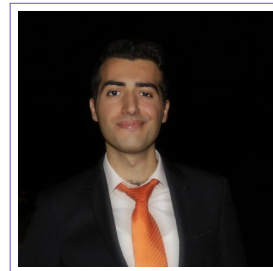


Wassim Kabalan

Curriculum Vitae

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in [wassimkabalan](https://www.linkedin.com/in/wassimkabalan)
🔗 [ASKabalan](https://askabalan.github.io)



Profile

Computational cosmologist building **differentiable, distributed cosmology software** (JAX/NCCL/CUDA) for full-field inference, with a focus on **open-source** and **HPC at scale**.

Open-Source Software (selected)

- **jaxDecomp** — Author/Maintainer • JAX bindings to cuDecomp (multi-GPU 3D decomposition + distributed FFTs, NCCL).
- **JaxPM** — Main contributor & maintainer • Differentiable particle-mesh simulations in JAX (multi-accelerator).
- **FURAX** — Main contributor & maintainer • JAX building blocks for inverse problems; used for Simons Observatory component separation.
- **jax-healpy** — Main contributor • JAX-native HEALPix utilities; AD/GPU-ready.
- *Contrib*: **S2FFT** — CUDA spherical harmonics to reduce JAX JIT compile time.

Research & Professional Experience

Dec 2023 – Present **PhD Researcher in Cosmology**, APC, CNRS/IN2P3, Paris

Thesis goal:

- Develop **differentiable, distributed N-body simulations** as weak-lensing forward models for **LSST**-scale, gradient-based cosmological inference.
- Implement **CMB component separation** with **spatially varying foreground parameters** to reduce bias in the *tensor-to-scalar ratio* (r) for **full-sky** missions (e.g., **LiteBIRD**).

Oct 2019 – Oct 2023 **Software Infrastructure Engineer**, Dassault Systèmes, Vélizy-Villacoublay

- Optimized CATIA cache/conversion pipeline (**C++/Linux**); profiling-led changes improved throughput and reliability for large CAD data flows.
- Led Linux convergence for a large **C++** rich client.
- Built **GitLab CI/CD** for multi-team releases; automated testing, packaging, and deployments.

Jan 2019 – Oct 2019 **Data Acquisition Engineer (for Renault)**, SERMA, Guyancourt

- Wrote a **C** decoder for automotive **ECU** binary sensor data.
- Built **Python (multiprocessing)** post-processing on an **88-core** server for high-throughput logs.
- Automated **CAN-bus** data conversion; packaged tools with **CMake**.

Selected Talks & Tutorials

May 20–23, 2025	JAXPM: A JAX-Based Framework for Scalable and Differentiable Particle-Mesh Simulations	Bayesian Deep Learning Workshop
May 20–23, 2025	Bayesian Inference for Cosmology with JAX [Tutorial]	Bayesian Deep Learning Workshop
Nov 18–20, 2024	Massively Parallel Computing in Cosmology with JAX [Tutorial]	CoPhy 2024
Jun 10–12, 2024	Differentiable and Distributed Particle-Mesh N-body Simulations	LSST France 2024

Publications & Software (selected)

Refereed

- Spagnoletti, A., Boucaud, A., Huertas-Company, M., **Kabalan, W.**, and Biswas, B. (2024). Bayesian Deconvolution of Astronomical Images with Diffusion Models: Quantifying Prior-Driven Features in Reconstructions. arXiv:2411.19158 [astro-ph.IM]. *Contribution*: set up JAX-based deconvolution code and ran multi-node simulations on Jean Zay HPC.
- Sommer, K., **Kabalan, W.**, and Brunet, R. (2024). Infrared Radiometric Image Classification and Segmentation of Cloud Structure Using Deep-learning Framework for Ground-based Infrared Thermal Camera Observations. EGU sphere Preprint 2024-101. *Contribution*: created and ran JAX-based U-Net model on Jean Zay HPC. Code: github.com/ASKabalan/infrared-cloud-.

Software

(journal)

- **Kabalan, W.**, Lanusse, F., Boucaud, A., and Aubourg, E. (2025). *jaxDecomp: JAX Library for 3D Domain Decomposition and Parallel FFTs*. Submitted to JOSS.

In Preparation

- **Kabalan, W.**, Lanusse, F., Boucaud, A., and Aubourg, E. (2025). *JAXPM: A JAX-Based Framework for Scalable and Differentiable Particle-Mesh Simulations*.
- **Kabalan, W.**, Rizzieri, A., Sohn, W., Beringue, B., Basyrov, A., Chanial, P., Boucaud, A., and Errard, J. (2025). *A novel approach to optimize clustering for parametric map-based component separation for upcoming CMB polarization satellites*.

Skills

Programming	Python (7y), JAX (2y), C++ (5y), CUDA (3y), PyTorch (1y)
HPC & GPU	NCCL, MPI, Slurm, Nsight; multi-node GPU, distributed FFTs
ML/Stats	Bayesian inference (MCMC, HMC, NUTS), simulation-based inference; NumPyro/BlackJAX
DevOps	GitHub/GitLab CI, packaging (PyPI), containers, Linux, CMake, TDD

Languages

French	Native
English	Professional proficiency (C1)
Arabic	Native
German	Basic (A2)

Education

Nov 2023 – Dec 2026 (expected)	PhD, Physics of the Universe , <i>Université Paris Cité</i> , Paris APC, CNRS/IN2P3 Thesis: <i>Automatically differentiable and distributed Probabilistic Programming for wEAk gravitational LensING inference</i> Advisors: Eric Aubourg, Josquin Errard, Alexandre Boucaud, François Lanusse
Apr 2023 – May 2023	Advanced AI for Data Analysis (Executive Education) , <i>École Polytechnique</i> , Palaiseau
Sep 2016 – Sep 2018	M2, Electronics, Electrical & Automation , <i>Université Gustave Eiffel</i>
Sep 2013 – Nov 2016	Licence, Engineering Science , <i>Université Paris-Est Créteil (UPEC)</i>