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RESEARCH INTERESTS

- **Representation learning and compression:** Designing ways to encourage highly structured and highly compressed representation of data in scientific domains.
- **Latent dynamics for world models:** Building generative models of dynamical systems that support inference, simulation, and discovery in reduced dimensional spaces.
- **AI for scientific discovery:** Building autonomous and semi-autonomous systems that combine learned dynamics, physical priors, and language-model reasoning to improve scientific discovery.

EDUCATION

- Doctor of Philosophy**, Princeton University 2022– Expected early 2027
• **Thesis:** *Physics-informed latent dynamics for scientific machine learning*
• **Advisor** Prof. Peter Melchior
- Honours** (First class), Australian National University 2021
• **Thesis:** *Cosmic ray transport in compressible ionised MHD turbulence*
• **Advisor** Prof. Mark Krumholz
- Bachelor of Mathematics**, Queensland University of Technology 2017–2020
• **Major:** *Applied and Computational Mathematics*
- Bachelor of Science**, Queensland University of Technology 2017–2020
• **Major:** *Physics*

PROFESSIONAL EXPERIENCE



NYU/Polymathic AI 2026
Research Intern | Advisors: [Carol Cuesta-Lazaro](#), [Pavel Izmailov](#)
AI for Scientific Experimentation and Discovery: Developing novel physics benchmarks, and RL pipelines to train LLM-based science agents to perform scientific discovery. [Webpage](#)

AWARDS AND HONORS

- 2026 [Schmidt Science Fellows](#) (selected as Princeton nominee)
- 2022 [Princeton Graduate Program First Year Fellowship in Natural Sciences](#)
- 2021 [Bok Honours Scholarship](#) in Astrophysics at the RSAA
- 2020 Deans List of Commendation for academic excellence (2017, 2018, 2019, 2020)
- 2019 [ICRAR-Pawsey Centre Vacation Scholar](#)

SOFTWARE AND TECHNICAL SKILLS

Contributed, and led development of numerous open source scientific projects.

- [Path-minimized latent ODEs](#), JAX based software for path minimized latent ODE models.
- Major contributor to [Scarlet2](#), python based software for galactic source deblending. Contributed a score-based diffusion model to act as neural priors for galaxy morphology.
- Co-developer of [CRIPTIC](#), C++ software for simulation of cosmic ray transport

Technical skills

Languages: Python (JAX, PyTorch, diffrax, equinox), C++, R, MATLAB, FORTRAN (*ordered by proficiency*)

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

SUPERVISION/MENTORSHIP

Undergraduate Summer Research Program

- Research supervisor of Gabrielle Florencia
- Co-supervisor with Prof. Charlotte Ward and Prof. Peter Melchior for Sofia Birmingham

SELECTED TALKS

- “Latent ODEs for learning rate scheduling”. *Polymathic AI*, Flatiron Institute 2026.
- “Machine Learning for Astrophysics”. *Princeton Undergraduate Research School*, Princeton 2025.
- “Latent ODEs for time series modelling and inference”. *Ciela Institute’s Astromerique student talk series*, (virtual) 2024.
- “Score-based diffusion models with uncertainty quantification”. *Data Science X Astro seminar*, 2024.
- “Spotting hallucinations in inverse problems with data-driven priors”. *ICML ML4Astro workshop, Hawaii*, 2023.
- “Score-based diffusion models for galaxy separation”. *Cosmic Connections Symposium*, Flatiron Institute, NY, 2023.

TEACHING EXPERIENCE

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| • AST205 Planets and the Universe (1 Semester) | • SEB115 Experimental Science (2 Semesters) |
| • SEB104 Challenges in Science (3 Semesters) | • PVB101 Physics of the Very Large (2 Semesters) |
| • SEB113 Quantitative Analysis (3 Semesters) | • BVB204 Statistics for Ecology (2 Semesters) |

PROFESSIONAL SERVICE

Referee contributions


- | | |
|---|---|
| • NeurIPS 2023, 2024, 2025 | • The Astrophysical Journal |
| • ICML 2023, 2025, 2026 (Gold reviewer) | • Monthly Notices of the Royal Astronomical Society |
| • ICLR 2026 | |

OUTREACH AND COMMUNITY SERVICE

Mercer Community College Machine Learning club

- I am passionate about the importance of education, especially those from disadvantaged backgrounds
- I lead yearly workshops teaching local community college students programming and machine learning skills
- Students from this have gone on to participate in both internship opportunities and transfer offers at 4-year institutions such as Princeton University and others

PUBLICATIONS

(8 first-author, 14 total  Scholar)

([†]led by my student, * *joint first author*)_{2/3}

Note: prior to 2026 published under Matt L. Sampson (as on google scholar)

Machine learning

- [1] **Wiemann***, M. L., Smith*, L. M., Cuesta-Lazaro, C., Izmailov, P., Melchior, P., Mishra-Sharma, S., Wilson, AG., (2026), [DISCOVERPHYSICS: Benchmarking LLMs for out-of-the-box scientific thinking](#)
Code: [DISCOVERPHYSICS](#), [Website/Leaderboard](#)
In review at *NeurIPS*
- [2] **Wiemann, M. L.**, Melchior, P., Saydjari, A., (2026), Interleaved Noise Curricula for Improved Clean, Corrupt and OOD Performance
In submission
- [3] **Wiemann, M. L.**, Melchior, P., (2026), [Optimization as a Dynamical System: Generative Schedules from Latent ODEs](#)
In review at *Transactions on Machine Learning Research*
- [4] Yan, A.[†], **Sampson, M. L.**, Melchior, P., (2025), [A novel approach to classification of ECG arrhythmia types with latent ODEs](#)
NeurIPS Time Series for Health Workshop
- [5] **Sampson, M. L.**, Melchior, P., (2025), [Path-minimised latent ODEs as inference models](#)
Machine Learning: Science and Technology, 6, 025047
- [6] **Sampson, M. L.**, Melchior, P. (2023), [Spotting Hallucinations in Inverse Problems with Data-Driven Priors](#)
ICML ML4 Astro Spotlight talk

Computational Physics & Domain Applications

- [1] **Sampson, M. L.**, et al., (2026), [Two-moment cosmic ray fluid - plasma coupling in isothermal, supersonic, magnetized turbulence relevant to the interstellar medium](#)
The Astrophysical Journal
- [2] Melchior P., Ward, C., Remy B., **Sampson, M. L.**, Siegel, J., (2026), [SCARLET2 Astronomical scene modelling in JAX](#).
Journal of open source software
- [3] **Sampson, M. L.**, Melchior, P., Ward, C., & Birmingham, S. (2024), [Score-matching neural networks for improved multi-band source separation](#)
Astronomy and Computing, 49, 100875
- [4] Ward, C., Melchior, P., **Sampson, M.L.**, et al., (2025), [Disentangling transients and their host galaxies with scarlet2: A framework to forward model multi-epoch imaging](#).
Astronomy and Computing, 100930
- [5] **Sampson, M. L.**, Beattie, J. R., Krumholz, M. R., et al. (2023), [The turbulent diffusion of streaming cosmic rays through compressible, partially ionised plasma](#).
Monthly Notices of the Royal Astronomical Society 519 (1), 1503-1525
- [6] 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
- [7] 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
- [8] 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.