

Lucas F. Secco | Resume

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Education

Ph.D. in Physics & Astronomy

University of Pennsylvania

2015–2020

M.Sc. in Physics

University of São Paulo (Brazil)

2013–2015

B.Sc. in Physics

Federal University Rio Grande do Sul (Brazil)

2009–2013

Research Experience

University of Chicago

Kavli Institute for Cosmological Physics Postdoctoral Fellow

2020– present

- Led analysis of 500 million astronomical data features with Bayesian posterior sampling, inferring cosmological model parameters with 2% accuracy, a 2× improvement over then state-of-the-art, leading to a main-author publication with over 120 citations.
- Improved predictive models by accurately determining regions of the data that do not follow linear physics assumptions using comparison with simulations, minimizing biases on inferred model parameters to less than 25% of a standard deviation.
- Extracted a first-ever detection of faint non-Gaussian signals from data by optimally engineering features and proving those signals statistically inconsistent with experimental errors, verifying an unobserved effect predicted 20 years prior.
- Forecasted the constraining power of cross-correlations between optical and microwave data sets 10 years into the future, determining the relative priority of data uncertainties to be addressed and resulting in publication by undergraduate mentee.

University of Pennsylvania

Research Assistant (Dark Energy Survey Collaboration)

2015–2020

- Led large (>20) and small (<5) teams of physicists, astronomers and data scientists in the cleaning/maintenance of data sets by organizing periodic meetings and workshops; rewarded with exclusive data access rights and co-authored over 30 publications.
- Created thousands of mock data sets modeled as log-normal stochastic realizations in order to quantify the cross-covariance of observables, providing numerically stable covariance matrices crucial for parameter inference and chi-squared optimization.
- Predicted novel signals of dark matter properties on galaxies by running N-body simulations on supercomputers; forecasted that observations of these new effects may lead to two-fold improvement on state-of-the-art confidence intervals with future data.

University of São Paulo (Brazil)

Research Scholar

2013–2015

- Modeled galaxies as biased random samples and found optimal estimators for data cross-correlations with a Fisher information matrix approach, leading to an expected ten-fold improvement of experimental constraints and the award of national scholarship.

Technical Skills

Statistics & Data Science

- Supervised learning (linear & logistic regression, neural networks, random forests), k-means, principal component analysis, covariance estimation, statistical significance evaluation, Bayesian parameter inference, data engineering, analysis of simulations.

Programming

- Python, Git, LaTeX, Unix, MacOS, Microsoft Office Suite, TensorFlow, scikit-learn.

Honors & Awards

Kavli Postdoctoral Fellowship (University of Chicago)

2020-2023

Dark Energy Survey Collaboration Builder Data Rights (University of Pennsylvania)

2019

Early Career Scientist Travel Grant (Dark Energy Survey)

2017-2018

São Paulo Research Agency (FAPESP) Scholarship

2013-2015

Selected Publications

Complete list with over 45 publications as main or contributing author in: <https://lfsecco.com/publications>

1. **L. F. Secco**, T. Karwal, W. Hu, E. Krause (2022)
The Role of the Hubble Scale in the Weak Lensing vs. CMB Tension (arXiv:2209.12997)
2. K. Hoffmann, **L. F. Secco**, J. Blazek et al. (2022)
Modeling intrinsic galaxy alignment in the MICE simulation (PRD 106,12351)
3. **L. F. Secco**, M. Jarvis, B. Jain, C. Chang et al. (2022)
Dark Energy Survey Year 3 Results: Three-Point Shear Correlations and Mass Aperture Moments (PRD 105,103537)
4. Z. Zhang, C. Chang, P. Larsen, **L. F. Secco** et al. (2022)
Transitioning from Stage-III to Stage-IV: cosmology from galaxy \times CMB lensing and shear \times CMB lensing (MNRAS 514,2181)
5. **L. F. Secco**, S. Samuroff, E. Krause, B. Jain et al. (2022)
Dark Energy Survey Year 3 Results: Cosmology from Cosmic Shear and Robustness to Modeling Uncertainty (PRD 105,023515)
6. E. Krause, X. Fang, S. Pandey, **L. F. Secco** et al. (2021)
Dark Energy Survey Year 3 Results: Multi-Probe Modeling Strategy and Validation (arXiv:2105.13548)
7. Dark Energy Survey Collaboration et al. (incl. **L. F. Secco**) (2021)
Dark Energy Survey Year 3 Results: Cosmological Constraints from Galaxy Clustering and Weak Lensing (PRD 105,023520)
8. Dark Energy Survey Collaboration et al. (incl. **L. F. Secco**) (2019)
Dark Energy Survey Year 1 Results: Constraints on Extended Cosmological Models (PRD 99,123505)
9. **L. F. Secco**, A. Farah, B. Jain, et al. (2018)
Probing Self-interacting Dark Matter with Disk Galaxies in Cluster Environments (ApJ 860,32)
10. L. R. Abramo, **L. F. Secco**, A. Loureiro (2016)
Fourier analysis of multitracer cosmological surveys (MNRAS 455,3871)

Selected Invited Seminars & Conferences

1. Inconsistencies in the Growth of Structure Conference - **Sesto Center for Astrophysics**, Sesto, Italy (Jul 25th 2022)
2. APEC Seminar - **Kavli IPMU Tokyo University**, Tokyo, Japan (Jun 29th 2022)
3. Gravity Conference - **Yukawa Institute for Theoretical Physics**, Kyoto, Japan (Jun 23rd 2022)
4. HEP/Astro Seminar, **University of Michigan**, Ann Arbor, MI (Oct 11th 2021)
5. CosmoStatistics Q&A Seminar (virtual) - **CEA Paris-Saclay**, Paris, France (July 2nd 2021)
6. Cosmology Seminar (virtual) - **Max Planck Institute for Astrophysics**, Garching, Germany (June 22nd 2021)
7. Astronomy Seminar - **Columbia University**, New York NY (Jan 23rd 2020)
8. BCCP Cosmology Seminar, **UC Berkeley**, Berkeley, CA (Oct 15th 2019)
9. KIPAC Cosmology Seminar, **Stanford university**, Stanford, CA (Oct 14th 2019)

Service and Outreach

Volunteer Physics & Maths Teacher (Spring 2017)

Taught series of weekend lectures on high school level physics and maths to adult Brazilian immigrants living in NY & NJ who did not possess a Brazilian secondary education degree at the Legion of Good Will (New York, NY)

Public Speaking (2016–2022)

Talks and live demonstrations of physics experiments given to general audiences on numerous occasions, including the Sulzer Public Library (Chicago IL) and the Philadelphia Science Festival (Philadelphia PA).

Organization of Seminars and Student Representation (2013–2022)

Founded and ran for two years a student-aimed Cosmology Journal Club at the University of São Paulo (2013–2015), representative of the Early-Career Scientists in the Dark Energy Survey advocating for career development of collaboration students (2016–2017), organized weekly KICP seminars for the Astronomy and Cosmology groups at UChicago (2021–2022).