

# LUCAS DE SÁ

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## RESEARCH INTERESTS

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Physics of compact objects. Stellar and binary evolution. Population synthesis. Gravitational waves.

## EDUCATION

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- Ph.D. Astronomy** Institute of Astronomy, Geophysics and Atmospheric Sciences - U. São Paulo (IAG-USP) 2021 - 2025 (expected)  
*Advisor:* Prof. Dr. Jorge E. Horvath  
*Project title:* Compact object binaries over cosmic time
- B.Sc. Physics** São Carlos Institute of Physics - U. São Paulo (IFSC-USP) 2017 - 2020  
*Advisor:* Dr. Gustavo D. Telles  
*Project title:* Machine learning optimization of a magneto-optical trap

## PUBLICATIONS

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### FIRST AUTHORED

4. **L. M. de Sá**, L. S. Rocha, A. Bernardo, R. R. A. Bachega, J.E. Horvath. *Compact object populations over cosmic time II. Compact object merger rates and masses over redshift from varying initial conditions.* (submitted to MNRAS)
3. **L. M. de Sá**, A. Bernardo, L. S. Rocha, R. R. A. Bachega, J. E. Horvath. *Compact object populations over cosmic time I. A pipeline for time-evolving population synthesis.* (submitted to MNRAS)
2. **L. M. de Sá**, A. Bernardo, R. R. A. Bachega, L. S. Rocha, P. H. R. S Moraes, J. E. Horvath (2023). *An Overview of Compact Star Populations and Some of Its Open Problems.* [Galaxies](#), **11**(1), 19.
1. **L. M. de Sá**, A. Bernardo, R. R. A. Bachega, J. E. Horvath, L. S. Rocha, P. H. R. S Moraes (2022). *Quantifying the Evidence Against a Mass Gap between Black Holes and Neutron Stars.* [ApJ](#), **941**, 130.

### SECOND OR THIRD AUTHOR

3. J. E. Horvath, **L. M. de Sá**, L. S. Rocha, G. Y. Chinen, L. G. Barão, M. G. B. de Avellar (accepted by World Scientific). *Evolution of long-period compact radio sources.* [arXiv:2402.06866](#).
2. L. S. Rocha, J. E. Horvath, **L. M. de Sá**, G. Y. Chinen, L. G. Barão, M. G. B. de Avellar (2023). *Mass Distribution and Maximum Mass of Neutron Stars: Effects of Orbital Inclination Angle.* [Universe](#), **10**(1), 3.
1. J. E. Horvath, L. S. Rocha, **L. M. de Sá**, P. H. R. S. Moraes, L. G. Barão, M. G. B. de Avellar, A. Bernardo, R. R. A. Bachega (2023). *A light strange star in the remnant HESS J1731-347: Minimal consistency checks.* [A&A](#), **672**, L11

### CONFERENCE PROCEEDINGS

6. **L. M. de Sá**, A. Bernardo, R. R. A. Bachega, L. S. Rocha, J. E. Horvath (submitted). *Binary synthesis of merging compact object populations from evolving initial conditions.*

5. **L. M. de Sá**, A. Bernardo, R. R. A. Bachega, L. S. Rocha, J. E. Horvath (submitted). *Compact object populations over cosmic time*.
4. L. G. Barão, **L. M. de Sá**, A. Bernardo, J. E. Horvath (2023). *Describing the evolution and perturbations to biodiversity using a simple dynamical model*. [Astron. Nachr.](#), e20230025
3. **L. M. de Sá**, A. Bernardo, R. R. A. Bachega, L. S. Rocha, J. E. Horvath (2022). *Effects of a non-universal IMF and binary parameter correlations on compact binary mergers*. [Astron. Nachr.](#), 344, e20220089.
2. A. Bernardo, L. Paulucci, **L. M. de Sá**, J. E. Horvath (2022). *Counting states: a combinatorial analysis of SQM fragmentation*. [Astron. Nachr.](#), 344, e220100
1. J. E. Horvath; A. L. C. Bernardo; R. R. A. Bachega; **L. M. de Sá**; L. S. Rocha; P. H. R. S. Moraes (2022). *Quantifying the Evidence Against a Mass Gap between Black Holes and Neutron Stars*. [Astron. Nachr.](#), 344, e220106

## BOOKS

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2. J. E. Horvath, **L. M. de Sá**, R. R. Fernandes, L. S. Rocha, R. R. A. Bachega, L. G. Barão (2023). *A natureza do mundo físico: do que é feito o Universo? Do Iluminismo à Ciência Contemporânea [The nature of the physical world: what is the Universe made of? From the Enlightenment to Contemporary Science]*. Vol. 2 (Livraria da Física, São Paulo).  
Second book in a two-volume series on the History of Physics and its Philosophy for a non-academic audience.
1. J. E. Horvath, **L. M. de Sá**, R. R. Fernandes, L. S. Rocha, R. R. A. Bachega, L. G. Barão (2023). *A natureza do mundo físico: do que é feito o Universo? Dos pré-Socráticos à Revolução Científica [The nature of the physical world: what is the Universe made of? From the pre-Socratics to the Scientific Revolution]*. Vol (Livraria da Física, São Paulo).  
First book in a two-volume series on the History of Physics and its Philosophy for a non-academic audience.

## INVITED TALKS

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- Mar 2024** **City University of São Paulo**, NAT Colloquium, *Population synthesis of compact object mergers over cosmic time*
- Oct 2023** **University of São Paulo**, Midday Astronomy seminar, *Current problems in the compact object mass distribution*
- Jun 2023** **São Paulo State University**, Astrophysics & Cosmology Journal Club, *Modeling compact object mergers over redshift*

## CONFERENCE CONTRIBUTIONS AND PARTICIPATION

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- Apr 2024** **Contributed talk**, 2nd FAPESP/BAYLAT Workshop "High-energy astrophysics in the multi-messenger era"  
*São Carlos, Brazil*
- Mar 2024** **Participation**, Workshop on stable mass transfer in binaries: from onset to remnants  
*New York, USA*
- Nov 2023** **Parallel session**, XVII Latin American Regional IAU Meeting  
*Montevideo, Uruguay*
- Oct 2023** **Plenary session**, XLVI Annual Brazilian Astronomical Society Meeting  
*Rio de Janeiro, Brazil*

- Jun 2023** **Poster**, Thematic School GWsNS-2023: Gravitational Waves from Neutron Stars  
*Aussois, France*
- May 2023** **Contributed talk**, 1st FAPESP/BAYLAT Workshop "High-energy astrophysics in the multi-messenger era"  
*Erlangen, Germany*
- Mar 2023** **Participation**, 4th G2Net Training School  
*Thessaloniki, Greece (virtual)*
- Sep 2022** **Poster**, 10th International Workshop on Astronomy and Relativistic Astrophysics  
*Antigua, Guatemala (virtual)*
- Nov 2020** **Poster**, 10th São Carlos Institute of Physics Integrated Week  
*São Carlos, Brazil (virtual)*.

## FUNDING

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- Jul 2021 - now** **National Council of Scientific and Technological Development (CNPq)**  
Ph.D. scholarship
- Nov 2023** **São Paulo Research Foundation (FAPESP)/Bavarian Academic Center for Latin America (BAYLAT)**  
Visit to the Erlangen Centre for Astroparticle Physics (ECAP) to collaborate with Alison Mitchell and Giovanni Cozzolongo on pulsar wind nebula populations and gamma-ray observations.  
*Erlangen, Germany*

## SERVICE

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- 2024** Substitute graduate representative, Congregation  
*IAG-USP*
- 2023** Titular graduate representative, Graduate Committee of the Astronomy Program  
*Department of Astronomy, IAG-USP*  
Helped lead graduate student-professor discussions on new regulations for the possibility of accumulating other paid work with scholarships.
- 2023** Substitute graduate representative, Technical-Administrative Council  
*IAG-USP*
- 2021 - 2022** Member of the "Student Permanence and Formation Support Program for Graduates" Work Group  
*USP Graduate Student Associations (APGs)*  
Participated in research and writing of, and advocacy for, a proposal for extending a pre-existing program of financial aid for socioeconomically vulnerable undergraduate students to graduate students in the University, including organization of an [online discussion](#) and writing of an [article](#). Resulted in the [extension](#) of the aforementioned program to graduate students starting in 2023 (links in Portuguese).

## DATA AVAILABILITY

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- L. M. de Sá**, A. Bernardo, R. R. A. Bachega, L. S. Rocha, P. H. R. S Moraes, J. E. Horvath (2023), data from *An Overview of Compact Star Populations and Some of Its Open Problems*, on [Zenodo](#).

## OUTREACH

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**Jan 2022 - now** Writing about High-Energy Astrophysics and History & Philosophy of Physics for the [Instagram profile of the GARDEL group](#) (in Portuguese).

## LANGUAGES

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Portuguese (native), English (fluent), French (intermediate), Spanish (intermediate)