Noemi Anau Montel

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Research Interests

My research interests lie towards analyzing complex astrophysical and cosmological datasets at various observable scales for new physics searches. In particular, my work uses novel scientific machine learning techniques to develop innovative data analysis pipelines and statistical algorithms. The aim is to alleviate the statistics challenges facing the fields of astrophysics and cosmology in light of high-quality data from current and future observatories.

Professional Experience

Max Planck Institute for Astrophysics **Garching, DE**
Research Fellowship Nov. 2024 – present

Education

ORCiD

University of Amsterdam, GRAPPA Institute **Amsterdam, NL**
Ph.D. in Physics Oct. 2020 – Oct. 2024
Thesis: *Simulation-based inference for astrophysical data*
Advisor: Christoph Weniger

Università di Torino **Torino, IT**
Laurea magistrale in Fisica Teorica (equivalent to *M.Sc.* in Theoretical Physics) Oct. 2018 – Jul. 2020
Grade: 110/110 magna cum laude with honors
Advisor: Nicolao Fornengo

Laurea triennale in Fisica (equivalent to *B.Sc.* in Physics) Oct. 2015 – Jul. 2018
Grade: 110/110 magna cum laude
Advisor: Paolo Gambino

Publications

arXiv Inspire HEP

Journal publications:

1. G. F. Abellan, N. Anau Montel, O. Savchenko, C. Weniger, *How to embed any likelihood into SBI: Application to Planck + Stage IV galaxy surveys and Dynamical Dark Energy*, , [arXiv:2507.22990]
2. C. Eckner, N. Anau Montel, F. List, F. Calore, C. Weniger, *A robust neural determination of the source-count distribution of the Fermi-LAT sky at high latitudes*, , [arXiv:2505.02906]
3. O. Savchenko, G. Franco Abellan, F. List, N. Anau Montel, C. Weniger, *Fast Sampling of Cosmological Initial Conditions with Gaussian Neural Posterior Estimation*, , [arXiv:2502.03139]
4. N. Anau Montel, J. Alvey, C. Weniger, *Tests for model misspecification in simulation-based inference: from local distortions to global model checks*, Phys.Rev.D 111, 083013, [arXiv:2412.15100]
5. N. Anau Montel, J. Alvey, C. Weniger, *Scalable inference with Autoregressive Neural Ratio Estimation*, Mon.Not.Roy.Astron.Soc. 530 (2024) 4, [arXiv:2308.08597]

6. A. Coogan, N. Anau Montel, K. Karchev, M. W. Grootes, F. Nattino, C. Weniger, *The effect of the perturber population on subhalo measurements in strong gravitational lenses*, Mon.Not.Roy.Astron.Soc. 527 (2024) 66, [arXiv:2209.09918]
7. N. Anau Montel, A. Coogan, C. Correa, K. Karchev, C. Weniger, *Estimating the warm dark matter mass from strong lensing images with truncated marginal neural ratio estimation*, Mon.Not.Roy.Astron.Soc. 518 (2023) 2746, [arXiv:2205.09126]
8. C. Correa, M. Schaller, S. Ploeckinger, N. Anau Montel, C. Weniger, S. Ando, *TangoSIDM: Tantalizing models of Self-Interacting Dark Matter*, Mon.Not.Roy.Astron.Soc. 517 (2022) 3045, [arXiv:2206.11298]

Conference publications:

9. O. Savchenko, F. List, G. Franco Abellan, N. Anau Montel, C. Weniger, *Mean-Field Simulation-Based Inference for Cosmological Initial Conditions*, Machine Learning and the Physical Sciences Workshop at the 38th Conference on Neural Information Processing Systems (NeurIPS 2024) [Paper] [Poster] [arXiv:2410.15808]
10. F. List, N. Anau Montel, C. Weniger, *Bayesian Simulation-based Inference for Cosmological Initial Conditions*, Machine Learning and the Physical Sciences Workshop at the 37th Conference on Neural Information Processing Systems (NeurIPS 2023) [Paper] [Poster] [arXiv:2310.19910]
11. K. Karchev, N. Anau Montel, A. Coogan, C. Weniger, *Strong-Lensing Source Reconstruction with Denoising Diffusion Restoration Models*, Machine Learning and the Physical Sciences Workshop at the 36th Conference on Neural Information Processing Systems (NeurIPS 2022) [Paper] [Poster] [arXiv:2211.04365]
12. N. Anau Montel, C. Weniger, *Detection is truncation: studying source populations with truncated marginal neural ratio estimation*, Machine Learning and the Physical Sciences Workshop at the 36th Conference on Neural Information Processing Systems (NeurIPS 2022) [Paper] [Poster] [arXiv:2211.04291]

Seminars and Conference Talks

† = remote

Invited talks:

- IAIFI Workshop 2025 — Cambridge (MA), US, Aug. 2025
- BASP Frontiers 2025 — Villars-sur-Ollon, FR, Jan. 2025
- EAS 2024 – AI in astronomy session — Padova, IT, Jul. 2024
- PHYSTAT-SBI 2024 — Garching, DE, May. 2024

Seminars:

- Cambridge-LMU seminar — †, May. 2025
- Max Planck Institute for Astrophysics — Garching, DE, Dec. 2024
- Donostia International Physics Center (Cosmology & Astrophysics group) — †, Apr. 2024
- Utrecht University (Institute for Theoretical Physics) — Utrecht, NL, Apr. 2024
- Harvard University (Department of Physics) — Cambridge (MA), US, May. 2023
- Radbound University (Donders Institute) — †, Jan. 2022

Contributed talks (and posters = ⋆):

- EuCAIFCon 2025 (selected for highlight plenary talk) [slides] — Cagliari, IT, Jun. 2025
- ORIGINS Lensing Day [slides] — Garching, DE, Nov. 2024
- GRAPPA 10 year anniversary conference [slides] — Amsterdam, NL, Jul. 2023
- The Road to Differentiable and Probabilistic Programming in Physics [slides] — Munich, DE, Jun. 2023

- Third EuCAPT annual symposium at CERN [slides] — Geneva, CH, May. 2023
- Cosmic Connections (Symposium at Flatiron Institute) ⋆ — New York (NY), US, May. 2023
- Novel approaches to characterise the Galactic Centre Excess [slides] — Annecy, FR, Mar. 2023
- Simulation-based inference with Swyft Workshop [slides] — Amsterdam, NL, Jan. 2023
- NeurIPS 2022, ML and the Physical Sciences Workshop ⋆ [poster] — New Orleans (LA), US, Dec. 2022
- Identification of Dark Matter (IDM) 2022 [slides] — Vienna, AU, Jul. 2022
- Likelihood-free in Paris [slides] — Paris, FR, Mar. 2022
- UK National Astronomy Meeting (NAM) 2021 [slides] — †, Jul. 2021

Teaching and Supervision Experience

Teaching assistant (preparing and leading tutorials, designing and marking exams) for master courses:

- Advanced Cosmology (16 hours); Lecturer: C. Weniger — Winter 2024
- Machine Learning for Physics and Astronomy (64 hours); Lecturer: C. Weniger — Spring 2022, 2023
- Quantum Field Theory 3 (16 hours); Lecturer: M. Isachenkov — Winter 2023
- Quantum Field Theory (32 hours); Lecturer: E. Verlinde — Fall 2020

Guest lecturer for the Professional Skills and Career Development Physics and Astronomy course (2023).
Research supervisor for 3 master students and 1 bachelor student, devising their projects and providing weekly supervisor support on their theses.

Professional Activities and Community

Reviewer:

- *Journal Reviewer*: Nat.Astron., OJAp
- *Workshop Reviewer*: NeurIPS Machine Learning and the Physical Sciences Workshop — 2023, 2024

Co-Organizer:

- Munich Dark Matter Meetings — 2025-2026
- LSS Day in Munich — Oct. 2025
- Dutch Machine Learning for Gravitational Waves Meeting — Dec. 2023
- Simulation-based inference with Swyft Workshop — Jan. 2023
- GRAPPA Colloquium — 2022 – 2024

Professional Skills

github.com/NoemiAM

Programming skills:

- *Expert*: Python (including `PyTorch`, `JAX`), bash, vim, slurm, Git, LaTeX.
- *Intermediate*: Mathematica, C++, html.

Languages: fluent English, native Italian, intermediate French.