Alexandre Adam

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Education

Ph.D., Physics, Université de Montréal *2022–Present*

- Advisor: **Laurence Perreault-Levasseur**
- Research focus: **High-dimensional Bayesian Inference in Astronomy**

M.Sc., Physics, Université de Montréal *2020–2022*

- Advisor: **Laurence Perreault-Levasseur**
- Research focus: **Recurrent Inference Machines and Gravitational Lensing**
- GPA: 4.3/4.3

B.Sc., Physics, Université de Montréal *2017–2020*

- Overall GPA: 4.0/4.3

Teaching and Mentoring

Teaching Assistant

PHY1234 · Introduction to Numerical Physics *2021*
Grading homeworks, assistance in lab work University of Montréal

PHY3711 · Cosmology and Extragalactic Physics *2024–2025*
Grading homeworks Unviersity of Montréal

Research Mentoring

Noé Dia — Undergraduate intern *2022–2024*
Guided summer research leading to 2 publications

Antoine Bourdin — Undergraduate intern *2023–2024*
Guided summer research leading to 1 publication

Salma Sahli — M.Sc. Student *2024–2025*
Primary mentor and technical support leading to 1 publication

Gabriel Missael Barco — M.Sc. Student *2024*
Primary mentor and technical support leading to 1 publication

Summer School Courses

Introduction to Recurrent Neural Networks *2022*
Instructor for the Astromatic hackaton

Introduction to Diffusion Models and Bayesian Inference *2023*
Instructor for the Astromatic hackaton

Awards and Fellowships

NSERC graduate research doctoral program · 115 000$ *2023*
Hydro-Québec scholarship (Declined) · 20 000$ *2023*
IVADO MSc excellence scholarship · 40 000$ *2020*
Dean's list *Fall 2017-2019; Winter 2018-2020*

Service and Outreach

Reviewer for Astronomy and Astrophysics *2025*
Reviewer for Monthly Notices of the Royal Astronomical Society *2023*
Reviewer for Machine Learning and the Physical Sciences at NeurIPS *2023-2024*
Reviewer for Machine Learning for Astrophysics at ICML *2023-2024*
Organizer for the Astromatic hackaton and summer school *2022-2023*
Wrote a blog for the Ciela Institute website *2024*

Conference Contributions

IAIFI Summer Workshop, Cambridge, MA, USA — August 12, 2025
High-dimensional Bayesian Inference with Diffusion Models and Generative Flow Networks — Invited Talk

International BASP Frontiers Conference, Villars-sur-Ollon, Switzerland — January 29, 2025
Echoes in the Noise: Posterior Samples of Faint Galaxy Surface Brightness Profiles with Score-Based Likelihoods and Priors — Poster

Physics in the AI Era, Pisa, Italy — September 25, 2024
Solving inverse problems with diffusion models — Invited Talk

Annual CRAQ Meeting, Saint-Alexis-des-Monts, Qc, Canada — May 8, 2024
Echoes in the Noise: Posterior Samples of Faint Galaxy Surface Brightness Profiles with Score-Based Likelihoods and Priors — Contributed Talk

CD3×Simons Foundation Workshop, Kashiwa, Japan — January 25, 2024
Echoes in the Noise: Posterior Samples of Faint Galaxy Surface Brightness Profiles with Score-Based Likelihoods and Priors — Contributed Talk

243rd American Astronomical Society Meeting, New Orleans, LA, USA — January 9, 2024
Echoes in the Noise: Posterior Samples of Faint Galaxy Surface Brightness Profiles with Score-Based Likelihoods and Priors — Poster

ML4PS at NeurIPS, New Orleans, LA, USA — December 15, 2023
Echoes in the Noise: Posterior Samples of Faint Galaxy Surface Brightness Profiles with Score-Based Likelihoods and Priors — Poster

Cosmic Connections: A ML×Astrophysics Symposium, New York, NY, USA — May 24, 2023
Posterior Samples of Source Galaxies in Strong Gravitational Lenses with Score-Based Priors — Contributed Talk

Annual CRAQ Meeting, Saint-Alexis-des-Monts, Qc, Can — May 9, 2023
Posterior Samples of Source Galaxies in Strong Gravitational Lenses with Score-Based Priors — Contributed Talk

ML4PS at NeurIPS, New Orleans, LA, USA — December 15, 2022
Posterior Samples of Source Galaxies in Strong Gravitational Lenses with Score-Based Priors — **Spotlight Talk** (4/188 accepted)

Boom! A Workshop on Explosive Transients with LSST (Virtual) — July 29, 2022
Pixelated Reconstruction of Gravitational Lenses using Recurrent Inference Machine — Contributed Talk

ML4Astro at ICML, Baltimore, MD, USA — July 22, 2022
Pixelated Reconstruction of Gravitational Lenses using Recurrent Inference Machines — Poster

Annual CRAQ Meeting, Magog, Qc, Canada — May 9, 2022
Free-Form Reconstruction of Gravitational Lenses using Recurrent Inference Machine — Contributed Talk

Likelihood-free in Paris, France — April 21, 2022
Free-Form Strong Gravitational Lensing Reconstruction using Recurrent Inference Machine — Contributed Talk

IVADO Digital October (Virtual) — October 21, 2022

Posterior Samples of Source Galaxies in Strong Gravitational Lenses with Score-Based Priors — Poster

IAIFI Summer Workshop, Cambridge, MA, USA — August 8, 2022
Pixelated Reconstruction of Gravitational Lenses using Recurrent Inference Machines — Poster

Annual CASCA Meeting (Virtual) — May 18, 2022
Free-Form Reconstruction of Gravitational Lenses using Recurrent Inference Machine — Poster

IVADO Digital October (Virtual) — October 29, 2021
Automatic Reconstruction of Gravitational Lenses — Contributed Talk

Centenaire du département de physique, Montréal, Canada — October 20, 2021
Apprentissage automatique de la reconstruction de lentilles gravitationnelles — Poster

Peer-reviewed publications

First author

5. **A. Adam**, C. Stone, C. Bottrel, R. Legin, Y. Hezaveh, L. Perreault-Levasseur.
Echoes in the Noise: Posterior Samples of Faint Galaxy Surface Brightness Profiles with Score-Based Likelihoods and Priors.
NeurIPS Workshop on Machine Learning and the Physical Sciences, (2023)
The Astrophysical Journal, vol. 169 (5), pp. 254 (2025).
arXiv:2311.18002
4. R. Legin*, **A. Adam***, Y. Hezaveh, L. Perreault-Levasseur. (*: Equal contribution)
Beyond Gaussian Noise: A Generalized Approach to Likelihood Analysis with non-Gaussian Noise.
The Astrophysical Journal Letters, vol. 949 (2), L41 (2023).
arXiv:2302.03046
3. **A. Adam**, Y. Hezaveh, L. Perreault-Levasseur, M. Welling.
Pixelated Reconstruction of Foreground Density and Background Surface Brightness in Gravitational Lensing Systems using Recurrent Inference Machines.
The Astrophysical Journal, vol. 951 (1), pp. 6 (2023).
arXiv:2301.04168
2. **A. Adam**, A. Coogan, N. Malkin, R. Legin, L. Perreault-Levasseur, Y. Hezaveh, Y. Bengio.
Posterior samples of source galaxies in strong gravitational lenses with score-based priors.
NeurIPS Workshop on Machine Learning and the Physical Sciences (2022).
arXiv:2211.03812
1. **A. Adam**, L. Perreault-Levasseur, Y. Hezaveh.
Pixelated Reconstruction of Gravitational Lenses using Recurrent Inference Machines.
ICML Workshop on Machine Learning for Astrophysics (2022).
arXiv:2207.01073

As primary mentor for junior researcher

5. N. Dia, M. J. Yantovski-Barth, **A. Adam**, M. Bowles, P. Lemos, A. M. M. Scaife, Y. Hezaveh, L. Perreault-Levasseur.
IRIS: A Bayesian Approach for Image Reconstruction in Radio Interferometry with expressive Score-Based priors.

Submitted to The Astrophysical Journal (2025)
arXiv:2501.02473

4. S. Salhi, **A. Adam**, L. Albert, R. Doyon, L. Perreault-Levasseur
Score-based models for 1/f correlated noise correction in James Webb Space Telescope spectral data.
NeurIPS workshop on Machine Leanring and the Physical Sciences (2024).
ML4PS2024:258
3. A. Bourdin, R. Legin, M. Ho, **A. Adam**, Y. Hezaveh, L. Perreault-Levasseur. *Inpainting Galaxy Counts onto N-Body Simulations over Multiple Cosmologies and Astrophysics.*
ICML workshop on AI for Science (2024).
arXiv:2408.00839
2. G. M. Barco, **A. Adam**, C. Stone, Y. Hezaveh, L. Perreault-Levasseur.
Tackling the Problem of Distributional Shifts: Correcting Misspecified, High-Dimensional Data-Driven Priors for Inverse Problems.
The Astrophysical Journal, vol. 980 (1), pp. 108 (2024).
arXiv:2407.17668
1. N. Dia, M. J. Yantovski-Barth, **A. Adam**, M. Bowles, P. Lemos, A. M. M. Scaife, Y. Hezaveh, L. Perreault-Levasseur.
Bayesian Imaging for Radio Interferometry with Score-Based Priors.
NeurIPS Workshop on Machine Learning and the Physical Sciences (2023).
arXiv:2311.18012

As author with significant contribution

11. L. Leuzzi, M. Meneghetti, **A. Adam**, L. Moscardini, C. Giocoli.
Observation-driven simulations of strong lensing galaxy clusters.
Submitted to Astronomy and Astrophysics (2025).
10. R. Legin, C. Stone, **A. Adam**, G. M. Barco, A. Coogan, N. Malkin, L. Perreault-Levasseur, Y. Hezaveh.
Mind the Information Gap: Unveiling Detailed Morphologies of z 0.5-1.0 Galaxies with SLACS Strong Lenses and Data-Driven Analysis.
Submitted to The Astrophysical Journal (2025).
arXiv:2511.19595
9. C. Stone, R. Legin, **A. Adam**, N. Malkin, G. M. Barco, L. Perreault-Levasseur, Y. Hezaveh.
Pixellated Posterior Sampling of Point Spread Functions in Astronomical Images.
Submitted to The Astrophysical Journal (2025).
arXiv:2511.19594
8. E. Angeloudi, M. Huertas-Company, J. Falcón-Barroso, L. Perreault-Levasseur, **A. Adam**, A. Boecker.
The spatially-resolved effect of mergers on the stellar mass assembly of MaNGA galaxies.
Accepted for publication in Astronomy & Astrophysics (2025)
arXiv:2509.25340
7. C. Stone, **A. Adam**, A. Coogan, L. Perreault-Levasseur, Y. Hezaveh.
`caskade`: building Pythonic scientific simulators.
Journal of Open Source Software, vol. 10 (113), pp. 8786 (2025).
joss.08786
6. C. L. Rhea, J. Hlavacek-Larrondo, **A. Adam**, R. Kraft, Á. Bogdán, L. Perreault-Levasseur, M. Prunier.
Deconvolving X-Ray Galaxy Cluster Spectra Using a Recurrent Inference Machine.
The Astronomical Journal, vol. 169 (5), pp. 268 (2025).
arXiv:2409.10711

5. C. Stone, **A. Adam**, A. Coogan, M. J. Yantovski-Barth, A. Filipp, L. Setiawan, C. Core, R. Legin, C. Wilson, G. M. Barco, Y. Hezaveh, L. Perreault-Levasseur.
Caustics: A Python Package for Accelerated Strong Gravitational Lensing Simulations.
Journal of Open Source Software, vol. 9 (103), pp. 7081 (2024).
arXiv:2406.15542

4. S. Venkatraman, M. Jain, L. Scimeca, M. Kim, M. Sendera, M. Hasan, L. Rowe, S. Mittal, P. Lemos, E. Bengio, **A. Adam**, J. Rector-Brooks, Y. Bengio, G. Berseth, N. Malkin.
Amortizing intractable inference in diffusion models for vision, language, and control.
Proceedings of the Conference on Neural Information Processing Systems, vol. 37, pp. 76080–76114 (2024).
arXiv:2501.20971

3. M. Sendera, M. Kim, S. Mittal, P. Lemos, L. Scimeca, J. Rector-Brooks, **A. Adam**, Y. Bengio, N. Malkin.
Improved off-policy training of diffusion samplers.
Proceedings of the Conference on Neural Information Processing Systems, vol. 37, pp. 81016–81045 (2024).
arXiv:2501.05098

2. C. L. Rhea, J. Hlavacek-Larrondo, , R. Kraft, Á. Bogdán, **A. Adam**, L. Perreault-Levasseur..
Unraveling the mysteries of galaxy clusters: recurrent inference deconvolution of X-ray spectra
NeurIPS workshop on Machine Learning and the Physical Sciences (2023).
arXiv:2311.18014

1. M. Pasquato, S. Haddad, P. Di Cintio, **A. Adam**, P. Lemos, N. Dia, M. Petrache, U. Niccolò Di Carlo, A. Alberto Trani, L. Perreault-Levasseur, Y. Hezaveh.
The search for the lost attractor.
NeurIPS Workshop on Machine Learning and the Physical Sciences (2023).
arXiv:2311.16306