

# Lucas de Sá

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## Research Interests

Physics of compact objects. Massive stellar and binary evolution. Massive star formation. Population synthesis. Gravitational-waves.

## Education

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

## Research positions

<b>Pre-Doctoral Fellow</b>	Center for Computational Astrophysics Flatiron Institute <i>Advisors:</i> Dr. Lieke van Son & Dr. Matteo Cantiello, CCA/Princeton	Sep 2024 - Jan 2025
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## Funding

<b>2025 (upcoming)</b>	<b>Astrophysics Centre for Multi-messenger studies in Europe (ACME)</b> Visit to Gran Sasso Science Institute (GSSI), as part of the 1st ACME Transnational Access (TNA) call. <i>L'Aquila, Italy</i>	
<b>Jul 2021 - Jun 2025</b>	<b>National Council of Scientific and Technological Development (CNPq)</b> Ph.D. scholarship. <i>São Paulo, Brazil</i>	
<b>Sep 2024 - Jan 2025</b>	<b>Flatiron Institute Pre-Doctoral Fellowship</b> 4.5 months fellowship, including paid housing in New York and conference funding ~ \$15k. <i>New York, USA</i>	
<b>Nov 2023</b>	<b>São Paulo Research Foundation (FAPESP)/Bavarian Academic Center for Latin America (BAYLAT)</b> Visit to the Erlangen Centre for Astroparticle Physics (ECAP) to collaborate with Dr. Alison Mitchell and Giovanni Cozzolongo, M.Sc., on pulsar wind nebula populations. <i>Erlangen, Germany</i>	

## Invited talks

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<b>May 2025</b>	<b>CCA-FI</b> , Pre-Doctoral Symposium	<i>New York, USA</i>
<b>Jan 2025</b>	<b>Columbia University</b> , THEA Seminar	<i>New York, USA</i>
<b>Jan 2025</b>	<b>CCA-FI</b> , Stars & Plasma Meeting	<i>New York, USA</i>
<b>Nov 2024</b>	<b>UC San Diego</b> , STRAND Seminar	<i>San Diego, USA</i>
<b>Mar 2024</b>	<b>City University of São Paulo</b> , NAT Colloquium	<i>São Paulo, Brazil</i>
<b>Oct 2023</b>	<b>University of São Paulo</b> , Midday Astronomy seminar	<i>São Paulo, Brazil</i>
<b>Jun 2023</b>	<b>São Paulo State University</b> , Astrophysics & Cosmology Journal Club	<i>São Paulo, Brazil</i>

## Conferences

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<b>Sep 2025</b>	<b>Upcoming talk</b> , IAUS 402: Massive Stars Across Redshifts in the Era of JWST and Large-Scale Surveys <i>Ensenada, Mexico</i>
<b>Mar 2025</b>	<b>Contributed talk</b> , Stellar black hole formation and detection workshop <i>Kyoto, Japan</i>
<b>Jun 2024</b>	<b>Contributed talk</b> , Physics Of Extreme Massive Stars International Conference <i>Rio de Janeiro, Brazil</i>
<b>Apr 2024</b>	<b>Contributed talk</b> , 2nd High-energy astrophysics in the multi-messenger era workshop <i>São Carlos, Brazil</i>
<b>Mar 2024</b>	<b>Participation</b> , Stable mass transfer in binaries: from onset to remnants <i>New York, USA</i>
<b>Nov 2023</b>	<b>Contributed parallel talk</b> , XVII Latin American Regional IAU Meeting <i>Montevideo, Uruguay</i>
<b>Oct 2023</b>	<b>Contributed plenary talk</b> , XLVI Annual Brazilian Astronomical Society Meeting <i>Rio de Janeiro, Brazil</i>
<b>May 2023</b>	<b>Contributed talk</b> , 1st High-energy astrophysics in the multi-messenger era workshop <i>Erlangen, Germany</i>
<b>Sep 2022</b>	<b>Poster</b> , 10th International Workshop on Astronomy and Relativistic Astrophysics <i>Antigua, Guatemala (virtual)</i>
<b>Nov 2020</b>	<b>Poster</b> , 10th São Carlos Institute of Physics Integrated Week <i>São Carlos, Brazil (virtual)</i>

## Publications

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### FIRST AUTHORED PAPERS

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* (2024). **MNRAS**, **535**, 2041
3. **L. M. de Sá**, A. Bernardo, L. S. Rocha, R. R. A. Bachega, J. E. Horvath. *Compact object populations over cosmic time I. BOSSA: a Binary Object environment-Sensitive Sampling Algorithm* (2024). **MNRAS**, **535**, 2019
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 AUTHORED PAPERS

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

## OTHER CO-AUTHORED PAPERS

1. O. G. Benvenuto, M. A. De Vito, M. Echeveste, M. L. Novarino, N. D. Pires, **L. M. de Sá**, J. E. Horvath (2025). *Formation and nature of "Huntsman" binary pulsars*. *A&A*, 698, L5.

## BOOK CHAPTERS

1. J. E. Horvath, **L. M. de Sá**, L. S. Rocha, G. Y. Chinen, L. G. Barão, M. G. B. de Avellar. *Evolution of long-period compact radio sources driven by winds*. In: Pulsar Astronomy, Unveiling Compact Stars with China's New Facilities. *World Scientific*, 2025

## Books

3. J. E. Horvath, L. S. Rocha, **L. M. de Sá**, N. D. Pires, M. G. B. de Avellar, L. G. Barão, D. V. Rodrigues, R. Miwa, L. R. Gusmão, G. Chenin (2025). *O Bê-a-Bá da Astrofísica, um Guia para Desnorteados: Supernovas, Buracos Negros e Estrelas de Nêutrons no Nosso Universo [The ABC of Astrophysics, a Guide for the Disoriented: Supernovae, Black Holes and Neutron Stars in Our Universe]*. (Livreria da Física, São Paulo).  
An introduction to high-energy astrophysics and current research topics surrounding compact objects for a non-academic audience.
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 (Livreria 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. 1 (Livreria da Física, São Paulo).  
First book in a two-volume series on the History of Physics and its Philosophy for a non-academic audience.

## School participation

**Aug 2024 Participation**, Cosmological History: from Gravitational Waves to Exoplanets  
São Paulo, Brazil

**Jun 2023 Poster**, Thematic School GWsNS-2023: Gravitational Waves from Neutron Stars  
Aussois, France

**Mar 2023 Participation**, 4th G2Net Training School  
Thessaloniki, Greece (virtual)

**Feb 2020 Participation**, 2020 Summer School of the Institute of Physics of the University of São Paulo  
*São Paulo, Brazil*

## Data & Software

3. BOSSA and COMPAS datasets for BBH, BHNS and BNS mergers from "Compact object populations over cosmic time II". Available at <https://zenodo.org/records/13909307>.
2. **BOSSA** Initial sampling algorithm for binary populati-messenger studies in Europe (ACME)on synthesis, self-consistently implementing correlated and environment-dependent initial conditions. **L. M. de Sá, 2024**. Available at <https://github.com/LucasMDeSa/BOSSA>.
1. **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*. Available at <https://doi.org/10.5281/zenodo.7508626>.

## Service

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

## Outreach

- 2022 - now** Writing about High-Energy Astrophysics in the [GARDEL profile](#).
- 2022 - 2024** Writing for the "*Do Que É Feito o Universo?*" [*What is the Universe Made Of?*] series on the History and Philosophy of Physics in the [GARDEL profile](#).

## Other skills

**CODING** Python (expert): main working language; writing BOSSA; general data analysis. Linux, bash (intermediate). Fortran (basic): MESA working language.

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