

Hugo Simon

Cosmology and Machine Learning PhD candidate

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Experience

- 2023/09–2026/09 **Cosmology and Machine Learning PhD candidate**, CEA, Irfu, Gif-sur-Yvette, France
- *Scalable Bayesian inference with automatically differentiable simulators for the cosmological analysis of the DESI spectroscopic survey.* Advisors: A. de Mattia and F. Lanusse.
 - Million-dimensional sampling with differentiable cosmological simulators (JAX libraries) 🐍.
 - Field-level inference of primordial non-Gaussianity from DESI survey.
 - **2 weeks invitation at CCA Flatiron Institute**, New York City, USA, working on annealing policies for high-dimensional Langevin sampling.
 - **1 month invitation at Ciela and Mila Institutes**, Montréal, Canada, working on diffusion models for field-level inference.
 - Monthly organisation of the Cosmology Journal Club at CEA, spanning 3 different labs.
 - Referee for Astronomy & Astrophysics.
 - 30h of DESI observing shifts.
- 2022/05–2023/01 **Machine Learning Research Engineer**, CNRS, UMR 9189 CRISAL, Lille, France
- *Subsampling methods for large datasets learning.* Advisors: R. Bardenet and S. Ghosh.
 - Improving sample complexity of coresets with determinantal point processes.
- 2021/05–2021/08 **Statistics Research Intern**, UCLouvain, ISBA, Louvain-la-Neuve, Belgium
- *Improving Monte Carlo variance reduction methods.* Advisors: J. Segers and F. Portier.
 - Asymptotic results on adaptive importance sampling with control variates.
- 2020/09–2021/03 **Avionics R&D Intern**, Safran Electronics & Defense, Éragny, France
- *Refining aerodynamic characterization methods from simulated and flight test inertial data.*
 - Optimal control, Kalman filtering, semi-physical Bayesian RNN (pytorch, casadi, Matlab).
- 2019/07–2019/08 **Bioinformatics Research Intern**, INRIA, UMR 6074 IRISA, Rennes, France
- *Identifying key regulators within multiomic networks.* Advisors: E. Becker and F. Moreews.
 - Transforming and analysing large metabolic graphs international databases (Python, Docker).
- Summers 2017 & 2018 **Laboratory & Field Research Technician**, INRAE, UMR 1349 IGEPP, Le Rheu, France
- *Biological experimenting and data analysis for insect population dynamics modeling.*

Education

- 2021–2022 **MSc in Maths, Imaging, Machine Learning (MVA)**, ENS Paris-Saclay, *highest honours*
- Studying: Bayesian/deep/reinforcement/geometric/topological/graph learning, neuroscience, image/language/signal processing, transport theory, random matrix theory 🐍.
- 2018–2022 **MEng in Applied Maths and Computer Science**, Télécom Paris, *highest honours*
- Top-tier French graduate school in computer science, executive engineering, and digital innovation.
 - Studying: mathematics, computer science, physical optics, quantum physics, electronics, medical robotics, philosophy, economics.
 - Specializations: image/language/signal processing and machine learning, stochastic modeling and calculus, theoretical computer science.
- 2016–2018 **Preparatory Classes for Grandes Écoles**, Lycée F. Rabelais, Saint-Brieuc, France
- Selective scientific studies for the competitive admission to the top-tier French graduate schools.
- 2016 **Scientific baccalaureate**, Lycée T. Monod, Le Rheu, France, *highest honours*
- French secondary school diploma.

Selected Talks

- 2025/07 **Cosmological information from redshift surveys**, SCfA Riccardo Giacconi, Sesto, Italy
- Optimal extraction of primordial non-Gaussian signal from galaxy redshift survey.*

- 2025/07 **DESI Meeting**, LBNL, Berkeley, USA
Toward field-level analysis of primordial non-Gaussianity with DESI tracers.
- 2025/06 **CoBALt**, Institut Pascal, Orsay, France
Field-level constraints on inflation from galaxy redshift surveys.
- 2025/05 **BDL3**, APC, Paris, France
Benchmarking field-level cosmological inference from galaxy redshift surveys.
- 2024/12 **NeurIPS**, Vancouver, Canada
Small coresets via negative dependence: DPPs, linear statistics, and concentration (poster, remote).
- 2024/11 **GDR CoPhy**, IAP, Paris, France
Probabilistic programming for cosmology (2h lecture and tutorial).
- 2024/07 **DESI Meeting**, Aix-Marseille Université, Marseille, France
Standardized benchmark for field-level cosmological inference from galaxy surveys.
- 2024/06 **EDSU-Tools**, Noirmoutier, France
 ➤ *Cosmological inference at the field-level from galaxy surveys.*
 ➤ *How to cook a universe? (2h science communication at secondary school level).*
- 2024/05 **Cosmo21**, Chania, Greece
Fast and differentiable cosmological simulator for field-level inference from galaxy surveys (poster).
- 2024/04 **zero2Cosmo**, CEA, Gif-sur-Yvette, France
Introduction to Bayesian inference (2h lecture and tutorial).
- 2023/03 **Quantum Sampling**, Pompeu Fabra University, Barcelona, Spain
 ➤ *Improving sample complexity of coresets with determinantal point processes.*
 ➤ *Bounds on numerical integration (1h lecture).*

Teaching & Outreach

- 2024/09–2024/12 **Biostatistics**, Université Paris-Saclay, Gif-sur-Yvette, France
20h lecture at Bachelor-level in Biology.
- 2024/09–2024/12 **Statistical Modeling**, Université Paris-Saclay/ENSTA, Gif-sur-Yvette, France
15h lecture at Master-level in Mathematics.
- 2024/06 **How to cook a universe?**, Collège O. de Gouges, Sainte Pазanne, France
2h science communication at secondary school level.
- 2024/05 **PHENIICS Fest**, Université Paris-Saclay, Gif-sur-Yvette, France
& 2025/07 Introduction to cosmology for physics students at doctoral school festival (talk and poster).