MATT SAMPSON

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Experience

Princeton University

Graduate Researcher (Machine Learning)

• Designed, implemented, tested score-based diffusion model to assist in galaxy source separation. To be used in upcoming large telescope surveys Python (JAX, equinox), HPC/GPU computing, remote/cluster computing

- Implemented method for computing efficient 2^{nd} order methods quantifying hallucinations in neural networks (JAX)
- Developed automated scripts to extract data from large telescope surveys via intermediate remote clusters **bash**, Python

Australian National University

Honours Researcher (Computational Astrophysics/Software)

- Assisted in the development of a novel cosmic ray propagation code CRIPTIC (C++, Python, bash)
- Troubleshot, fixed bugs and implemented features such as continuous time integration, external file reading, into the source code (GDB: The GNU Project Debugger)

Queensland University of Technology

Research Assistant (Computational Statistician)

- Assisted in development of statistical tools improving on standard MCMC routines, increase runtime performance by 90% with no drop model quality MATLAB, bash
- Designed and developed statistical analysis tools for very large datasets in biology **Python**, **R**, **MATLAB**, **bash**, work resulting in publications for the biology team.

Technical Skills

Languages: Python (JAX, PyTorch, Flax, equinox, scipy, pandas), C++, FORTRAN, R, MATLAB Mathematical: advanced calculus and linear algebra, ODEs/PDEs, statistics and probability, Bayesian inference, computational statistics

Dev/Databases/Other: Git, bash, remote/cluster computing, high-performance computing, SQL

Education

Princeton University, NJ, USA	2022 - 2026 expected
Ph.D. in Computational Astrophysics (machine learning)	
Princeton University, NJ, USA	2023
Masters in Computational Astrophysics (machine learning)	
Australian National University, Canberra, Australia	2021
Honours (similar to US masters) in Computational Astrophysics	First class honours, GPA 6.9/7
Queensland University of Technology, Brisbane, QLD, Australia	2020
Bachelor of Mathematics (Applied and Computational)	Awarded with distinction GPA $7/7$
Queensland University of Technology, Brisbane, QLD, Australia	2020
Bachelor of Science (Physics)	Awarded with distinction GPA $6.9/7$
Publications	

- Sampson, M. L., Melchior, P., Ward, C., & Birmingham, S. (2024). "Score-matching neural networks for improved multi-band source separation" arXiv preprint arXiv:2401.07313
- Sampson, M. L., Beattie, J. R., Krumholz, M. R., Crocker, R. M., Federrath, C., Seta, A. (2023) "The turbulent diffusion of streaming cosmic rays through compressible, partially ionised plasma." Monthly Notices of the Royal Astronomical Society 519 (1), 1503-1525 Citations: 20
- Sampson, M. L., Melchior, P. (2023) "Spotting Hallucinations in Inverse Problems with Data-Driven Priors" ICML ML4 Astro
- Krumholz, M. R., Crocker, R. M., Sampson, M. L., (2022) "Cosmic Ray Interstellar Propagation Tool using Itô Calculus (CRIPTIC): software for simultaneous calculation of cosmic ray transport and observational signatures." Monthly Notices of the Royal Astronomical Society 517 (1), 1355-1380 Citations: 7
- Stevenson, S., Sampson, M. L., Powell, J., et al. (2019). The impact of pair-instability mass loss on the binary black hole mass distribution. The Astrophysical Journal, 882(2), 121. Citations: 128
- Beattie, J. R., Krumholz, M. R., Federrath, C., Sampson, M. L., Crocker, R. M. (2022). "Ion Alfvén velocity fluctuations and implications for the diffusion of streaming cosmic rays" Frontiers in Astronomy and Space Sciences Citations: 13

Jan 2021 – Nov 2021 Australia

2022 - Present

NJ.USA

2019 - 2021

- Remote Brisbane, QLD, Australia