Jaime Ruiz-Zapatero

Research Software Engineer | python julia | UK ES
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Summary

I am a research software engineer at the Advanced Research Computing (ARC) centre of University College London (UCL) developing infrastructure for the LSST and Euclid cosmological surveys to enable new science. I also have a deep interest in accelerating Bayesian inference with gradient methods and Gaussian processes as tools for model-agnostic science.

Education

2020 - 2024	PhD Astrophysics at **University of Oxford** `Supervisors`: David Alonso and Pedro Ferreira	STFC studentship St Cross College studentship
2023 Jan-May	Long term attachment at BCCP, **UC Berkeley** `Supervisors`: Uroš Seljak	
2016 - 2020	Msci Theoretical Physics at **UCL** `Supervisor`: Benjamin Joachimi	MAPS faculty Dean's list Additional seasonal prize for merit First class honours
2014 - 2016	Bachillerato cientifico-tecnologico at **La Salle Buen Pastor**	Matricula de honor Premio extraordinario de Bachillerato

Honours

Expertise

Classical machine learning: developed tests of fundamental assumptions of Cosmology using Gaussian processes as tools for agnostic modelling.

Big data reduction: co-author of the largest repository of consistently combined summary statistics in Cosmology from pixel maps.

High-dimensional statistical inference: developed gradient based inference algorithms to constrain thousands of parameters.

Auto-differentiable programming: developed the first library of auto-differentiable methods for cosmology in `Julia`.

Work Experience

Research Software Engineer for LSST and Euclid at UCL, London (UK) April 2024 - Current
Euclid: building summary statistics from pixel maps.
LSST: speeding photometric uncertainty marginalisation.

Probabilistic programming engineer at the CBL Lab, Cambridge (UK) June-Dec 2023
Refactored the `Turing.jl` library for Bayesian inference from a monolithic into a microservice design by writing a new interface between `Turing.jl`'s probabilistic programming language and external inference algorithms.

Natural language processing internship at Satalia (UK) Aug-Sept 2019
Developed a natural language processor to classify employees reports into the company's projects as well as a scheduler to asses and minimize project delays based on Monte Carlo simulations.

Teaching and other responsibilities

2022	Special Relativity and Symmetries tutor at St Peter's College (Oxford).	2020-2022	BIPAC Cosmology journal club organizer and chair.
2021	Leveling up physics mentor (Oxford).	Current	Referee for OJA, EPJ-C, JCAP and APJ

Selected Projects

MicroCanonicalHMC.jl (2023) Link to repository
Gradient based inference algorithm inspired by the dynamics of the microcanonical ensemble.

LimberJack.jl (2021-2023) Link to repository
Fully differentiable `Julia` code to compute predictions of summary statistics of cosmological observables.

Cosmoteka (2020-2023) Link to repository
Biggest repository of summary statistics combined in an statistically consistent way in Cosmology.

Selected Talks and Seminars

- Kavli Institute of Cosmology - Cambridge, November 2023 — 1 hour talk
- Royal Observatory of Edinburgh - Edinburgh, November 2023 — 30 mins talk
- IAP - Paris, November 2023 — 1 hour talk
- EAS 2023 - Krakow, July 2023 — 15 mins talk
- KIPAC cosmology seminar - Stanford University, March 2023 — 1 hour talk
- CNRS cosmology seminar - CNRS, December 2022 — 1 hour joint talk
- IberiCOS 2022 - Institute of Space Science in Barcelona, May 2022 — 15 mins talk
- Portsmouth cosmology seminar - University of Portsmouth (remote), May 2022 — 1 hour talk

Publications

1. García-García, C. *et al.* The growth of density perturbations in the last 10 billion years from tomographic large-scale structure data. **2021,** 030. arXiv: 2105.12108 [astro-ph.CO] (Oct. 2021).

2. Ruiz-Zapatero, J. *et al.* Geometry versus growth. Internal consistency of the flat ΛCDM model with KiDS-1000. **655,** A11. arXiv: 2105.09545 [astro-ph.CO] (Nov. 2021).

3. Ruiz-Zapatero, J. *et al.* Impact of the Universe's expansion rate on constraints on modified growth of structure. **106,** 083523. arXiv: 2207.09896 [astro-ph.CO] (Oct. 2022).

4. Ruiz-Zapatero, J. *et al.* Model-independent constraints on Ω_m and H(z) from the link between geometry and growth. **512,** 1967–1984. arXiv: 2201.07025 [astro-ph.CO] (May 2022).

5. Bonici, M., Bianchini, F. & Ruiz-Zapatero, J. Capse.jl: efficient and auto-differentiable CMB power spectra emulation. *arXiv e-prints,* arXiv:2307.14339. arXiv: 2307.14339 [astro-ph.CO] (July 2023).

6. Hadzhiyska, B. *et al.* Cosmology with 6 parameters in the Stage-IV era: efficient marginalisation over nuisance parameters. *The Open Journal of Astrophysics* **6,** 23. arXiv: 2301.11895 [astro-ph.CO] (July 2023).

7. Jego, B. *et al.* Constraining the physics of star formation from CIB-cosmic shear cross-correlations. **520,** 583–598. arXiv: 2209.05472 [astro-ph.CO] (Mar. 2023).

8. Jego, B. *et al.* The star-formation history in the last 10 billion years from CIB cross-correlations. **520,** 1895–1912. arXiv: 2206.15394 [astro-ph.GA] (Apr. 2023).

9. Ruiz-Zapatero, J. *et al.* LimberJack.jl: auto-differentiable methods for angular power spectra analyses. *arXiv e-prints,* arXiv:2310.08306. arXiv: 2310.08306 [astro-ph.CO] (Oct. 2023).

10. Ruiz-Zapatero, J. *et al.* Analytical marginalization over photometric redshift uncertainties in cosmic shear analyses. **522,** 5037–5048. arXiv: 2301.11978 [astro-ph.CO] (July 2023).