

# Justine Zeghal

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## Appointments

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### Université de Montréal

Postdoctoral Research Fellow in machine learning and cosmology at Ciela and Mila Institutes

- Supervisors: Yashar Hezaveh and Laurence Perreault-Levasseur

Montréal, Canada

11/2024 - Present

## Education

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### Université Paris Cité, Astroparticules et Cosmologie (APC)

Ph.D. in Astrophysics and Machine Learning

- Thesis: Neural Compression and Neural Density Estimation for Cosmological Inference
- Supervisors: François Lanusse, Alexandre Boucaud and Eric Aubourg

Paris, France

10/2021 - 10/2024

### Polytech Lyon

Msc. in Applied mathematics

- Academic Excellence: Ranked Top 2 in my cohort.

Lyon, France

09/2018 - 09/2021

### Polytech Paris Saclay

Preparatory classes

Paris Saclay

09/2016 - 09/2018

## Publications

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### PAPERS

**J. Zeghal**, D. Lanzieri, F. Lanusse, A. Boucaud, E. Aubourg. Is differentiability useful? Simulation-Based Inference Benchmark for LSST Weak Lensing, 2023.

→ **Summary of contributions:** project lead, produced all the results and wrote the paper.

D. Lanzieri\*, **J. Zeghal\***, T. L. Makinen, F. Lanusse, A. Boucaud, J.L. Starck. Optimal Neural Summarisation for Full-Field Cosmological Implicit Inference, 2024.

→ **Summary of contributions:** co-lead the project, implemented 3 out of 5 of the compression methods benchmarked in the paper and contributed to the writing of the paper.

### CONFERENCE PROCEEDINGS/ABSTRACTS

**J. Zeghal**, F. Lanusse, A. Boucaud, E. Aubourg, B. Remy, D. Lanzieri. The impact of neural architectures on the efficiency of cosmological simulation-based inference, *Rencontres de Moriond Cosmology*, 2022.

→ **Summary of contributions:** project lead, developed and implemented the method and produced all the results.

**J. Zeghal**, F. Lanusse, A. Boucaud, B. Remy, E. Aubourg. Neural Posterior Estimation with Differentiable Simulators, *ICML 2022 Workshop on Machine Learning for Astrophysics*, 2022.

→ **Summary of contributions:** project lead, developed and implemented the method and produced all the results.

## Project Membership

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Member of the Rubin Observatory LSST Dark Energy Science Collaboration

Member of the Rubin Observatory LSST Informatics and Statistics Science Collaboration

## Reviews

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ICML 2023 Workshop on *Machine Learning for Astrophysics*. I reviewed 4 papers.

NeurIPS 2023 Workshop on *Machine Learning and the Physical Sciences*. I reviewed 2 papers.

## Meetings Organized

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2022 **LOC**, Bayesian deep learning for cosmology and time domain astrophysics

Paris, France

## Talks & Posters

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2024 **Invited Talk**, Tools WG session of GDR Cophy

Paris, France

2024 **Seminar**, Rencontres Statistiques Lyonnaises

Lyon, France

2024 **Seminar**, IP2I seminar

Lyon, France

2023 **Flash Talk**, ML-IAP/CCA-2023 Debating the potential of machine learning in astronomical surveys 2

Paris, France

2023 **Poster**, Hammers & Nails - Swiss Edition

Ascona, Switzerland

2023 **Poster**, Dark Energy Science Collaboration meeting

Menlo Park, USA

2023 **Talk**, Cosmic Connections: A ML X Astrophysics Symposium at Simons Foundation

New York City, USA

2022 **Talk**, IN2P3/IRFU Machine Learning workshop

Paris, France

2022 **Poster**, Dark Energy Science Collaboration meeting

Chicago, USA

2022 **Poster**, Machine Learning for Astrophysics workshop at ICML

Baltimore, USA

2022 **Talk**, Bayesian deep learning for cosmology and time domain astrophysics

Paris, France

2022 **Talk**, Likelihood-free in Paris

Paris, France

2022 **Talk**, Cosmology with Weak Lensing: Beyond the Two-point Statistics

Remote

2022 **Poster**, Rencontres de Moriond Cosmology

La Thuile, Italy

## Teaching

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2023 **Teaching assistant**, *Machine learning for Physicists* – MSc. students at Université Paris Cité

Paris, France

06/2023 **Lecturer**, *Introduction to Normalizing Flows* - Astroinformatics summer school

Fréjus, France

## Open-source Projects

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- sbi\_lens
- JAX-Based log-normal weak lensing simulator.
  - Written in Python: JAX, NumPyro, tensorflow-probability.

## References

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**Dr. Eric Aubourg** (Senior Researcher)

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**Dr. Alexandre Boucaud** (Research Engineer)

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**Dr. Francois Lanusse** (Researcher)

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Université de Liège

Liège, Belgium