## Publications

- 2022 *Soldati, R. R., Dasari, D. B., Wrachtrup, J., & Lutz, E.* (2022). Thermodynamics of a minimal algorithmic cooling refrigerator. **Physical Review Letters**, **129**(3), 030601. [[quant-ph:2109.14056](#)].
- 2021 *Soldati, R. R., Menicucci, L. S., & Yokomizo, N.* (2021). Universal terms of the entanglement entropy in a static closed universe. **Physical Review D**, **104**(12), 125016. [[hep-th:2106.06803](#)].
- 2021 *Soldati, R. R., Mitchison, M. T., & Landi, G. T.* (2021). Multipartite quantum correlations in a two-mode Dicke model. **Physical Review A**, **104**(5), 052423. [[quant-ph:2105.09260](#)].
- 2016 *da Paz, I. G., Soldati, R., Cabral, L. A., de Oliveira Jr, J. G. G., & Sampaio, M.* (2016). Poisson's spot and Gouy phase. **Physical Review A**, **94**(6), 063609. [[quant-ph:1609.09023](#)].

## Teaching

- |                   |                     |                          |                                  |
|-------------------|---------------------|--------------------------|----------------------------------|
| 2020/1            | Teaching Assistant. | University of São Paulo. | Physics 1, Classical Mechanics.  |
| 2021/22<br>Winter | Teaching Assistant. | University of Stuttgart. | Mathematical Methods of Physics. |
| 2022<br>Summer    | Teaching Assistant. | University of Stuttgart. | Electrodynamics.                 |

## Events and presentations

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|----------|--|------------|---|
| Jun 2022 | Quantum Thermodynamics Conference 2022 | QUB/Online | Poster on "Thermodynamics of a minimal algorithmic cooling refrigerator." |
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Aug 2021	Quantum Thermodynamics Summer School	SwissMap	Poster on "Multipartite quantum correlations in a two-mode Dicke model."
Sep/Oct 2019	Predoc School on Interaction of Light with Cold Atoms	Les Houches	Poster on "Symmetry Breaking in a U(1) Dicke model."
Nov 2018	Workshop Physics in the Department	UFMG, Brazil	Talk delivered on "Universal terms of the entanglement entropy in Einstein space."
Nov 2017	Workshop Physics in the Department	UFMG, Brazil	Talk delivered on "Quantum correlations for scalar field in closed spacetime."
Mar 2016	II Workshop on Quantum Field Theory and Quantum Optics	UESC, Brazil	Talk delivered on "Poisson spot with matter waves."

More details on schools I participated below.

- Aug 2021 [Quantum Thermodynamics Summer School](#), *SwissMap Research Station, Les Diablerets. Organized by ETH Zurich and Squid.*
- Nov/Dec 2020 [A mini-course on Quantum-Information Thermodynamics](#), *Online, hosted by USP.*
- Aug 2020 [Online School on Ultra Quantum Matter](#), *Perimeter Institute.*
- Sep/Oct 2019 [Predoc School on Interaction of Light with Cold Atoms](#), *Les Houches.*
- Sep 2019 [School on Interaction of Light with Cold Atoms](#), *ICTP-SAIFR.*
- Jul 2019 [XXI Giambiagi Winter School – Quantum simulations and quantum metrology with cold trapped ions](#), *University of Buenos Aires.*
- Apr 2019 [Minicourse on Quantum Gravity from the QFT perspective](#), *ICTP-SAIFR.*
- Jun 2018 [1st Joint ICTP-Trieste/ICTP-SAIFR School on Particle Physics](#), *ICTP-SAIFR.*
- Jan/Feb 2018 [Mathematics Summer Programme](#), *UFMG.*
- Aug 2017 [XVI Brazilian School on Cosmology and Gravitation](#), *CBPF.*
- Jul 2016 [IFT-Perimeter-SAIFR Journeys into Theoretical Physics](#), *ICTP-SAIFR.*

## Research experience

2019 – present **Ph.D. in a double-degree programme (CNPq and DAAD fellowships)**, *Cotutelle by Prof. Gabriel Landi and Prof. Eric Lutz, USP, University of Stuttgart.*

I am currently working on the theory and applications of information theory in the thermodynamics of quantum refrigerators. We investigate different platforms and their correlation profiles to characterize the advantages and overall differences on the operation of refrigerators in a genuine quantum regime.

2017 – 2018 **Master's degree research project (CNPq scholarship)**, *advised by Prof. Nelson Yokomizo, UFMG.*

My master's degree research project is on the behaviour of universal contributions to entanglement entropy in field theory. It is known that the area law for entropy gets corrections due to curvature of spacetime, and we are looking for them using numerical methods and lattice regularisation for the fixed background of the Einstein universe.

- 2016 **Undergraduate research project (CNPq scholarship)**, advised by Prof. Marcos Sampaio, UFMG.  
Study of the Poisson spot with matter waves using path integral formulation and including effects of decoherence. We also noticed how the Poisson spot intensity is augmented when the Gouy phase shift is taken into account, leading to better fit of experimental data for interferometry of deuterium molecules.
- Summer 2015 **Final project for Science Without Borders scholarship programme**, advised by Prof. Ian Terry, Centre for Materials Physics, Durham University.  
Simulations with the software MCNP6 of the response of transistors to irradiation from the beta decay of  $Sr^{90}$  and  $Y^{90}$  and the characteristic X-ray spectrum of a  $Ag$  target.
- July 2013 – June 2014 **Institutional Program to aid the Research of Newly Licensed Doctors (PRPq scholarship)**, advised by Prof. Ethan Cotterill, Department of Mathematics, UFMG.  
Gonality of tree-decomposed graphs: identification of tree decomposition of metric graphs with the *chip-firing burning algorithm* and use of *cut-and-join* method for visualizing the embedding of graphs on a Riemann sphere.

### Other projects

- Lecture recording I am part of the team managing the recording and live stream of lectures during the academic years of 2021 and 2022 at the University of Stuttgart. I have been particularly responsible for the two lecture courses: 1) Mathematical Methods of Physics; 2) Electrodynamics.
- Institute seminar In 2019 I assisted the organization of the [Quantum Discussions](#) seminar series at USP, with Prof. Gabriel Landi, with the aim to bring closer together research at the interface between quantum information, condensed matter and high-energy physics.
- Group seminar I have been responsible from the second half of 2017 to 2018 for managing the weekly meetings of the Group for Fundamental Theory at UFMG, which include a seminar given by one of our members or invited speakers. I have also worked on setting up the group's webpage, at [GFT](#).

### Languages

- Portuguese Native  
Spanish Basic  
English Fluent