LUCAS DE SÁ

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RESEARCH INTERESTS

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

EDUCATION

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

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. *Compact object populations over cosmic time.* Boletim da SAB, 35, 167

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

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.

INVITED TALKS

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

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

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 **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 FAPESP/BAYLAT Workshop "High-energy astrophysics in the multi-messenger era"
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 PARTICIPATIONS

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

FUNDING

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

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

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*, on Zenodo.

OUTREACH

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

LANGUAGES

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