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.

Research positions

Humboldt Research Fellow

Institut für Theoretische Astrophysik, Zentrum für Astronomie — Oct 2025 - present
Universität Heidelberg

Ph.D. Candidate

Instituto de Astronomia, Geofísica e Ciências Atmosféricas — Mar 2021 - Jun 2025
Universidade de São Paulo
Advisor: Prof. Dr. Jorge E. Horvath, University of São Paulo

Pre-Doctoral Fellow

Center for Computational Astrophysics — Sep 2024 - Jan 2025
Flatiron Institute
Advisors: Dr. Lieke van Son & Dr. Matteo Cantiello, CCA/Princeton

Education

Ph.D. Astronomy — Mar 2021 - Jun 2025
Instituto de Astronomia, Geofísica e Ciências Atmosféricas
Universidade de São Paulo
Advisor: Prof. Dr. Jorge E. Horvath
Project title: Compact object populations over cosmic time

B.Sc. Physics — Mar 2017 - Feb 2021
Instituto de Física de São Carlos
Universidade de São Paulo
Advisor: Dr. Gustavo D. Telles
Project title: Machine learning optimization of a magneto-optical trap

Funding

Oct 2025 — **Astrophysics Centre for Multi-messenger studies in Europe (ACME)**
Visit to Gran Sasso Science Institute (GSSI), as part of the 1st ACME Transnational Access (TNA) .
L'Aquila, Italy

Jul 2021 - Jun 2025 — **National Council of Scientific and Technological Development (CNPq)**
Ph.D. scholarship.
São Paulo, Brazil

Sep 2024 - Jan 2025 **Flatiron Institute Pre-Doctoral Fellowship**
4.5 months fellowship, including paid housing in New York and conference funding ∼ $15k.
New York, USA

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 Dr. Alison Mitchell and Giovanni Cozzolongo, M.Sc., on pulsar wind nebula populations.
Erlangen, Germany

Invited talks

Nov 2025 **ECAP-FAU**, (upcoming) Department seminar — *Erlangen, Germany*
May 2025 **CCA-FI**, Pre-Doctoral Symposium — *New York, USA*
Jan 2025 **Columbia University**, THEA Seminar — *New York, USA*
Jan 2025 **CCA-FI**, Stars & Plasma Meeting — *New York, USA*
Nov 2024 **UC San Diego**, STRAND Seminar — *San Diego, USA*
Mar 2024 **City University of São Paulo**, NAT Colloquium — *São Paulo, Brazil*
Oct 2023 **University of São Paulo**, Midday Astronomy seminar — *São Paulo, Brazil*
Jun 2023 **São Paulo State University**, Astrophysics & Cosmology Journal Club — *São Paulo, Brazil*

Conferences

Sep 2025 **Contributed talk**, IAUS 402: Massive Stars Across Redshifts in the Era of JWST and Large-Scale Surveys
Ensenada, Mexico

Mar 2025 **Contributed talk**, Stellar black hole formation and detection workshop
Kyoto, Japan

Jun 2024 **Contributed talk**, Physics Of Extreme Massive Stars International Conference
Rio de Janeiro, Brazil

Apr 2024 **Contributed talk**, 2nd High-energy astrophysics in the multi-messenger era workshop
São Carlos, Brazil

Mar 2024 **Participation**, Stable mass transfer in binaries: from onset to remnants
New York, USA

Nov 2023 **Contributed parallel talk**, XVII Latin American Regional IAU Meeting
Montevideo, Uruguay

Oct 2023 **Contributed plenary talk**, XLVI Annual Brazilian Astronomical Society Meeting
Rio de Janeiro, Brazil

May 2023 **Contributed talk**, 1st High-energy astrophysics in the multi-messenger era workshop
Erlangen, Germany

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).

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

Service

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-faculty 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 "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 - 2025 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)

List of publications

Peer-reviewed publications

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

2. Shu-Xu Yi and 77 co-autors, including **L. M. de Sá** (2025). Prospects for time-domain and multi-messenger science with eXTP (2025). Sci. China Phys. Mech. Astron., 68, 119506
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.

Books & Chapters

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. Bãrao, 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]*. (Livraria 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 (Livaria 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 (Livaria da Física, São Paulo).
   First book in a two-volume series on the History of Physics and its Philosophy for a non-academic audience.

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`.