

Justine Zeghal

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Appointments

Université de Montréal

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

- Supervisors: Yashar Hezaveh and Laurence Perreault Levasseur

Montréal, Canada

11/2024 - Present

Education

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

Engineering school, Polytech

Applied mathematics

- Academic Excellence: Ranked Top 2 in my cohort.

Lyon, France

09/2018 - 09/2021

Engineering school, Polytech

Preparatory classes

Paris Saclay

09/2016 - 09/2018

Publications

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:** I am the project lead. I 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:** I 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:** I am the project lead. I 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:** I am the project lead. I developed and implemented the method and produced all the results.

Project Membership

Member of the Rubin Observatory LSST Dark Energy Science Collaboration

Member of the Rubin Observatory LSST Informatics and Statistics Science Collaboration

Reviews

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

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

Paris

Talks & Posters

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

2023	Teaching assistant , <i>Machine learning for Physicists</i> – MSc. students at Université Paris Cité	Paris, France
06/2023	Lecturer , <i>Introduction to Normalizing Flows</i> - AstroInformatics summer school	Fréjus, France

Open-source projects

sbi_lens

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

References

Dr. Eric Aubourg (Senior Researcher) aubourg@apc.in2p3.fr	CNRS Paris, France
Dr. Alexandre Boucaud (Research Engineer) alexandre.boucaud@apc.in2p3.fr	CNRS Paris, France
Dr. Francois Lanusse (Researcher) francois.lanusse@cnrs.fr	CNRS Paris, France
Pr. Gilles Louppe (Professor) g.louppe@uliege.be	Université de Liège Liège, Belgium