Matt Sampson

Homepage Scholar matt.sampson@princeton.edu LinkedIn Github

Experience

Princeton University **2022 – Present**
Graduate Researcher (Machine Learning) *NJ,USA*

- 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 **Jan 2021 – Nov 2021**
Honours Researcher (Computational Astrophysics/Software) *Australia*

- 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 **2019 – 2021**
Research Assistant (Computational Statistician) *Remote – Brisbane, QLD, Australia*

- 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**